RESEARCH

Jonas Bergmann

At Risk of Deprivation

The Multidimensional Well-Being Impacts of Climate Migration and Immobility in Peru

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Migration ist eines der zentralen Globalisierungsphänomene des 21. Jahrhunderts. Entsprechend groß ist das Interesse an Fragen der politischen Regulierung und Gestaltung der weltweiten Migration, den Rechten von Migrantinnen und Migranten und der Integration von der lokalen bis zur globalen Ebene. Die Buchreihe ist interdisziplinär ausgerichtet und umfasst Monographien und Sammelwerke, die sich theoretisch und empirisch mit den Inhalten, Strukturen und Prozessen lokaler, regionaler, nationaler und internationaler Migrations- und Integrationspolitik befassen. Sie richtet sich an Wissenschaftlerinnen und Wissenschaftler, Studierende der Geistes-, Sozial-, Wirtschafts- und Rechtswissenschaften sowie an Praktikerinnen und Praktiker aus Medien, Politik und Bildung.

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This book is the marginally abridged version of the author's dissertation, which was submitted and defended at the Faculty of Humanities and Social Sciences at the Humboldt-Universität zu Berlin in 2022. Prof. Helga Weisz (Humboldt-Universität zu Berlin) and Prof. Susan F. Martin (Georgetown University) supervised the dissertation.

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[1] German names: *Deutscher Wetterdienst; Bundesministerium für Umwelt, Naturschutz, und nukleare Sicherheit; Deutscher Akademische Austauschdienst; Studienstiftung des deutschen Volkes; Stiftung der Deutschen Wirtschaft.*

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[3] Original Spanish names: *Ministerio del Ambiente (MINAM); Ministerio de la Mujer y Poblaciones Vulnerables (MIMP);* and *Servicio Nacional de Meteorología e Hidrología del Perú (SENAMHI).*

under pandemic conditions. Thank you very much. And thank everyone else who has gifted my journey with their presence.

Abstract

Worsening climate impacts are forcing subsistence farmers worldwide to decide whether to stay in place or migrate. Both alternatives, immobility and mobility, are presumed to affect multiple dimensions of human well-being. Yet, knowledge about the well-being impacts of such climate (im)mobilities and their underlying mechanisms of action remains limited. Impact studies are rare and often only focus on select wealth effects while overlooking how climate migrants or stayers self-assess their wider state. To address this gap, this work analyzes how and why climate (im)mobilities affect both people's objective needs (including livelihoods, education, health, housing, basic services, safety from hazards, security, and social relatedness) *and* their subjective well-being (emotional balance, cognitive satisfaction, and views of the future). It compares the impacts of diverse climate (im)mobilities on such multidimensional well-being across three case studies in Peru's major topographical zones: (1) rural-to-urban migration and immobility related to water scarcity in the highlands, (2) flood-driven entrapment and planned relocation in the rainforest, and (3) internal disaster displacement following the 2017 Coastal El Niño. A mixed methods approach was applied, drawing on interview data from 93 affected people and over 60 experts. In the Coastal El Niño case, existing countrywide survey data from close to 190,000 respondents were assessed as well. Based on these analyses, the study identifies the multidimensional well-being effects of climate (im)mobilities and mechanisms of action with the aim of informing research, policies, and planning in this area. The findings highlight that well-being impacts were on average more net-negative than net-positive, regardless of whether farmers stayed or migrated. The principal limitation for achieving well-being was structural constraints, such as development gaps, weak governance, marginalization, and land issues. In most cases, prior structural constraints were reproduced or exacerbated. Similarly, the

more damaging the climate impacts were, the higher the risk of an ensuing well-being decline. Affected people's agency and their ability to moderate losses were often very limited. While the observed well-being impacts were multifaceted, most elements of people's need fulfillment tended to affect one other significantly. Often, these elements also jointly determined the direction of change in people's subjective well-being. These results suggest that the well-being impacts of climate (im)mobilities depend heavily on structural conditions and the severity of climate impacts; as such, many poor farmers are left with limited agency and only marginal influence over outcomes. The identified vulnerabilities thus challenge prevalent framings of "migration as adaptation" and rather stress the need to protect affected people's human rights and human security while redressing loss and damage. To this end, the study proposes measures that could help reduce climate risks, protect stayers, facilitate movement in dignity, and safeguard migrants' well-being. Without substantial investments in such efforts, climate impacts could sharply reduce numerous subsistence farmers' well-being globally—irrespective of whether they stay or migrate. The study also discusses methodological and conceptual implications as well as future research needs.

Keywords: Climate change · Migration · Displacement · Relocation · Immobility · Well-being · Peru

Verschärfende Klimafolgen stellen weltweit Menschen, die von Subsistenz-landwirtschaft abhängen, zunehmend vor die Entscheidung, ob sie vor Ort bleiben oder migrieren. Es wird vermutet, dass beide Alternativen, Mobilität und Immobilität, vielfältige Dimensionen des menschlichen Wohlergehens beeinflussen können. Jedoch ist der derzeitige Wissensstand über die Auswirkungen von Klimamigration oder Immobilität auf menschliches Wohlergehen und die zugrunde liegenden Wirkmechanismen nach wie vor begrenzt. Wirkungsstudien sind rar und konzentrieren sich oft nur auf ausgewählte Wohlstandseffekte, ohne zu untersuchen, wie Betroffene ihre weitere Situation selbst einschätzen. Um diese Lücke zu schließen, vergleicht diese Studie wie und warum Klima(im)mobilitäten *sowohl* die objektive Bedürfniserfüllung der Menschen (einschließlich Lebensunterhalt, Bildung, Gesundheit, Wohnen, Grundversorgung, Schutz vor Umweltgefahren, Sicherheit und soziale Verbundenheit) *als auch* deren subjektives Wohlbefinden (emotionales Gleichgewicht, kognitive Zufriedenheit und Zukunftsaussichten) beeinflussen. Die Arbeit vergleicht die Auswirkungen verschiedener Arten von Klima(im)mobilitäten auf multidimensionales Wohlergehen anhand von drei Fallstudien in den wichtigsten topographischen Zonen Perus: (1) Land-Stadt-Migration und Immobilität im Zusammenhang mit Wasserknappheit im Hochland, (2) hochwasserbedingtes Eingeschlossen-Sein (entrapment)

und geplante Umsiedlungen im Regenwald sowie (3) Binnenflucht nach der Küsten-El Niño Katastrophe im Jahr 2017. Es wurde ein Mixed-Methods-Ansatz angewendet, der sich auf Interviewdaten von 93 Betroffenen und über 60 Expert:innen stützte. In der Fallstudie zum Küsten-El Niño wurden ebenso bestehende landesweite Erhebungsdaten von beinahe 190,000 Befragten ausgewertet. Basierend auf diesen Analysen identifiziert die Studie die multidimensionalen Auswirkungen von Klima(im-)mobilitäten auf menschliches Wohlergehen sowie zugrundeliegende Wirkmechanismen mit dem Ziel, Wissen für Forschung, Politik und Planung in diesem Bereich bereitzustellen. Die Ergebnisse unterstreichen, dass die Auswirkungen auf das Wohlergehen der landwirtschaftlich Beschäftigen im Durchschnitt eher nettonegativ als nettopositiv waren, unabhängig davon, ob sie vor Ort blieben oder migrierten. Das maßgebliche Hindernis für das Erreichen von Wohlergehen stellten strukturelle Beschränkungen dar, wie Entwicklungslücken, schwache Regierungsführung, Marginalisierung und Landprobleme. In den meisten Fällen wurden anfängliche strukturelle Beschränkungen reproduziert oder verschärft. Auf ähnliche Weise war das Risiko einer Minderung von Wohlergehen desto höher, je schädlicher die Klimafolgen waren. Die Handlungsfähigkeit der Betroffenen und ihre Möglichkeiten, Verluste auszugleichen, waren oft stark begrenzt. Wenngleich die beobachteten Auswirkungen auf das Wohlergehen vielschichtig waren, beeinflussten sich die meisten untersuchten Elemente der menschlichen Bedürfniserfüllung erheblich gegenseitig. Gemeinsam bestimmten diese Elemente der objektiven Bedürfniserfüllung häufig auch die Richtung der Veränderung im subjektiven Wohlbefinden der Betroffenen. Diese Ergebnisse deuten darauf hin, dass die Auswirkungen von Klima(im-)mobilitäten auf das Wohlergehen stark von den strukturellen Bedingungen und der Schwere der Klimafolgen abhängen, so dass viele mittellose Landwirt:innen nur begrenzte Handlungsmöglichkeiten und einen geringen Einfluss auf die Ergebnisse haben. Die identifizierten Vulnerabilitäten stellen somit die weitverbreitete Darstellung von „Migration als Klimaanpassung" in Frage und betonen stattdessen die Notwendigkeit, Menschenrechte und Menschliche Sicherheit von Betroffenen zu schützen sowie klimabedingte Verluste und Schäden auszugleichen. Zu diesem Zweck schlägt die Studie Maßnahmen vor, die dazu beitragen könnten, Klimarisiken zu reduzieren, vor Ort bleibende Menschen zu schützen, Migration in Würde zu ermöglichen und das Wohlergehen von Migrant:innen zu sichern. Ohne erhebliche Investitionen in solche Bemühungen könnten Klimafolgen das Wohlergehen zahlreicher Subsistenzlandwirt:innen weltweit stark beeinträchtigen – unabhängig davon, ob sie vor Ort bleiben oder migrieren. Die Arbeit erörtert abschließend methodische und konzeptionelle Einsichten sowie zukünftige Forschungsbedürfnisse.

Schlüsselwörter: Klimawandel · Migration · Flucht · Geplante Umsiedlung · Immobilität · Wohlbefinden · Peru

El empeoramiento de los impactos climáticos está obligando a l@s agricultores de subsistencia de todo el mundo a decidir si permanecer en el lugar o migrar. Se presume que ambas opciones, la movilidad y la inmovilidad, afectan múltiples dimensiones del bienestar humano. Sin embargo, el conocimiento sobre los impactos de las (in)movilidades climáticas en el bienestar y sus mecanismos de acción subyacentes sigue siendo limitado. Los estudios de impacto son escasos y, a menudo, solo se enfocan en efectos de riqueza seleccionados mientras pasan por alto de cómo l@s migrantes climátic@s o los que se quedan autoevalúan su estado más amplio. Para abordar esta brecha, este trabajo analiza cómo y por qué las (in)movilidades climáticas afectan *tanto* a las necesidades objetivas de las personas (incluidos los medios de vida, la educación, la salud, la vivienda, los servicios básicos, la exposición a los peligros, la seguridad y las relaciones social) *como* a su bienestar subjetivo (equilibrio emocional, satisfacción cognitiva y perspectivas del futuro). El estudio compara los impactos de las diversas (in)movilidades climáticas en el bienestar multidimensional a través de tres estudios de caso distribuidos en las principales zonas topográficas de Perú: (1) la migración rural-urbana y la inmovilidad relacionadas con la escasez de agua en la sierra, (2) el atrapamiento y la relocalización planificada impulsados por las inundaciones en la selva tropical, y (3) el desplazamiento interno después del evento de El Niño Costero de 2017. Los casos fueron analizados aplicando un enfoque de métodos mixtos, en base a los datos de las entrevistas de 93 personas afectadas y más de 60 expert@s. En el caso de El Niño Costero, también se evaluaron los datos de encuestas existentes que cubren todo el país, con cerca de 190,000 encuestados. A partir de estos análisis, el estudio identifica los efectos de las (in)movilidades climáticas en múltiples dimensiones del bienestar y los mecanismos de acción con el objetivo de informar la investigación, las políticas y la planificación en esta área de estudio. Los resultados destacan que los impactos en el bienestar fueron, en general, más netos negativos que netos positivos, independientemente de si l@s agricultores migraron o no. La principal limitación para lograr el bienestar fueron las restricciones estructurales, como las brechas de desarrollo, la gobernanza débil, la marginación y los problemas relacionados a los terrenos. En la mayoría de los casos, las restricciones estructurales existentes se reprodujeron o exacerbaron. De manera similar, cuanto más dañinos fueron los impactos climáticos, mayor fue el riesgo de una consiguiente disminución del bienestar. La agencia de las personas afectadas y su capacidad para mitigar pérdidas a menudo fueron muy limitadas. Si bien los impactos observados en el

bienestar fueron multifacéticos, la mayoría de los elementos de la satisfacción de las necesidades de las personas tendieron a afectarse entre sí significativamente. A menudo, estos elementos asimismo determinaron de manera conjunta la dirección del cambio en su bienestar subjetivo. Estos resultados sugieren que los impactos de las (in)movilidades climáticas en el bienestar dependen en gran medida de las condiciones estructurales y la gravedad de los impactos climáticos; como tal, much@s agricultores pobres se quedan con una agencia limitada y solo una influencia marginal sobre los resultados. Por lo tanto, las vulnerabilidades identificadas cuestionan los marcos predominantes de "migración como adaptación" y más bien enfatizan la necesidad de proteger los derechos humanos y la seguridad humana de las personas afectadas mientras se reparan pérdidas y daños. Con este fin, el estudio propone medidas que podrían ayudar a reducir los riesgos climáticos, proteger a las personas que se quedan, facilitar el movimiento con dignidad y salvaguardar el bienestar de l@s migrantes. Sin inversiones sustanciales en tales esfuerzos, los impactos climáticos podrían reducir drásticamente el bienestar de numeros@s agricultores de subsistencia a nivel mundial, independientemente de si migran o no. El estudio también discuta las implicaciones metodológicas y conceptuales, así como las necesidades futuras de investigación.

Palabras clave: Cambio climático · Migración · Desplazamiento · Relocalización · Inmovilidad · Bienestar · Perú

Contents

Abbreviations and Acronyms

Codes for Study Sites and Respondents

(H-#)   Huancayo
(L-#)   Lima
(LP-#)   Lower Piura
(UP-#)   Upper Piura
(V1-#)   Village 1, in the Lima Region in the Peruvian highlands
(V2-#)   Village 2, in the Lima Region in the Peruvian highlands
(V3-#)   Village 3, in the San Martín Region in the Peruvian rainforest
(V4-#)   Village 4, in the San Martín Region in the Peruvian rainforest

Other Abbreviations and Acronyms

ABM   agent-based model
ADB   Asian Development Bank
AIC   Akaike information criterion
ANA   National Water Authority (Peru)
         (Spanish: Autoridad Nacional del Agua)
ARA   Regional Environmental Authority (San Martín)
         (Spanish: Autoridad Regional Ambiental San Martín)
CEN   Coastal El Niño
         (Spanish: El Niño Costero)

CENEPRED	National Center for Disaster Risk Estimation, Prevention and Reduction (Peru) *(Spanish: Centro Nacional de Estimación, Prevención y Reducción del Riesgo de Desastres)*
CEPES	Peruvian Center for Social Studies *(Spanish: Centro Peruano de Estudios Sociales)*
CEPLAN	National Center for Strategic Planning (Peru) *(Spanish: Centro Nacional de Planeamiento Estratégico)*
CIMA	Training Group in Environmental Sciences (University of Piura) *(Spanish: Grupo de Formación en Ciencias del Medio Ambiente)*
COVID-19	Coronavirus Disease 2019
CP	Central Pacific (El Niño)
DRR/DRM	disaster risk reduction and management
EGRIS	Expert Group on Refugee and IDP Statistics
ENAHO	National Household Survey (Peru) *(Spanish: Encuesta Nacional de Hogares)*
ENSO	El Niño–Southern Oscillation
EP	Eastern Pacific (El Niño)
EPICC	East Africa Peru India Climate Capacities Project
FAO	Food and Agriculture Organization of the United Nations
GCA	Global Center on Adaptation
GCM	general circulation model
GDP	gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery
GLOF	glacial lake outburst flood
IASC	Inter-Agency Standing Committee
IDB	Inter-American Development Bank
IDMC	Internal Displacement Monitoring Centre
IDP(s)	internally displaced person(s)
IKI	International Climate Initiative *(German: Internationale Klimaschutzinitiative)*
INAIGEM	National Institute for Research on Glaciers and Mountain Ecosystems (Peru) *(Spanish: Instituto Nacional de Investigación en Glaciares y Ecosistemas de Montaña)*
INDECI	National Civil Defense Institute (Peru) *(Spanish: Instituto Nacional de Defensa Civil)*

INEI	National Institute of Statistics and Informatics (Peru)
	(Spanish: Instituto Nacional de Estadística e Informática)
INRENA	National Institute of Natural Resources (Peru)
	(Spanish: Instituto Nacional de Recursos Nacionales)
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
IRIS	International Recommendations on IDP Statistics
ISIMIP	Inter-Sectoral Impact Model Intercomparison Project
JIPS	Joint IDP Profiling Service
KNOMAD	Global Knowledge Partnership on Migration and Development
L&D	Loss and Damage
m.a.s.l.	meters above sea level
MHPSS	Mental Health & Psychosocial Support
MIDIS	Ministry of Development and Social Inclusion (Peru)
	(Spanish: Ministerio de Desarrollo e Inclusión Social)
MIMDES	Ministry of Development and Social Inclusion (Peru)
	(Spanish: Ministerio de la Mujer y Desarrollo Social)
MIMP	Ministry of Women and Vulnerable Populations (Peru)
	(Spanish: Ministerio de la Mujer y Poblaciones Vulnerables)
MINAGRI	Ministry of Agriculture and Irrigation (Peru)
	(Spanish: Ministerio de Agricultura y Riego)
MINAM	Ministry of Environment (Peru)
	(Spanish: Ministerio del Ambiente)
MINJUSDH	Ministry of Justice and Human Rights (Peru)
	(Spanish: Ministerio de Justicia y Derechos Humanos)
MMC	Mayors Migration Council
MML	Municipality of Lima
	(Spanish: Municipalidad Metropolitana de Lima)
NAP	National Adaptation Plan
NASA	National Aeronautics and Space Administration (USA)
NDCs	Nationally Determined Contributions (Paris Climate Agreement)
NELM	New Economics of Labor Migration
NGO	Non-Governmental Organization
OCHA	UN Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
OWB	objective well-being
PAHO	Pan-American Health Organization
PCA	principal component analysis

PCM	Presidency of the Council of Ministers (Peru)
	(Spanish: Presidencia del Consejo de Ministros)
PIK	Potsdam-Institut für Klimafolgenforschung
	(English: Postdam Institute for Climate Impact Research)
PISCO	Peruvian Interpolated data of the SENAMHI's Climatological and hydrological Observations
PWB	psychological well-being
QTA	Qualitative Text Analysis
QUAL	qualitative
quant	quantitative
RCC	Authority for Reconstruction with Changes (Peru)
	(Spanish: Autoridad para la Reconstrucción con Cambios)
RCP	representative concentration pathway
SD	standard deviation
SDGs	Sustainable Development Goals
SENAMHI	National Meteorological and Hydrological Service (Peru)
	(Spanish: Servicio Nacional de Meteorología e Hidrología del Perú)
SERNANP	National Service of Natural Areas Protected by the State (Peru)
	(Spanish: Servicio Nacional de Áreas Naturales Protegidas por el Estado)
SINAGERD	National System for Disaster Risk Management (Peru)
	(Spanish: Sistema Nacional de Gestión del Riesgo de Desastres)
SISFOH	Household Targeting System (Peru)
	(Spanish: Sistema de Focalización de Hogares)
SLR	sea-level rise
SSP	shared socioeconomic pathway
SST	sea surface temperature
SWB	subjective well-being
UGEL	Local Educational Management Unit (Peru)
	(Spanish: Unidad de Gestión Educativa Local)
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
	(formerly known as the United Nations International Strategy for Disaster Reduction (UNISDR))
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change

UNGA	United Nations General Assembly
UNHCR	United Nations High Commissioner for Refugees
UNISDR	see UNDRR
USAID	United States Agency for International Development
WBGU	German Advisory Council on Global Change (Germany) *(German: Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen)*
WFP	World Food Programme
WHO	World Health Organization
WIM	Warsaw International Mechanism
WMO	World Meteorological Organization

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Part I
Setting the Stage

Introduction

Worldwide, climate hazards increasingly pose existential threats to subsistence farmers (Cohn et al. 2017; Niles & Salerno 2018). Worsening hazards include both *abrupt* events, such as floods, and *gradual* processes, such as glacier retreat (Pörtner et al. 2022). Many subsistence farmers struggle to manage such hazards where they live because they are multidimensionally poor (Donatti et al. 2019; Sietz et al. 2012). As a result, climate impacts are increasingly influencing their migration decisions (Cissé et al. 2022; FAO et al. 2018). For example, when water gradually becomes scarcer and threatens harvests, smallholders may send a household member to the city to find work (Wrathall et al. 2018). As another example, abrupt floods that destroy farmers' fragile shelters may lead to displacement (Ginnetti et al. 2019), sometimes of entire communities that require state-supported planned relocation (Bower & Weerasinghe 2021). Such climate migration has become a reality in numerous areas worldwide and is projected to increase further as climate impacts intensify (Clement et al. 2021; Rigaud et al. 2018). Simultaneously, many affected people are either unable to leave risk areas or do not wish to do so (immobility) (Benveniste et al. 2022; Choquette-Levy et al. 2021).

Both migrating from and remaining in areas facing climate hazards can have sweeping and enduring impacts on the well-being of affected people. While a new home can provide benefits such as safety from climate hazards, better access to education, and new sources of income, migrants often also face severe risks (Adger et al. 2014; Cissé et al. 2022). Such risks include precarious work, unsafe housing, discrimination, loss of social ties and traditions, increased hazard exposure, dissatisfaction with life, emotional stress, and loss of hope for the future (e.g. Melde et al. 2017). Similarly, some people who remain in risk zones may have the capacity to adapt locally to climate impacts and thus preserve their well-being within their home communities, whereas others with limited resources may

become trapped and experience recurrent loss and damage that threatens their well-being (Ayeb-Karlsson et al. 2018; Mallick & Schanze 2020). Nevertheless, the implications of climate migration and immobility (or climate (im)mobilities) for people's well-being remain poorly understood. Few studies provide comprehensive analyses of how moving or staying influences multiple facets of objective need fulfillment. Even less research examines how affected people self-evaluate their lives, how they feel, and how they look to the future in these situations.

In this interdisciplinary, mixed methods dissertation, I aim to address these gaps by dissecting multidimensional well-being impacts related to varied climate (im)mobilities within Peru. The study examines all four types of climate (im)mobilities identified by the United Nations Framework Convention on Climate Change (UNFCCC 2010) and the Intergovernmental Panel on Climate Change (IPCC 2022a), namely migration, displacement, relocation, and immobility. Peru provides a fitting case to examine such dynamics. The tropical country can be considered a microcosm of the global challenges caused by climate change because it is home to examples of most of the Earth's climate zones, vastly varying landscapes, and megadiverse ecosystems (MINAM 2015). Moreover, Peru's large rural population remains poor and reliant on livelihoods that are susceptible to climate impacts (USAID 2017; World Bank 2021c). Many farmers live in areas that are highly exposed to hazards, which climate change is intensifying (SINAGERD et al. 2014). As a result, abrupt and gradual water-related hazards, such as floods and glacier retreat, have increasingly influenced farmers' migration decisions. In addition, Peru's deeply rooted systems of internal migration suggest that moving will remain an important response strategy in a future affected by climate change (see review in Bergmann et al. 2021a). Simultaneously, large numbers of people remain in areas affected by hazards, at least at the onset of hazards (Adams 2016; Koubi et al. 2016; SINAGERD et al. 2014).

To investigate the well-being impacts of climate migration and immobility within Peru, I applied a mixed methods design. Detailed interview data from 81 affected people across Peru's three large natural zones—its coastal desert, highlands, and rainforests—and one focus group with 12 participants shed light on the complexity of these effects and their underlying mechanisms of action. To gather contextual information, I also held discussions with more than 60 experts. In addition, I examined the well-being impacts of displacement in the coastal case study from a complementary angle by using survey data from close to 190,000 respondents.

By assessing multidimensional well-being effects and their mechanisms of action, the dissertation pursues two main goals. First, it aims to inform debates about the potential of migration as an adaptation strategy and about loss and

damage due to climate change. Second, it strives to provide evidence that can support development and adaptation planning to safeguard the well-being of the growing number of climate migrants and people in immobility.

1.1   Context and Scope of the Research

Climate change is rapidly altering the planet Earth (Hallegatte et al. 2016; Pörtner et al. 2022). Greenhousse gas emissions, mainly from the use of fossil fuels and land-use changes, have already caused global warming of approximately 1.1 °C above pre-industrial levels and continue to raise global temperatures by nearly 0.2 °C per decade (IPCC 2018b, 2021). This warming and other emissions-driven changes in the climate system are multiplying climate-change-related hazards worldwide. Observed variability and average trends, such as rainfall per year, have begun to shift. Simultaneously, weather extremes, such as heavy rainfall events and heat waves, are intensifying and becoming more frequent. These changes have already started to have concerning effects. Examples abound: glaciers and ice sheets have retreated globally, the oceans have warmed and acidified, and sea levels have risen by 0.2 m since the early 20th century; extreme events, such as droughts and ten-year heatwaves, likely occur two to three times more often now than they did in the base period of 1850–1900 (IPCC 2021); land degradation and desertification have intensified (IPCC 2019b); and extensive coral reef losses have been observed in various oceans (IPCC 2019a).

In the approaching decades, all elements of life on Earth will be confronted with increasing climate risks (IPCC 2021). Examples of risks for physical systems include additional coastal erosion and further changes in the cryosphere. Risks for biological systems comprise further losses of coral reefs and mass species extinction, while crop losses and human ill-health are examples of risks for human systems (Díaz et al. 2019; IPCC 2014). These climate risks often interact with non-climatic stressors such as pollution, soil degradation, and overexploitation of resources. As the term "risk" implies, the potential future magnitude of these effects is concerning but not entirely predetermined. While the emissions accumulated since the Industrial Revolution have made several impacts unavoidable (Huntingford et al. 2020; Zhou et al. 2021), the magnitude of future climate risks depends partially on the socioeconomic and emissions pathways that are pursued in the upcoming decades (IPCC 2021). On the one hand, societal factors such as demographic change, development, and governance influence the extent of human and natural systems' exposure and vulnerability to hazards. For example, societal factors will determine the future growth of settlements in threatened areas and the

changes in people's resources and abilities to deal with hazards. Simultaneously, the ways in which societies live, produce, and consume will drive greenhouse gas emissions. Despite the committed warming due to accumulated past emissions, a profound and rapid mitigation of emissions could still lower risks substantially (IPCC 2021, 2022b; Masson-Delmotte et al. 2018). Transformative mitigation action might reduce future warming to a more manageable magnitude of well below 2 °C—or ideally below 1.5 °C—by 2100, a goal to which 192 parties committed in the Paris Agreement (UNFCCC 2015). Far from guaranteeing a safe future, warming of this extent would still entail moderate to high risks, for example due to more frequent and severe hot temperature extremes, extreme precipitation events, and droughts in drying regions (IPCC 2014, 2021). However, current real-world action suggests a path that is likely to result in global mean temperatures 2.7 °C above those of pre-industrial times by 2100 (Climate Action Tracker 2021; WMO 2021), and the window for action is closing rapidly. If warming of this extent or even greater were to occur, related impacts such as extreme heat stress would become nearly impossible to manage in several world regions (Andrews et al. 2018; Mora et al. 2017a). Additionally, greater warming would increase the risk of exceeding various tipping points in the Earth system, such as the collapse of large ice sheets or the dieback of tropical rainforests, which would lead to abrupt, severe, and partially irreversible feedback effects worldwide (Lenton et al. 2008; Lenton et al. 2019).

Although projections of the extent of climate risks for human development vary, the risks are severe in all scenarios (Pörtner et al. 2022). Climate change is the largest threat to the goals of human development, namely, to expand human well-being and people's freedom to live their lives as they choose (Alkire 2016; Gough 2015; Sen 1999). Climate impacts compromise human security, peace, and states' ability to govern (Adger et al. 2014). They also undermine the livelihoods of people who already suffer from multidimensional poverty and inequality, exacerbate non-climatic stressors, and can create poverty traps (Birkmann et al. 2022; Cohn et al. 2017). Most at risk are people with preexisting susceptibilities, such as those with high dependency on ecosystem services, livelihoods that are not easily diversified, and poor shelter. Equally at risk are persons who face intersecting discrimination related to factors such as age, ethnicity or "race",[1] gender, and physical ability. Impacts can also create new vulnerabilities, push more people into poverty, and increase inequality (Birkmann et al. 2022). As one example,

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[1] I opt for the term *ethnicity or "race"* instead of *race*, which is a social construct common in the United States. However, there is only *one* human race, and using this term is "problematic at best and harmful at worst"; it "should be used with caution for its history is one of misuse and injustice", see ASHG (2018); Bhopal (2004: 442); Yudell et al. (2016: 564).

without major development efforts, climate impacts could drive around 100 million additional people into extreme poverty by 2030 (Hallegatte et al. 2016). As another case in point, climate change and infectious diseases are linked in multiple ways, which can increase the risk of pandemics such as that of COVID-19 (Caminade et al. 2019; Wu et al. 2016).

Globally, people are struggling to confront these worsening climate impacts. While some attempt to deal with the impacts where they live, others migrate to prepare for future hazards or to cope with damage already experienced (Castells-Quintana et al. 2018). Examples of local coping or adaptation strategies include changes in crop, farming, land, and water management, as well as financial practices (Challinor et al. 2014; Owen 2020). At once, climate hazards, together with other factors such as a shortage of jobs or educational opportunities, are increasingly shaping people's decisions about whether to leave affected areas. Although migration is multicausal, and climate impacts intersect with economic, political, social, and demographic drivers, meta-analyses corroborate that climate signals are relevant in migration decisions (Beine & Jeusette 2021; Hoffmann et al. 2020; Hoffmann et al. 2021). Climate-induced harm influences whether people aspire to move, the resources they have available to implement this choice, and the larger societal structures such as government policies that facilitate or hinder their decisions. With worsening hazards, the future scale of climate migration could be substantial. Conservative estimates of recent models indicate that in a scenario with high emissions and unequal development, close to 3% of the total population in six developing regions[2] may become internal climate migrants by 2050 (Clement et al. 2021; Rigaud et al. 2018). Simultaneously, meta-analyses demonstrate that such increasing climate impacts can reduce resources and decrease migration for other groups (Hoffmann et al. 2020; Šedová et al. 2021). Given these possibly large numbers of affected people, it is imperative for policy and planning to understand the impacts of climate migration or immobility on affected people's lives and well-being.

Although investigations of the impacts of climate-induced (im)mobilities are few, general migration studies underscore that moving can have large effects on multiple dimensions of life (Lagakos 2020; Lucas 2021a; Selod & Shilpi 2021), as the following examples illustrate for a number of key dimensions. Many internal migrants profit from moving in terms of the human development indicators of income, education, and health (UNDP 2020). However, these indicators are not improved for all migrants, and benefits can be accompanied by challenges

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[2] East Asia & the Pacific; Eastern Europe & Central Asia; Latin America; North Africa; South Asia; Sub-Saharan Africa.

in terms of exclusion, discrimination, insecurity, and a lack of access to basic services or decent work (Melde et al. 2017; UNESCO 2020). Depending on the context, settling in a new place can result in mental illness or improved mental health (Foo et al. 2018; Mak et al. 2021; Stillman et al. 2015). Additionally, distance from close contacts and social support systems can cause psychological distress after migration (Hynie 2018; Selod & Shilpi 2021; World Bank 2017b). The review of evidence in the latest IPCC report emphasizes that displacement and involuntary migration in particular have "generated and perpetuated vulnerability" (2022a: 12). On the other side of the equation, people who remain in their areas of origin may profit from remittances such as technology or money (Mohapatra et al. 2012; Obi et al. 2020), but these benefits can be distributed unevenly and thus increase inequality (Azizi 2021; Le Dé et al. 2013). In some cases, emigration can strain social relations, erode traditions, and deprive sending communities of a labor force, thereby contributing to food insecurity (Lucas 2021c; Obi et al. 2020; Sherman et al. 2015). While less evidence is available regarding the well-being impacts of immobility, persons involuntarily trapped in adverse situations may suffer from impoverishment, food insecurity, health issues, and hostility and violence (Brubaker et al. 2011; Herren 1991; Mallick & Schanze 2020; Schwerdtle et al. 2017; Sow et al. 2016). Altogether, these examples illustrate that (im)mobilities can affect most dimensions of people's lives deeply and enduringly. Nonetheless, a major research gap remains regarding the impacts of climate migration and immobility (Clement et al. 2021; Hoffmann et al. under review).

Since climate (im)mobilities influence such a wide range of factors, it is important to choose an adequate lens through which to frame and assess their impacts. The decision of what to include and exclude when measuring impacts is not trivial and has tangible implications because only what is defined can be measured and assessed and thus inform policy and planning. To begin with, the idea of immobility has gained traction since the publication of the seminal Foresight (2011) research report and has generated at least three narratives (Ayeb-Karlsson et al. 2018). Despite their differences, these three narratives all imply that studies should focus on measuring the economic, social, and political risks related to immobility. The dominant narrative warns of extreme impoverishment risks related to forced immobility (Adger et al. 2015; Black et al. 2011a; Black et al. 2013). A second discourse expands this narrative by highlighting the dangers arising from entrapment that extend beyond economic damage, such as discrimination, racism, and violence (Black & Collyer 2014; Geddes et al. 2012; Geddes 2015; Sow et al. 2016). Finally, a few authors have raised the criticism that actors who promote migration as a solution to "entrapment" are concealing an

agenda of racial management, exploitation, and the maximization of capital circulation through mobility (Baldwin 2016; Felli & Castree 2012). By contrast, other authors have recently highlighted that certain groups *decide* to remain immobile (Farbotko et al. 2020; Farbotko & McMichael 2019; Mallick et al. 2020; Mallick & Schanze 2020). Consequently, these scholars focus more on assessing people's agency, resistance, adaptation and livelihood options, social equality, and human rights.

Next, studies on climate migration also apply various frames and metrics.[3] Initially, scholars tended to frame the implications of such migration through a prism of human rights protection or security ("environmental refugees") (Piguet 2013), often using the topic as a "shorthand for climate security concerns in general" (Baldwin et al. 2014: 125). For assessing the impacts of migration, this viewpoint implies a focus on possible violations of the human rights of affected people or on conflict in destinations. Partially in response to the security lens, other scholars re-framed the issue from a *human* security perspective (Dalby 2002, 2012; Methmann & Oels 2015). In this view, affected people's vulnerabilities are the central criterion for assessing impacts. Moreover, since the 2000 s, there has been a major shift in the research, which has gone from highlighting the forced nature of climate migration to emphasizing it as a possible adaptation to climate change (Black et al. 2011a; McLeman 2016a; McLeman & Smit 2006; Webber & Barnett 2010). Climate adaptation refers to attenuating or circumventing the harm caused by climate impacts, for example by protecting exposed assets, reducing and diversifying risk, or changing location (Adger et al. 2014; Adger et al. 2018). The new migration-as-adaptation framing is based on the New Economics of Labor Migration (NELM) theory, which sees migration as a group risk management strategy that seeks to diversify income sources (Stark 1978; Stark & Bloom 1985; Stark & Taylor 1989). Additionally, the framing is informed by empirical migration studies, in particular those conducted in drought areas (Gray & Mueller 2012; Henry et al. 2003; McLeman & Hunter 2010; McLeman & Smit 2006). This re-framing of migration as a possible means of adaptation has become a central perspective in the literature. It has been adopted by major actors such as the IPCC (Adger et al. 2014) and is embodied in policy processes such as the Cancún Adaptation Framework (UNFCCC 2010), the Global Compact for Migration (UNGA 2018), and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Guadagno 2016; UNISDR 2015).

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[3] Parts of this and the next paragraph draw on Bergmann (2019).

This new framing of migration as adaptation has proved a powerful antidote to prior discourses that securitized or victimized migrants, yet its adequacy continues to be debated. While this shift in framing has directed crucial research and policy attention to the potential positives of migration, various scholars cast doubt on the extent of the agency of migrants who must confront severe hazards, and criticize the lack of attention paid to structural inequalities that shape people's attempts to move for adaptation (Sakdapolrak et al. 2016; Schade et al. 2016; Vinke et al. 2020). Others criticize the migration-as-adaptation lens as a neoliberal shift of responsibility for climate adaptation from emitting states and home governments to individuals, which conceals climate injustice dimensions, the moral need and urgency of protection, as well as the losses preceding and following migration (Bettini et al. 2017; Bettini & Gioli 2016; Gemenne 2015). Similarly, I argue in this dissertation that although understanding the adaptive potential of climate migration is key, this perspective has blind spots and risks ignoring the full extent of migration's meaning for people's lives. A large empirical study has demonstrated that although migration may hold some adaptation potential for certain households, it can also erode the adaptive capacities of households with preexisting vulnerabilities (Warner & Afifi 2014). The IPCC also acknowledges that climate change will "have significant impacts on forms of migration that compromise human security" (Adger et al. 2014: 758) as it may "perpetuate or amplify [poorer] migrants' socio-economic precarity" (Cissé et al. 2022: 56), for example if the migrants are exposed to new climate hazards at their destination. Displacement and planned relocation are forms of coping with negative to mixed results at best (Melde et al. 2017). Thus, while member states of the UNFCCC recognized migration as a possible form of adaptation in the Cancún *Adaptation* Framework and committed to improve related "understanding, coordination, and cooperation" (UNFCCC 2010: para. 14(f))—constituting a landmark catalyst for policy attention (Nash 2018; Warner 2012)—they also considered mobility under the Warsaw International Mechanism (WIM) for *Loss and Damage* with the aim to "avert, minimize and address displacement" (Task Force on Displacement 2018: 1). In contrast to adaptation, the Loss and Damage prism centers on negative climate impacts that overwhelm people's adaptive capacity and thus emphasizes the severe or irreversible harms that climate change can produce (James et al. 2014; Tschakert et al. 2019). For example, when adaptation limits are transgressed, losses of housing, livelihoods, cultural practices, and biodiversity can induce migration or harm those who remain. Accordingly, the Loss and Damage lens implies a focus on protection, compensation, and remedies for assessing the impacts of climate (im)mobilities. It emphasizes that "migration is not socially neutral or simple" even when it facilitates successful adaptation

to climate impacts (Adger et al. 2018: 40). On the contrary, migration can create far-reaching social costs and risks, including disruption of social cohesion, loss of life satisfaction, emotional stress, and despair regarding the future. The migration-as-adaptation lens, which is often focused on select economic measures of success based on NELM assumptions, tends to overlook such types of impacts. Moreover, adaptation aims only to preserve a status quo or return to zero by avoiding or attenuating climate impacts. In this sense, migrating would be desirable if it allowed people to reduce and adjust to harm. However, the goal, from a development perspective, should go beyond allowing migrants to balance out climate impacts so that they can return to a previous and possibly precarious state. Rather, concerned actors should ensure that migrants can flourish and be well. Martin Seligman, the founder of Positive Psychology, advanced a similar argument when discussing his discipline: "[It was not] enough for us to nullify disabling conditions and get to zero. We needed to ask, what are the enabling conditions that make human beings flourish? How do we get from zero to plus five?" (cited in Wallis 2005: para. 2). Assessing climate migration or immobility through an adaptation prism stops short at the essential point of the assessment: how these phenomena influence people's multidimensional well-being. The timeliness of this focus on well-being is highlighted by the fact that the latest IPCC report for the first time includes an entire chapter on well-being, which also discusses health, migration, and conflict (Cissé et al. 2022).

Examining the impacts of climate migration and immobility requires comprehensive and locally grounded measures of well-being. The few existing studies overemphasize indicators chosen by outside experts that are thought to represent the adaptive potential of migration (e.g. Melde et al. 2017). Migration can strongly influence such *objective* measures of *well-being* (OWB) that gauge means and conditions to meet human needs, such as income, health, and education (UNDP 2020). These measures are essential to appraise the conditions that presumably enable migrants and stayers to "be well". Although they provide important information, there are empirical and conceptual limitations to the use of such objective measures alone to infer the overall impacts of (im)mobilities and design adequate policy responses. First, well-being needs and goals depend on weightings given by people themselves, which vary across time and contexts (OECD 2013). Universalistic approaches that assume the same patterns of needs in all human beings disregard sociocultural differences across countries and regions. Well-being research must therefore be grounded in local contexts (Yamamoto et al. 2008; Yamamoto & Feijoo 2007). The decision about which needs are central to people and thus measured should be informed by research conducted with the respective populations. Second, conditions judged as decent

from the outside do not automatically translate into positive lives in people's own evaluations. Consequently, assessing changes in migrants' or stayers' objective conditions is necessary but not sufficient to gain a comprehensive understanding (Forgeard et al. 2011; Tay et al. 2015). As Campbell wrote, "ultimately, the quality of life must be in the eye of the beholder, and it is there that we seek to evaluate it" (1972: 422). Well-being relates not only to how needs are met but also to how people evaluate need fulfillment in the present (Costanza et al. 2007) and how they look to the future (Gulyas 2015). Migration can have significant effects on these measures of *subjective well-being* (SWB) (Haindorfer 2019b; Helliwell et al. 2018b). For example, migration may help people to reduce the harm they face from climate impacts, but it makes a great difference to their well-being how satisfied they remain with their lives after migrating, if they experience more negative or positive emotions, and if they look to the future with fear or hope. Since SWB measures directly assess people's lived experiences and the significance they attach to them, they provide a more complete picture of what migration or staying means for people. SWB is also a means to an end in itself because it contributes to health, longevity, social relationships, workplace success, and other domains (Carver et al. 2010; Diener et al. 2017a). SWB perspectives are thus relevant for policy and planning in many fields (Diener & Tay 2016; OECD 2013) and are a valuable lens for studying climate (im)mobilities. Because measures of OWB and SWB both have distinct advantages and limitations, a combined application of these measures offers a more detailed and "full picture of human flourishing" than either one alone (Costanza et al. 2007; Forgeard et al. 2011: 98; OECD 2013). To summarize, this dissertation aims to assess the multidimensional well-being impacts related to climate migration and immobility in Peru. To this end, I analyze how migrants and stayers can fulfil the human needs they prioritize and investigate how they evaluate their own lives, feel about the present, and see their futures.

1.2   Research Questions and Objectives

The main research question in this dissertation—*in what ways and why does migrating from, or staying in, areas harmed by climate hazards affect people's well-being?*—comprises several sub-questions and research objectives. First, I am interested in empirical effects: what well-being impacts do affected people experience? Given that well-being is a multidimensional concept (OECD 2013), how do various components of objective well-being, such as income, health, and

education, relate to one another? Do changes in objective and subjective indicators such as emotional balance contrast or complement each other? In addition, I investigate effects across localities: in what ways does migration affect not only the persons who leave but also those who remain in their communities of origin (Gemenne & Blocher 2017)? Finally, because well-being is not a state but a process (Copestake 2008b; Laczko & Appave 2013), another research interest is the evolution of effects: how do people's situations and their assessments thereof change over time?[4]

My second interest is in the underlying mechanisms of action. What determines, moderates, and mediates the well-being of migrants and stayers? Why do the well-being effects evolve? I aim to examine the social conditions under which migrating or staying have positive, neutral, or negative well-being impacts. How do structural constraints and opportunities, together with the conditions and resources required to migrate or stay, influence well-being impacts (Bartram 2015)? For example, which configurations of social structures affect an individual's likelihood of faring better or worse in different well-being dimensions after moving or staying? Why do people with similar starting conditions sometimes fare differently? Which factors at the individual, community, and societal levels influence these impacts?

This investigation of the well-being impacts related to climate (im)mobilities and their mechanisms of action stands to make several contributions to research, policy, planning, and public debate. First, the study can make an original contribution to the limited empirical research on what migrating from or remaining in areas facing climate hazards means for affected people. As worsening climate impacts will increase migration in many contexts but also constrain movement in others (Clement et al. 2021; Rigaud et al. 2018), it is key to examine how (im)mobilities affect the multilayered dimensions of people's well-being. However, studies that adopt a well-being lens are still rare, especially for hazard-driven instances of (im)mobilities. By using mixed methods—an approach that is still rare in this field (Boas et al. 2020)—this study also contributes to methodological development in this subject area. Second, the analysis may yield important information for policymakers and practitioners who are interested in safeguarding or improving affected people's well-being. The cases that are analyzed respond to calls in major international frameworks (UNFCCC 2010) to further the knowledge about migration, displacement, and relocation. The cases also include

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[4] A group of migration scholars emphasizes the need for life-course approaches that take into account effects across generations, see King et al. (2006). Such approaches could usefully extend this work in the future.

voluntary and involuntary immobility, which are two under-researched areas of concern (Cissé et al. 2022). Evidence regarding how such climate (im)mobilities contribute to multidimensional changes in people's objective and subjective conditions is vital to inform climate adaptation action, development strategies, and remedies or compensation for Loss and Damage. Therefore, I situate the results of this dissertation within the policy discussions about migration as adaptation (Gemenne & Blocher 2017) and about Loss and Damage (Thomas & Benjamin 2020). By identifying the well-being effects of climate (im)mobilities and explaining their fundamental mechanisms of action, this dissertation aims to help devise better policies and improve planning to meet people's complex needs at the national or subnational levels and to allocate scarce government resources more efficiently. Moreover, the findings could inform international adaptation efforts and help development donors devise programs that target people's needs more effectively. Third, the study strives to humanize the debates on climate migration. Climate migrants are often portrayed as passive victims, scapegoats, profiteers, or security threats, or they are framed in other ways that ignore the human dimension and complexity of climate migration (e.g. Bettini 2013; Durand-Delacre et al. 2021; Geddes et al. 2012; Hartmann 2010; Myers 1993). By demonstrating how migrating from or remaining in areas facing climate hazards shapes human wellbeing, I attempt to place the affected people and the stories of their attempts to confront climate hazards at the center of the discussion. The focus on multiple nuances of human well-being aims to provide a view of climate migrants and stayers as complex human beings with needs, emotions, fears, and hopes who are attempting to live a life that they have reason to value despite the challenges they face.

1.3   Structure of the Dissertation

To achieve these objectives, this dissertation is structured in three main parts.

(1) The first part "Setting the Stage" includes the introduction, the conceptual framework, the research approach, and a review of the existing evidence base.
(2) The second part "At Risk of Deprivation" details the empirical results and discussion of each case study, a comparative analysis of these case studies, and the induction of propositions regarding the research questions.

(3) Finally, the concluding part "Seeing Behind the Curtain" presents the implica-
      tions, recommendations, and research needs following from this dissertation.
      It closes by providing an outlook on possible future developments regarding
      the nexus between climate (im)mobilities and well-being.

In the first part, I set the stage for the research and subsequently explain the con-
ceptual framework of the dissertation. To understand the initiation and conditions
of migration, I draw on the Aspirations-Capabilities Framework (de Haas 2014,
2021). To analyze the impacts of migrating or staying, I build on a resource-
based model of migrant transitions (Ryan et al. 2008) and use a locally grounded
well-being concept drawing on theories of human needs (Gough 2015) and SWB
(Diener & Tay 2016). In the following chapter, I explain the implications of the
applied research philosophy of critical realism. Based on this discussion, I detail
the mixed methods research design with two concurrent streams of qualitative and
quantitative methods that I applied to answer the research questions. The quali-
tative strand is central and draws on primary data collected in interviews with 81
affected people and 12 focus group participants. I analyze this data using qual-
itative text analysis (Kuckartz 2014b; Kuckartz & Rädiker 2019). More than 60
discussions with experts add contextual information. In addition, for the displace-
ment case, I use regression analyses based on large-scale data from two Peruvian
surveys to examine differential displacement risk and well-being impacts (INEI
2017a, 2018a). To provide a baseline for the following empirical analysis, this
first part of the dissertation closes by reviewing the existing evidence on the nexus
between hazards, (im)mobilities, and well-being.

   In the second part of the dissertation, I discuss the empirical results of the
case studies carried out in Peru's three large topographical areas. First, I per-
form a qualitative analysis of the well-being impacts of internal migration from
areas with *gradual* climate hazards in Peru's highlands and immobility in home
villages. This migration occurred mostly from rural to urban areas and in the
context of progressive climate hazards emerging from glacier retreat and rain-
fall changes. The second case study adds qualitative results on a special case of
migration, in which people aspire to move but have low capabilities to pursue
migration. It analyzes the outcomes of two communities threatened by *abrupt*
riverine flooding that requested planned relocation to more secure sites within
Peru's rainforest. Only one of them succeeded in relocating after many years of
limbo; the second is still in involuntary immobility at the time of writing. In
the third results chapter, I analyze qualitative and quantitative data to understand
differential displacement risk and how people have fared following displacement
due to *abrupt* flooding during the 2017 Coastal El Niño. At the end of each of

the three case studies, I induce propositions on well-being dynamics in climate (im)mobilities by drawing on the observed well-being effects and mechanisms of action. This part of the dissertation ends with a comparative analysis of the findings of the three case studies, in which I use the full evidence base to induce overarching propositions on well-being impacts related to climate (im)mobilities.

To conclude, I highlight the broader implications of these findings, provide recommendations for how to enhance or preserve well-being in climate (im)mobilities, identify areas where additional research is required, and provide an outlook on possible future dynamics in Peru and beyond.

Conceptual Approach

<div style="text-align: right">**2**</div>

In this chapter, I discuss the main concepts and the theories guiding this research on the impacts of migration from, and immobility in, areas harmed by climate hazards. They include the applied approaches to climate impacts (2.1), related (im)mobilities (2.2), and their well-being effects (2.3).

2.1   Climate Change Hazards and Impacts

To decipher how climate change leads to local effects, the starting point are *hazards*, namely events or trends which can damage natural and human systems (IPCC 2018a: 551; UNGA 2016: 18; UNISDR 2015). Hazards can be individual, consecutive, or combined in their origins and effects. They can have varied intensities, magnitudes, and frequencies. I distinguish between two types of hazards: *gradual (or slow-onset)* hazards that evolve over a longer period, such as sea-level rise, and *abrupt (sudden-onset)* hazards that materialize fast, often due to distinct events, such as storms. I follow this coarse differentiation also made by the UNFCCC (2013) and others for two reasons, but recognize that they are Ideal types with limitations.[1] First, the speed of hazard onset often determines the type of responses taken by concerned actors. Second, it also shapes the strategies

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[1] For example, sudden-onset hazards can cause cumulative damage, which extends beyond the effects of the single hazards. As another example, flooding and wildfires are typically categorized as sudden-onset hazards, although riverine floods or wildfires in some cases develop over long periods. Finally, slow- and sudden-onset hazards are not separated in all cases but can also interact. For example, *gradually* rising sea levels can increase more *abrupt* storm surges.

available to affected people, including whether to migrate, flee, or stay. Typically, abrupt events create more unplanned and rapid migration that can be prolonged; they can also lead to pre-hazard anticipatory migration as well as post-hazard return or redistribution movement (Black et al. 2013; Fussell et al. 2014). By contrast, gradual hazards usually first lead to attempts to adapt locally but can involve increasingly permanent migration later (Koubi et al. 2016). I use *hazards* as the shorthand for *climate (change-related) hazards*, focusing on *hydrometeorological* or *climatological* hazards which are either likely attributable to climate change (Stott et al. 2016) or which provide a temporal analog for projected climate hazards (Ford et al. 2010).[2] Hence, I also examine events or trends that cannot (or cannot yet) be attributed to climate change, if they represent dynamics that will likely be aggravated by climate change, and thus provide useful insights for the present by analogy.[3] The primary focus is on *water-related hazards* that climate change will render more salient in Peru, such as rainfall changes or floods (Christensen et al. 2013; Giorgi et al. 2014) as well as glacier retreat (Vuille et al. 2018).

Hazards can create varied *impacts* depending on *exposure and vulnerability*. *Exposure* concerns location; it is the "inventory of elements in an area in which hazard events may occur" (Cardona et al. 2012: 69). People, their livelihoods,[4] infrastructure, ecosystem services and other elements can suffer damage when they are located where hazards hit. Exposure is necessary but not sufficient for impacts; an element exposed to harm can have traits that protect it from damage (Field et al. 2012). For example, farmers' may be exposed to drought, but they may have irrigation to offset possible damage. Therefore, *vulnerability* is the third key variable to consider (UNFCCC 1992: 2, 4, 9).

(Social)[5] vulnerability has emerged as a central but contested concept in climate studies (Füssel & Klein 2006). The literature abounds with conceptualizations (Otto et al. 2017), but many lack clear definitions. Two common features guide my approach (Smit & Wandel 2006). First is the idea of "susceptibility" (Eakin & Luers 2006: 366) or "sensitivity" (Möller et al. 2022: 47) to harm. Human systems suffer from a "varying degree of adverse effects" to the same

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[2] The hazard definition applied here excludes other technological, geological, biological, and extraterrestrial hazards.

[3] See section 3.2.1 for a more detailed discussion of this temporal analog approach.

[4] For a conceptualization, see the *Sustainable Livelihoods Framework* by Chambers & Conway (1992); Scoones (1998).

[5] Vulnerability is my shorthand for *social vulnerability*. *Social* emphasizes the interest in human systems in this study.

harm they are exposed to given their "differential social vulnerability" (Schellnhuber et al. 2016: 274). These differences emerge due to internal (person-specific) and external (socioeconomic and locational factors) lines of differentiation (Otto et al. 2017). Internal factors determining vulnerability include age, (dis)ability and health status, ethnicity or "race", gender, and religion. External factors include access to assets, cultural knowledge, education, social status, political power, and wealth; they can also comprise varied structural conditions, such as governance (Cardona et al. 2012; Oppenheimer et al. 2014). The second feature of vulnerability is the lack of capacity to cope with or adapt to hazards (e.g. Füssel 2012; Möller et al. 2022). While *coping capacity* refers to basic functioning and managing adversity in the short to medium term, *adaptive capacity* means the transformative ability to adjust to, address, and take advantage of changes over the long term (Möller et al. 2022: 4, 12). Coping and adaptive capacity combine to *resilience* (Möller et al. 2022: 37–38). For this study, it is sensible to include the lack of capacity to cope and adapt under the umbrella of vulnerabilities, although some scholars prefer to frame it as a separate component. Vulnerability is not fixed but can change during (im)mobilities. To summarize, human-made changes in the climate can create hazards with detrimental impacts, if elements of interest are located in the way of hazards, and if these are sensitive to related harm as well as deprived of strategies for managing the harm.

2.2 Initiation and Impacts of Migration or Immobility

2.2.1 Terminology and Definitions

Migration lacks an internationally agreed upon definition,[6] but most concepts revolve around the idea of "a person who moves away from his or her place of usual residence" (IOM 2019: 130). Table 2.1 summarizes three key dimensions applied in this study.

First, migration has a *spatial dimension*. I define that the change of place of usual residence (UNDESA 1998: 9) requires a geographical move to another settlement, at least transferring to another village.[7] I focus on *internal* migration *within countries*, unless otherwise noted. The data used here comes from two

[6] Part of this section draws on Bergmann (2019).

[7] Note that in some cases of community-wide planned relocation and acute forced migration, people establish a new settlement in close geographic proximity. This type of movement is still included under "migration".

Table 2.1 Defining dimensions of migration in this study

	Spatial **threshold**	*Temporal* **threshold**	*Motivational* **threshold**
Minimal requirements for <u>**primary**</u> **data**	Change of usual residence across human settlements	Significant presence of at least one month at destination	Need or intention to stay
Usual requirements for applied <u>**secondary**</u> **data**	Change of district	Recent migrant (<60 months) Lifetime migrant (>60 months)	–

Note: The applied definitions for secondary data originates from the Peruvian Census 2017 (INEI 2018a) and a special survey on the effects of Coastal El Niño-related hazards in 2017 (INEI 2017a), see section 3.2.2.

sources with slightly different spatial thresholds: when using primary data, I consider people as migrants if they change their community. The Peruvian surveys with providing my secondary data define migration as living in a district different than the previous usual residence or the place of birth (INEI 2016a; Sánchez Aguilar 2012a, 2012b). Districts are the finest administrative boundary in Peru, followed by Provinces and Regions. Second, migration requires crossing a *temporal threshold* of stay. For primary data, I define that at least one month of presence at destinations is needed, to include the many people in Peru who move for short periods, such as seasonal or temporal migrants, but exclude temporary travel or commuting (UNDESA 1998).[8] For secondary data, I use the surveys' criteria. Third, for the primary data, I define that migration also requires an *intention or a need* to live at the destination, which can imply varied shades of *voluntariness,* depending on migrants' aspirations (de Haas 2021) (see section 2.2). In summary, with climate migration I refer to a change of the usual residence from an area with climate hazards, for at least one month, with the intention or need to stay. (Climate) migration is the umbrella term for varied types of movements, involving different shades of voluntariness. It encompasses what policy language refers to as *migration*, *displacement*, and *planned relocation* (UNFCCC 2010).

I add three qualifications. First, migration is a continuous process and not a state. The process before migration is also part of the journey, and beyond the physical transition, changing homes also results in a process of internal, psychosocial, and economic migration with varied effects (Han 2005), which are the

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[8] The UN distinguishes between short-term migration (< one year) and long-term migration (> one year), see UNDESA (1998: 94, 123). Some key studies use a threshold of three months for internal migration, see e.g. Melde et al. (2017).

focus of this study. Second, not only individuals, but also groups, households, or entire communities can move. Occasionally, a community (or parts of it) relocates with some degree of planning permanently to another site or is forced or assisted to move by a third party (Brookings et al. 2015). Such planned relocation can occur in anticipation or after hazards and is also examined in this study. Third, even when affected by severe hazards, migration is not the predetermined or sole response. Many people are unable or unwilling to leave and stay in areas facing climate hazards, a still understudied fact (Foresight 2011; Zickgraf 2018). I refer to this opposite of migration as *immobility*, which can be *involuntary, acquiescent,* or *voluntary* (de Haas 2021) (see section 2.2).

Weaving these concepts together, I use *(climate) (im)mobilities* as the shorthand for migration from, or immobility in, areas facing climate hazards. Scholars lack consensus on terms for these phenomena (Dun & Gemenne 2008). Controversies persist around (a) the terms for moving or staying and (b) how the causal link to hazards is expressed. Early studies tended to use the term environmental or climate refugee (Bates 2002; El-Hinnawi 1985; Jacobson 1988; Myers 1993) but over time, environmental or climate migrant has become common (Hugo 1996; Renaud et al. 2007).[9] For this study, "refugee" is not fitting as it refers to people crossing borders, whereas I focus on internal migration. Next, I use *climate (im)mobilities* for people staying in or migrating from areas facing climate hazards instead of implying a strong causality through prefixes such as "climate change-*driven*" or "climate-*induced*" migration, because this study focuses on the impacts of climate (im)mobilities rather than on the exact drivers—which remains an important field of research (Borderon et al. 2019; Foresight 2011; Hoffmann et al. 2020). This approach is close to the working definition for climate migration by the International Organization of Migration (IOM) (2011: 33, 2019: 29) and to the logic adopted by the seminal Foresight report (2011: 34).

2.2.2 Starting Migration: Aspirations-Capabilities Framework

Migration theories address questions such as why people decide to move; when they turn intentions to move into migration; and how movement affects people and places. They come from anthropology (Brettell 2016), economy (Greenwood 2016), geography (Wright & Ellis 2016), sociology and political science

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[9] Still, some authors who had originally championed seemingly neutral terms (such as climate-induced migration) later argued that these failed to adequately express the often-forced nature of the phenomenon, see Gemenne (2015).

(White & Johnson 2016), and other fields. Various migration theories implicitly draw on one of the three main sociological paradigms—functionalist, conflict, and symbolic interactionist (Castles 2012; de Haas 2021)—as briefly synthesized in the following.

Migration theories based on the functionalist paradigm consider migration as a balancing and optimization strategy and migrants as rational, utility-maximizing black boxes. Main approaches include neoclassical theories, such as the push and pull model by Lee (1966), the Harris-Todaro model (1970), and gravity models (Beine et al. 2016). Social network theory (Gurak & Caces 1992; Massey & España 1987) and New Economics of Labor Migration (NELM) (Stark 1978; Stark & Bloom 1985; Stark & Taylor 1989) also have certain functionalist assumptions. However, it is questionable if migration is a free and rational optimizing behavior. Behavioral economics emphasize, for example, that rationality is bounded and information imperfect (World Bank 2015). Moreover, functionalist perspectives overlook people's agency and cannot explain why migration is channeled into social and spatial channels characterized by unequally distributed power, restrictions, opportunities, and benefits. The overemphasis on the representative migrant moving after cost-benefit calculus and for better opportunities ignores underlying variation and contributes to this omission. The functionalist assumption that systems are predisposed to equilibrium without interference does not account for the fact that migration can reproduce, exacerbate, or introduce new inequalities between groups (for example, income groups) and across space (for example, rural and urban zones). It also overlooks how states and structures, such as networks, can constraint movements (de Haas 2014, 2021).

By contrast, migration theories based on the conflict paradigm (or historical-structural theories) hold that structural inequalities restrain, regulate, and drive migration (Brettell & Hollifield 2014a; Massey et al. 1993). Migration, in turn, can reproduce inequalities, rather than leading to equilibria. Powerful actors such as states and businesses irregularize migrants, exploit their labor, and scapegoat them. According to de Haas (2021), examples include neo-Marxist conflict theory, dependency theory (Frank 1966), world systems theory (Wallerstein 1974), dual and segmented labor theory (Piore 1979), and critical globalization theory (Sassen 1991). However, these top-down approaches ignore migrants' agency. Migrants are not merely passive victims of adverse structures shifted around by an exploitative system. Although they do face great inequalities and restrictions, their rational (but bounded) aspirations do influence decisions to move, and many of them do improve their quality of life by moving, while challenging the control and restrictions imposed on them (de Haas 2021).

Finally, migration theories based on the symbolic interactionist paradigm stress migrants' individuality and interactions. Examples are theories on transnationalism (Portes et al. 1999; Schiller et al. 1992; Vertovec 1999), multicultural societies (Vertovec 2007), diaspora dynamics (Cohen 2008; Gilroy 1994), and creolization (Cohen & Toninato 2010; Palmié 2006). Many empirical studies on micro-level dynamics of migrants' livelihoods, identities, and experiences use this paradigm. However, some of these studies overlook the larger structural forces and systemic variables involved.

Although the many available migration theories are seen as complementary tools (Brettell & Hollifield 2014a; Massey et al. 1993), empirical studies tend to use little theory, specifically those on climate migration (Hunter et al. 2015; Piguet 2018). Most investigations, if they apply theory, do not use a framework suited for the complex interactions between structure and agency[10] in migration and other social processes (Bakewell 2010). By contrast, the Aspirations-Capabilities Framework by de Haas (2010b, 2014, 2021) provides a complex view of structure and agency and a lens applicable to many forms, instances, and areas of migration and immobility. De Haas emphasizes that migrants' agency is visible in their aspirations and capabilities to move. Such agency is real but limited by structural constraints and opportunities. The framework makes it possible to analyze how varied types of migration and immobility—with different agency and structural conditions—affect well-being, a key advantage as these conditions shape linked outcomes (Laczko & Appave 2013; UNDP 2009).[11]

2.2.2.1   Agency through Aspirations and Capabilities

People's individual or collective *agency* to act is restricted by structural constraints (see discussion on structure below), but it is real within that bounded circle. Regarding migration decisions, this agency is constituted by individual *aspirations* and *capabilities* (de Haas 2021). First, people have socially and culturally formed life goals and they perceive different chances to move or stay, which shape migration aspirations. Aspirations can be instrumental (means to an

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[10] *Structure* refers to regular "patterns of social relations, beliefs and behaviour", see de Haas (2021: 14). Ethnicity, power, and other factors or institutions delineate people's routines, perceived opportunities, and constraints. *Agency* refers to people's autonomy, or to the "limited but real ability of human beings (or social groups) to make independent choices" which, in turn, can shape their surrounding structures, see de Haas (2014: 21).

[11] The theoretical framework also dovetails with my critical realist perspective: it permits me to situate migration in processes of social change, but also to investigate migrants' agency, structure, interactions, and feedback mechanisms.

end) and intrinsic (value of migration in itself). Since people have different preferences and perceptions, not all react in the same fashion to the same stimuli. Using Hirschman's (1970) work, one can argue that people may either aspire to *stay* (*loyalty* to the local setup or attempting to enact local change by exercising *voice*) or they may *exit* (migration) if they expect better chances elsewhere. Second, individuals need *capabilities* to move,[12] such as access to different social, economic, and human capitals or resources. Table 2.2 reviews combinations of aspirations and capabilities and identifies degrees of voluntariness.

Table 2.2   Aspirations-Capabilities-derived (im)mobility types

		Migration capabilities *(social, economic, and human)*	
		Low →	*High*
Migration aspirations	*Low ↓*	Acquiescent **immobility**	Voluntary **immobility** *and* Forced **migration**
	High	Forced **immobility** (entrapment)	Voluntary **migration**

Note: Created by the author, building on and adapting work by de Haas (2021: 22).

Different agency can result in two migration types (de Haas 2021). First, people with high aspirations and high resources *migrate voluntarily* (for example, high-wage migration). Second, when resources are high but aspirations to move are low, *forced migration* results (for example, displacements). The flipside is immobility. *Voluntary immobility* means low aspirations to move despite high resources. *Acquiescent immobility* occurs when both resources and desires to migrate are low. If desires to move are high but low resources hinder movement, *forced immobility* results (*entrapment*). While I use the prefixes *voluntary* and *forced* (or *involuntary*), the reality is seldom as clear-cut and unambiguous as these stylized Ideal types; all cases of migration and immobility can have elements of voluntariness and force, and are located on a continuum (Hugo 1996).[13]

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[12] Other authors have referred to this as *motility* (see Kaufmann et al. (2004)), and still others view migration in itself as a *resource* (see Lockley et al. (2008); Ryan et al. (2008)).

[13] Defining thresholds between *voluntary* and *forced* cases implies a degree of artificial delineation. Even seemingly *voluntary* migration can be linked to financial or social necessities, and the character of migration can also change even during the journey, for example, when migrants become victims of trafficking, see de Haas (2021). For these reasons, I follow

Moreover, migration capabilities and aspirations interact. For example, more education can make people aspire lives elsewhere; the loss of resources can reduce aspirations; aspiring migrants may start acquiring skills necessary to realize their desires ("brain gain" (Kone & Özden 2017)); and those desiring to stay may withdraw resources from potential migration capabilities for local change. Finally, migration aspirations and capabilities do not only interact, they are also driven from below and above: agency depends on *individual factors* (such as age and health) as well as on *structural constraints and opportunities*, as explained next.

2.2.2.2 Structural Constraints and Opportunities

Structures at different levels strongly *constrain* or *enable* individual's actions. They include states, socialization, institutions, policies, networks, culture, power, customs, norms, and other factors or processes. Together, they channel migration and immobility patterns and conditions into specific paths. Based on Isaiah Berlin's work (1969), de Haas conceives these constraints and opportunities as manifested in migrants' *negative* and *positive liberties* (2014: 33). *Negative liberty* (freedom from) is determined by the absence of constraints to exercise agency to stay or move. *Positive liberty* (freedom to) refers to the presence of structural opportunities for people to move or stay. Structural constraints and opportunities co-exist; for example, visa policies hinder the movement of some while enabling others to move. Together, they lead to four Ideal types of migration that occurs in *free, improvement, distress,* or *survival* conditions. Although not discussed by de Haas (2021), I argue here that structural factors do not only affect migration but also immobilities, as summarized in Table 2.3.

Table 2.3 (Im)mobility forms resulting from structural constraints and opportunities

		Presence of opportunities (positive liberty)	
		Low →	*High*
Absence of constraints (negative liberty)	*High ↓*	**Improvement** migration or immobility	**Free** migration or immobility
	Low	**Survival** migration or immobility	**Distress** migration or immobility

Note: Created by the author, building on and adapting work by de Haas (2021: 27).

Hugo's (1996) argument that migration decisions are situated on a *continuum* of voluntariness.

First, people may underake *free migration* when highly enabling conditions are present and constraints absent, which is often true for high-wage migration. Neoclassical migration theories can shed more light on such migration, which is not observed in this dissertation and therefore not further discussed.

Second, *improvement migration* results if constraints are moderate, but opportunities are lower than for *free* migration. Because *improvement migration* occurs in this study, I briefly review the major applicable theories here. Network theories of migration hold that social networks can partially balance out the absence of structural opportunities typical for this form of movement. Networks are "sets of interpersonal ties" between migrants and stayers (Massey et al. 1993: 448), which reduce costs and risks for migration or increase expected returns, for example, by providing contacts for shelter or to potential employers. Thereby, networks make follow-on migration more likely. Beyond network theories, the New Economics of Labor Migration (NELM) theory indicates that households who lack enabling conditions may pool resources to send a family member to work elsewhere (Stark 1978; Stark & Bloom 1985; Stark & Taylor 1989). Migration is thus framed as a group strategy to diversify income sources and reduce risks for both migrant and non-migrant members, for example through remittances. Migration of a family member can provide self-insurance, such as against crop losses, or generates capital required for investments (Massey et al. 1993). It may not yield absolute gains in all cases, but it may buffer shocks and help improve deprivations relative to other groups.

Third, strong constraining and low enabling conditions can drive *survival migration*.[14] *Survival* migrants lack protection, are prone to exploitation, and face high mobility restrictions, while they have little opportunities to move safely, for example, due to restrictive policies (de Haas 2021). Examples include internally displaced people and irregular migrants. *Distress migrants* face similarly strong structural constraints, but slightly more enabling conditions. Because *survival* and *distress* migrationare frequent in this dissertation, I explore the limited applicable theoretical views here (Piguet 2018). Extant theories hold that even *survival* and *distress* migrants keep some choice and theorize initial flight along a continuum of acuteness (Johansson 1990; Kunz 1973, 1981; Richmond 1988, 1994, 2002). *Acute* (or *reactive*) *distress* or *survival* migrants flee fast from imminent threats, often with little resources and toward any nearby, safer site, while those escaping in *anticipation* (or *proactively*) may have more time, information, and resources for planning and selecting sites. In addition, FitzGerald and Arar (2018)

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[14] Instead of de Haas' (2021) term *precarious* migration*,* I use *survival* migration to emphasize the involved adversity.

demonstrate that flight often proceeds in stages. After initial flight to safe havens close to source, secondary and tertiary movements can follow on to other, more selected sites. The authors also argue that standard migration theories can shed light on *distress* and *survival* cases. For example, NELM provides several such transferable insights. It shows that when life is threatened, not all household members may flee given financial burdens and risky trajectories; that even those with enough resources may wait until thresholds of risk are crossed; and that groups often decide together on who is to flee, while characteristics such as age or gender shape the decisions.

2.2.2.3 Feedbacks and Bidirectional Links between Structure and Agency

Enabling and constraining conditions can work in different directions, rendering "complex, non-linear and sometimes counterintuitive" effects on people's agency (de Haas 2014: 27). First, *constraining conditions* can affect both migration aspirations and capabilities. For example, more hazards can raise migration aspirations, but they can also reduce needed resources or dishearten people. Second, *enabling conditions* mostly affect resources to move, but can also indirectly shape aspirations, by raising access to resources needed to realize them. For example, higher income can increase migration in the short run despite improving local conditions (Martin 2003). Indirectly, more enabling conditions can also raise the "capacity to aspire", including through migration (de Haas 2021: 26).

Simultaneously, migrants who exert agency can either reproduce, reinforce, or modify macro structures to a limited extent through cumulative (Massey 1990) or contextual feedback effects (de Haas 2010b). They may occur through migration networks, translocality, or remittances. For example, migration can shape structural ideas of gender roles and belonging to social classes. Such feedback effects remain understudied. Different variations of this feedback argument can be found in the broader theories of Bourdieu and Wacquant (2004), Coleman (2000), Giddens (1984), and others.

In summary, de Haas' (2021) framework provides a useful lens for studying various types of (im)mobilities. It enables me to investigate agency (desires and resources to migrate), while situating people's bounded agency in structural conditions that enable or constrain movement. Moreover, the framework permits me to investigate interactions between agency and structure as well as feedbacks, thus locating migration within broader social change. In Figure 2.1, I summarize the framework. While the framework is useful for analyzing the initiation and conditions of (im)mobilities, it does not illuminate their effects, which are the focus here and discussed next.
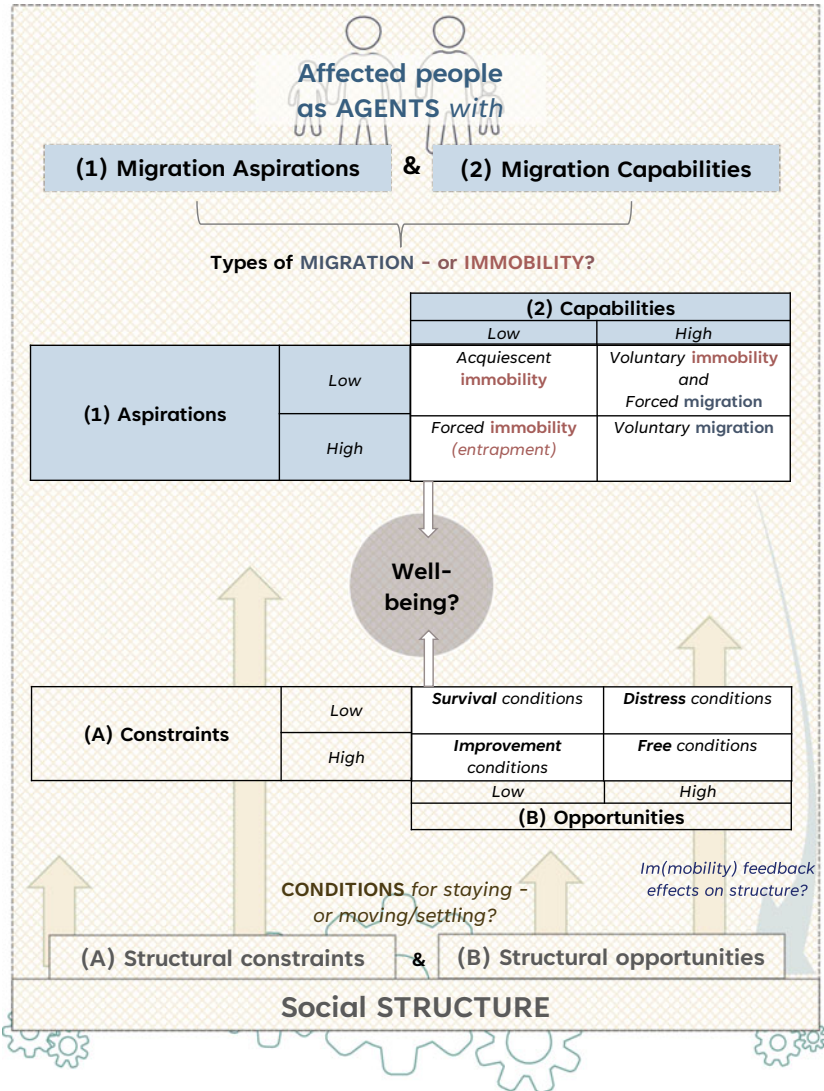
Figure 2.1 Aspirations-Capabilities Framework and structure-agent interactions. (Note: Created by the author, building on de Haas' (2021) framework and including the amendments explained above)

2.2.3   Processes and Mechanisms Shaping Outcomes of (Im)mobilities

Few studies on climate (im)mobilities use theories, especially those discerning the resultant effects (Hunter & Nawrotzki 2016; Piguet 2018). Migration can be considered as a passage in life (leaning on van Gennep 1960), with the separation from an existing situation, transition, incorporation, and adjustment to new conditions. Throughout, people must rebuild their lives and manage new economic, institutional, social, and cultural variables. In this section, I first present an overview of relevant theories and then identify key processes and mechanisms through which the impacts for migrants and stayers unfold by using the lens of Ryan and colleagues' Resource-Based Model (2008).

2.2.3.1   General and Sociological Migration Theories

Most general migration theories center on the initiation and perpetuation of movement (e.g. Brettell & Hollifield 2014b; Massey et al. 1993; Piguet 2018) but provide few insights into the impacts and how they evolve (Melzer & Muffels 2017).[15] Closest are anthropological theories, which center on migrants' lived and human experiences (Brettell 2014, 2016), and sociological views, discussed next.

Sociological theories explain individual factors in migration outcomes while treating migrants as "embedded mover[s]" in networks (Boyd 1989; White & Johnson 2016: 70). They are concerned with how migrants[16] adjust[17] to new

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[15] For example, neoclassical economic theories underscore the utility-maximizing rationales of migrants, yet do not detail relevant processes in destinations (King 2012). Rational choice economic theories assume that only those migrate who, after evaluating costs and gains, expect to profit (Sjaastad 1962). Yet, information is imperfect and conditions may change, resulting in miscalculations. The Harris-Todaro model assumes that migrants move to cities despite high urban unemployment and informal sector growth as long as they expect higher incomes (Harris & Todaro 1970). However, the model remains focused on economic changes and fails to provide details on other consequences. Next, historical-structural models frame migration as the search of means to subside in unequal and exploitative labor markets (King 2012); and while these models imply that migrants may face dire lives, they do not explicate how these effects arise.

[16] While most theories focus on migration, Emanuel Marx (1990) provides one example of a sociological approach on the social world of refugees, their relationships, and networks, and how these change throughout flight and settlement.

[17] I will use *adjustment* rather than the common term *adaptation*, to avoid confusion with *climate adaptation*.

lives, how they are incorporated or excluded, how these processes shape belonging and identity, and how migration changes destinations (Brettell & Hollifield 2014a; Zhou 1997). Since traditional sociological models focus on intergroup processes in populated destinations, they mainly apply to one of my three cases studies, namely migration from highland villages to cities (chapter 5). In the other two cases—planned relocation in Peru's rainforest and displacement in the coastal zone—the migrants moved together with most of their communities to spaces without host communities (chapters 6 and 7); similarly, immobile populations stayed in the same communities. Thus, I only briefly discuss sociological theories and mostly for the highland case.

In the long-dominant classical *assimilation* model, immigrants are pulled by their roots, but naturally assimilate into the dominant destination mainstream to gain social mobility over generations (Park et al. 1925; Park 1928; Stonequist 1937). Assimilation is not without obstacles, such as exclusion by the majority and institutions due to social markers attributed to migrants (Warner & Srole 1945), cultural differences, and limited intergroup contact (Gordon 1964). Nonetheless, all classical models assume that migrants abandon their ethnic distinctiveness over time. As one important refinement, segmented assimilation theory emphasizes that host communities are often significantly stratified. Thus, migrants move into different segments, whose historically contingent contexts of reception (human capital, family structure, and modes of incorporation) drive varied acculturation[18] tracks over time (Haller et al. 2011; Portes et al. 2005; Portes & Zhou 1993). Obstacles for inclusion can include de-industrialization and labor markets split into high- and low-wage jobs as well as discrimination due to ascribed minority group statuses. Critics point to empirical discrepancies of these models, including the persistence of ethnic sub-societies (Haller et al. 2011), and developed theoretical responses (Alba & Nee 2005; Perlmann & Waldinger 1997). The normative tenet that migrants should and will assimilate into a uniform, dominant mainstream is also debated (Geschwender 1978; Rudmin 2003; Rumbaut 1997).[19] More recent, fundamental critiques of "integration" approaches to

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[18] Acculturation here refers to the "processes that summarize the relations between immigrant children, their parents, and the wider ethnic community", see Waters et al. (2010: 1170).

[19] In a more nuanced view, Berry framed *acculturation* strategies as "the dual process of cultural and psychological change" resulting from intergroup contact (2016: 15), which depends on the relations sought among groups and the maintenance of heritage culture and identity. The strategies adopted by ethnocultural groups can result in integration, assimilation, separation, or marginalization, while societies can strive for multiculturalism, melting pots, segregation, or exclusion (Berry 1992, 1997, 2009). While more differentiated, Berry's model has

migration also question their normative, nationalist, and neocolonial assumptions (Favell 2019; Saharso 2019; Schinkel 2018, 2019).

Although all these theories focus on *international* migrants, several insights are transferable to my case study of rural-to-urban, *internal* climate migrants in Peru, who likewise "are transiting significant cultural space" (White & Johnson 2016: 77). For example, the theories suggest these migrants may enter different segments of unequal and stratified host communities and acculturate with the multiple aspects of the new urban life at different speeds and depths, as they encounter varied obstacles. I provide more details in the case study of rural-to-urban migration in chapter 5.

One theoretical insight applicable to all case studies herein is that the structural (dis)advantages which climate migrants experience in host areas depend on socially ascribed identity factors, such as age, ethnicity or "race", or sex. For analyzing such processes, *intersectionality* may provide a valuable lens. It highlights people's multiple and multifaceted identities as well as how marginalization and privileges related to these identities can change in different social, spatial, and temporal settings (Collins & Bilge 2020; Crenshaw 1989; Howard & Renfrow 2014). I strive to discuss differential impacts in Peru in this study whenever possible but time and resource constraints prevented a full-fledged intersectional analysis. Future work could differentiate even more how impacts they depend on intersecting sociocultural and biological factors (Anthias 2008; Bastia 2014; Cundill et al. 2021).

2.2.3.2   Resource-based Model of Migrant Adaptation to a New Site

The sociological models above offer limited insights for my case studies which lack pre-defined host communities, namely immobility and community relocation or displacement. For examining key processes and mechanisms of transitions in all the case studies in more detail, the Resource-Based Model of Migrant Adaptation to a New Site (RBMMA) offers a more fitting lens (Ryan et al. 2008).[20] While RBMMA is focused on migrants, its key tenets also have explanatory power for immobility.

RBMMA posits that migrants can lose personal, material, social, and cultural *resources* throughout migration. Examples include physical and psychological

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also been criticized for ignoring acculturative bidirectionalities (Rudmin et al. 2016; Ward 2008). Other theories underscore that intergroup contact is a two-way-street (Croucher & Kramer 2017; Kramer 2019).

[20] The authors build on theories on migrants' mental health, which use different medical or psychosocial stress models.

resources, assets, social support, networks, skills, knowledge, and beliefs learned within given cultures. Migrants require resources to satisfy *needs*, pursue *goals*, and address *demands*, while navigating *constraints* and *opportunities*.[21] Unsatisfied needs result in distress and alienation.[22] Resources are not only needed for initiating movement, but all phases of the migration life cycle (before, during, and after movement) can de- or increase preexisting resources, facilitate new resources, or deplete them. Resource changes can shape initial decisions to move, and later, migration journeys continue to affect resources in many ways.

These changes in resources before and during migration also influence migrants after settlement, when they strive to rebuild their lives by replacing or substituting recoverable losses. Such attempts are shaped by personal constraints and constraints in migrants' new environments. For example, resources can become devalued, obsolete for adapting to the new sociocultural setting, or blocked by policies.[23]Migrants also gain and lose new resources after arrival. Levels of resources can change as much as their value to migrants, depending on the relevance of the needs, goals, and demands in destinations. Over time, migrants' frames of reference for assessing outcomes can change, as explained further below. Stress results when migrants (a) lose resources; when they are (b) threatened with such losses; when (c) expected returns on investments do not materialize; or when (d) the new site obliterates goals or obstructs their attainment. Stress may also emerge from four demand events or situations in the migration process: (a) *demand overload* (resources insufficient to satisfy needs or goals); (b) *demand strain* (finite resources for competing priorities); (c) *aversive demands* (hostile external events and experiences); and (d) *demand insufficiency* (un- or underchallenging situations).

In summary, the Resource-Based Model effectively identifies key mechanisms and processes in the development of impacts of (im)mobilities, which I highlight in Figure 2.2. With its focus on needs, resources, and goals, the model underscores the human dimensions of migration (and, by extension, immobility). It usefully illustrates how losses experienced before and during (im)mobilities—such as those related to climate hazards—can continue to affect well-being long

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[21] Since the authors do not develop their concepts of *needs* and *goals* fully, I explain them in detail in section 2.3.

[22] The authors' ideas of *resources* dovetails with de Haas' (2021) idea of *capabilities* (2.2.2). He frames them as social, economic, and human resources, which excludes the cultural dimension that Ryan and colleagues highlight.

[23] While RBMMA focuses on constraints, de Haas' (2021) and Kunz's (1981) frameworks highlight that structural opportunities also matter, and migration has feedback effects on structures.

after. Notably, migrants can face new demands in destinations (which may include exposure to new hazards) when they are navigating constraints and opportunities for changing their resource base. Not only resources and goals may change but also migrants' *frames of reference* for assessing outcomes, as I explain in more detail below. Finally, the model emphasizes that the well-being of migrants and stayers depends on fulfilling varied needs and goals, two concepts which I explore in detail in the following section.
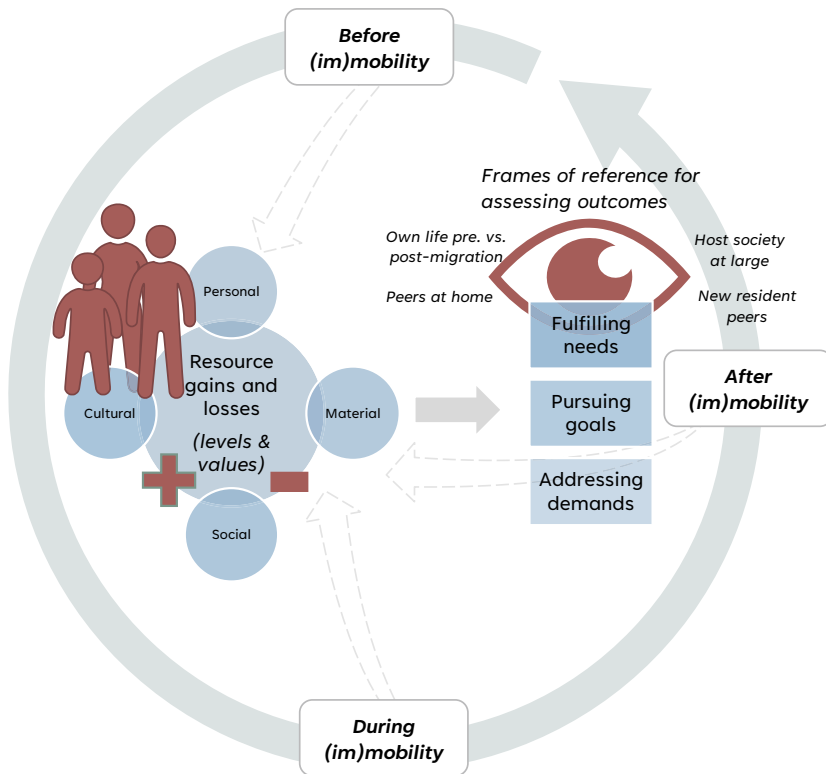
Figure 2.2 Key elements in the development of impacts during the life cycle of (im)mobilities. (Note: Created by the author, drawing on the model by Ryan and colleagues (2008) and the discussion below on frames of reference)

RBMMA posits that migrants use different frames of reference to assess outcomes (Ryan et al. 2008). Initially, many compare their own lives pre- and post-migration. Relative changes matter. For example, if few needs had been fulfilled in areas of origin, even small gains in destinations are valued highly, but low starting resources also raise susceptibility to resource losses. Conversely, greater initial resources may increase resilience; they provide chances for aggregated gains and permit easier adjustment. Peers staying in home areas provide another reference point through social comparison. Over time, migrants may shift their reference points away from their own previous lives or peers at origin; instead, they may compare themselves to (segments) of the resident population.

While not explicated by the authors, these ideas draw on comparison (or discrepancy) theory, which states that people use several benchmarks to assess their situations. The theory comprises (a) adaptation level theory, (b) social comparison theory, and (c) aspiration theory, which assume (a) prior life circumstances, (b) peers, and (c) future expectations as benchmarks for subjective evaluations (Haindorfer 2019a; Schyns 2000, 2001). First, (hedonic) adaptation level theory (also: dynamic equilibrium or set point theory) stipulates that people grow accustomed to new stimuli and recurring situations, which therefore are assumed to change people's subjective assessments only transiently (Brickman et al. 1978; Scitovsky 1992). Even after strongly positive or disruptive events—such as a relative's death—people are thought to adapt and return to equilibrium levels (Diener et al. 2009; Lucas 2007; Sheldon & Lucas 2014). This theory thus predicts that migrants' subjective evaluations may change at first but then return to a stable set range, holding them in a hedonic "treadmill" (Brickman 1971). Second, aspiration theory states that people assess their lives by evaluating their goal fulfillment (Henne, Thorsten and Stutzer, Alois 2014). Migrants constantly change aspirations after settling, and as a result, the benchmark for success can change. Third, established psychological research (Festinger 1954; Gruder 1971; Hyman 1942; Wills 1981) indicates that all humans compare themselves to others for self-evaluation (Wood et al. 2007).[24] Such social comparisons can result in relative

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[24] More recent research indicates that social comparisons are applied for different self-evaluation purposes, such as self-assessment, self-enhancement, self-improvement, and self-verification; the preference for eye-level, downward, or upward comparisons depends on self-esteem, personality, affect, threat levels, and other factors; and that such comparisons can have varying positive and negative effects on people, see Buunk & Gibbons (2007); Gerber et al. (2018).

deprivation (Melzer & Muffels 2012, 2017):[25] people can feel angry, resentful, or frustrated when they believe that they have less than others (Crosby 1976; Crosby & Gonzalez-Intal 1984; Merton & Kitt 1950; Schulze & Krätschmer-Hahn 2014: 5443). As targets of comparison, models assume either society at large[26] (Sen 1983) or members of a reference group (Runciman 1966). Applied to this study, migrants and stayers may thus assess their relative rank in society or compare themselves with others similar to them, for example, those in comparable social positions, jobs, or residential zones, and those with similar characteristics, at home or in destinations.

To summarize, migrants use varied frames of reference to assess their situations. Pre- and post-(im)mobility changes can be assessed in all case studies in this dissertation, and these internal standards thus are the analytical focus. Conversely, new peers only matter as a benchmark for rural-to-urban migrants who move to new host communities, whereas the rainforest and coastal migrants moved to uninhabited areas. Due to time constraints, I could not collect detailed data on all vantage points; future work could assess all relevant frames of reference. Nevertheless, chapter 5 with the rural-to-urban migration case study provides various insights into comparisons with peers at home.

2.3   Well-Being Impacts of (Im)mobilities

In chapter 1, I have argued why multilayered well-being provides an appropriate lens for my research questions. First, other common prisms to assess impacts of climate (im)mobilities—such as human rights protection, security, human security, or adaptation—are valuable but imply different priorities regarding the data to be collected and the measures to be evaluated. This study sets a more ambitious benchmark than recent migration as adaptation perspectives, which are concerned with preserving a status quo or returning to zero after climate hazards. Rather, the aim here is to investigate if migrants and stayers can "be well" and lead the lives they aspire to (leaning on Sen's (1999) idea of development). Well-being analysis is a more comprehensive and human-centered view of effects related to

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[25] Conversely, NELM theory argues that *relative deprivation* can also affect a household's likelihood of *initiating* migration, see Czaika & de Haas (2012); Stark (2006); Stark & Taylor (1989).

[26] This mechanism partially explains the *Easterlin Paradox*: if incomes rise for most in society, social comparison effects counterbalance expectable surpluses in happiness over time, see Easterlin (1974); Easterlin & O'Connor (2020).

(im)mobilities beyond standard economic measures of success, as it moves people and their varied *needs*, *goals*, and *resources* to the center of the discussion (see previous section). Second, even when migration facilitates successful climate adaptation, it "is not socially neutral or simple" (Adger et al. 2018: 40). Especially those forced to move can face great psychological, social, and cognitive stress (Helm et al. 2018; Schwerdtle et al. 2020). In addition, not all movements that net improve socioeconomic indicators also raise subjective well-being (SWB), and vice versa, making a SWB lens a valuable complement to more objective indicators (OECD 2013). For example, even those who improve materially may feel poorer in a larger sense when they experience loneliness or despair (Wright 2010, 2011). By using socioeconomic indicators chosen by outside experts as proxies for migrants' adaptive capacities (Gemenne & Blocher 2017; Melde et al. 2017), the few existing studies move subjectively felt well-being effects to a dead corner. Finally, a certain degree of outside forcing is likely even for climate migration that is framed as anticipatory and adaptive (Gemenne 2015); analyzing the related loss and damage requires to "engage more deeply with values, places, and people's experiences" (Tschakert et al. 2017: 1). A SWB lens serves these purposes well. Moreover, SWB also ought to be measured because it is a means to an end that contributes to health, relationships, and other spheres (see chapter 4). This focus on well-being is also in line with the IPCC's latest approach (Cissé et al. 2022). Below, I review well-being concepts and define it as how the needs that climate migrants or stayers prioritize are met (*measures of objective well-being*, OWB); how they evaluate their life situations cognitively and emotionally in the present; and how they look to the future (*measures of SWB)*. Then, I specify the indicators chosen to represent OWB and SWB.

2.3.1   Terminology and Definition

Well-being concepts used in similar ways include capability, human development, happiness, living standards, quality of life, prosperity, utility, and social welfare (McGillivray 2007). Among these terms, I choose well-being to link this work to the centuries-old discussions of what "being well" means to people (Copestake 2008a) and the rise of well-being as a "major research focus in development studies" (Gasper 2008: 47). The term "be-ing" usefully underlines the active process needed for a good life (Gough et al. 2008) and still leaves space to define the scope of the desired state of being well (Copestake 2008b). Many ideas with different purposes exist of what constitutes a "good life" (Dodge et al. 2012;

Gasper 2007; McGillivray 2007). They structure what goals people value and pursue, how they build institutions, and how they make political decisions (Adler & Seligman 2016). Defining and measuring well-being is thus "unavoidably political" (Copestake 2008b: 1). Well-being is a normative concept, person-centered, and it aims for more than just avoiding harm by setting a high quality and sufficient quantity of life as the goal (Copestake 2008b; Gasper 2008). There is "no settled consensus on its meaning" (Gough et al. 2008: 5), and well-being has often been described, but seldom defined (Dodge et al. 2012). I draw inspiration from several sources.

First, McGillivray's seminal review of well-being concepts defines it as "the state of individuals' life situation" (2007: 3). I draw on this non-normative definition as it usefully underscores that well-being concerns all spheres of life and many factors that may differ between individuals. While *life situations* dynamically change over time, the term *state* underscores the momentary nature of the assessment. Second, for further refinement, Costanza and colleagues define well-being as "the extent to which objective human needs are fulfilled in relation to … perceptions of subjective well-being" (2007: 269). Similarly, Gough and colleagues use well-being as an umbrella for the "objective circumstances of the person and their subjective evaluation of these" (2008: 5). In these views, being well depends on "what a person has; what they can do with what they have; and how they think about what they have and can do" (McGregor 2008: 317). These definitions usefully emphasize that being well arises from abilities to meet needs, in practice or as a possibility. *Needs* are normatively prioritized goals, whose fulfillment through different satisfiers results in OWB, and whose absence leads to harm (Gasper 2008); in section 2.3.2, I explain the notion in detail. Moreover, the definitions above highlight that it also matters how people *perceive* and *evaluate* current need fulfillment (SWB). Various reasons speak in favor of this perspective. First, means to meet human needs do not necessarily translate into what Sen and Nussbaum (1993) would call valuable functionings. For example, income does not equal subjectively felt greater well-being if it is spent on self-destructive behavior (McGillivray 2007). Second, measures on need fulfillment describe the conditions that people deem necessary for a good life, but do not measure directly if they *perceive* their lives as positive (Campbell & Converse 1972). Although linked, need fulfillment and respective evaluations are not the same (Tay & Diener 2011). Even when all needs are fulfilled, people may feel discontent, hopeless, or realize that they have been pursuing the wrong goals. For example, in Latin America, human development indices are only weakly correlated with people's SWB (Rojas 2018). SWB centers on one "end goal of all human activities" (Tay et al. 2015), namely the direct perception that life is going

well (Diener & Tay 2016; OECD 2013), and that the future offers chances for desired outcomes (Gulyas 2015). It thereby provides a valuable, complementary window into people's inner lives that also incorporates the distinct weights they give to nuances of their well-being (OECD 2013). Third, the evidence indicates that SWB is not only an essential metric but also a means to an end, as it shapes health, relationships, and work (Paul 2016; see section 4.2.2). For these reasons, I argue that frameworks to analyze well-being effects of climate (im)mobilities ought to integrate SWB.

While I consider SWB a useful complement to OWB, it is not sufficient as a standalone measure. SWB can be affected by a lack of information, norms, mental capacity, psychological resilience when facing adversity, the cultural and linguistic context of interviews, and other factors (OECD 2013). Evaluations can be made with different suitability (Veenhoven 2015) and people can mis-assess their situations (Kagan 1994). Framing effects—such as comparisons with prior own states or with reference groups—may shape results (Fujita 2008; Fujita & Diener 2013). Further, response shifts or adaptive preferences (Crettaz & Suter 2013) can, to some extent, mean that "one's preferences and perceptions adjust to one's situation… to reinterpret it as normal and tolerable" (Gasper 2007: 35). Rather, I frame well-being as consisting of both non-subjective and subjective aspects (Dolan et al. 2017; Gough et al. 2008). OWB and SWB have their distinct values and limits, and a mix offers a fuller perspective than either one alone (Costanza et al. 2007; OECD 2013). While early well-being accounts tended to be utilitarian and focused on few dimensions, multidimensional accounts prevail nowadays (Alkire 2002; Gough et al. 2008), and "future assessments should combine both measures of objective and subjective well-being, in order to provide the full picture of human flourishing" (Forgeard et al. 2011: 98). In line with debates on how to measure societal progress beyond income, SWB research is expanding fast (Diener et al. 2017a). In summary, I define well-being as the state of people's life situations based on need fulfillment, their present evaluation thereof, and their views of the future. Below, I examine the literature on the key elements of my definition.

2.3.2 Conceptualization of Key Well-Being Elements

The applied definition underscores that gauging migrants' well-being requires three measures: (a) on people's need fulfillment (OWB) as well as on (b) their present evaluation of need fulfillment and (c) views of the future (SWB) (Costanza et al. 2007, 2008; Gasper 2007). OWB and SWB measures can be

self-reported or subject-independent (Gasper 2007), as listed in Table 2.4. In this work, I use self-reports (interview and surveys), in which affected people explain and evaluate their need fulfillment.

Table 2.4 Possible measures of SWB or OWB and indicators

	Self-report indicators	Non self-report (subject-independent) indicators
Measures of OWB	Self-report objective *(for example: "I can walk 100 meters")*	Objective *(for example observing how far people (can) walk)*
Measures of SWB	Self-report subjective *(for example: "I am very satisfied with how far I can walk")*	Objective *(for example monitoring of types of brain function and physiological indicator that express SWB)*

Note: The approach chosen here is underlined. Adapted by the author from Gasper (2007: 33).

I select a substantive good approach to identify measures of OWB and elements of hedonic approaches for measures of SWB.[27] By contrast, I reject the idea of people as homines oeconomici focused on desires or revealed preferences. In such utilitarian notions, people are considered well when they fulfill their inclinations (Gasper 2007). Often, these preferences are measured through income or consumption as proxies for well-being (Chambers & Echenique 2016). Such an approach is not suitable for this dissertation for four reasons. First, these proxies neither gauge well-being nor preferences directly, but rather the monetary choices made (Gasper 2007). Second, not all preferences can be expressed adequately in money but may still be relevant for well-being, such as relationships. Third, consumption choices only reveal what people are prepared to and able to pay for desires, a limitation for poor zones, such as the deprived Peruvian communities investigated here. Finally, there are also obstructive consumption patterns such as

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[27] Parfit's (1992) seminal categorization of well-being theories lists three streams, namely those which see well-being as substantive goods; as satisfaction; and as desire (Scanlon 1993). One can add eudaimonia as a fourth approach, which sees well-being as realizing the human potential (Huta 2014). An eudaimonic approach could usefully expand the framework herein in the future but is not in the scope of this study; I explain the related potential in section 9.1.

addictions or preferences to harm others that, if fulfilled, can reduce well-being (Sagoff 1994; Scanlon 1993) (Table 2.5).

Table 2.5 Major existing approaches to well-being

	Well-being as	**Use in this study**
Substantive goods (objective list) theories	Listings of elements that make a "good life", concerning access or achieved valued functionings	For measures of OWB
Hedonia	Achieving satisfaction or pleasure	For measures of SWB (added: views of the future)
Eudaimonia	Realizing the human potential	(Possible future extension)
Desire theories	Fulfilling revealed preferences or desires	Not used

Note: Created by the author, building on and extending the overview by Gasper (2007) and Parfit (1992).

2.3.2.1 Measures of OWB (Need Fulfillment)

In the definition applied here, OWB focuses on how human needs are met or on means and conditions to meet them theoretically. Below, I explain that needs comprise things that persons value and manage to do or be in their lives, and satisfiers contribute to or permit these needs (Gasper 2008). To identify the needs and satisfiers of interest here, I use a substantive good approach (Parfit 1992; Scanlon 1993). Such approaches frame well-being as the access to, or achievement of, lists of substantive goods that can facilitate a state of being well (although, as implied in my definition and argued before, not everyone subjectively experiences life as positive even if needs are fulfilled, and vice versa).

2.3.2.1.1 Needs in Different Substantive Good Approaches

Between 1938 and 2000, at least 39 attempts were made to define well-being through substantive good lists (Alkire 2002). Such lists can be stipulated; be based on analytical work; drawn from consultations with people; or emerge in a combination thereof (Gasper 2007). Stipulated lists can, for example, draw on religious principles or traditions (for an overview, see Gore 1930). Lists can also be based on analytical work, as illustrated by Rawls' list of prerequisites for planning

and implementing rational life, which he deduced from rational thinking (Rawls 1993, 2005).[28]Nussbaum's (1992, 2012, 2013) list of functional capabilities is a key example of an approach derived from formal criteria and ethical reflections.[29] Her work builds on Sen's capabilities approach, which does not explicate a list of universal outcomes (Sen 1999; Sen & Nussbaum 1993). Rather, well-being for Sen is how people can function with available resources. People can value doing different activities (beings or doings, or functionings) and capabilities refer to the opportunity and freedom to achieve valued combinations of functionings. Well-being is what people can achieve, and what they prioritize according to their needs; according to Sen, well-being is leading the life one aspires to live.

By contrast, the substantive good lists that inform the measures of OWB in this study draw on theories of "needs" derived from analytical work. Theories of needs have a long history. Early, Maslow (1943) considered humans as innately driven by seeking to satisfy physiological needs first, and only then needs for safety, love, self-esteem, and self-actualization. He saw needs as built-in drives that regulate behavior (Gasper 2008). Although this theory is often cited, critics have pointed to a lack of scientific foundations and its hierarchal and ethnocentric conception of needs (Hofstede 1984; Mittelman 1991; Neher 1991). The idea of needs, still, has continued to influence policy and practice. In the 1970s, various UN agencies championed a basic needs lens to development practice, focused on the bare minimum required for physical health, such as food and shelter (Jolly 1976; Stewart 1985). The poverty line was defined by the absence of means to satisfy these needs. Thus, needs referred to means to ends (as opposed to Maslow's idea of built-in drives) (Gasper 2008). Later, these approaches were criticized as lacking scientific rigor, being overly focused on consumption and subsistence rather than progress and self-reliance, and remaining uninformed by class and group conflicts (Ghai 1978). Basic needs views were based on ethically or publicly prescribed priorities that the state should strive to provide. They fell in disuse in the 1980s and 1990s (Gasper 2008, 2009). During these years, Penz (1986), Braybrooke (1987), and Max-Neef and colleagues (1991; 1986) further developed the needs concept. The latter argue that being well depends on fulfilling fundamental human needs specific to humans.[30] While these needs are

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[28] Rawls' list includes rights, liberties, opportunities, income, wealth, and the social bases of self-respect.

[29] Her (non-exhaustive) list of ten capabilities for human functioning includes life; bodily health; bodily integrity; senses, imagination, and thought; emotions; practical reason; affiliation; living in relation with other species; play; and control over one's environment.

[30] Such as subsistence, protection, affection, understanding, participation, leisure, creation, identity, and freedom.

universal, the means to achieve them (coined as satisfiers) are of different types and dependent on time, place, and culture.

Later, Doyal and Gough (1984, 1991) integrated these and other advances in their theory of human need. Instead of seeing needs as in-built behavioral drives, they use needs normatively as aims "that everyone either does or should try to achieve" for the universal goal of avoiding serious harm (Doyal & Gough 1991: 35).[31] For the authors, the two normative, universal basic needs are (a) physical health and (b) cognitive autonomy. Physical health needs are vital to avoid serious harm, such as hunger or diseases, and these needs can be satisfied with objects, activities, and relationships that have universal features. Such satisfiers comprise food; water; shelter; non-hazardous work and physical environments; physical security; health care; security in childhood; significant primary relationships; economic security; safe birth control and childbearing; and education. While satisfiers can have universal features, their properties can vary culturally, such as types of food. Additionally, these satisfiers create conditions (mental health, thinking skills, and chances for social participation) in which cognitive autonomy can be satisfied (making cogent choices to achieve intentional goals). Hence, in this theory, two universal objective needs exist, but they can manifest or express themselves differently in different cultures and be met through culturally varied satisfiers (Gasper 2008).

These refined needs conceptions gained traction again in development practice in the 1990s. For example, need fulfillment is the focus of the early 1990s Human Development Index, the late-1990s Millennium Development Goals, and the 2015 Sustainable Development Goals (Gasper 2008; Gough et al. 2008).[32] Doyal and Gough's theory also shaped the Wellbeing in Developing Countries (WeD) project in the 2000s, which aimed to re-direct development practice toward well-being

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[31] This distinction matters for well-being analyses, since fulfilling drives does not automatically advance normative goals that increase well-being. Some needs are outmoded drives and do not fulfill any goals but may still raise well-being; others such as addictive drives fulfil objectives, but not normatively prioritized ones, and may threaten well-being. Still others are needed for normative goals but lack a motivational drive; therefore, even when the need is unsatisfied, the required action to improve well-being is not automatically mobilized. The constellation that needs are requisites for non-normative goals and simultaneously lack drive is less important for well-being analyses, see Gasper (2008).

[32] Current ideas of development practice often remain based on this model of "needs first" (targeting the satisfaction of multiple basic needs). Additional prisms include "income first" (envisaging material income, leisure, and choices); "rights first" (envisioning social justice and equity); and "local first" designs (aiming for community solidarity and local self-determination) Copestake (2008b, 2011). For a detailed review of development thinking, see Rapley (2007).

thinking. This project links needs and well-being approaches in a way that can usefully inform this empirical study.[33]

2.3.2.1.2 Specifying Needs for the Peruvian Context

Fulfilling needs is the precondition for OWB, but "different conceptions of well-being lead to different specifications of need" (Gasper 2008: 59). Often, lists of needs are stipulated by experts. Yet, I argue that three reasons speak for a different approach. First, such expert lists can constitute elitist knowledge shaped by researchers' values that is removed from the local context of their use (Copestake 2011; Crisp 2017; Gasper 2007).[34] Second, they can be questioned from a decolonial perspective, especially in former colonies such as Peru (Escobar 1995; Yamamoto et al. 2008).[35] With these criticisms in mind, I second the argument that well-being studies must be informed by local contexts (Chambers 2003; Yamamoto et al. 2008).[36] Local culture and values influence ideas of the good life (Diener et al. 2018b; Schimmack et al. 2002; Suh et al. 1998); weightings vary across time and context (OECD 2013); and "developing countries people's thoughts and emotions matter" as the experts of their lives (Yamamoto 2007: 1). A locally sensitized approach is also relevant for this work. *Emic* research in the Andes and the Amazonas (from within the groups of interest, not from an observer view (Kottak 2012)) reveals that well-being conceptions in traditional Peruvian villages are different from, although shaped by, those of individualism and autonomy in the Global North (Alvarez 2008; Yamamoto 2014, 2016; Yamamoto & Feijoo 2007). Villagers lean on ancestral lifestyles and traditions revolving around collective behavior, community, cooperation, reciprocity, nuclear family, self-consumption lifestyles, as well as physical

[33] Although the *theory of human need* was developed mostly referring to high-income countries (see Gasper (2008)), its criticism of income as the main proxy of development and its advocacy for a broader understanding of needs can be connected well with ideas of well-being.

[34] Often, educated and wealthy thinkers in the Global North create such lists based on research with affluent respondents with lives that differ considerably from the lives of the poor, see Copestake (2009).

[35] Decolonialism questions the universality claim of knowledge produced by the "matrix of power" in the Global North, see Mignolo (2007b: 156). For example, Peruvian researchers in the WeD project showed "strong opposition" to universalist concepts (see Copestake (2011: 104)) of well-being from the Global North, which, in their view, degraded developing countries to "the ball required to play the game", see Yamamoto (2007: 1).

[36] Similarly, Max-Neef (1991) and Doyal and Gough (1991) argued that needs are universal, but properties of satisfiers vary, and thus can be identified for specific times and places, for example, through community consultations.

and spiritual health. Hence, a locally grounded approach is key for my research in traditional rural communities in Peru (Adler et al. 2016).

My objective is neither to "essentialize" experiences of people in the Global South and to "overemphas[ize] the unchanging nature" of their world (Copestake 2008b: 13). Nor do I uncritically approve of all local notions and practices, even harmful ones, for the sake diversity, a common criticism identified by Nussbaum (2012). Rather, grounding universal models in local reality acknowledges that they have shared, but also different views about the good life and deprivations (Altamirano et al. 2004; Nuijten & Vries 2003). Since location and history shape the relationships to factors that make for a good life (Álvarez et al. 2008), an approach is required that is "universally comprehensible but … nevertheless sensitive to particular social, economic and cultural contexts" (McGregor et al. 2015: 2). To me, being well means the ability to achieve goals shared by all people as well as those set within specific local contexts. This conception matters beyond theoretical discussions. Well-being and development ideas also structure the work of development actors, who "often act in a way that fails to give sufficient weight to the wellbeing of all those affected by their actions" (Copestake 2008b: 1). Such failures can stem from knowledge production detached from local realities (Mignolo 2007a, 2012). By analogy, this study of climate (im)mobilities should account for the well-being notions held by affected people in Peru. Therefore, I identified needs and satisfiers from existing research with deprived Peruvians (Copestake 2008c, 2011) and adjusted these items through analysis of the new data collected for this study, as explained next.

The main source for identifying local Peruvian needs was the WeD research mentioned above (Copestake 2008c, 2011). Starting from Doyal and Gough's (1991) theory, it offers a well-being approach as conceived by deprived Peruvians. To identify local well-being notions, scholars reviewed the literature and collected extensive data[37] from seven poor, diverse sites in Peru (Altamirano et al. 2004; Alvarez 2008). Respondents specified 35 well-being goals, and factor analysis identified three underlying latent goals (shown in Table 2.6). Respondents also cited seven resources as key means to achieve these goals, including migrating (Copestake 2011; Lockley et al. 2008).[38]

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[37] Data collection included interviews with 419 individuals; a questionnaire on resources and needs with 1004 households; a survey on well-being with 550 individuals; semi-structured interviews with 71 key migration informants; and surveys on income and expenditure with 254 households. Researchers lived in the sites for over a year, see Copestake (2009).

[38] The three goals are (a) *a place to live better* (a clean/nice environment, living without violence or delinquency, and getting ahead or resolving problems); (b) *raising a family* (having a partner and children); and (c) *improvement from a secure base* (job, education, food and

Table 2.6 Components of well-being ranked by Peruvian respondents

Latent goals and their component items	Importance	
	Mean	Rank
A place to live better	1.53	–
• Getting ahead / resolving problems	1.56	8
• Tranquility: without violence or delinquency	1.54	9
• Clean and nice environment	1.47	14
Raise a family	1.07	–
• Children	1.09	25
• Marriage	1.06	26
• Partner	1.03	28
Improvement from a secure base	1.68	–
• Health	1.88	1
• Daily food	1.85	2
• Education for children	1.77	3
• Room or house	1.68	4
• Work for a salary	1.59	6
• To be a professional	1.51	12
• Consumer goods	1.17	24
Other individual items	–	–
• Electricity, water, sanitation	1.63	5
• Good family relations	1.57	7
• To be good with god and/or the church	1.53	10
• To be of good character	1.52	11
• Education for yourself	1.51	13
• Public transport	1.44	15
• Improvement in the community	1.41	16
• Household goods	1.38	17
• Getting on well with neighbors	1.37	18
• Recreational space, like sports complex	1.37	19
• To teach others what you know	1.36	20
• Neighbors participate in an organized way	1.28	21

Table 2.6 (continued)

Latent goals and their component items	Importance	
	Mean	Rank
• Clothes	1.26	22
• Friendship	1.18	23
• Telephone or other form of communication	1.06	27
• Shop, buying and selling (cattle, crops)	0.97	29
• Member of communal/community association	0.95	30
• Own transportation	0.92	31
• To be in a position of authority	0.7	32
• Go to fiestas	0.42	33
• Participate in organizing fiestas	0.29	34

Note: Respondents rated importance as very necessary (2), necessary (1), or not necessary (0). Adapted from Copestake (2009: 9).

Based on these results, WeD defined well-being as "a state of being with others in society where (a) people's basic needs are met, (b) where they can act effectively and meaningfully in pursuit of their goals, and (c) where they feel satisfied with their life" (Copestake 2008b: 3). This definition has many commonalities (and some nuanced differences)[39] with my own, which frames well-being as the state of people's life situations, based on need fulfillment, the present evaluation thereof, and views of the future. While the WeD results provide a valid foundation for specifying goals and needs relevant in the local Peruvian context, I also interviewed people in areas beyond WeD's sites in Central Peru. I therefore verified, prioritized, and adjusted the WeD measures of OWB through my own interview data. Using concept- and data-driven coding of the data (see 3.2.1), I

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health, and goods). Besides migrating, further resources were getting loans, renting or leasing land, saving, inheriting, having social contacts, and being able to secure support from organizations.

[39] First, both definitions combine OWB and SWB. Yet while WeD uses "satisfaction with life", I apply the terms "evaluation of need fulfillment" or "SWB", which are better suited for the subjective, cognitive and emotional assessments implied (as explained in section 2.3). Second, WeD stressses the relational ("state of being with others") as a standalone category, whereas I subsume *social relatedness* as a need in OWB. Third, the WeD definition emphasizes the active pursuit of goals ("act effectively and meaningfully"), while I point to the outcome of this pursuit ("need fulfillment") and resulting evaluations. Fourth, WeD does not integrate views of the future, as opposed to my framework.

merged or moved certain elements and added or renamed items. Figure 2.3 shows the resulting OWB framework for this work.
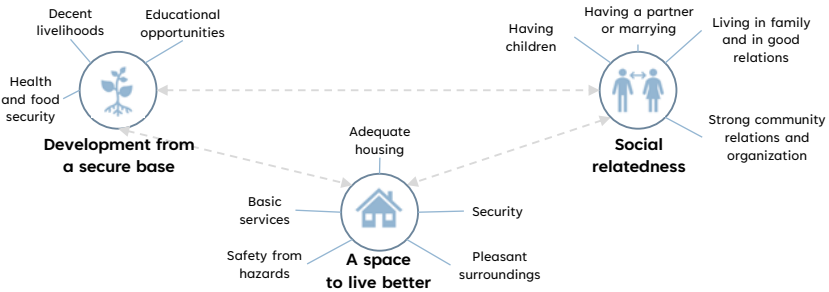
Figure 2.3   Locally grounded framework for assessing OWB in Peru. (Note: Created by the author)

In summary, the three central OWB categories for this research are (a) *development from a secure base*, (b) *social relatedness*, and (c) *a space to live better*. Four comparisons validate the relevance of the chosen components. First, the selected items cover most intermediate needs cited by Doyal and Gough (1991).[40] Second, they cover most impoverishment risks ensuing from forced migration identified in Cernea's (2004) influential work. Figure 2.4 shows the eight major sub-elements of this impoverishment risk. To counter these risks, Cernea classifies eight required reconstruction efforts, which closely align with the OWB elements identified here and corroborate their significance.[41]

Third, the items selected here also cover most indicators proposed by international organizations to measure vulnerability in displacement and to assess

[40] *A space to live better* covers Doyal and Gough's items adequate protective housing; non-hazardous physical environment; physical security; and non-hazardous work environment. *Development from a secure base* contains their items economic security; adequate nutritional food and water; appropriate education; and appropriate health care (security in childhood, safe birth control and childbearing are implicit in my item health and food security). Finally, *social relatedness* covers Doyal and Gough's item significant primary relationships.

[41] Reemployment is included in *decent livelihoods*; adequate nutrition and health care are covered by *health and food security*; social inclusion is echoed in *social relatedness*; and finally, land-based reestablishment, house reconstruction, as well as restoration of community assets and services are contained in *a space to live better*. Three differences with Cernea's model are my inclusion of safety from hazards and pleasant surroundings as items of interest (within *a space to live better*), as well as the exclusion of his item community reconstruction (partially covered in *social relatedness*).
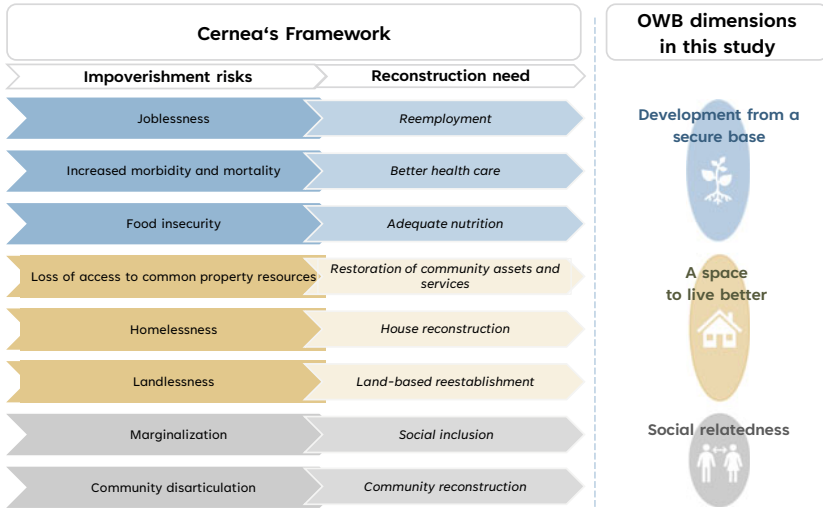
Figure 2.4 Comparison of Cernea's model and OWB dimensions in this study. (Note: Created by the author, drawing on the model by Cernea (2004))

progress toward durable solutions, a right enshrined in principles 28–30 of the Guiding Principles on Internal Displacement (OCHA 1998). The conceptual framework here includes most of the eight requirements to end displacement defined by the UN Inter-Agency Standing Committee (IASC 2010) Framework on Durable Solutions for Internally Displaced Persons (The Brookings Institution & University of Bern 2010), which was operationalized later (JIPS 2018).[42] Similarly, the International Recommendations on IDP Statistics (IRIS) have drawn on the IASC framework to develop metrics for measuring progress in addressing vulnerabilities (EGRIS 2020). The framework applied in this study cover most of these metrics.[43] Three main differences are that none of the international metrics

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[42] *Development from a secure base* and *a space to live better* cover the requirements access to livelihoods and employment; enjoyment of an adequate standard of living without discrimination; effective and accessible mechanisms to restore housing, land and property; and long-term safety and security. Family reunification is covered by *social relatedness.* The framework applied here does not cover access to personal and other documentation without discrimination; participation in public affairs without discrimination; and access to effective remedies and justice.

[43] My categories *development from a secure base* and *a space to live better* cover the following suggested indicators: safety and security; adequate standard of living (including food

on displacement vulnerabilities include SWB, social *relatedness* is mostly limited to family reunification, whereas the framework here does not cover suggested political and legal items, such as access to documentation.

Finally, the needs chosen for this study cover key development objectives enshrined in the 17 Sustainable Development Goals (SDGs).[44] *Development from a secure base* is closely aligned with SDGs 1–4 and 8. *A space to live better* echoes SDGs 6, 9, and 11 as well as SDGs 7 and 11 in part. By contrast, the SDGs only implicitly cover the two other dimensions applied here, namely *social relatedness* and *subjective well-being*. In addition, the needs applied here do not cover SDGs with relevance at the societal level, such as those relating to biodiversity (SDGs 5, 10, 12, and 14–17).

2.3.2.2 Measures of SWB

After having specified the OWB items, I turn to discuss measures for how people evaluate present need fulfillment and how they view the future. The umbrella term *subjective well-being* (SWB) is rooted in hedonic philosophy (from ancient Greek hēdonḗ, "pleasure"). This tradition frames being well as achieving different pleasures or satisfactions while reducing discomfort and pain, as embodied in writings by Epicurious, Bentham, Hobbes, and Locke (Huta & Ryan 2010; Kashdan et al. 2008). Psychological SWB research builds on this notion and has been a central field of Positive Psychology (Diener 1984, 2000; Pavot & Diener 1993). It frames SWB as "the extent to which a person believes or feels that his or her life is going well" (Diener et al. 2018a: 1). Measures of SWB are direct, internal, self-reported evaluations of how people assess their lived experience and the significance they attach to them (Diener 2000; OECD 2013). How such evaluations arise is explained next.

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security, shelter and housing, medical services, and education); access to livelihoods; and restoration of housing, land and property. Access to documentation is not covered.

[44] SDGs 1–4 and 8 are no poverty; decent work; good health and well-being; zero hunger; and quality education. SDGs 6, 9, 11, 7, and 11 are clean water and sanitation; industry, innovation and infrastructure; sustainable cities and communities; affordable and clean energy; and climate action. SDGs 5, 10, 12, 14–17 are life below water and on land, responsible consumption and production, peace and justice, income and gender equality, and partnerships to achieve the Goals. The SDGs only implicitly cover *social relatedness* and *SWB* through Goal 3 on Good Health and Well-being, which according to the WHO, refers to "a state of complete physical, mental and social well-being" (1948: 1), emphasis added.

2.3.2.2.1 Evaluation of Need Fulfillment in the Present

People have varied inner abilities "to cope with the problems of life", which *can* translate into an inner, present „subjective enjoyment of life" (Veenhoven 2015: 208).[45] Yet, good chances do not automatically lead to positive results; and equally, limited chances can be occasionally sufficient for positive results. Present SWB depends on two pathways: first, cognitive calculations of goal realization or *satisfaction* in life domains, and second, inferences based on *emotions* (Veenhoven 2014, 2015). The first path to SWB is satisfaction, the cognitive evaluation of current need fulfillment (Diener et al. 2010; Diener et al. 2017a).[46] The second path to present SWB is having more positive than negative emotions over time (Diener 1984; Schwarz et al. 1999).[47] Taken together, research emphasizes that cognitive and emotional paths are correlated, but distinct; and while both matter for SWB, affective appraisal is often principal (depending on social and normative contexts) (Busseri 2018; Dolan et al. 2017; OECD 2013; Suh et al. 1998; Veenhoven 2015). Present SWB stems mostly from people's mental appraisals of emotional balances and, to some degree, of their cognitive satisfaction (Kahneman & Riis 2006; Pavot & Diener 1993). Researchers thus characterize present SWB by (a) high experiences of positive feelings, (b) low experiences of negative feelings (emotional balance), and (c) high cognitive satisfaction (Busseri 2018; Diener 1984; Diener & Tay 2016; Schwarz et al. 1999). SWB appraisals come with varying degrees of confidence, reflection, and suitability (Veenhoven 2015). Since SWB is a mental assessment made and felt by people, it can be asked for. For emotional balance, people are asked repeatedly to record their affect or to fill out diaries about activities and linked feelings. SWB studies ask people to assess (cognitive) satisfaction with domains of live or live overall, commonly

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[45] The same holds true for *outer chances* for a good life, such as safe physical and social environments, which may translate into *outer life outcomes* or actual utility of one's life for the environment, see Veenhoven (2015).

[46] When people mentally evaluate satisfaction, they either assess discrepancies between socially and culturally varying goals and reality or they calculate the sum of pleasures and pains in life domains, compare their relative social standing, and identify the balance (see section 2.2.3: Frames of reference), see Paul (2016). Besides these two bottom-up calculations, overall present SWB also shapes domain satisfaction top-down Headey et al. (1991).

[47] People infer SWB from how well they generally feel, see Veenhoven (2015). They usually draw on present mood for gradually recalling and assessing longer-term emotions because mood signals how things are going overall, as opposed to more immediate feelings. A good mood depends on meeting needs. For recalling mood, people focus on the frequency of pleasant (for example, joy) and unpleasant affect (for example, sadness) rather than their intensity. This sum of positive and negative feelings is coined emotional balance, see Diener et al. (2017a).

in surveys[48] (OECD 2013). In this study, I interviewed people and derived their SWB from their narratives (see section 3.2.1 on the qualitative strand).

Critically, the hedonic tradition does not favor more positive thoughts and emotions at all costs, without limits, or in all cases (Gruber et al. 2011). Transient negative emotions are normal and needed in specific situations, such as after losses. Moreover, the types of valued positive states can differ across cultures and some positively sensed emotions, such as hubris pride, do not create benefits. In addition, positive emotions can lead to suboptimal behavior when people must detect threats and react fast; when they must make appraisals that require systematic processing of information; and in certain social situations. Finally, the benefits of SWB—such as better health—do not require exceedingly high levels; rather, "frequent but mild positive moods may be sufficient" (Diener et al. 2017a: 94).

2.3.2.2.2 Views of the Future

The two emotional and mental evaluations discussed above are concerned with need fulfillment in the present (and to some degree, the past). For this study, I decided to add *views of the future* as a third dimension (Glatzer 2012; Gulyas 2015).[49] The additional prism is valuable for three reasons. First, well-being feelings and thinking about the past, the present, and the future are linked but not the same; for example, one can be grateful for the past and content in the present but pessimistic about the future (Forgeard & Seligman 2012; Seligman 2002). I agree that "people with hope and those without are of different subjective well-being, given all other components of well-being are equal" (Glatzer 2015: 10) and "how we perceive the future can greatly affect how we feel in the present" (Pleeging et al. 2021a: 1019). For example, migrants with unmet needs who either look to the future with hope or with fear will experience different SWB.[50] Second,

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[48] Typical examples are the single-item question "how satisfied are you with the life you lead" from the Eurobarometer, and the five questions used in the Satisfaction with Life Scale (see Diener et al. (1985)).

[49] Exemplary positive emotions about the future include hope, optimism, faith, trust, and confidence, whereas negative ones include fear, worry, hopelessness, despair, and pessimism, see Forgeard & Seligman (2012); Seligman (2002).

[50] One caveat applies: while being hopeful and optimistic mostly yields positive downstream effects (see review in section 4.2.2), positive views of the future can be harmful in some cases, see Forgeard & Seligman (2012; Pleeging et al. (2021a). They are detrimental when danger is imminent or when health and professional decisions must be made; when adverse or unfitting goals are pursued; when they are based on illusions or denial of reality; when a goal realistically cannot be achieved; when they act as a defense mechanism; or when they prevent action to improve an adverse situation.

climate change shapes people' future expectations through various mechanisms (Doherty & Clayton 2011; Helm et al. 2018; Manning & Clayton 2018), including uncertainty, distress, helplessness, and anxiety on the negative end (Fritze et al. 2008), for example after the loss of place (Tschakert & Tutu 2010; Warsini et al. 2014). Because such processes will likely also affect people who stay in or leave areas that face climate hazards, it is valuable to measure their views of the future. Third, (im)mobilities are driven not only by aspirations for the future (see section 2.2.2), but can also alter future outlooks, for example, by creating risks and uncertainty (e.g. Williams & Baláž 2012). The review in chapter 4 provides more details. For these reasons, views of the future offer a valuable additional prism for assessing climate (im)mobilities.

Researchers have conceptualized outlooks on the future differently. Studies on hope(lessness)[51] typically focus on "expectations of improvement or deterioration of the economic, social or personal situation" in most fields (Pleeging et al. 2021b: 3). Social science studies tend to center on external sources of hope (for example, conflict, culture, or history); its social experience; and its external effects, such as societal mobilization. By contrast, for psychological approaches, hope is an active force for individual and concrete goals; they often have two common elements, namely (a) a future desire and (b) the belief that this desire can be achieved (Pleeging et al. 2021b). Hope can be conceptualized as a multidimensional experience with at least these three layers (Pleeging et al. 2021b; Pleeging et al. 2021a): its cognitive and motivational dimensions (Snyder et al. 1991; Snyder 2000, 2002) as well as its emotional function (Fredrickson 2001).

In the end, hope, optimism, and positive expectations (and their antonyms) are all future-oriented, expectancy-based states or beliefs that desired events will (or will not) outweigh negative events in the future. They are often used interchangeably despite fine conceptual differences (Milona 2020; Peterson & Seligman 2004; Pleeging et al. 2021b), which I will also do for ease.[52] Under the umbrella term "views of the future", I follow the definition of hope as "a positive expectation that something good will happen, or that the future will be better than the present", and fear being the reverse (Gulyas 2015: 872). Optimism is a state with more hope than fear regarding the future, pessimism the reverse, and

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[51] For brevity, I will use *hope* as the shorthand for both hope or hopelessness.

[52] Studies agree more on definitions for optimism than for hope. They suggest that hope and optimism are mostly aligned when desired outcomes have a significant probability to eventuate, but less so when they are not probable yet important; in other words, "hope is tapped into when odds are low yet individuals are highly invested in the outcome", and offers limited personal control, see Bailey et al. (2007); Bruininks & Malle (2005); Bury et al. (2016: 588).

neutralism means that there is no expectation of change (Gulyas 2015). People's arrays, experiences, and effects of such hopes and fears are heterogenous. Pleeging et al. (2021a) provide a review of the varied objects and sources of hope, the diverse possibilities to experience hope, and its variable effects. Moreover, future outlooks can have varied subjects. Especially in more collectivist societies, subjects can include family, peers, or spiritual beings (Bernardo 2010), a vital insight for Peru given its collectivist leaning (Alvarez 2008; Yamamoto 2014, 2016; Yamamoto & Feijoo 2007). To learn about people's views of the future in this study, I used interviews (see section 3.2.1).

2.3.2.2.3 Possible SWB Outcomes

SWB combined with OWB, as used here, offers a broad view of the effects of climate (im)mobilities that is greater than the sum of its parts (Forgeard et al. 2011), since it permits examining outer and inner life chances as well as results (Glatzer 2015). However, objectively fulfilled needs do not mechanically lead to the subjective perception that needs are satisfied or vice versa (Veenhoven 2015), so that OWB and present SWB can converge or diverge (Glatzer & Zapf 1984; Zapf et al. 1987), as can views of the future (Gulyas 2015). Figure 2.5 displays the range of possible outcomes. (A) *true well-being* refers to a state in which people in good conditions evaluate and experience their present lives as good; it can be attended by *enfolded hope* or *dramatized* future *fear*. Conversely, (b) *deprivation* denotes people in adverse conditions who evaluate and experience their lives as negative, which can be combined with *precarious hope* or *enforced future fear*. In between, (c) *fragile dissonance* is a state when people live in good conditions, hold negative evaluations and feelings, but also hope for the future, whereas *high dissonance* means they lack such hope. (D) *adjustment* means positive present satisfaction and feelings despite negative conditions; it is *fragile* when combined with fear and *high* when accompanied by hope for the future.

Combining the measures of SWB and OWB developed in this chapter renders a comprehensive framework for assessing the well-being effects of climate (im)mobilities, as presented in Figure 2.6.
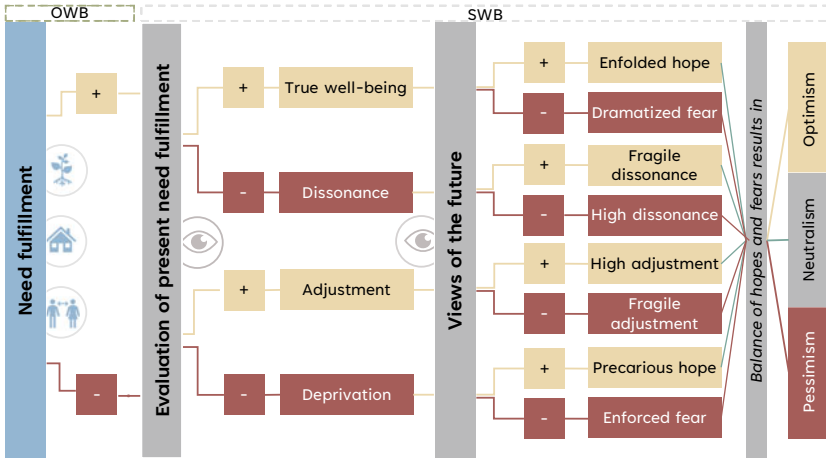
Figure 2.5 Differential possibilities of OWB and SWB outcomes. (Note: Created by the author, building on the work by Gulyas (2015)[53])

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[53] I added the prefix *true* to the original term. Rather than *adaptation*, I use *adjustment* to distinguish it from other usage.
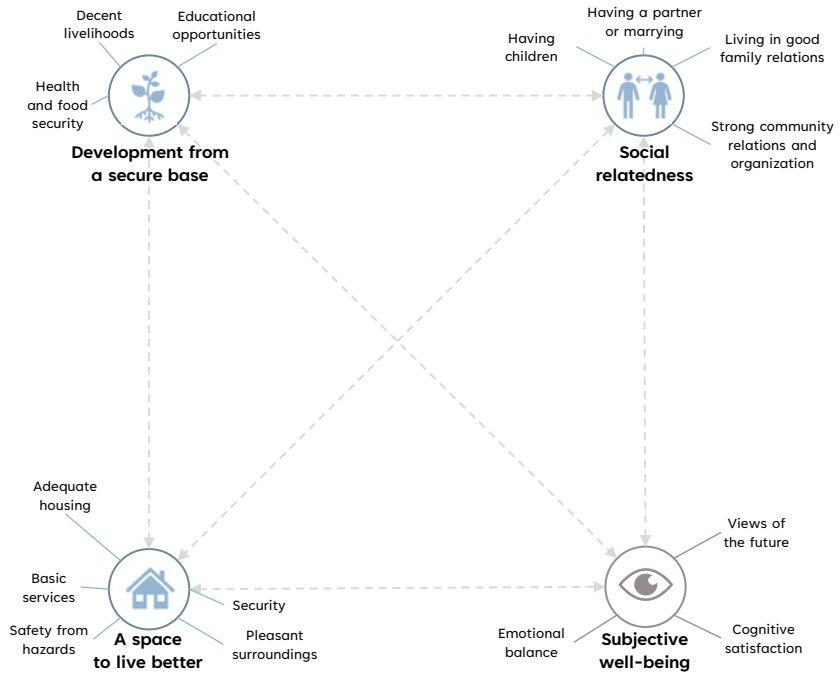
Figure 2.6 Measures of OWB and SWB applied for assessing impacts of climate (im)mobilities. (Note: Blue icons designate OWB and the grey icon SWB. Created by the author)

Research Philosophy, Methodological Implications, and Research Design

3

In this chapter, I explain the choices for the four different layers of the research approach applied in this dissertation, which are illustrated in Figure 3.1 (Saunders et al. 2011). I used a critical realist research stance, applied retroduction and abduction as modes of reasoning, and analyzed both qualitative case studies and survey data in a mixed methods approach.

3.1 Critical Realist Stance and Implications

First, the *philosophical* (or *research*) *stance* as the outermost layer refers to assumptions about the nature of reality (ontology), valid knowledge and knowing (epistemology), and values and aims of research (axiology). Few migration studies explicate their philosophical stance (Castles 2012; Iosifides 2012). This dissertation is based on critical realism, which combines a realist ontology and relativist epistemology. This research philosophy has gained a standing in social sciences and serves this study for four reasons (Maxwell & Mittapalli 2010). First, its ontology allows for a complex analysis of why well-being changes in (im)mobilities occur, and what role structure and agency play therein. Second, its epistemology favors diversity in research perspectives, methods, and data, which is useful for examining alternative explanations of well-being impacts. Third, the stance makes it possible to incorporate the role of the human mind into research,
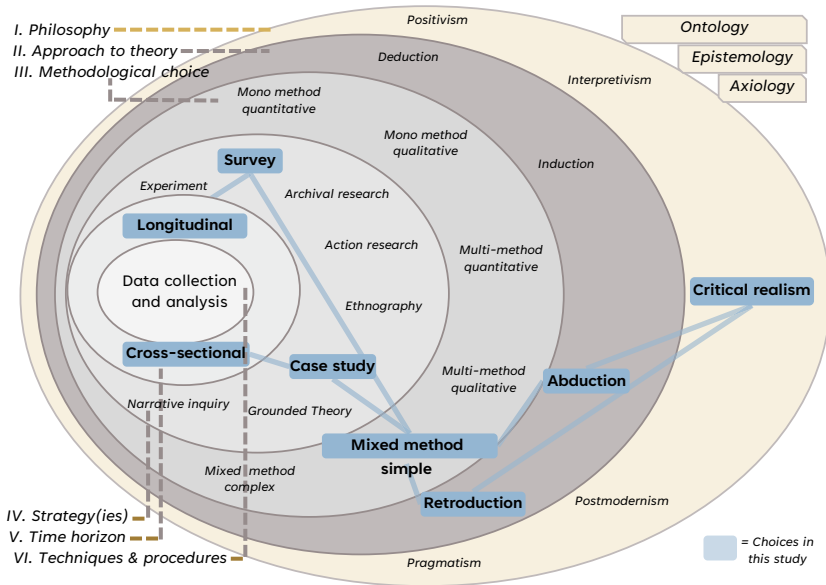
Figure 3.1 Layers of research and application in this study. (Note: Blue boxes indicate the choices made in this study. Reproduced from Saunders et al. (2019: 130) and edited by the author.)

for example, the insight that biases may lead migrants to misinterpret their well-being situations. Finally, critical realism has a strong value orientation, which is, in my view, essential when studying well-being in the context of climate injustices and in an unequal society such as Peru (Iosifides 2012; Maxwell 2012; World Bank 2021b).

Second, philosophic stances come with different *approaches to theories* or *modes of reasoning*. Theories are "the analysis and statement of how and why a set of facts relates to each other" (Kumar 2011: 21). Approaches to theories refer to different mental operations to construct order and logic in data and to connect data with theory. The critical realist goal is to develop hypothetical models for the mechanisms and structures behind empirically observed phenomena and build theories of them with multiple viewpoints (Lawson et al. 2009). Realism permits both using existing theories and provides guidance on how theory can be developed. Induction (going from data to broader theory) and deduction (testing theory-derived hypotheses with data) serve as the foundation for abduction and

retroduction (Hartwig 2007).[1] In other words, I will "continue to ask the question why?" (Easton 2010: 124), use counterfactual thinking, study extreme or surprising cases, and compare cases to identify generative mechanisms (Danermark et al. 2002).

Third, *methodology* applies the research stance and modes of reasoning systematically to the research (Castles 2012). It discusses how scholars can retrieve and produce knowledge about the social world and why which type of *methods* can provide valid data (Teddlie & Tashakkori 2010). Given the critical realist premises, both quantitative and qualitative research methods can produce valid knowledge under certain conditions (Iosifides 2012; Maxwell & Mittapalli 2010).[2] Given these complementarities of qualitative and quantitative approaches, it is methodologically sensible to combine them (Sayer 1992; Seawright 2016). Qualitative methods can discern social action, intentions, and meanings around (im)mobilities and well-being. They can address context, complexity, and diversity, and shed light on generative mechanisms. Conversely, quantitative methods are valuable to systematically inquire diversity and regularities in well-being effects; to scale and compare scales; to measure the strength of influences; and to test and refine hypotheses about mechanisms. Various prior mixed methods studies have used critical realism (Shannon-Baker 2016) and several authors have

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[1] *Abduction* means "a theoretical redescription of events, phenomena and processes using certain conceptual schemes and frameworks" (see Iosifides (2012: 43)), with the aim of re-describing and re-contextualizing the observed by relating it to a rule, see Danermark et al. (2002)). *Retroduction* refers to "identifying the necessary conditions for the occurrence of certain events, processes or phenomena" (see Iosifides (2012: 43)) and asking about the more fundamental "transfactual conditions, structures and mechanisms" that must exist for something to be possible, see Danermark et al. (2002: 80).

[2] Quantitative methods can discern persistent regularities (or semi-regularities), patterns, and effect distributions; they allow investigating "formal relations of similarity" and find "descriptive, representative generalizations" (Danermark et al. 2002: 165). Nonetheless, quantitative research is limited to observable and quantifiable objects, while quantification and aggregation, in turn, can lead to simplistic representations of the social world that can ignore diversity, context, and outliers, and may lead to basic, biased models (Maxwell & Mittapalli 2010). While quantitative research uses an established range of methods to distinguish correlation from causation, it is often not sufficient for *understanding* generative mechanisms, which depend on process, contexts, and underlying conditions (Cook et al. 2002). Conversely, qualitative methods can shed light on generative mechanisms behind quantitatively observed regularities by elucidating contexts and tracing in detail how processes materialize in specific cases (Iosifides 2012). Nevertheless, small qualitative samples cannot adequately represent the full diversity of a setting or population, so that care must be taken to avoid "simplistic generalizations" (Maxwell & Mittapalli 2010: 160).

called for mixed methods to study migration (Castles 2012; Iosifides 2012, 2017). I explain the research design in detail in section 3.2.

Before, I close with discussing how the critical realist value base shapes this research. Critical realist research aims at reducing domination and expanding freedom or flourishing (Maxwell 2012).[3] It is based on a similar argument as critical social theories that theory should serve emancipation and not mere knowledge creation (Horkheimer 1982; Lawson et al. 2009). I agree that in a world where migration offers opportunities for few wealthier people while many marginalized groups confront restrictions and control, "realist explanatory critiques of social relations of injustice and of their effects and consequences are urgently needed" (Iosifides 2012: 47). All knowledge generation is a social practice with impacts; it should aim to inform those affected by domination and inequality to empower them in their struggles for self-determination. In this study, I attempt to do so by revealing structures of domination, control, oppression, and exclusion before and after people leave areas facing climate hazards; how these structures shape the uneven distribution of opportunities to migrate in the first place and under humane conditions; and how they shape chances to preserve well-being. I also attempt to expose mechanisms behind well-being changes of migrants and stayers, and how climate (im)mobilities modify, reduce, reproduce, or reinforce such structural inequalities. In doing so, I refrain from dominant discourses of managing and controlling migrants.

Finally, I also attempt to approach the subjects of inquiry (self-)critically. Producing knowledge is a social practice shaped by politics, power, and by researchers themselves. Evaluating knowledge requires awareness that it is produced by communication, which, in turn, typically occurs in unequal social settings that favor certain narratives. My own values, socialization, and biases can have influenced this research. As a relatively young, male, white academic from the Global North, my socialization is different from that of most interviewees. I interviewed people of all different ages, also much older ones; of different ethnicities and religions; as well as with a different upbringing and socioeconomic situation. While I have studied and lived in Latin America, speak Spanish, and prepared scientifically and culturally for the fieldwork, these differences have shaped interviews, the analysis, and interpretations. I am aware that relationships with the respondents were often unequal. Lastly, while I have tried

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[3] Critics raise that using these goals as the value base of research results in bias, see Hammersley (2009). I argue that all research is value-laden, even allegedly value-free positivist studies. The latter only do not expose the values that underlie research. Applying values in research always implies judgement, but such judgement calls are justified if research explores and exposes social structures of inequality, as is the case here.

to be as impartial as possible, I acknowledge that all collected data on empirical events linked to concepts like (im)mobilities and well-being are value-laden and do not represent one objective truth.

3.2   Mixed Methods Research Design

After having explained the three outer layers of this research approach, I turn to discuss the concrete choices for the research design and *methods* in the next section. Methods are the procedures and practices chosen to collect and analyze data, as justified by the methodology (Castles 2012).

   To study the well-being impacts of climate (im)mobilities in Peru in this dissertation, I use an ex-post-facto, convergent parallel design with qualitative methods weighted more heavily than quantitative ones (Creswell & Clark 2017). An ex-post design is appropriate here given the absence of experimental options, which could have reduced the influence of unobserved third factors, such as self-selection of migrants (McKenzie et al. 2010; McKenzie & Yang 2010; Stillman et al. 2015). This choice was most realistic for the time and resource horizon of this study and is in line with prior guidance for studies in this research field (Banerjee et al. 2013; Melde et al. 2017; Milan & Gioli 2015). I partially address the lack of experimental setup through method and results triangulation.

   The chosen critical realist stance favors mixed methods approaches, which bring several benefits for studying climate (im)mobilities and well-being. Foremost, social science studies apply mixed methods to use strengths of both qualitative and quantitative strands while reducing their individual limitations (Kelle 2014; Teddlie & Tashakkori 2010). Beyond, mixed methods allow testing whether both components produce convergent results (corroboration); shedding light on respective blind spots (completeness); and raising the integrity of findings (credibility) (Bryman 2006; Kelle 2014; Schoonenboom & Johnson 2017; Tashakkori & Teddlie 2010). These advantages lead eminent scholars like Stephen Castles to argue that "most forms of migration research are likely to require 'mixed-methods approaches'" (2012: 21; Fauser 2018).

   In mixed methods designs, qualitative and quantitative strands can be weighted differently and integrated at different points (Kelle 2014; Schoonenboom & Johnson 2017). In this study, I prioritized the qualitative component due to its unique adeptness to assess the meaning of people's climate-related experiences in the social world (Nature Climate Change 2021). For comparability, I conducted the

same qualitative methods in all three large zones of Peru (highlands, rainforest, and coast). Moreover, data and time constraints allowed for one additional quantitative analysis of the Coastal El Niño case. I performed both components concurrently but separately to preserve data independence and triangulation options, and integrated them later through meta-inferences (Tashakkori & Teddlie 2010). This approach is coined convergent parallel or parallel mixed design (Creswell & Clark 2017; Schoonenboom & Johnson 2017). Figure 3.2 provides an overview of the applied research design.
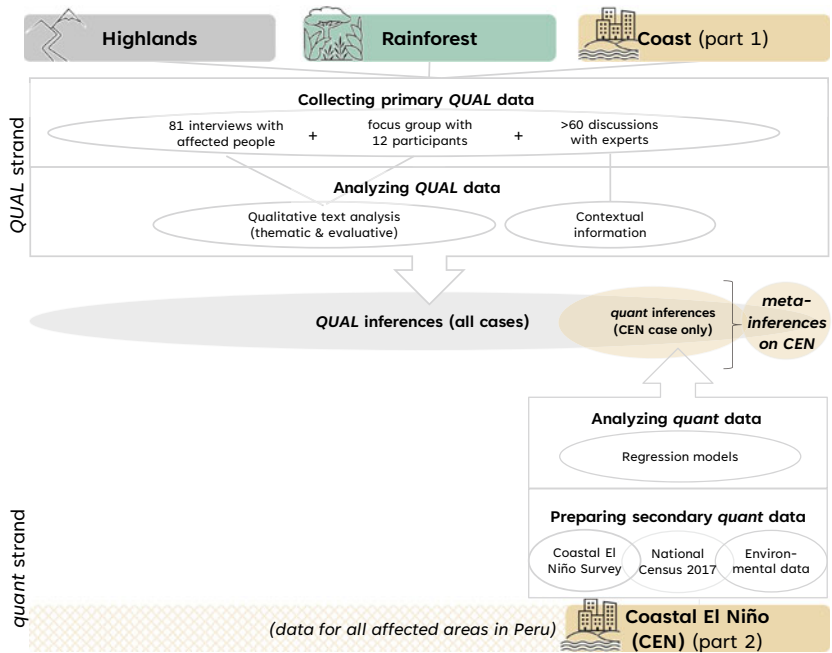
Figure 3.2 Overview of the applied mixed methods design. (Note: Created by the author)

In this paragraph, I briefly outline the applied methods before I explain them in detail below. I started the central qualitative research with a review of the evidence (see chapter 4). Afterwards, I collected data through 81 problem-centered

interviews (Witzel & Reiter 2012), one focus group with 12 affected people (Morgan 1999b), and discussions with over 60 experts. Next, I analyzed the data through Qualitative Text Analysis to examine effects, mechanisms, social system dynamics, and structures (Kuckartz & Rädiker 2019). For the parallel quantitative study on the Coastal El Niño, I assessed extensive survey data through regression models. To evaluate differential displacement risk, I used a dataset collected by Peru's National Institute of Statistics and Informatics (INEI)[4] directly after the disaster with close to 190,000 affected adults spread across all of Peru. Additionally, INEI on request created a customized, merged dataset of that survey and the National Census collected later in the same year, which I analyzed to identify the effects of displacement on well-being.

3.2.1   Qualitative Methods

I mainly used qualitative methods to analyze affected people's narratives on the experienced well-being changes and underlying mechanisms of action. I collected data during several weeks of research in the Peruvian communities of interest during three visits in 2018 and 2019. Another scheduled visit in 2020 to present results and liaise with stakeholders was held virtually due to COVID-19 restrictions. The collected data included (a) problem-centered interviews with 81 (36 m / 45f) migrants and family members to explore their perceptions on hazards and well-being impacts of (im)mobilities (Witzel & Reiter 2012); (b) one focus group with 12 (3 m / 9f) pupils in a sending community to cover an important group underrepresented in the interviews (Vogl 2014); and (c) more than 60 discussions with experts such as policy makers, researchers, and practitioners to gain background insights into structural conditions that shape well-being effects (Gläser & Laudel 2010; Helfferich 2014).

   The qualitative strand is case-oriented and uses the comparative method for "rich descriptions of a few instances" of typical cases of villages of departure or immobility and areas of arrival, focusing on "context, complexity and difference" in the chosen cases (Della Porta 2008: 216, 221). The dense knowledge created in this small-N case comparison is useful for discovering well-being effects and mechanisms. While the three cases in Peru are distinctively configured in space and time, the knowledge gained in these in-depth studies can help to build more generalized concepts "that transcend the validity of individual cases" (Della Porta 2008: 206). I explain the site selection below.

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[4] Original Spanish name: *Instituto Nacional de Estadística e Informática* (INEI).

3.2.1.1 Site Selection

I collected data from Peru's three major regions to cover the following cases (Figure 3.3):

(1) Long-distance rural-to-urban migration from two villages in the highlands of the Lima Region and immobility in these areas, influenced by *gradual* glacier recession and rainfall changes;

(2) short-distance, attempted planned relocation (community-wide migration) of two villages in the rainforest Region of San Martín due to *abrupt* floods, resulting in entrapment and only one eventual relocation; and

(3) short-distance displacement (*acute*, forced migration) from several villages in the coastal Region of Piura, forced mainly by *abrupt* flooding.

Figure 3.3 The three Regions for the qualitative data collection in Peru. (Note: The map on the left displays Peru's location in Latin America, the one on the right the Regions within Peru where qualitative data was collected. Created by the author using paintmaps.com © and mapchart.net © and edited subsequently)

Figure 3.4 below specifies the distribution of these villages across Peru's three large natural zones.
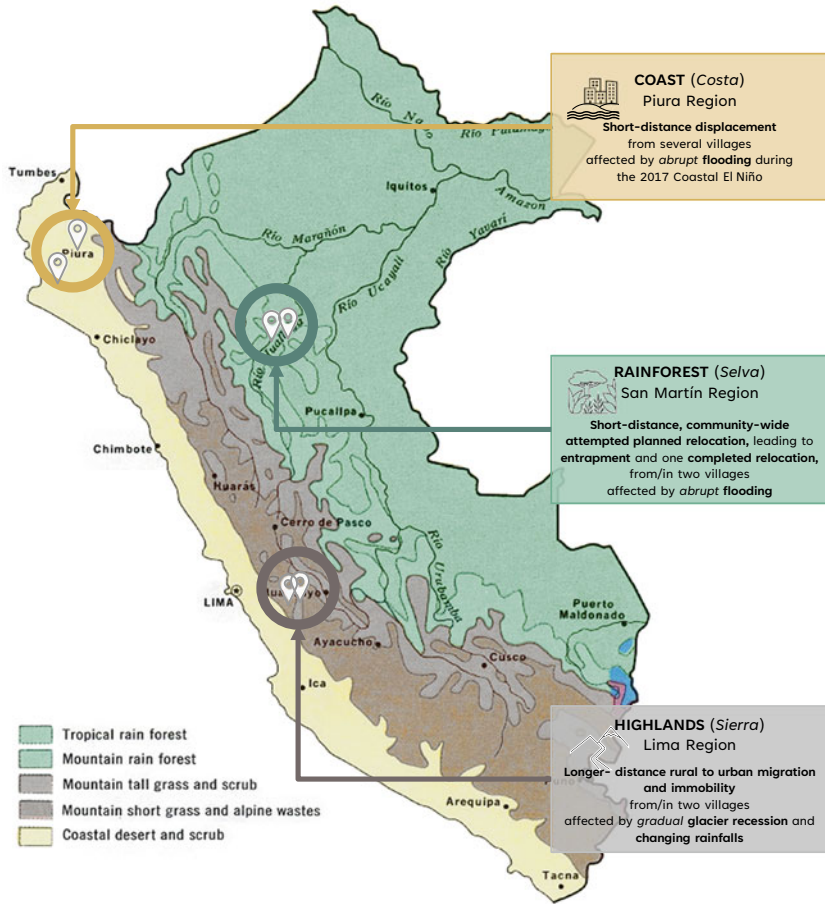
Figure 3.4 Sites for qualitative data collection across Peru's three large regions. (Note: To protect the respondents, the pins indicate approximate locations only. Created by the author, based on CIA (1970))

I selected the areas of origin of migrants (and the homes of stayers) with a view to match three criteria:

(1) Rural villages with similar, locally typical *subsistence livelihood systems* that
(2) have experienced impacts of *water-related climate hazards* typical for *Peru's three large topographical zones* (highlands, rainforest, and coast), which
(3) have influenced *(im)mobilities* in forms characteristic for these hazards, but varied across cases, resulting in diverse well-being conditions.

First, I selected areas with livelihoods—and by extension with (im)mobility patterns—susceptible to climate hazards. The chosen villages primarily use ecosystem-based livelihoods and are typically home to smallholder subsistence farmers with low levels of income, education, and health, who tend to be among the groups most vulnerable to climate impacts (Cohn et al. 2017; Donatti et al. 2019; Niles & Salerno 2018). Selecting villages with these similar livelihood features reduced the number of confounding variables and facilitated better insights into well-being mechanisms; nonetheless, even similar villages are never the same and keeping all contextual variables constant is impossible.

Second, I chose home villages of migrants and stayers affected by either *gradual* or *abrupt* water-related hazards, which were either directly related to climate change or provided temporal analogs. To begin with, I set the focus on water (and related hazards) because it is one of Peru's adaptation priorities in its Nationally Determined Contributions (NDCs) and National Adaptation Plan (NAP) (GoP 2015; MINAM 2021), while global reviews highlight its role in climate (im)mobilities (Nagabhatla et al.; Wrathall et al. 2018). Next, the ex-post design required to select areas where people could *notice* physical (for example, glacier retreat) or temporal effects of hazards (for example, changes in rainfall timing) which influence (im)mobilities (Laczko & Aghazarm 2009). I selected three hazard dynamics that the systematic review for this study identified as the most typical influences on (im)mobility patterns in Peru's three large topographical zones: glacier recession (alongside rainfall changes) in the highlands (*Sierra*); floods in the rainforest (*Selva*); and El Niño events in the coastal zone (*Costa*) (Bergmann et al. 2021a; see also reviews in results chapters 5–7). On the one hand, I selected *Sierra* villages harmed by *gradual* hazards directly attributable to climate change, namely glacier recession (Seehaus et al. 2019) and changes in the rainfall regime (Heidinger et al. 2018). Studies demonstrate that both such glacier retreat (e.g. Alata et al. 2018; Altamirano Rua 2021; Figueiredo et al. 2019; Heikkinen 2017; Wrathall et al. 2014) and rainfall changes (e.g. Hook & Snyder 2021; Lennox 2015; Milan 2016; Milan & Ho 2014) can alter migration in the *Sierra*. On the other hand, I chose villages affected by two types of *abrupt*

hazards for which climate change attribution is not as clear, but which provide temporal analogs for future climate impacts.[5] To begin with, I selected two *Selva* villages harmed by floods, which periodically affect (im)mobilities in this region (e.g. Hofmeijer et al. 2013; Langill 2018; List 2016; Sherman et al. 2016). When habitability is threatened, the state has occasionally attempted to relocate entire communities (Bernales 2019; Desmaison et al. 2018; Estrada et al. 2018; Lopez 2018; Pittaluga 2019). While extreme floods have already increased in the *Selva* (Barichivich et al. 2018; Gloor et al. 2013; Marengo & Espinoza 2016), it remains unclear how much more likely climate change made the specific floods analyzed in this study. Yet, given that extreme floods have increased in this region overall, and climate change is projected to raise them further (Duffy et al. 2015; Langerwisch et al. 2013; Zulkafli et al. 2016), the cases do provide valuable insights into a dynamic with increasing importance. Moreover, I selected sites on the *Costa* harmed by the 2017 Coastal El Niño (CEN) floods. Peru's coast is periodically affected by severe flooding due to El Niño events (Sanabria et al. 2018), which are among the main drivers of *acute* migration in this zone (Bayer et al. 2014; Ferradas 2015; French & Mechler 2017; Venkateswaran et al. 2017). Climate change made the specific 2017 CEN analyzed here at least 1.5 times more likely (Christidis et al. 2019). Even independently of the exact climate attribution for this event, the analysis of the 2017 CEN sheds light on a type of phenomenon that Peru will face more often due to climate change (Cai et al. 2015; IPCC 2019a; Peng et al. 2019). (Lastly, choosing one case per zone also did justice to Peru's diverse topography and made the findings relevant for national policymakers, who typically think in these boundaries.)

   Third, I selected departure and arrival points of diverse spatial and temporal forms of migration to observe varied conditions for well-being changes. Migration was either propelled suddenly (coast and rainforest) or driven over longer time frames (highlands), as shaped by the *abrupt* and *gradual* hazards discussed above. Moreover, I sought to investigate various forms of (im)mobilities along the

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[5] The temporal analog approach is useful to infer possible future impacts of climate change, related (im)mobilities, and well-being implications, see Smit & Wandel (2006). How a system reacts to hazards now can shed light on possible interactions in another time or area for a similarly structured and organized system, see Ford et al. (2010). While systems are never identical and analogs cannot echo future situations perfectly, they can provide a useful empirical starting point and are often employed in research on human dimensions of climate change, see McLeman & Hunter (2010); Sherman et al. (2015). The specific conditions for climate impacts in selected sites provide overarching insights for similar localities that can expect to see more frequent and severe hazards of the same type, see Berrang-Ford et al. (2011). Therefore, notwithstanding causal attribution to climate change, the analogs can provide insights for the future.

spectrum of more voluntary (some cases from the highlands) and forced instances (highlands, coast, and rainforest). I also chose (im)mobilities involving different numbers of people, from individuals to households (highlands and some coastal cases) and entire communities (coast and rainforest). These choices intended to satisfy quality criteria for case selections (Gerring & Cojocaru 2016; Seawright & Gerring 2008).[6]

The local partners facilitating the selection of cases included the Mountain Institute for the highlands; San Martín's Regional Office of Security and National Defense and the Peruvian National Center for Disaster Risk Estimation, Prevention and Reduction (CENEPRED) for the rainforest cases; as well as Caritas and the student group CIMA at the University of Piura for the coast.[7] Gaining access to the research sites and subjects is a key task of empirical research, and these partners allowed me to enter the villages together with local experts who had known the respondents for years. This approach is common in studies on hard-to-reach migrant populations (Bloch 2007; Ho & Milan 2012). Once the sites were determined, sampling and interviewing followed to gather the qualitative data.

3.2.1.2 Data Collection

The analytical units were individual migrants and members of migrant households who either accompanied these migrants or stayed at home (stayers). I targeted the heads of migrant households, and occasionally additional household members like spouses, to gain insights into their experiences related to hazards, (im)mobilities, and well-being. For families of migrant members who had moved away, I attempted to interview the new head of household in the village of origin.

I used non-probabilistic, iterative sampling orientated at contrasts, which some authors coin as *theoretical sampling*. I selected this strategy to systematically

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[6] For *comparability*, I only selected rural agrarian villages with mainly poor subsistence farmers as sending communities. To ensure *plentitude*, I visited at least two areas per region and several villages in each region. To guarantee sufficient *variation*, I selected a range of values for the variables of interest, namely various forms of (im)mobilities leading to diverse conditions for well-being changes. For *independence*, I chose villages across Peru's three large areas that are spatially and socioeconomically distinct. To raise *representativeness*, I discussed the case selection with local experts in ministries, academia, and civil society so that they would reflect properties of a larger number of cases. These discussions also served to do justice to the *boundedness* criterion.

[7] I reiterate my deep gratefulness to these partners. Their original Spanish names are: *Instituto de Montaña*; *Oficina Regional de Seguridad y Defensa Nacional de San Martín*; and *Centro Nacional de Estimación, Prevención y Reducción del Riesgo de Desastres; Cima (Grupo de Formación en Ciencias del Medio Ambiente) de la Universidad de Piura*.

contrast cases and reveal themes, connections, and divergences; to compare the
mechanisms which express themselves in the different cases; and to illustrate the
diversity of well-being constellations, similar as in grounded theory (Corbin &
Strauss 2014; Przyborski & Wohlrab-Sahr 2014; Strübing 2014).[8] After inter-
views, I iteratively read through notes to find incipient patterns and themes around
well-being effects and mechanisms, which guided the selection of new intervie-
wees until returns of further interviews diminished and saturation was reached,
which was the case after 81 interviews.[9] The sampling differed slightly in the
three cases. Migrants from the villages in the *Selva* and *Costa* moved in large
clusters and over short distances, so that they could be readily tracked in desti-
nations. Accompanied by local partners, I spent several days in these sites and
went from home to home to select and interview migrants until saturation was
reached. By contrast, sampling longer-distance migrants from the *Sierra* required
two steps. I started by interviewing households in the Andean home villages
affected by hazards, and then used snowball (or chain referral) sampling to trace
migrants in urban areas.[10] Regarding destinations, I focused on Junín's Regional
capital Huancayo and the national capital Lima for two reasons. First, intervie-
wees in the villages observed that these were the main destinations. Second,
both cities featured migrant hometown associations from the Province of origin,
which organized events that offered chances to meet migrants. I conducted all
interviews in Spanish without interpreters. As all inhabitants in the study areas
spoke Spanish, no exclusions due to language had to be made.

   For conducting the interviews, techniques with varying premises exist (Hopf
2015; Lamnek & Krell 2016). Broadly speaking, they are either like *structured*

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[8] Such sampling does not aim to saturate existing categories (such as age or gender, as in
selective sampling), but rather to select cases that shed light on the key topics for the research
questions, see (Witzel & Reiter (2012). Thus, I recruited participants with varied well-being
paths or with similar outcomes despite dissimilar conditions.

[9] Some authors argue that one interview can be enough, others indicate that saturation can
be reached after six to twelve interviews, or between 20 and 50 interviews, see Baker et al.
(2012); Guest et al. (2006); Guest et al. (2017).

[10] In snowball sampling, initial respondents refer researchers to others with similar back-
grounds in their networks, see Biernacki & Waldorf (1981); Sadler et al. (2010). After
identifying and interviewing migrant households in the villages of origin, I asked whether
they could connect me with the absent relatives and other migrants. I repeated this step until
saturation was reached for the family interviews and sufficient contacts to urban migrant
were identified. In the next step, I contacted and visited the migrants in the cities for inter-
views, and asked each one of them for additional contacts to migrants from their villages until
saturation was reached.

mining for information or *narrative travelling* (Kvale & Brinkmann 2009: 48–50).[11] I decided that combining structured and narrative interviewing served the research interest here best for two reasons. First, it puts researchers in an active position so they can use scientific research knowledge to structure key topics in the interview. Yet, second, it does not limit the proper local perspectives of respondents or impede the chance of discovering novel aspects. To this end, I used elements of the problem-centered method (Kurz et al. 2000; Witzel & Reiter 2012),[12] which brings together the knowledge of the researcher and respondents in a dialogue. Interviewees are competent (but partially biased) insider experts of their lives. Researchers enter as well-informed travelers with scientific knowledge to openly learn, and at once, to assist in reconstructing the meaning of the insider knowledge regarding the research interests.

Accordingly, a prerequisite for this research was compiling information on the interviewee's living conditions. I had gathered this knowledge in a preliminary sensitizing framework that defined the direction of interest and initial priorities. Later, during the interviews, I assessed and situated new empirical observations by continuously mentally referring to this knowledge. Based on the framework, I developed a topical guide with a road map of key interview topics (Figure 3.5 and Electronic Supplementary Material). The guide provided structure and enabled me to re-center on the research interest during interviews, although the relevance and sequence of topics depended on respondents' accounts and the guide was adjusted to new data received. In this way, the guide also ensured comparability across interviews by establishing similar topical complexes in each dialogue.

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[11] *Mining* allows searching for specific information through pre-defined interests and standardized questions. Yet, it provides limited opportunities to discover new or unanticipated aspects, and changing prearranged criteria is difficult. By contrast, *travelling* is like open wandering in the interviewee's experiences. This form facilitates an unprejudiced view of how interviewees construct their subjectivity, but is less goal-orientated, and can require substantive time and resources.

[12] The German term *Problem* underscores the focus on a societal issue with practical relevance for the respondent, in this case, the impacts of (im)mobilities (the *Problemstellung*). *Centering* means that researcher and respondent jointly establish a focus on the research subject of interest. See Witzel & Reiter (2012).
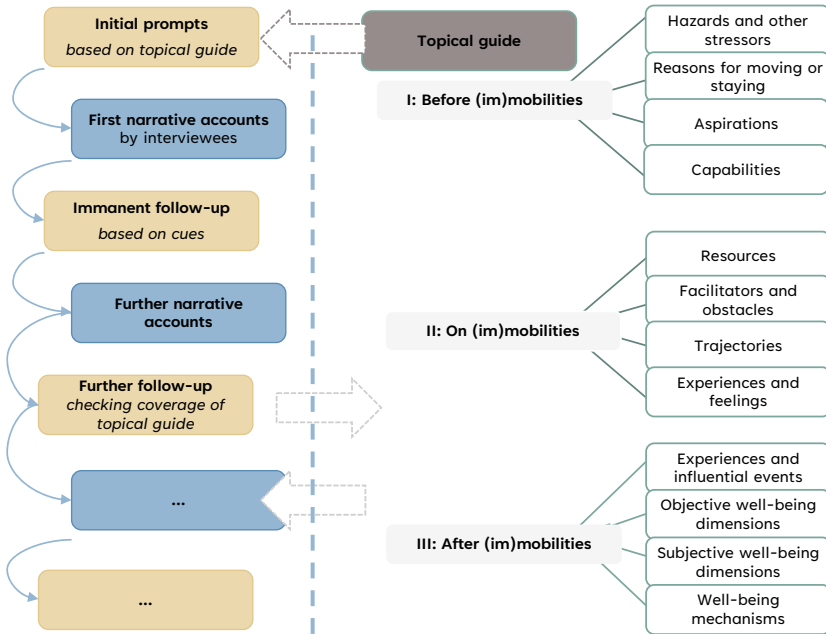
Figure 3.5 Topical guide and topical complexes. (Note: Created by the author)

Conducting the interview proceeded in several stages (Witzel & Reiter 2012). Bearing in mind that the questions were personal and partially sensitive, I left it to the respondents to decide on a setting in which they felt most comfortable to speak (and which still permitted decent recording). Often, we spoke at their homes but when outside, I asked to talk at a small distance from other people (Figure 3.6). Afterwards, a warming up phase with informal conversations with respondents followed to build a relationship. Then, I briefly explained the research project and answered initial questions. Afterwards, I provided an introductory explanation for the interview, including ethical and data protection information as well as a request for permission to record (see Electronic Supplementary Material). Opening questions followed to facilitate narrative accounts by the respondents; they prompted interviewees to tell me the story of how their lives and well-being had changed since they had migrated or stayed. These narrative accounts provided cues for the follow-up conversation on well-being effects

and their causes. Next, I asked follow-up questions to encourage additional narrative accounts and to stimulate self-reflection, sporadically providing imaginative prompts or pre-interpretations. I also used strategies to improve understanding where suitable. When topics from the topical guide were omitted, I asked ad-hoc questions on them, usually toward the end. Closing the interview involved various steps. First, I collected data on age, gender, livelihoods, occupation, and other factors to compare profiles. The recordings stopped here. Second, I debriefed respondents and thanked them for the insights shared. I invited final questions or thoughts and provided information on how to contact me. Third, after leaving the interview site, I wrote postscripts that captured key information for self-debriefing, as sketches of the interviews with first interpretations and cues that would later support the analysis of the data.

Figure 3.6   Photo of an interview with an affected farmer. (Note: Photo taken by colleagues from the *Mountain Institute*)

Besides individual interviews, I convened one focus group with adolescents, as they were previously underrepresented in the data (Figure 3.7). This method brings together people from a target group to engage in a moderated discussion and interaction, which provides different types of insights than individual interviews (Krueger & King 1999; Morgan 1999b). Twelve pupils (3 m / 9f) aged 14 to 16 years old participated. The sampling was purposive: through local partners

in the school, pupils in the final classes before graduating from school—and thus facing the decision whether to stay or migrate—were invited. Questions followed the topical guide for the interviews in a discreetly structured approach. I allowed participants to open their own directions but also applied moderation tools to refocus group dynamics on the research interests. To this end, I used a funnel approach, moving from initially broader, open-ended questions encouraging narration to the central topics, and finally, to specific questions on the research interests (Krueger 1999; Morgan 1999a).

Figure 3.7   Photo of the focus group with pupils in a study site in the highlands. (Note: Photo by the author)

The charts in Figure 3.8 below summarize key data of the 93 affected people. The tables in the respective results chapters 5–7 provide information disaggregated by regions. They illustrate that while most interviewees were at working age, I also covered younger and older groups. Women are slightly overrepresented in the data. While most respondents were mestizo, I was able to sample one indigenous village. Primarily, most interviewees worked in agriculture, and almost all households were agricultural. Finally, across Peru's three large zones, I interviewed similar shares of migrants, displaced persons, relocatees and those trapped but aspiring to relocate, as well as other stayers.
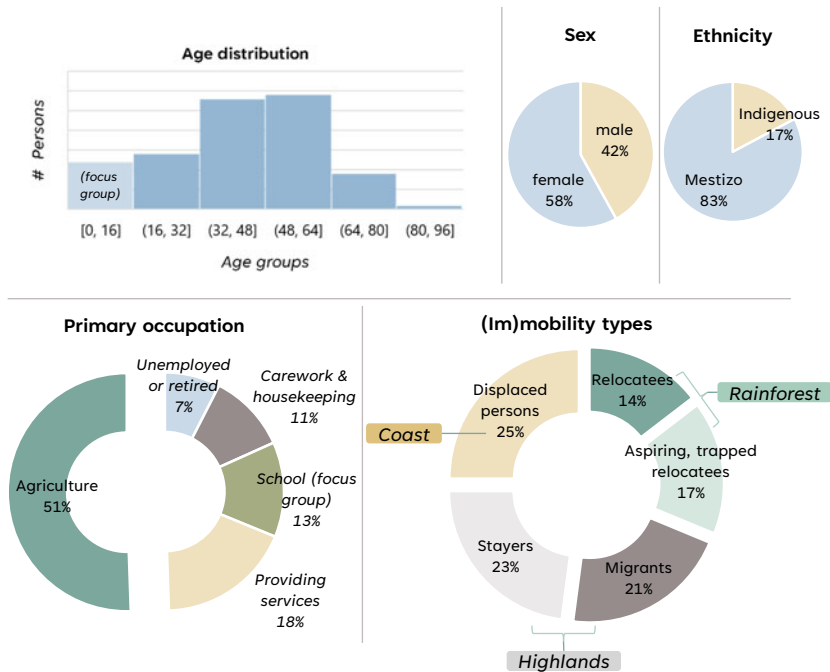
Figure 3.8 Qualitative data profiles of 93 affected people. (Note: The graphs illustrate the profiles of 81 interviewees and 12 focus group participants. Created by the author)

I also conducted discussions with experts for background context on the larger structural factors and processes behind the well-being effects of (im)mobilities in Peru. I identified the experts through desk research and referral from authorities, civil society, and international organizations working on related topics. They included experts at higher state levels, such as staff in national ministries, and at the local level, such as village heads. In total, I discussed with more than 60 policy makers, officials, practitioners, academics, and activists working in diverse entities (Figure 3.9).

Discussions with experts are not a method as such; rather, they are defined by the target group of respondents, namely experts (or key informant), and their special knowledge, position, and access to information about climate change, (im)mobilities, and well-being (Witzel & Reiter 2012). While the interviews with affected people aimed at distilling their subjectivity, discussions with experts
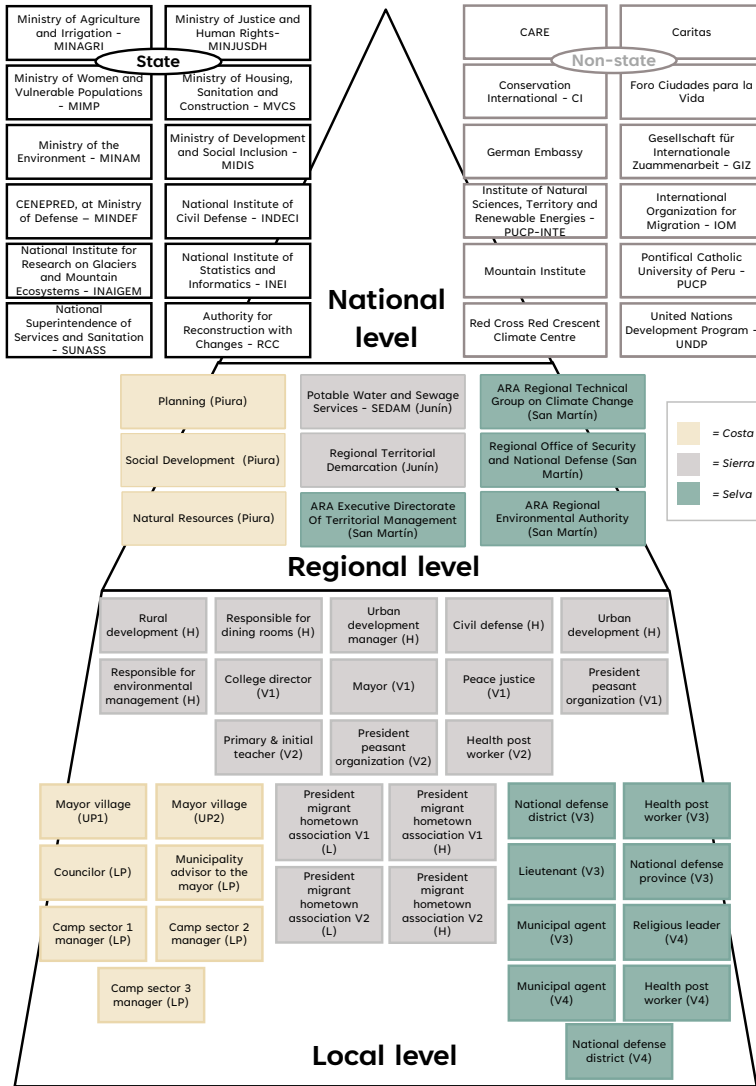
Figure 3.9 Experts consulted across administrative scales and fields of expertise. (Note: Boxes colored beige indicate discussions with experts from the *Costa*, gray from the *Sierra*, and green from the *Selva*. V1 and V2 = village 1 and village 2 in the *Sierra;* H and L = Huancayo and Lima; V3 and V4 = village 3 and 4 in the *Selva*; LP and UP = Lower and Upper Piura on the *Costa.* Created by the author)

intended to find more neutral views on the effects of (im)mobilities held by people who are not research objects themselves (Bogner & Menz 2009; Gläser & Laudel 2010; Helfferich 2014).[13] To this end, I used elements of the problem-centered method (Witzel & Reiter 2012).[14] These discussions fed into the analysis via field notes taken and were not recorded or transcribed.

3.2.1.3 Transcription and Text Analysis

The next step for analyzing the information contained in the recorded interviews with affected people was transcribing them into text. Transcription is an integral part of qualitative analysis processes because it requires selective decisions that imply a first sampling and analysis of the oral material, and results in interpretive constructions (Davidson 2009; Kvale 2007; Sandelowski 1994; Wellard & McKenna 2001). To guarantee careful transcription, the EPICC project at PIK hired a Peruvian student assistant who typed the Spanish transcriptions manually. I provided the assistant with detailed notation, confidentiality, and data protection instructions as well as information on the study purpose, as recommended by the literature (Stuckey 2014; Wellard & McKenna 2001). The transcriptions are based on intelligent verbatim guidelines, with cues of some nonverbal behavior, an approach which can increase reliability, dependability, and trustworthiness of the results (Easton et al. 2000; Stuckey 2014). In this way, the assistant only discreetly adjusted information for readability, without changing the core of what was said. Finally, the assistant proofread all transcripts and I checked and listened to some of the transcribed tapes for quality control (MacLean et al. 2004). After transcription, I deleted any data that could identify the interviewee, such as names, workplaces, and specific positions (Stuckey 2014). The transcription guidelines are in the Electronic Supplementary Material.

Amon the many approaches used for analyzing qualitative data (Flick 2009; Gläser & Laudel 2010; Mayring 2014), I selected thematic and evaluative Qualitative Text Analysis (QTA) after Kuckartz (2010, 2014b; Kuckartz & Rädiker 2019) as the central method for analyzing the transcribed interviews in this dissertation. Thematic (or content-related) analysis enables "identifying, systematizing, and analyzing topics and subtopics and how they are related", while evaluative analysis is about "assessing, classifying, and evaluating content" (Kuckartz 2014b:

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[13] Nevertheless, expert knowledge is also formed by personal experiences, aspirations, and socialization.

[14] The method stipulates that discussions with experts require significant prior knowledge so that the researcher can structure the conversation and reconstruct knowledge. Researchers thus become co-experts, but still aim for a dialogue with narrations and moderately re-center on the research interests along the topical guide.

68). I used this combination to understand factual changes in well-being as well as underlying processes.[15] The QTA followed a five-step approach with reference to the research questions (Kuckartz 2014b) (Figure 3.10).

Using MaxQDA software, first I added several variables to the cases for comparative analysis later (age; gender; interview site; occupations; and (im)mobility status). Then, I systematically read entire interviews with a view to *understanding* their meanings for the research questions (Kuckartz 2014b).

Afterwards, I created a combination of thematic and evaluative *categories* in a mixed, concept- and data-driven approach.[16] In a first step, I derived concept-driven, thematic and evaluative categories and sub-categories from the research questions, central concepts, theories, and topical guide in this study. For example, for categories on objective well-being, I adjusted and extended previous findings from ressearch with deprived groups in Peru (Copestake 2008c) (see section 2.3). Initial categories also evolved from the topical interview guide, for example, on migration capabilities, aspirations, and drivers. The coding started with these categories. Second, while coding the first 30% of all interviews, I added new, data-driven categories using a subsumption strategy (Kuckartz 2014b; Mayring 2010): I probed all text step by step to find new topics around the research questions. Then I subsumed aspects already covered by existing categories under those. Finally, I created new (sub-)categories for new aspects. For evaluative categories (such as well-being changes in health), I defined three ordinal levels: positive/improving, neutral, or negative/deteriorating. While coding the first 30% of the material, I also adjusted the concept-driven categories as needed. Third, I compiled all text segments for each category, developed category definitions and anchor examples (and differentiation from other codes, where needed), and fixed the category system. Finally, I used this system to code the whole material. The category system is detailed in the Electronic Supplementary Material.

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[15] Beyond, I also explored the use of fine structure and system analyses for a deeper level of understanding, see Froschauer & Lueger (2003). However, the preconceived ideas of the German discussants and their social conditions (foreign, white, academic, wealthy, researchers) were too different from the Peruvian context. To apply this method, the original Spanish texts would have also required a translation into English or German that would have further blurred words and meanings.

[16] Categories (sometimes labelled *codes*) in social research are "a term, a heading, a label that designates something similar under certain aspects", see Kuckartz & Rädiker (2019: 184). They depict commonalities. As umbrella terms, they are based on criteria that allow subsuming common features to lower complexity and sort information on research interests. They are the central analytical tool in QTA, which "stands or falls by its categories", see Berelson (1952: 147). All categories together form the *category system.*

The circles contain the following text, arranged around the central question:

(1) Reading the data intensively

(2) Building the coding frame

(3) Coding the data

(4) Analyzing the coded data

(5) Presenting the results

In what ways and why does migrating from, or staying in, areas harmed by climate hazards affect people's well-being?
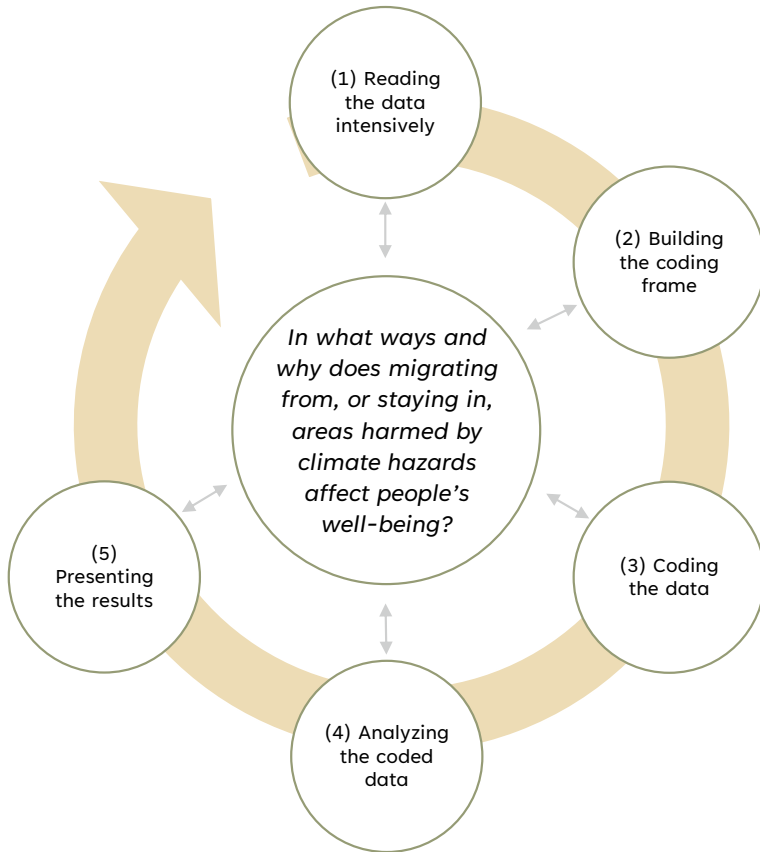
Figure 3.10 The analytical process of Qualitative Text Analysis. (Note: Reproduced and edited by the author, based on Kuckartz (2014b: 40))

Subsequently, I used three tools to analyze the data based on these categories (Kuckartz 2014b; Kuckartz & Rädiker 2019). First, I focused on *topics and subtopics*, analyzing each main category regarding what was discussed and what was omitted or evaded, as well as what tendencies and singularities emerged across cases. I thereby aimed to account for the criticism that QTA tends to overstress frequently mentioned topics, reproduce mainstream and dominant narratives, and

suppress or deny other contents and their absence (George 1959). Second, I examined *relationships between* main *categories* and their sub-categories. For example, I analyzed how well-being components within the category *development from a secure base* (livelihoods, education, health and food security) related to each other, and also how this main category related to the other three main categories. Third, I examined *trends across groups*, for example by comparing views of people engaging in varied types of (im)mobilities, driven by either *abrupt* or *gradual* hazards. Building on these tools, I drew conclusions on the research questions and identified new questions arising from the analysis.

3.2.1.4 Ethical Considerations and Data Protection

Research with human subjects must address ethical challenges (Friedrichs 2014), especially when asking migrants or stayers, some of whom in vulnerable situations, about sensitive topics (van Iiempt & Bilger 2012). Ethics require taking responsibility for the researchers' actions as well as providing accountability and redress options (Dench et al. 2004). The principle of "do no harm" is key for qualitative studies, which imply personal and little standardized interactions. Guidelines and regulations commonly highlight the Belmont principles.[17] The German Professional Association of Sociologists and the American Sociological Association share similar criteria (Friedrichs 2014).

To comply with these standards, I asked respondents for their written informed consent to participate in interviews (see Electronic Supplementary Material).[18] Further, I explained which information would be collected and how it would be used. I also detailed the research procedures and products as well as related potential benefits and risks. As migration research often influences real policies, scholars need to be aware of possible impacts on their respondents and reflect on which data truly needs to be collected (van Iiempt & Bilger 2012).[19] Next, prior to the interviews, I explained that confidential information would be treated as

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[17] Respect for human dignity, justice, and beneficence, which are to be fulfilled through four strategies: "informed consent, non-deception, privacy and confidentiality, and accuracy", see Christians (2005: 144).

[18] Receiving *genuine* consent from respondents who are in vulnerable situations can be challenging, as they may consent due to power dynamics, see Mackenzie et al. (2007). Therefore, I stressed that participation was voluntary, and that refusal to participate or to answer specific questions would not result in negative consequences.

[19] Although I strived to understand possible risks for the respondents, I recognize that I am an outsider without full knowledge of their social circumstances and cannot rule out all negative impacts.

such, and that the data would not be used in ways that could compromise respondents. I stressed that I would never reveal people's clear names or the names of their hometowns, and since I interviewed respondents from small settlements, I carefully assessed if they could be identified despite the deletion of these names. In the analysis, I use a numbering system (for example, V1–4 for respondent 4 from village 1) and broad categories (such as age group) to refer to interviewees. Then, I asked for written permission to record, transcribe, and use the information academically. Finally, I restricted access to recordings and transcripts to myself and the student hired for transcription, under strict data protection policies. Focus groups require equal attention to ethical principles (Morgan 1999b), especially as the one conducted here was with adolescents.[20] One overarching ethical challenge in the qualitative part was dealing with inequalities in the relationship with the interviewees (Lammers 2007). I, as a foreign, privileged researcher, met people in often-vulnerable situations in which power relations, hierarchies, and strong socio-economic differences were salient. I attempted to be aware of these factors to avoid that people participated against their will, for example, due to social pressure or fear of negative consequences, and bearing in mind that there might be personal reasons to participate (Glazer 1982). I emphasized that the interviews had academic character and would not entail financial compensation, which was key as many deprived respondents hoped for support.[21] Ethical considerations also applied to the time after collecting the qualitative data. (Most

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[20] I highlighted voluntary participation and the right to refuse to answer questions, assured confidentiality, and informed participants that what they said would never be quoted with their names. Participants were free to take breaks or leave at any point. Especially when discussing potentially sensitive or stressful aspects, I set limits for the discussion and tried to avoid over-disclosure by participants which they might regret later, or which might expose them.

[21] In some cases, respondents still approached me for non-financial help. No official guidelines exist on adequate reactions to such requests, and according to van Iiempt and Bilger, they constitute "an ethical challenge that is open for debate and strongly influenced by one's personal views" (2012: 461). In the critical realist view taken here, practical help and advocacy were desirable whenever feasible without compromising the research quality, if respondents explicitly requested and agreed to such non-financial support. Interviewing requires building trustworthy relationships and a reciprocal process of giving and receiving, and research with people in vulnerable positions must go beyond doing no harm toward reciprocal benefits: "when a human being is in need and the researcher is in a position to respond to that need, non-intervention in the name of 'objective' research is unethical", see Mackenzie et al. (2007: 316). In my view, researchers are often well-positioned and may even have a duty to speak on behalf of their respondents if the latter lack voice to speak for themselves.

of these considerations also applied to the quantitative strand discussed further below).[22]

3.2.1.5   Limitations

The research design offered various strengths—which are discussed in the conclusions (chapter 9)—but also implied limitations. First, the site selection was strongly shaped by what local partners suggested as accessible locations. Although I chose sites representing diverse conditions, partners did not propose areas that would be too dangerous for an outsider. Thus, the study might not cover well-being processes of people in insecure vicinities. I attempted to compensate for this possible limitation through discussions with experts and the quantitative strand, which provides data for all settings.

Second, not all migrants of interest could be sampled and interviewed. For example, men, adolescents, and older adults are underrepresented in the data, and I did not interview children due to ethical concerns. In particular, the snowballing technique applied for tracing migrants from the *Sierra* might have created biases and blind spots (Jacobsen & Landau 2003). People without close contacts in their villages of origin were possibly not reached and respondents' personal situations might have further shaped the reach. For example, some migrants may have declined interviews as they were either ashamed of their situations or doing so well that they did not care to spend time with an outsider. In addition, not all migrants came to hometown association meetings where most interviews took place, some possibly because they lacked money for the necessary travel or time due to their hard work. Nevertheless, snowballing was the most robust option available for the set-up of this study and built upon prior studies in this field (Koubi et al. 2016; Laczko & Aghazarm 2009). In research with hard-to-reach populations, accurate sampling frames tend to be unavailable or too expensive to create, as was the case here (Bloch 2007). In such cases, chain referral through

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[22] Storing and cleaning the data from the fieldwork involved a strict protocol for data protection, such as encrypted storage in a separate virtual partition with password protection and saving identifying information separately from files with substantive responses. The student assistant hired for transcription signed a contract with strict data protection requirements. When analyzing data and formulating interpretations, I considered potential risks and benefits for the respondents, especially when dealing with inconsistencies in the primary data, for example, what respondents revealed and what they seemed to adapt, distort, or conceal, see van Iiempt & Bilger (2012). Before disseminating the findings through this dissertation and other publications, I took care to review how the outputs could affect respondents first. Finally, since affected people shared their time and information with me, I also attempted to share the results of this study with them in reciprocity. However, since COVID-19 made traveling to Peru difficult, I could not share the results directly on-site as originally planned.

intermediaries, service providers, and local organizations—such as the migrant hometown associations here—is common. In addition, as the new respondents often have friendly and trusted ties with the chain referrers, such sampling can build more motivation and higher response rates among otherwise hard-to-reach groups than other methods (Bloch 2007; Faugier & Sargeant 1997). Building such access and personal relationships is key for interviewing people who may be otherwise reluctant to participate and allows for an efficient use of time and resources (Atkinson & Flint 2001; Heckathorn 2002; Rodgers 2004).

Third, in some cases it was not possible to follow through with the interview techniques suggested by the problem-centered method. Respondents were often on the move or occupied, so that conversational instead of overly formalized approaches were required. Moreover, many respondents did not provide long narrative accounts in response to opening questions or further prompts, which led to some situations where question-response schemes prevailed. In addition, as interviews mostly took place in places familiar for respondents, occasionally, more people joined in and created small group discussions. These additional accounts often opened new views, but occasionally, they also changed the conversation dynamics. In such situations, social desirability, hierarchies, and fear of over-disclosure may have shaped the main respondents' answers (Reczek 2014).

Third, I initially had envisaged more focus groups, yet time, resource, and later COVID-19 constraints impeded this goal. The focus group in the *Sierra* provided valuable insights and might have been usefully replicated in other settings to explore narratives of other specific groups. For example, distilling female group views would have been interesting to contrast male narratives, since gender aspects are often salient in rural areas in Peru (Milan 2016). However, with around 60% of the interviewees being women, female views are still duly accounted for. Valuable insights could also have been gained through additional focus groups with members of receiving communities or with groups divided between migrants faring better and those faring worse in destinations. I accounted for this change in plans by considering results across varied sub-groups of respondents in the analysis.

Fourth, Qualitative Text Analysis also implied certain limitations. To start with, additional coders or reviewers could have increased the reliability and quality of the category system (Kuckartz & Rädiker 2019) but were not available due to resource constraints. Beyond, QTA alone may not pierce through the surface of all interview content (Rosenthal 2018), and as a code-based analysis, it risks detaching text from the original context (Hitzler & Honer 1997). I countered this constraint by accounting for the sequential structure and *Gestalt* of key cases, which raised the understanding of the meaning of the texts and their contexts

(Hopf 1995; Hopf & Hopf 1997; Hopf & Schmidt 1993). Finally, because I met several experts in the context of work trips for the EPICC project at PIK, some of the discussions were infused with discussions around project needs and results, which occasionally conflicted with a structured interview approach. For this reason and due to time and resource constraints, these discussions with experts were not recorded or transcribed; rather, I used notes taken from the conversations with experts mostly as contextual information for the analysis.

Lastly, while several features of the study design raised the validity of results—including in-depth interviews with affected people and triangulation with experts—findings should still be read with two limitations in mind. First, the cross-sectional data may mask longer-term changes in OWB and SWB or lagged interactions. Intergenerational and life-course views would provide additional value for time-dependent effects (Dustmann & Glitz 2011; Singh et al. 2019) and longitudinal data could provide supplementary insights (KNOMAD 2015). For example, the lack of long-term data impeded an evaluation of possible long-term, positive side-effects of the 2017 CEN on the *Costa* (such as more pasture, planting areas, and forests, which were witnessed in prior events (Sperling et al. 2008)), which could influence people's well-being. Finally, for the *Selva* and *Costa* cases, limits of temporal analogs must be kept in mind, so that the results of this study may be transferable to a large degree to future El Niño events or rainforest floods, but not fully (Berrang-Ford et al. 2011; Ford et al. 2010). As just one example, governance strongly shapes the emergence of disasters (e.g. Ahrens & Rudolph 2006; UNDRR 2020) and strongly affected the well-being effects for displaced persons and relocatees in this study; however, it remains unclear how Peruvian institutions, policies, and governance may change in the future, and how these changes would affect well-being outcomes in turn.

3.2.2   Quantitative Methods

This section explains the data and methods used in the statistical analyses to study differential displacement risk and the effects of displacement on people's well-being after the Coastal El Niño (CEN) floods in March 2017. I give additional details in the full empirical case study in chapter 7.

3.2.2.1   Data

The quantitative analyses make use of two datasets compiled by INEI. First, INEI collected data from households and public buildings in areas affected by the CEN through a survey conducted between mid-April and end of April 2017. Through

this "CEN Survey"[23], it aimed to improve the understanding of damages and the characteristics of affected people, their dwellings, and public infrastructure. To gather the data, INEI asked local authorities in the 892 districts declared in a state of emergency due to the CEN (Table 3.1) to identify all affected rural villages as well as the affected blocks in urban areas, in which enumerators then recorded data from all heads of households and information about all public buildings (INEI 2017a, 2017c).[24] Altogether, the CEN Survey registered 398,148 persons in 199,938 dwellings and 2,615 public buildings. This analysis focuses on the 186,437 adult respondents whose homes where directly affected and experienced at least minor damages.[25] The extensive CEN Survey provides a first valuable data point about the most affected areas in Peru shortly after the main floods had affected Peru in March 2017.

Table 3.1 Areas for data collection in the CEN Survey

Region	Number of affected districts	Region (*continued*)	Number of affected districts (*continued*)
Áncash	166	Lambayeque	38
Lima	148	Ica	33
Cajamarca	127	Tumbes	13
La Libertad	83	Huánuco	2
Piura	65	Moquegua	1
Huancavelica	61	Junín	1
Ayacucho	53	Cusco	1
Arequipa	52	Madre de Dios	1
Loreto	47		

Note: Data were collected in 892 districts declared in a state of emergency during the 2017 CEN. Reproduced from INEI (2017c: 4).

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[23] Census of Population, Housing, and Public Infrastructure Affected by El Niño Costero 2017, original Spanish name: *Censo de Población, Vivienda e Infraestructura Pública Afectadas por El Niño Costero 2017.*

[24] For more technical details regarding sampling and enumeration, refer to INEI (2017c).

[25] The analysis excludes children below 18 years to avoid double counting and because the survey did not contain relevant data for them on key well-being items, such as employment.

   The second dataset is the Peruvian National Census 2017 (INEI 2018c),[26] which was by chance enumerated seven months after the CEN disaster and thus six months after the CEN Survey. To support this research, INEI searched for the 398,148 respondents of the CEN Survey of April 2017 among the 29.4 million entries of the National Census collected on the 22nd October 2017 (INEI 2018c).[27] INEI found 342,009 CEN respondents in the Census (87.2%), whereas 49,933 persons (12.7%) could not be cross identified. The well-being analysis here focuses on the 186,437 adult CEN Survey respondents with affected homes, of whom 164,084 (88%) could and 22,353 (12%) could not be cross-identified in the National Census data. This attrition could be due to various reasons. For example, persons surveyed in the CEN could have passed away, moved abroad, lived in areas that could not be surveyed, or refused to cooperate in the enumeration. However, because the differences between the identified and non-identified groups are not large, they should not lead to a strong systematic attrition bias in the analyses. The summary statistics for the CEN Survey respondents with homes affected by the disaster demonstrate that the respondents who could not be identified in the National Census did not differ substantially from the cross-identified population regarding key social factors (Table 3.2). The two groups had almost identical rates of secondary education, civil status, and disabilities. In the group cross-identified in the Census, approximately five percentage points less respondents lived in small rural villages and around five percentage points more were unemployed or female compared to the non-matched group.

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[26] Original Spanish name: *Censos Nacionales 2017: XII de Población, VII de Vivienda y III de Comunidades Indígenas.*

[27] I would like to reiterate my gratitude to the colleagues at INEI for supporting this research. They first cleaned the CEN Survey data and removed entries without information on surnames, which left 391,942 records. Afterwards, it identified the CEN Survey respondents in the Census based on identical names, surnames, dates of birth, sex, districts of residence, and identity document numbers through a deterministic linking application in SQL Server. Entries with a similarity of more than 85% were selected. INEI then tracked further cases through probabilistic linking with names, surnames, and similar ages, as well as through visual review. Duplicates were removed.

Table 3.2 Summary statistics on CEN Survey respondents cross-identified in the National Census and those not re-identified

Variable	N	Mean	Median	SD	Min	Max
CEN Survey respondents *cross-identified* in the National Census						
Age	164,084	44.005	41	17.74	18	99
Female	164,084	.527	1	.499	0	1
Disability	164,084	.085	0	.279	0	1
Secondary education	164,084	.513	1	.5	0	1
In partnership	163,243	.403	0	.49	0	1
Living in small rural village	164,084	.233	0	.423	0	1
Unemployed	163,433	.496	0	.5	0	1
CEN Survey respondents *not identified again* in the National Census						
Age	22,353	43.434	39	20.161	18	99
Female	22,353	.466	0	.499	0	1
Disability	22,353	.092	0	.289	0	1
Secondary education	22,353	.523	1	.499	0	1
In partnership	22,175	.37	0	.483	0	1
Living in small rural village	22,353	.286	0	.452	0	1
Unemployed	21,985	.452	0	.498	0	1

Note: For all variables but age, 0 = no and 1 = yes. The comparison considers only affected, adult household members.

3.2.2.2   Regression Models

These datasets were then used to analyze the research questions explained above through several regression models. The first analysis estimated how different environmental, socioeconomic, and demographic factors influenced the displacement risk of the households. Because the outcome is binary coded, the estimation was completed with logistic regression models. Model 1 considered only the influence of exogenous environmental factors, such as topographical and rainfall data.[28]

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[28] The rainfall data was drawn from the MERRA-2 dataset, which is based on GPM satellite data and provided by NASA. Riccardo Biella helped with the data extraction and resampling to a 1 km resolution using bilinear interpolation. The topographical data (maximum elevation

This baseline model was then gradually extended by including further information on household composition and demographic characteristics (model 2) as well as on livelihood factors and wealth (model 3). I detail the model parameters in the empirical section 7.3.

The second analysis centered on how displacement affected people's well-being. It started by comparing the well-being of the displaced households to those whose houses were affected but who could remain at home directly after the disaster, based on summary statistics of the CEN Survey. Because this exceptional sample covers close to the full affected population, summary statistics render robust results on people's well-being outcomes. Then, five linear regression models were specified to explore the impact of the displacement on well-being seven months after the CEN under control of a broad set of environmental, demographic, and socioeconomic variables. The sample in this part of the analysis were the affected adult CEN Survey respondents who could be tracked in the National Census. To understand the displacement effects, a well-being index based on indicators available in the data was built, mainly using items for *a space to live better* and, to some degree, items for *development from a secure base* (see section 7.3 for details). The impacts on well-being were then analyzed through various models. Baseline model 1 comprised displacement as the only parameter. The next models added gradually more control variables for environmental factors (model 2), household composition and demographics (model 3), livelihood characteristics and wealth (model 4), and individual characteristics (model 5). The models thereby control for the potential non-randomness of the displacement risk. People do not randomly migrate or flee but factors such as age, sex, and well-being can systematically shape the probability of movement (Aksoy & Poutvaara 2021; Borjas et al. 1992; Kaestner & Malamud 2014). The controls are needed since the observed well-being outcomes might therefore not be due to the displacement itself, but due to pre-movement factors that made displacement more likely in the first place.

3.2.2.3   Limitations

The quantitative work allowed for a novel analysis of differential displacement risk and well-being impacts in an extensive sample of affected people from all of Peru. Thereby, the work complemented the in-depth qualitative analysis of well-being effects and mechanisms in coastal Piura usefully. Despite generating this added value, the results should be read with the following limitations in mind.

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and elevation range in the districts as well as average distance to inland water bodies) were distilled from the GTOPO30 digital elevation model, which has a 30 arcsec resolution.

First, because data was not available for all parameters, the analyses operated with a subsample of the respondents (see section 7.3). Data was not consistently enlisted for those households whose homes had remained *unaffected* by the disaster. Therefore, the analyses focused on the respondents who had indicated that the disaster had *affected* their houses negatively, and for whom data was available. The differences in displacement risk and well-being might be even larger if compared to the unaffected. In addition, as the study excludes respondents below 18 years to avoid double counting and due to missing data, it allows insights into children's situation by extension only.

Second, because the CEN Survey did not contain an explicit question on displacement status, the analysis is based on proxies that may be noisy. The assumption that uninhabitable homes equaled displacement (see section 7.3) is a plausible basis for the analysis. However, people with intact homes could still have fled, for example, because they were afraid of the disaster, had lost their livelihoods or health, or complied with the issued early warnings. Conversely, respondents whose homes were destroyed could still have decided to remain in place. Additionally, while the data on habitability allowed to infer that people were displaced one month after the CEN, information was missing if they had returned or remained in displacement due to the event seven months later.

Third, a possible attrition bias must be discussed for the well-being analysis because 12% of the subsample of interest was lost when merging the surveys. The remaining sample is still large, but if the attrition is not random, then the differences between the dropped-out and the remaining respondents could introduce a bias into the results and decrease the internal validity of the study (the identified relationships between variables). Yet, the summary statistics document that the differences between the remaining and the dropped-out respondents are marginal (Table 3.2). Additionally, the attrition affects the external validity less (the generalizability to the original population) as the sample still includes almost the entire possible population of the Peruvian households affected by the CEN.

Fourth, the surveys collected by INEI could not reflect the full range of well-being indicators of interest in this dissertation (see framework developed in section 2.3). Primarily, the data did not contain indicators on *social relatedness* and *subjective well-being*. While more data was available for the components *development from a secure base* and *a space to live better*, information was missing for several key subitems of these components, such as education or physical security. Therefore, the quantitative well-being analysis offers a robust indication of the life situations of a large group of affected people, but the scope of well-being which could be analyzed was limited. The qualitative analysis was a critical complement to understand the broader range of well-being changes of interest.

Fifth, there might be additional, district- or community-level factors that this analysis could not control for, but which could have influenced the well-being results. Examples include the quality of community networks and support, social participation, neighborhood infrastructure, local leadership and governance, and resource equity (Berkes & Ross 2013; Koliou et al. 2018). While the statistical analysis could not rule out indirect effects through these factors, the qualitative analysis partially compensates for this lack of data and offers insights into some of the possible influences.

Finally, the survey data offered two data points for up to seven months after the CEN, but neither allowed for insights into people's gradual development of well-being nor into the outcomes over the long term. Given that many persons displaced by the CEN have remained in prolonged displacement (AFP 2021; IOM 2017c, 2018), it would have been interesting to see how different groups have recuperated over time, and which factors have aided or impeded recovery. The qualitative data collected one year after the Census helped to discern some of these longer-term phenomena.

Despite these limitations, the analyses of the secondary quantitative data provide extensive information on the differential displacement risk and well-being of a large group of affected people across the entire country, which usefully complements the analysis of the primary qualitative data.

State of the Evidence on Climate (Im)mobilities and Well-Being

4

In this chapter, I review and synthesize the existing evidence relevant for the research questions of this dissertation. First, I briefly assess knowledge on the effects of hazards on (im)mobilities, underlying workings, and seminal studies in Latin America. Afterwards, I evaluate the literature on how migration in general—and climate-related cases in particular—can affect objective and subjective well-being (OWB and SWB). Finally, I discuss implications for this study. The chapter sets the stage for the subsequent discussion of the new empirical findings on Peru in chapters 5–7, which also contain detailed reviews of hazard-(im)mobility links in the respective study areas.

4.1 State of the Research on Links between Hazards and (Im)mobilities

4.1.1 Research Evolution and Landscape

Research on hazard-(im)mobility links has rapidly developed and applied varied foci (Flavell et al. 2020). After a first wave of research in the 1980s, studies have steadily risen and reached over 100 peer-reviewed outputs per year since 2008 (Ionesco et al. 2017). While first generation research focused on the causal contributions of hazards to migration (Jäger et al. 2009), second generation research expanded to more holistic assessments of migration as one among many livelihood strategies to address climatic and other stressors (McLeman & Gemenne 2018; Piguet 2013). Throughout, various streams of research have also mapped populations at risk of migration or projected future pathways (Clement et al.

Table 4.1 Identified synthesis studies of hazard-migration linkages worldwide

Region or focus	Author and year	# Studies analyzed
Africa	Borderon et al. 2019	53
Africa, Sahel	Jónsson 2010	13
Africa, Sahel	Neumann & Hermans 2017	53 case studies
Africa, Sub-Saharan Africa	Morrissey 2014	More than 30 studies
Africa, West Africa	van der Land et al. 2018	15 case studies
Arab Countries	Wodon et al. 2014	Unspecified
Asia	Hugo & Bardsley 2014	Unspecified
Asia	Ober 2019	Unspecified
Central Mediterranean Route	Bendandi 2020	Unspecified
Europe	Mulligan et al. 2014	Unspecified
Global	Field et al. 2012	Unspecified
Global	Gómez 2013	Unspecified
Global	Adger et al. 2014	At least 29 clearly specified
Global	Berlemann & Steinhardt 2017	Unspecified
Global	Beine & Jeusette 2021	51
Global	Piguet et al. 2018	1193 publications with 463 empirical case studies
Global	Cattaneo et al. 2019	Unspecified
Global	Flavell et al. 2020	Unspecified
Global	Hoffmann et al. 2020	30
Global	Kaczan & Orgill-Meyer 2020	17
Global	Šedová et al. 2021	116
Global	Yar & Wali 2020	Unspecified
Global	Cissé et al. 2022	Unspecified
Global (focus on agriculture)	Falco et al. 2018	Unspecified
Global (focus on agent-based models)	Thober et al. 2018	15 model studies
Global (focus on bibliometry)	Milán-García et al. 2021	140 from Web of Science, 193 from Scopus

Table 4.1   (continued)

Region or focus	Author and year	# Studies analyzed
Global (focus on cross-border)	Obokata et al. 2014	92
Global (focus on cross-border)	Veronis et al. 2018	183 articles
Global (focus on drylands)	Smith et al. 2011	34
Global (focus on ecoregions)	McLeman 2016b	160
Global (focus on low-lying coastal areas)	Costanza et al. 2011	Unspecified
Global (focus on health)	Zanhouo & Nana 2019	32
Global (focus on health)	Mazhin et al. 2020	20
Global (focus on health)	Schwerdtle et al. 2020	50
Global (focus on mountainous regions)	Kollmair & Banerjee 2011	Unspecified
Global (focus on quantitative methodologies)	Hoffmann et al. 2021	127
Global (sea-level rise)	McMichael et al. 2020	33
Global (focus on settlement abandonment)	McLeman 2011	246 cases (from a higher number of studies)
Global (focus on urbanization)	Morinière 2012	147
Global (focus on water-stress)	Wrathall et al. 2018	184
Hindu-Kush Himalayas	Banerjee et al. 2014	Unspecified
Latin America	Kaenzig & Piguet 2014	Unspecified
North America	Adamo & de Sherbinin 2014	Unspecified
Oceania	Campbell & Bedford 2014	Unspecified

Note: Created by the author.

2021; de Sherbinin & Bai 2018; Gemenne 2011; Warner et al. 2009). While scholars have also started to warn of risks linked to immobility in dangerous areas, this flipside of migration has remained studied less (Foresight 2011; Wiegel et al. 2019; Zickgraf 2018). Later, a third generation of studies has started to empirically assess the impacts of climate migration (e.g. Melde et al. 2017). I summarized existing synthesis studies in the field elsewhere (Bergmann 2019)

and briefly repeat main findings here, especially from reviews published later (Table 4.1).

The synthesis of existing reviews certifies that knowledge about climate *migration* has improved, yet with marked gaps and biases. Key hazards remain understudied; key geographic gaps persist; North–South divides in research and funding agendas have endured (Piguet et al. 2018; Wrathall et al. 2018); and publication biases exist (Šedová et al. 2021). Additionally, methodological choices strongly shape results (Beine & Jeusette 2021; Šedová et al. 2021). The variety of concepts, designs, and methods used—and diverse spatial and temporal scales, units, and data structures—have made it difficult to compare results and draw conclusions (Borderon et al. 2018; van der Land et al. 2018; Vinke & Hoffmann 2020). While research mostly consists of case studies (Gemenne 2018; Piguet et al. 2018), meta-analyses have advanced recently (Beine & Jeusette 2021; Hoffmann et al. 2021). Conversely, climate *immobilities* remain understudied (Cundill et al. 2021; Hoffmann et al. 2020).

4.1.2   Identified Effects and Underlying Mechanisms

Meta-studies find significant positive and negative effects of hazards on migration, especially in low- and middle-income and agriculturally-dependent countries (Beine & Jeusette 2021; Hoffmann et al. 2020; Šedová et al. 2021). Most migration is within countries and over long distances, rather than localized (Kaczan & Orgill-Meyer 2020), often from rural to urban areas (Šedová et al. 2021).

Both environmental hazards and benefits can shape migration (Bendandi 2020). Hazards can inhibit and accelerate existing movements or create entirely new flows, depending on the hazard type and duration (Beine & Jeusette 2021; Borderon et al. 2019). Especially extreme temperatures, water-stress, and rainfall changes have significant effects (Berlemann & Steinhardt 2017; Hoffmann et al. 2020; Šedová et al. 2021). The severity of hazards affects flows nonlinearly, depending on people's capabilities and vulnerabilities (Kaczan & Orgill-Meyer 2020). The impacts on migration also seem greater for recent hazards (Beine & Jeusette 2021; Šedová et al. 2021). The speed of hazards can create different outcomes. If *gradual* hazards make migration more or less likely remains disputed and depends on context (Borderon et al. 2019; Cattaneo et al. 2019; Zickgraf 2021). The most direct climate-migration link is displacement after *abrupt* extreme events (Cattaneo et al. 2019), which is usually short-term, short-distance, and shaped by gender and vulnerabilities (Berlemann & Steinhardt 2017; Cardona et al. 2012). Displacement can become permanent due to cumulative shocks and

extraordinary disasters, particularly for at-risk households (Berlemann & Stein-hardt 2017). Finally, abrupt extreme events can also drive in-migration, such as for reconstruction (Adger et al. 2014).

However, migration is not the default strategy. Even during *abrupt* disasters, displacement is often a last resort (Foresight 2011). Other people opt to stay despite *gradual* hazards. Alternative strategies include "on-farm adaptation, off-farm adaptation, informal credit, participation in risk-reducing networks, social protection policies, and international development assistance" (Cattaneo et al. 2019: 8). Additionally, climate impacts, such as reduced crop yields, can also decrease migration. Hazards that damage micro level factors such as health or wealth can reduce the ability to move even if hazards would make escape desirable (Choquette-Levy et al. 2021; Flavell et al. 2020; Kaczan & Orgill-Meyer 2020). As "vulnerability is inversely correlated with mobility", and moving requires resources, hazards may trap the most affected (Adger et al. 2014: 767; Kaczan & Orgill-Meyer 2020; Morrissey 2014). A meta-study observes immo-bility in multiple contexts, especially where liquidity constraints are tangible, and underscores that entrapment risk is especially high in low-income countries and for women (Šedová et al. 2021). Obstacles tend to be particularly high for cross-border migration (Veronis et al. 2018). Finally, hazards can raise stayers' vulnerabilities and cause downward spirals of poverty (Kaczan & Orgill-Meyer 2020).

While the evidence demonstrates that some people move to address climatic risks (McLeman 2016b), the underlying mechanisms are less clear. In many regions, such as the Sahel, migration is a common livelihood strategy and one among several options to respond to environmental change (Morrissey 2014). However, most reviews agree that establishing direct causation from hazards is difficult, because decisions to migrate are multicausal and climate risks inter-act with non-climatic stressors (Adger et al. 2014). As one example, migration due to sea level rise (SLR) is "multifaceted" and "further research is needed on the fundamental mechanisms underlying SLR migration, tipping points, thresh-olds and feedbacks, risk perception and migration" (Hauer et al. 2020: 28). A meta-analysis indicates that economic migration drivers are particularly sensi-tive to climate hazards, and income moderates and explains hazard-migration links partially (Hoffmann et al. 2020). For example, hazards can increase income variability or widen income gaps that propel migration (Cattaneo et al. 2019). As agrarian livelihoods are most likely to be affected (Borderon et al. 2019), changing rural wages and agricultural productivity are also key paths underly-ing migration (Berlemann & Steinhardt 2017; Falco et al. 2018). Additionally, climate-related conflict can moderate the relationships, but the direction of its

influence is context-specific (Cattaneo et al. 2019; Hoffmann et al. 2020). Besides livelihood erosion, hazards can also threaten non-economic factors key for people's place attachment and thereby drive migration, for example, by destroying cultural or spiritual ecosystem services such as sacred glaciers (Adger et al. 2014). These pathways remain understudied. Ultimately, (im)mobility dynamics seem to depend on time- and place-specific demographic, environmental, political, and socioeconomic contexts, alongside social differentiation, which makes multiple outcomes possible for any given hazard, occasionally in contradictory directions for different areas (Veronis et al. 2018). Both micro variables such as age, gender, and wealth as well as meso level factors such as social networks influence the propensity to move, often in heterogeneous ways (Borderon et al. 2019; Cattaneo et al. 2019). The interplay of hazards and structural changes can make migration more likely (Jónsson 2010) but institutions shape how such dynamics emerge (Morrissey 2014). Thus, while most reviews stress the multi-causality in (im)mobilities, it is still not clearly understood under which exact circumstances people affected by climate change are compelled to move (O'Neill et al. 2022). Uncertainties relate to the nature and extent of climate impacts, including non-linear changes; the complexities of human vulnerability to these changes; adaptation possibilities; and the intricacies involved in migratory decisions (Flavell et al. 2020). The effect of prior migration experience—or the absence thereof—is another research gap (Findlay 2011; Henry et al. 2003). While direct environmental channels today still seem less vital than economic and social ones, studies usually do not account for indirect effects, interactions (both chain-logical causation and independent operation), or complex pathways, and may thus underestimate the effects of hazards (Beine & Jeusette 2021; Borderon et al. 2019; Neumann & Hermans 2017; van der Land et al. 2018). Finally, solid theoretical frameworks that account for these complex links are scarce (Hunter et al. 2015; Piguet 2018). A seminal model highlights that hazards mostly shape economic, environmental, and political migration drivers, but micro and meso level variables also affect the initiation of movement (Black et al. 2011b).

4.1.3   Linkages in Latin America

In Latin America, the focus region of this study, a meta-analysis finds strong significant effects of hazards on migration (Hoffmann et al. 2020). Another study using 21 million census data points from eight South American countries (not including Peru) also observes significant effects of climate variability on migration, which is mostly directed toward cities. The effects are heterogeneous across

gender, age, country of residence, and depend on baseline climatic conditions (Thiede et al. 2016).

Nonetheless, research on climate migration in Latin America is limited (Figure 4.1), and even more so on immobility (Castellanos et al. 2022; Piguet et al. 2018). The only dated, academic review on climate migration in the region concludes that empirical studies are scant, particularly for Andean countries such as Peru (Kaenzig & Piguet 2014).[1] Especially "the broad absence of water stress-migration research across the continent is worrisome" (Wrathall et al. 2018: 14), a gap I aim to respond to through this study. For the Andean states beyond Peru, most research exists for Ecuador (e.g. Gray 2007, 2010; Gray & Bilsborrow 2013) and Bolivia (Balderrama 2011; Brandt et al. 2016; Kaenzig 2011, 2015). Most available studies center on Central American migration—often as it relates to the US—and focus on tropical storms as well as on links between drought, heat, and food security (Baez et al. 2017a, 2017b; IDB et al. 2017; Spencer & Urquhart 2018).

The IPCC's latest regional assessment observes with high confidence that Latin America is sensitive to climate migration dynamics, whose magnitude has been increasing due to water-related hazards, such as droughts, heavy rainfalls, floods, and storms. Climatic- and non-climatic drivers of migration interact in complex and partially indirect ways, while intersectional social factors influence propensities to move (Castellanos et al. 2022). Previous empirical studies agree that multiple hazards shape migration in the region (Kaenzig & Elizabeth Warn 2015; Kaenzig & Piguet 2012). Water hazards such as floods, glacier retreat, and rainfall variability affect many countries, but are "just one more factor added to social and political contexts that are sometimes steeped in deep inequality… and power dynamics" (Kaenzig & Piguet 2014: 171). Especially for *gradual* hazards, pathways are context-specific and multicausal. Vulnerabilities to water scarcity are high in the region but little evidence of effects on migration exist at present. Sea-level rise has not caused migration so far, but since many at-risk areas are urban and densely populated, pressure may rise. Besides temporary movements, some people use multiple residences to address hazards. Disaster displacement tends to be short-distance, short-term, and directed to urban destinations (Kaenzig & Piguet 2014). Movement often originates in climate-affected rural areas but tends to be a last resort. Immobility is a salient issue especially for the poor, who

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[1] Besides academic researchers, development actors have started to investigate climate migration in the region, see IOM (2017d); Oetzel & Ruiz (2017). An additional stream of research concerns related policies in Latin America, see Cantor (2016, 2015); Kälin & Cantor (2017); Lavenex et al. (2016); Llamas (2017); Medina (2021); Nansen Initiative (2015); Pires Ramos et al. (2017); Popp (2014); Yamamoto et al. (2018).

Number of case studies
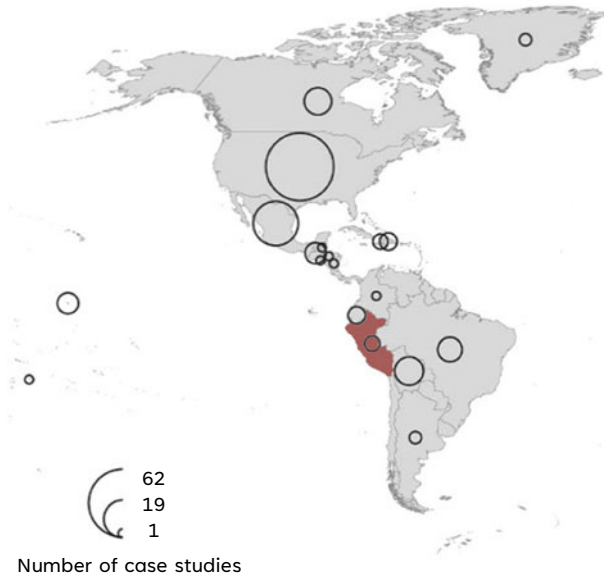
Figure 4.1 Prior country case studies on climate change and migration in the Americas. (Note: Peru is marked red. The size of the circles indicates the relative number of case studies. Based on 532 articles from the CliMig database (1970–2016). One article can contain multiple sites. Cropped from Piguet and colleagues (2018: 369), edited by the author)

may end up trapped in vulnerable situations. Others, however, make a conscious decision to stay due to high place satisfaction (Castellanos et al. 2022). The IPCC stresses that the outcomes of climate migration in the region are uncertain. While urban opportunities exist, the authors have high confidence that moving can reproduce structural problems and deepen pre-existing vulnerabilities, especially for socially disadvantaged groups (Castellanos et al. 2022: 85–86).

Looking to the future, the IPCC expects that climate migration will continue to increase in Latin America (Castellanos et al. 2022). The most robust study projects that in a worst-case scenario, slow-onset hazards may force up to 17.1 million migrants to move within their Latin America countries by 2050, representing 2.6% of the region's total population. They would leave areas with water stress and crop losses or those threatened by rising sea levels and storm surges. Yet, dedicated development action and climate mitigation could strongly change

these numbers. For example, a more climate-friendly scenario would result in up to 9.4 million internal climate migrants (Rigaud et al. 2018).

In summary, existing studies indicate that climate migration is a major issue in Latin America and projections suggest that it will gain relevance in the future. However, the breadth and depth of the evidence remains limited, especially on varied forms of (im)mobilities and their differential outcomes, a gap this study strives to bridge. In the next section, I assess the general literature on how climate (im)mobilities can affect well-being. (Additionally, in chapters 5–7, I discuss migration dynamics specifically for my three case study areas and provide in-depth reviews of the relevant evidence on exposure, vulnerability, and climate-(im)mobility links in these zones).

4.2   State of the Evidence on Links between (Im)mobilities and Well-Being

Well-being is the state of people's life situations, based on *need fulfillment*, their present *evaluation* thereof, and *views of the future*. Using this lens developed in Section 2.3, I first review possible effects of (im)mobilities on the fulfillment of relevant needs, namely *development from a secure base*, *a space to live better*, and *social relatedness*. Then, I assess the state of research on how (im)mobilities can affect people's cognitive and emotional need evaluation for the present and views of the future.

First of all, the evidence on the effects of climate *immobility* worldwide and in Peru is limited. Global studies suggest that risks may be high for trapped, non-resilient populations in areas severely affected by climate impacts, who may suffer from cumulative damage, food insecurity, health issues, as well as hostility, racism, and violence (Brubaker et al. 2011; Herren 1991; Mallick & Schanze 2020; Schwerdtle et al. 2017; Sow et al. 2016). Even though the dominant discourse highlights that risks related to immobility include "people losing their assets, falling into poverty traps, or suffering from a lack of capital", generalizations about impacts remain difficult because immobilities are multifaceted (Ayeb-Karlsson et al. 2018: 563). Since the empirical evidence on the impacts of immobilities is incomplete to such an extent, this review focuses on the effects of climate *migration*.

Second, research on climate migration is more readily available but rarely analyzes the impacts of such movements in destinations, as a systematic review of about 3,200 empirical studies finds (Rigaud et al. 2018; Zander et al. 2022). A prior review of mine distilled broad directions for Peru specifically (Bergmann

et al. 2021a). (Chapters 5–7 provide more detailed reviews of hazard-(im)mobility links and effects in the Peruvian areas of interest in this study). The studies reveal that some migrants within Peru can escape hazards, diversify incomes, acquire new skills, and send remittances to their communities (Badjeck 2008; Lennox 2015; Milan & Ho 2014). Conversely, more studies in Peru seem to suggest negative impacts on those moving and staying. First, farmers whose skills are not transferable to cities can end up in informal jobs, food insecurity, precarious housing with limited access to basic services, and exposed to new climate risks (List 2016; Sherman et al. 2015). Second, migration can heighten vulnerabilities in sending areas by eroding local knowledge and adaptive capacity, removing workers from labor-intensive agriculture, and increasing workloads for non-migrant women (Lennox & Gowdy 2014; Milan & Ho 2014; Sperling et al. 2008). Overall, studies argue that the outcomes depend on hazard patterns, migration trajectories, and profiles of receiving areas. Household vulnerability is another key determinant (Ho & Milan 2012): relatively well-off households can raise resilience through temporal migration that facilitates diversification; less resilient households may gain the bare minimum through survival migration; but when the poor migrate, resilience often erodes, because they tend to end up lacking income for remittances while sending areas are deprived of labor. Beyond migration, studies agree that prior disaster displacement has had a high toll on people in Peru (e.g. Espinoza-Neyra et al. 2017; Rojas-Medina et al. 2008) and relocations have reduced well-being by failing to consider place attachment, land and social issues, and livelihood necessities (e.g. Pittaluga 2019; Sperling et al. 2008) (Table 4.2).

Table 4.2 Synthesis of available studies on climate migration outcomes in Peru

Study	Outcomes
Adams 2012	*Migration:*
	– Possible well-being risks due to migrants' inability to recover non-provisional losses (predictive assessment)
Altamirano Girao 2012	*Migration:*
	– Negative social impacts – Increased hazard exposure in destinations
Altamirano Rua 2014	*Migration*:
	– Negative sociocultural impacts in areas of origin

(continued)

Table 4.2 (continued)

Study	Outcomes
Badjeck 2008	*Migration*
	+ Social remittances and technology transfers for areas of origin
	– Risk of higher costs, less educational chances, and social instability for migrants – Irregular housing and increased hazard vulnerability for migrants – Increased drug-use, unrest, and xenophobia in host communities
Badjeck et al. 2009	*Migration:*
	– Overexploitation of local fishing stocks and natural habitats by migrants – Conflict due to increased pressure on natural resources in destinations
Bernales 2019	*Relocation:*
	– Increased distance to old site obstructs livelihoods and basic services – Inadequate housing and urban design – Increasing insecurity
Desmaison et al. 2018	*Relocation:*
	+/– Durable housing materials, yet unadjusted to local climate (heat exposure)
	– Housing design, lot size, spatial distribution, and socio-spatial organization unadjusted to local context – Livelihood challenges due to asset and market distance, high transportation costs, and barriers for job uptake – Loss of identity links with territory
Espinoza-Neyra et al. 2017	*Displacement:*
	– Mental health burdens
Estrada et al. 2018	*Relocation:*
	– Livelihood challenges, remoteness from prior activities and alternatives – Urban design, basic infrastructure, and housing problems – Increased environmental pressure on protected area
Erwin et al. 2021	*Migration:*
	– Poorer migrants at risk of ending up in irregular settlements – Lack of electricity and water access

(continued)

Table 4.2 (continued)

Study	Outcomes
Ho & Milan 2012	*Migration:*
	+/− Household profiles determine possibility and outcomes of migration: adaptive, survival or erosive
	– Additional work and caregiving burdens for women in areas of origin
Jarman 2020	*Migration:*
	– Settlement in high-risk zones, unawareness of hazards
	Relocation, displacement:
	+ Reduced hazard exposure
Koubi et al. 2018	*Migration, displacement*
	– Possible conflict risk in destinations due to climate migrants' prior grievances (predictive assessment)
Langill 2018	*Migration:*
	– Increased hazard vulnerability in destinations
Lennox & Gowdy 2014	*Migration:*
	+ Income-earning opportunities
	– Migration becomes an imperative, not enhancing well-being – Possibly increased hazard vulnerability due to loss of labor force and traditional knowledge in areas of origin (*predictive assessment*)
List 2016	*Migration:*
	– Increased poverty due to school desertion of children sent to work
Lopez 2018	*Relocation:*
	+ Reduced hazard exposure
	– Losses of prior livelihoods due to increased distance to assets, markets, and transportation – Loss of basic services, culture, and identity – Strains on social relations
López-i-Gelats et al. 2015	*Migration:*
	– Shortage of labor, loss of traditional knowledge, and reduced adaptive capacity in areas of origin

(continued)

Table 4.2   (continued)

Study	Outcomes
Manzi 2005	*Relocation:*
	+ Increased access to land and market resources, reduced isolation, empowerment + Improved poverty and reduced environmental degradation
MIMP & IOM 2015	*Displacement:*
	– Livelihood challenges and loss of assets – Food insecurity, increased burden of physical and mental diseases – Risks due to insecurity and criminality – Inadequate temporary shelters
Oliver-Smith 2014	*Migration:*
	– Irregular and unplanned settlements, higher hazard vulnerability and exposure
Ramírez 2019	*Displacement:*
	– Possible contribution to spread of infectious diseases after disasters (predictive assessment)
Rojas-Medina et al. 2008	*Displacement, relocation:*
	– Mental health burdens
Rubiños & Anderies 2020	*Migration:*
	– Settlement in high-risk zones, unawareness of hazards
Sherman et al. 2015	*Migration*
	+ Income-earning opportunities + Some financial and social remittances to areas of origin; but limited due to…
	– … strained ties between migrants and stayers, who lack resources to support each other – Precarious jobs, unemployment, exploitation, and decreased resilience for migrants – Increased food insecurity for migrants – Housing and food insecurity due to loss of labor force in areas of origin – Loss of traditional knowledge and history in areas of origin
Sperling et al. 2008	*Migration*:
	+ Income earning compensates for losses and improves food security

Table 4.2   (continued)

Study	Outcomes
	– Migration becomes an imperative, puts migrants lacking demanded skills or qualifications in precarious jobs – School desertion due to migration – Erosion of local knowledge in areas of origin – Negative social impacts
	Relocation: – Negative social impacts
Tumi & Tumi 2013	*Migration*
	+ Income and food generation through temporary labor migration and after harvest losses + Remittances to improve food security and cover educational costs
Vidal Merino et al. 2020	*Migration:*
	+ Income and remittances generation after harvest losses

Note: Created by the author.

Because insights into the effects of climate migration within Peru are limited, it is sensible to also review (a) studies on climate migration in other areas and (b) the broader literature on migration and well-being, which can provide insights by analogy. To gauge this broader state of research adequately, I prioritize meta-analyses and systematic reviews when available. Moreover, in this review I also distinguish between different migration types and conditions (compare Section 2.2.2) in the few cases for which such data exists, because these factors affect outcomes. Overall, people forced to relocate or move may have less capabilities than those freely choosing to migrate, and may thus achieve less positive results (Bartram 2015; de Haan 1999; UNDP 2009). Similarly, although gender and other social factors—and their intersections—can strongly influence migrants' well-being, few studies disaggregate results accordingly (Fleury 2016; Selod & Shilpi 2021). Finally, when indicated, I also review results of cross-border migration because "remarkably little attention is given to the patterns of internal migration around the world…[and d]ata are relatively scarce and often out of date" (UNDP 2020: 33), especially for rural-to-rural and urban-to-urban migration (Selod & Shilpi 2021).

4.2.1   Effects on Objective Dimensions of Well-Being

I begin this review by analyzing data on how migration affects OWB, namely *development from a secure base*, *a space to live better*, and *social relatedness* (see Section 2.3).

4.2.1.1   Development from a Secure Base: Decent Livelihoods, Health and Food Security, and Educational Opportunities

Livelihoods are a key research interest in climate migration studies (Bardsley & Hugo 2010; Black et al. 2011a; McLeman 2016a; Tacoli 2009; Webber & Barnett 2010). Research emphasizes that the outcomes depend on intersectional variables, social mobility, and initial vulnerability profiles (Afifi et al. 2016; Jäger et al. 2009; Warner et al. 2009): people with greater resilience prior to moving can benefit from *adaptive migration*; others with less resources use *migration for survival* or for *erosive coping*; and the most deprived often lack capitals required to move. Climate impacts make beneficial conditions for migrants less likely, especially for forced migrants (Rigaud et al. 2018). Thus, the most affected may use migration in ways that raise vulnerability or end up trapped (Adger et al. 2015; Black et al. 2013; Zickgraf 2018). A cross-country study confirms these differentiated livelihood pathways. It finds that internal climate migrants mostly perceived positive effects on income and employment and around 40% of them learnt new skills; yet relocatees and forced migrants had fewer income sources, higher debts, and more vulnerabilities (Melde et al. 2017). Other reviews stress how relocations due to hazards can threaten livelihoods (Hino et al. 2017; Mazhin et al. 2020); in a global mapping, relocatees lost their revenues in one third of 308 cases (Bower & Weerasinghe 2021). Finally, disaster displacement can create chances for migrants "but most often it undermines their welfare" (IDMC 2021a: 18). In summary, migration may hold adaptive potential for more resilient groups but for more vulnerable ones, it threatens to be erosive coping or mere survival.

General migration studies complement these results. They indicate that *cross-border migration* to higher-*income* areas "typically brings about dramatic increases in the earnings of migrants" compared to areas of origin (Yang 2009: 6). Incomes are especially higher for voluntary migrants with higher capabilities (Dustmann & Glitz 2011; UNDP 2009) but the relationship holds for migrants in low-wage jobs or working below their skill levels (UNDP 2020). Migrants moving from lower to higher-income countries increase their incomes three to six times, and most migrants and refugees move from countries with lower to those with higher employment rates (World Bank 2018). Still, migrants are "at

a severe economic disadvantage" compared with natives upon arrival, and wages and employment converge only over time (World Bank 2018: 22). Progress is slower for refugees and irregular immigrants, who are often excluded from formal labor (World Bank 2018). Camp-based refugees often live in dire conditions; their chances to progress are low as they face restrictions, although "refugee economies" usually develop (Alloush et al. 2017; Bruijn 2009; Turner 2016).

Most *internal migrants* also move to wealthier areas (World Bank 2018) and have a "large urban premium" in *income* (although smaller than cross-border migrants), which holds across generations (Harttgen & Klasen 2009; Lucas 2021b; Selod & Shilpi 2021: 21). One study finds 25% returns for internal migrants (Lagakos 2020). Nonetheless, they initially earn less compared to locals and only gradually catch up (de Haan 1999). However, internal migrants are more often employed than locals (Tacoli 2007) and their movement also raises productivity and decreases inter-regional inequality in developing countries (Selod & Shilpi 2021). Overall, norms, policies, sociocultural distance, social capital, and information availability shape outcomes (Selod & Shilpi 2021). The results are often most challenging in adverse migration conditions. Specifically, many persons internally displaced due to conflict or disasters frequently face reduced employment, average incomes, and livelihoods (Cazabat 2020; World Bank 2017b). Similarly, relocatees often risk impoverishment, especially in forced cases (Arnall 2019; Cernea 2004; Piggott-McKellar et al. 2020; Wilmsen & Webber 2015), whereas voluntary cases can occasionally render higher incomes (Bazzi et al. 2016). The data seen so far emphasize that "very high" livelihood benefits and costs of internal migration can occur at once (Selod & Shilpi 2021: ii). Costs, including for transportation and subsistence, can reduce livelihood gains; such costs depend on trajectories, occupations, and individual variables (World Bank 2017b, 2018). For example, a review identifies jobs as the most salient migration-related stressor (Mak et al. 2021), and short-term employment migrants usually require long before making returns (Bedford et al. 2009). While migrants' occupational quality can be low at arrival (depending on migration corridors and skillsets), it improves "fairly rapid" (World Bank 2018: 197). Nonetheless, migrants often have jobs below their skill levels, and their human capital is frequently under-utilized or lost (McAuliffe et al. 2019). Especially cross-border migrants with low levels of education have to work in problematic "3D" jobs, in "low-skilled occupations that are shunned by members of the host society – manual labour that is often dirty, difficult, dangerous and in relatively isolated places" (Bedford et al. 2009: 64; Martin 2005). Irregularity raises the risk

of underemployment, low wages, high living costs, and exploitation (Baldwin-Edwards 2008). Similarly, such risks and discrimination are salient for female migrants, which often complicates their economic situation (Fleury 2016).

Few empirical studies on climate migrants' *health* outcomes exist (Schwerdtle et al. 2020). Reviews find that water and food security act as key moderators but outcomes are varied and context-dependent (Hunter et al. 2021; Schwerdtle et al. 2020); "in the early stages[, they] are expected to be similar to the health outcomes associated with refugees", including the risk of disease, disability, and loss of life (Mazhin et al. 2020: 97). Four major health concerns identified are (a) an altered distribution of infectious disease, partially due to high exposure during the journey or poor living and labor conditions especially in displacement and irregular settlements; (b) changes in non-communicable diseases, including food insecurity and diet-related diseases due to unfamiliar destinations and barriers in accessing healthcare; (c) psychosocial health challenges due to reduced social capital, deprivations, uncertainty, increased violence, and destruction of ecosystems or other resources key to migrants' identities; and (d) unequal access to health care in urban destinations, in relocations, or after hazards damaged infrastructure (Mazhin et al. 2020; Schwerdtle et al. 2020). Overall, climate migrants' profiles and conditions influence if moving is adaptive for health and food security (Schwerdtle et al. 2020; Warner & Afifi 2014). Results can thus be mixed: in a cross-country study**,** climate migrant households reported mostly positive effects on health and food security, including through better access to health care services (Melde et al. 2017), whereas a review in the Pacific finds that health worsened due to discrimination, poor housing, and livelihood barriers (Yates et al. 2021). Finally, forced climate migrants in particular bear severe health risks (McMichael et al. 2012); for example, mental health burdens after disaster displacement tend to be high, especially for women who experience violence and additional caregiving burdens (Rigaud et al. 2018).

General migration studies provide extensive, complementary results. *International migrants* seem to profit as they can gain access to better health facilities, staff, services, and health-enhancers, such as water and sanitation. For example, child mortality rates greatly decline across all migrant corridors (UNDP 2009, 2020). Mortality is also lower for migrants than for locals (Abubakar et al. 2018). Selection processes and sociocultural resources are reasons why most (particularly voluntary) immigrants in richer countries have better mortality and health than locals. Yet, this *healthy immigrant paradox* can cease the longer migrants stay due to acculturative stress and lifestyle changes (Markides & Rote 2015). Additionally, a meta-analysis finds that mortality premiums are clearer in high-income countries than for marginalized migrants in low- and middle-income

countries (Aldridge et al. 2018). Finally, morbidity can be larger for some diseases and among specific migrant groups (Abubakar et al. 2018; Alidu & Grunfeld 2018). Next, *rural-to-urban migrants* often improve health through access to better services, yet they tend to remain behind locals (Harttgen & Klasen 2009). In addition, a review demonstrates that internal migrants in poorer countries improve health through income gains, but benefits "can be counterbalanced by adverse living conditions" (Selod & Shilpi 2021: 26). Especially marginalized, irregular, and female migrants' tend to have constrained access to health services (Fleury 2016; UNDP 2020) and many migrants in 3D jobs suffer job-related hazards (Ratha et al. 2011). Moreover, two systematic reviews note that cardiovascular risk factors are greater for urban migrants than in rural groups (Hernández et al. 2012), and that migrants' self-perceived health is often worse than that of non-migrants (Lu et al. 2020; Nielsen & Krasnik 2010). For forced migrants, food security depends strongly on the host context (Bruijn 2009); their health tends to be better in urban than in camp settings (Crea et al. 2015). Finally, migration also strongly affects *mental health*, and the effects seem to depend on context, coping strategies, and personal resilience (Mak et al. 2021; Siriwardhana et al. 2014). A natural experiment finds that cross-border migration can raise mental health (Stillman et al. 2015), whereas two meta-analyses find opposite effects at arrival, for those un- or underemployed, and for those with downward social mobility (Das-Munshi et al. 2012; Foo et al. 2018). A different review and a meta-analysis report increased post-traumatic stress disorders among migrants and refugees (Bustamante et al. 2018; Lindert et al. 2009). Some risks are gendered, and a review finds that female migrants have a greater risk of perinatal mental health issues than non-migrant women (Fellmeth et al. 2017). For developing countries specifically, a review corroborates that rural-to-urban migration often involves high psychological costs (Selod & Shilpi 2021). Taken together, the existing reviews identify key health determinants as (a) pre-migration trauma; (b) post-migration income, employment, housing, language skills and interpretation, communication, continuity of care, confidence, social support; (c) financial, legal, cultural, and spatial challenges; and (d) structural and political factors, such as discrimination, gender inequalities, and exclusion from services (Abubakar et al. 2018; Brandenberger et al. 2019; Hynie 2018).

Lastly, the UNESCO underscores that *educational* effects remain understudied, but most climate migrants are likely "to suffer exceptional educational vulnerabilities" due to trauma, infrastructure failure, or administrative, economic, and linguistic access hurdles (2020: 4). By contrast, in one of the few existing cross-country studies, climate migrant households reported mostly positive effects, including through better access to services; yet not all benefitted, and

gains coincided with exclusion and discrimination (Melde et al. 2017). General migration studies provide additional insights. First, they show that educational selectivity shapes who migrates in the first place, and thereby also the outcomes (Bernard & Bell 2018). Second, migrants often move to improve children's education (UNDP 2020), and even before they move, the prospect of migration can raise educational investments both for migrants and their children (Dustmann & Glitz 2011). Third, many migrants' education profits from moving, especially when going from poorer to richer areas, where they have more years of schooling than at origin (Harttgen & Klasen 2009; UNDP 2020). Additionally, migrants from the poorest countries on average double school enrollment rates in richer countries (World Bank Group 2016). While migrants often improve educational attainment over generations, institutional and language barriers can slow the process of catching up with natives (Dustmann & Glitz 2011), and the accessibility of services is often gendered (Fleury 2016). Finally, educational effects for refugees depend on the host country and available international assistance (Bruijn 2009; World Bank 2020a).

4.2.1.2 A Space to Live Better: Adequate Housing, Basic Services, Pleasant Surroundings, Safety from Hazards, and Security

Climate migrants often move to cities (Adamo 2010; Black et al. 2011a), especially in the swiftly urbanizing Latin American region (Villa et al. 2017; Warn 2014). While these cities provide chances, risks also abound, including due to the effects of rapid urbanization, such as sprawl and irregular *housing* (Adger et al. 2020). Studies confirm that many climate migrants have constrained access to housing and basic infrastructure (Adger et al. 2020; Adger & Adams 2013; McMichael et al. 2012). For example, a cross-country study finds that their households fare worse than non-migrants concerning shelter and housing materials, which may raise vulnerabilities (Melde et al. 2017). In particular, disaster displaced persons frequently cannot satisfy basic shelter needs due to their definitive losses of portable assets and fixed capital (World Bank 2017b). Many displaced persons are forced to live in temporary shelter insufficient for lasting protection, which reinforces precarious living conditions and can trigger secondary displacement (IDMC 2020). Similarly, deficient shelter is widespread in planned relocations (Cernea 2004). A global mapping notes that main problems are "the availability and quality of infrastructure at the settlement site [as well as] architectural layout of homes and incompatibility with traditional ways of life or expectations" (Bower & Weerasinghe 2021: 9). General migration studies substantiate that housing conditions depend on context, such as financial resources,

family sizes, and conditions of arrival and at destination. Key factors include legal status, family networks, property prices, the quality of information, social housing, and social benefits. Especially migrants who settle first in a new place, those with low incomes, and those subjected to discriminatory practices are at risk of substandard housing (OECD & EU 2015). Finally, most refugees live in cites, where they "share accommodation, live in non-functional public buildings, collective centres, in slums and irregular types of settlements; often their living conditions are poor, cramped and unsafe" (UNHCR 2014: 13). Refugee camps in rural areas imply their own challenges.

Next, some climate migrants, displaced persons, and relocatees succeed in reducing *exposure* to hazards at least initially (Melde et al. 2017). Yet, others "tend to cluster in low-cost locations exposed to environmental hazards" (Adger et al. 2020: 397), and migrants writ-large continue to move toward areas highly exposed to climate hazards, such as coastal or deltaic cities exposed to sea-level rise (de Sherbinin et al. 2012; Foresight 2011; McGranahan et al. 2007). Cities also tend to expose migrants to unfamiliar environmental stressors, such as water and air pollution (Carrasco-Escobar et al. 2020; Chen et al. 2013) or urban heat stress (Tuholske et al. 2021). Therefore, the IPCC names new hazard exposure in destinations as one illustrative cause why certain forms of climate migration can "compromise human security" (Adger et al. 2014: 758). Similarly, a global relocation mapping highlights the risks related to secondary hazard exposure in many, but not all cases (Bower & Weerasinghe 2021). Within cities, many migrants also have higher *vulnerabilities* to hazards than locals because they often live in densely populated areas, and have no access to basic services or lack political voice (Adger et al. 2020; Adger & Adams 2013; McMichael et al. 2012). In general, disaster displacement risk is significant in many urban areas (IDMC 2021c). Disasters are more likely to harm the poorer segments of urban populations with limited political voice and subjected to structural disadvantages, which often includes migrants (de Sherbinin et al. 2007; Hallegatte et al. 2017). Migrants may also lack knowledge of hazards in new settings and fail to receive or understand early warnings (Melde et al. 2017). Even so, few cities account for the vulnerabilities of climate migrants (Gemenne et al. 2020) and their climate risks in destinations remain underreserached.

Beyond hazards, climate migrant households reported also greater human *insecurity* than non-migrants in one cross-country survey (Melde et al. 2017). A review on general migration reveals that women, especially those with irregular status, are at high risk of violence, sexual exploitation, and forced prostitution (Fleury 2016). Interpersonal and self-directed violence are also rife after disasters and during displacement (Asgary et al. 2013; Bruijn 2009; IDMC 2020;

McMichael et al. 2012; Rezaeian 2013; True 2013). While women displaced by disasters face high risks, men can also end up in vulnerable situations, for example, when norms demand male risk-taking behavior (Demetriades & Esplen 2008; Rigaud et al. 2018). Finally, insecurity is equally frequent in relocations. For example, a review in the Pacific region finds that relocations can raise conflicts between ethnic groups or over land and fishing rights (Yates et al. 2021). Relocatees may also experience organized violence or be relocated by force, occasionally for political or economic motives (Webber & Barnett 2010).

4.2.1.3 Social Relatedness

Even though the effects of climate migration on *social capital* and *networks* are salient, they remain underexplored. First, when suffering climate impacts, social factors affect capacities to remain in place or to migrate and the related outcomes (Nawrotzki et al. 2015; Webber & Barnett 2010). Second, migration itself also affects *social relatedness*, but the results are inconclusive. For example, most climate migrant households stated positive effects on family relations in one cross-country study (Melde et al. 2017). Yet, other studies argue that social exclusion is frequent for climate migrants in many cities (Adger et al. 2020). Moreover, reviews point out that displacement and relocations frequently fragment social networks and cohesion, which contributes to psychosocial issues, and may engender frictions, tensions, and discord among generations (Bower & Weerasinghe 2021; Schwerdtle et al. 2020). In relocations specifically, community support and social support are key to mitigate challenges and ease adjustment to unfamiliar settings; however, the possibility to maintain social relationships hinges upon community structure and relocation design (Yates et al. 2021).

Expanding these findings, reviews on general migration confirm that social networks are key for support in destinations (Munshi 2020; Selod & Shilpi 2021) and for recovery after displacement (World Bank 2017b). Social impacts depend on changing family and household dynamics throughout migration (Bedford et al. 2009). The distance to family members and translocal relationships can cause psychological distress for migrants (Selod & Shilpi 2021), and losing social support can have strong mental health repercussions (Fellmeth et al. 2017; Hynie 2018). Female migration can occur as a self-sacrifice for the family, but can also strain family ties, for example when it challenges patriarchal norms or when it involves translocal parenting. Female migrants with legal status and formal employment have better chances to become socially empowered (Fleury 2016). After disasters and displacement, social relations can change profoundly (Bonanno et al. 2010; Cohan & Cole 2002). For example, mental diseases and worsened parenting efficacy or support can harm family functioning (Green et al. 1991; Hackbarth et al.

2012; McDermott et al. 2010; McDermott & Cobham 2012; McFarlane 1987; Pfefferbaum et al. 2016). Successive displacements are common and can also disrupt social capital and networks, because building social ties requires years (World Bank 2017b). On the contrary, supportive primary relationships as well as family or community cohesion and support raise forced migrants' resilience against mental illnesses (Siriwardhana et al. 2014).

4.2.1.4   Effects on Sending Communities

Climate change, migration, and development are intertwined across localities (Lucas 2021a). Generally speaking, emigration can bolster development for sending communities, but it also implies costs and losses, so that the net effects on adaptive capacities in hometowns remain debated (Vinke et al. 2020): Webber and Barnett argue that "in most cases, and in aggregate, migration seems to contribute positively to the capacity of those left behind to adapt to climate change" (2010: 22), whereas others argue that emigration can increase precarity (Porst & Sakdapolrak 2018).

First, *economic* effects for sending households "are usually mixed… and in large measure [migration] can be seen as either virtuous or vicious for development" (Katseli et al. 2006; Martin 2005: 190). While sending areas of climate migrants often profit, the effects depend on the context and phase of migration and tend to be unevenly distributed (Rigaud et al. 2018; Webber & Barnett 2010). Since cross-border migration is too costly for many people, it can initially raise inequality in sending areas (see below on remittances); yet over time, the relationship between emigration and inequality at home seems to be U-shaped (McKenzie & Rapoport 2007). Wages in sending countries can increase for workers with similar, substitutable skills, while those with different or complementary skills stand to lose (World Bank 2018). A systematic review finds that international migration reduces labor force in rural areas, which can trigger child labor, land control losses, and a feminization of agriculture at home (Obi et al. 2020). Emigration can both reduce the labor force and erode traditions at home and thus raise food insecurity (Kothari 2003; Sherman et al. 2015). While emigration can also generate employment at home, labor availability, service delivery, and equality may decrease if many highly-skilled persons migrate (Katseli et al. 2006). Finally, human capital effects depend on context and can include brain drain (loss of human capital due to high-skill emigration), brain gain (increase in human capital investment), or brain circulation (knowledge diffusion and economic integration) (Beine et al. 2008; Kone & Özden 2017; McAuliffe et al. 2019).

Second, *financial flows* such as remittances, diaspora bonds, and fundraising by hometown associations can support relatives at home (Mendola 2012; Mohapatra et al. 2012). Reviews highlight that remittances can raise expenditures and reduce poverty for migrant households (Obi et al. 2020; Ratha et al. 2011), and children with migrant parents have usually more household assets (DeWaard et al. 2018). Multiplier effects due to remittances spending and changes in the labor market can also reach non-recipients (Katseli et al. 2006; Mendola 2012). As often-stable inflows, remittances can provide insurance against shocks or buffer them; they can thus also support recovery from—and to some extent preparedness to—climate impacts (Banerjee et al. 2017; Bendandi & Pauw 2016; Rigaud et al. 2018). Migrant networks may also aid home areas by delivering or organizing humanitarian or development projects, information, and political action (ADB 2012; Webber & Barnett 2010). Moreover, hometowns may profit from *social remittances*, such as technology and skill transfers (de Haas 2009; Levitt & Lamba-Nieves 2011). For example, migration can facilitate the spread of mobile phones (Hübler 2016; Kothari 2003). For climate migration, results are inconclusive: one cross-country study finds positive effects of remittances on poverty reduction but less so on adaptive capacity (Melde et al. 2017), while another one is more positive on the adaptive benefits (Scheffran et al. 2012). However, remittances also imply challenges. First, they can create dependencies (de Haas 2010a). Second, remittances may raise inequalities since the poorest often cannot migrate or their migrant members cannot remit (Le Dé et al. 2013; Schade et al. 2016; Tacoli 2011), but such effects remain debated (Azizi 2021). Third, benefits "might come at substantial social costs to the migrants and their families" (Ratha et al. 2011: para 1). For example, short-term employment migrants often have to service loans and fees for long, and thus, "the absence of regular remittances because of loan repayments poses a double burden on the left-behind" (Bedford et al. 2009: 64).

Third, remittances can have several *health effects*. While they are primarily spent on food, more affluent recipients also invest in health care and housing (UNDP 2009). Two reviews confirm that remittances often improve educational and health indicators, including food security (Obi et al. 2020; Ratha et al. 2011). A different review qualifies that remittances can reduce food insecurity and underweight, but not chronic undernourishment, while they may also increase unhealthy food intake (Thow et al. 2016). For climate migration, a cross-country study finds that it can stabilize food consumption in sending areas, yet outcomes depend on the profiles of migrants (Warner & Afifi 2014). Besides remittances, visits and returns can also improve health knowledge and preventative health care in sending areas (Hildebrandt & McKenzie 2005; UNDP 2009;

Yang 2009). Nevertheless, debates continue if some groups staying behind can suffer from increased morbidity for certain diseases or conditions (Abubakar et al. 2018). For example, while one review does not find different or worse outcomes for the physical health of children with absent parents (Abubakar et al. 2018), another meta-analysis reports that migration strongly worsened nutrition and mental health of left-behind children and adolescents "with no evidence of any benefit" (Fellmeth et al. 2018: 1). The health of left-behind, older family members in rural areas can also deteriorate (e.g. Ao et al. 2016).

Fourth, the effects of emigration on *education* at home can be mixed. They partially depend on "changes in family composition and the role of women within the family and society" (Katseli et al. 2006: 9). Especially wealthier households also spend remittances on education, which raises schooling rates and reduces child labor (Lucas 2021c; UNDP 2009; Yang 2009). Additionally, high-wage emigration can create brain gain when it raises stayers' desires to move and thus incentivizes spending on education (Dustmann & Glitz 2011; Kone & Özden 2017), but not always, for example, when more housework reduces school attendance and attainment (McKenzie & Rapoport 2011).

Fifth, the *social effects* of emigration on stayers differ and are shaped by age and gender. If men move, female stayers may experience greater autonomy, but also increased workload and emotional strains (Abdurazakova 2013); if women move, men may have to assume (often-unfamiliar) household and child caring duties, which can be challenging if norms frame such work as feminine (Fleury 2016). Long separations of children from parents and of couples create social strains in developing countries worldwide (Lucas 2021c). Ultimately, extended family networks are a key mediator for children and older adults to manage the absence of migrants (Bedford et al. 2009).

Lastly, the effects of migration on the *environment* at home are not fixed. Environmental stress can be reduced as population pressure is lowered, land abandoned, and agriculture de-intensified; yet weakened local resource management after emigration and rising consumption due to remittances can create opposite effects (Gray & Bilsborrow 2014; Rigaud et al. 2018; Scheffran et al. 2012).

4.2.1.5   Effects on Receiving Communities

While not the focus of this study, I also briefly review the possible effects of immigration on receiving areas. Overall, such effects depend on migrants' social factors as well as markets, structures, and policies at their destination (Rigaud et al. 2018; Webber & Barnett 2010). While climate migrants are often "used as 'scapegoats' for a host of larger socioeconomic structural issues" and portrayed as creating "competition, tensions and conflict" in receiving areas, reality

is more complex (Melde et al. 2017: 11). First, migration usually creates net *economic* benefits for receiving countries (Golding et al. 2018; McKinsey&Company 2016; World Bank 2018) and refugees also contribute to growth if they can work (Betts et al. 2014). Yet, unreceptive settings can induce brain waste (McAuliffe et al. 2019). Aggregate labor markets effects are often marginal, defined by the degree of skill complementarity between migrants and non-migrants (Clemens et al. 2018; OECD 2018; Ruhs 2015). If migration restocks the labor force, it supports wealth, taxes, public goods, pensions, and care systems; if labor is scarce overall or in certain segments, results can be mixed and may include labor market segmentation (Golding et al. 2018; McAuliffe et al. 2019; Webber & Barnett 2010). For example, meta-analyses in richer countries find that immigration affects wages and work marginally while native job losses are small at most (Longhi et al. 2008, 2010). However, a review argues that the effects can differ for internal migration in developing countries; because their labor markets tend to be more "dualistic and isolated… with a predominance of unskilled workers, migration could be more likely to depress local wages and the employment rate" in the short term (the longer term remains unclear) (Selod & Shilpi 2021: 29). The impacts of displacement camps for host areas are also mixed (Cazabat 2020). Such camps can increase wealth for nearby rural households, but also raise food prices and reduce wealth in urban areas (Alix-Garcia et al. 2018; Alix-Garcia & Saah 2010; Taylor et al. 2016). Regarding *health* and *education*, the evidence is mixed. Immigration creates additional demand for such services and may overcharge them, but it can also provide benefits. For example, the immigration of health workers is essential to maintain care systems in many countries (Connell 2010; Kingma 2018; Stilwell et al. 2004). As another health effect, migration and travel can, under certain circumstances, be one factor in the spread of communicable and infectious diseases in transit and receiving areas (Bedford et al. 2009; Heymann 2007; Tognotti 2013). Next, concerning *a space to live better*, findings are mixed. Internal migration is key for *urbanization,* a salient process in in the Global South (Cerrutti & Bertoncello 2003; Murillo 2014; UNDESA 2018; Villa et al. 2017). Urbanization, in turn, can cause "negative externalities, such as high unemployment, strained infrastructure, and environmental degradation"; however, cities can also help reduce poverty and environmental harm and are "often unfairly stigmatized" (Marcotullio et al. 2012; Rigaud et al. 2018: 35). How immigration affects urban adaptive capacities remains unclear (Barnett & Adger 2018), while its effects on local *environments* depend on context: ensuing clustered population growth can result in land-use change or degradation and pollution (Bilsborrow 1992; Hugo 1996), but not necessarily so (Muradian 2006; Price & Feldmeyer 2012). Finally, in receiving areas, immigration also

has complex and context-dependent *fiscal impacts* (Rowthorn 2008), as well as effects on *innovation*, *foreign direct investment, official development assistance,* and *trade flows* (Egger et al. 2012; McAuliffe et al. 2019; Webber & Barnett 2010); on *demography* (Coleman 2008; Rodríguez-Vignoli & Rowe 2018); on *social cohesion* and *diversity* (Bauloz et al. 2019; Reitz et al. 2009); and on *conflicts* (Burrows & Kinney 2016).

4.2.2   Effects on SWB

SWB—present emotional and cognitive evaluations of need fulfillment alongside views of the future—offers an additional analytical lens (see Section 2.3). Below, I first review the evidence on the general changeability of SWB and its effects before examining the links between migration and SWB.

4.2.2.1   Changeability and Effects of SWB

The evidence demonstrates that while certain factors stabilize present SWB, other processes can change it enduringly (Veenhoven 2015). Change factors exist at the macro and individual levels, with different durations of effects; the interaction of all the factors discussed below determines SWB (Diener et al. 2017a). First, the large SWB differences between countries is partially due to varied *macro conditions,* such as wealth, rule of law, freedom, inequality, corruption, and climate (Rentfrow 2018; Tay et al. 2014). This *livability of the surroundings* may explain about three quarters of the SWB variance between states (Veenhoven 2015). Research on the effects of the physical environment is limited; it suggests that SWB is highest in moderate climate zones; air quality can slightly decrease SWB; and differences between rural and urban areas are marginal (Veenhoven 2015).

Second, besides macro conditions, *individual factors* shape SWB, and people's *life-ability* may explain up to half of the variance (Veenhoven 2015). Genes and related personality and proficiencies fix a certain "set range" of long-term SWB (Diener & Biswas-Diener 2008: 162) but how strongly this range is "set" remains disputed (Anglim et al. 2020; Bartels & Boomsma 2009; Neve et al. 2012; Røysamb et al. 2018). Age and gender may have effects (Biermann et al. 2022; Senik 2015; Veenhoven 2015). Beyond these stable, inner life-ability factors, change can occur at the individual level for three reasons. To start with, a review and a meta-analysis find that psychological *interventions* can partially raise people's SWB over the long term (Koydemir et al. 2021; Solanes et al. 2021). In addition, *brief stimuli* such as weather, season, moods, random events,

and preceding questions can change SWB self-reports shortly, but appropriate survey design and data aggregation over time can reduce their influence (Diener et al. 2017a). Moreover, certain *life events* and *changes in life circumstances* can alter SWB, although the magnitude of effects has been debated (Cummins 2014). Hedonic adaptation level theory stipulates that people get used to new stimuli as well as to recurring or constant situations (see Section 2.3). Yet, while most people adapt to adverse or positive situations to a certain extent, a meta-analysis emphasizes that SWB is not static or always adaptable (Luhmann et al. 2012). *Recent life events* can shape well-being for some time (Suh et al. 1996) and certain *major life* (or course of life) *events* can shift SWB levels lastingly (Luhmann et al. 2012). Meta-analyses and longitudinal research find that major life events concern more the cognitive than the emotional dimension of SWB, and can have diverging impacts on these two features. They do not necessarily depend on the perceived desirability of the events. And their effects are more pronounced for certain individuals than others (Anglim et al. 2020; Luhmann et al. 2012; Luhmann et al. 2013; Yap et al. 2014).[2] A longitudinal, nationally representative study in Australia reveals that positive events, such as monetary gains and retirement can lastingly raise cognitive satisfaction, although followed by emotional adaptation (Kettlewell et al. 2020). Conversely, so-called *scarring* due to certain strong negative life events, such as unemployment, can enduringly reduce SWB even after remedy of the events (Jovanović 2019; Mousteri et al. 2018). For example, SWB can return to previous states after people are widowed or separated, but health shocks and financial losses decrease cognitive satisfaction and emotional balance without hedonic adaptation (Kettlewell et al. 2020). Migration figures among the life events that can shift present SWB beyond adaptation, as discussed in detail further below (Kettlewell et al. 2020; Luhmann et al. 2012; Luhmann et al. 2013).

Similarly, subjective *future-oriented states* can change to some degree, although a certain disposition for hope(lessness)[3] seems stable (Hellman et al. 2013). Hope has diverse internal and external sources (Pleeging et al. 2021b),

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[2] Some life satisfaction stability may be due to personality factors and parental influence, but people have varied volatility (variability within a certain period, but similar mean level over a longer period); medium and long-term changes can occur due to differences and changes in values, life priorities and behavioral choices, see Headey & Muffels (2018).

[3] For brevity, I will use hope as the shorthand term for both hope and its antonym hopelessness.

some of which are relatively firm (such as biology[4] and social factors or culture and history), whereas others appear more variable (such as past experiences and choices or social networks and work). Therefore, hope can be lost due to major life transitions, traumatic events, loss, failure, alienation, and lack of social connections, control, or progress (Edey & Jevne 2003; Snyder 2002). However, strong evidence simultaneously demonstrates that specific interventions can raise hope (Hernandez & Overholser 2021; Long et al. 2020).

Feeling well and being content with life in the present and having hope for the future are not only states that people desire but also have major downstream *effects* on them, as converging empirical evidence proves. Present SWB can raise work productivity, creativity, and how people contribute to their organizations; support health and longevity; improve caring social relationships; as well as increase virtuous behavior, such as volunteering and donations (Diener et al. 2017a; Diener et al. 2017b; Diener et al. 2018b). Due to these beneficial ripple effects, more positive emotions and cognitive satisfaction are mostly desirable, yet not at all costs, without limits, or in all situations (see Section 2.3). Likewise, having hope or not strongly affects several aspects of life. According to a review, possible internal effects of hope include motivation, personal development, positive feelings and comfort, meaning and purpose, or spiritual experiences, but also disappointment. Potential external effects include shared feelings of identity, socially shared capital, smoothed social interaction, virtuous or ethical behavior, or mobilizing large groups, but also societal disillusionment and abuse or manipulation of people (Pleeging et al. 2021b). Views of the future, such as outcome expectancies, are a key determinator of action and behavior (Feather 1992; Wigfield & Cambria 2021; Wigfield & Eccles 2000).[5] Hope and optimism are significantly correlated with better performance and success at work, improved social relations, and increased psychological and physical health, whereas hopelessness and pessimism deepen perceptions of vulnerability, uncontrollability, and unpredictability, and block action and engagement (Carver & Scheier 2014; Cheavens & Guter 2017; Forgeard & Seligman 2012; Long et al. 2020). Hope and positive future self-views also strongly predict SWB in the present (Lu et al. 2018; Satici 2016; Werner 2012)[6] and the relationship seems bidirectional (Long

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[4] The exact degree of genetic heritability remains unclear but may amount to around 30%, see Carver & Scheier (2014).

[5] This fact links back to Expectancy Value Theory (see Vroom (1964)), which holds that motivation for actions or behavior depends on the perceived (future) probability of achieving the desired outcome and the value attached to it.

[6] Three mechanisms are possible: hope can shape (a) the extent of creativity and perseverance and thus the creation of successful experiences, (b) the awareness of opportunities and their

et al. 2020; Pleeging et al. 2021a). Similar as for present SWB, more optimism and hope are typically beneficial, but exceptions exist (see Section 2.3). Finally, how people subjectively perceive their future time also affects well-being (Kooij et al. 2018). One reason is that different *future time perspectives* result in different motivations for action (Lens et al. 2012).[7] For example, children focus on exploring and learning, but people who perceive their future time as limited increasingly prioritize emotionally meaningful goals (Liao & Carstensen 2018).

4.2.2.2   Migration and Present SWB

While many migration theories presume that people move to maximize their standard of living (Brettell & Hollifield 2014b; King 2012; Massey et al. 1993; Piguet 2018), more complete measures of well-being are gradually entering academic debate and policy frameworks (Laczko & Appave 2013). Migration requires wide-reaching adjustments in daily lives, and OWB effects do not necessarily converge with SWB outcomes[8]; the related literature is relatively new but has advanced over the past decade (Haindorfer 2019a; Helliwell et al. 2018b; Hendriks & Commandeur 2018).

The SWB concept has to my knowledge not yet been directly applied to climate migration, but indirect evidence suggests that it can provide valuable additional insights. For example, one review finds that climate migration and relocation in the Pacific can render "new hope and reliefs from fears of … hazards" but "even the least disruptive movements caused significant stress", and can trigger strong fear, sadness, distress, and resentment by disrupting relationships to land, culture, identity, and social networks (Yates et al. 2021: 1). Studies only focused on OWB would miss such key findings.

Given the shortage of SWB studies on climate migration, research on general migration provides supplementary, but occasionally mixed results, as discussed below. Most studies focus on cross-border *free* and *improvement* migration to rich destinations, but less so on internal, *distress,* or *survival* movements (Hendriks & Commandeur 2018; Knight & Gunatilaka 2018). Existing analyses are

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use, and (c) the openness to new situations, relationships, or impressions, and thus the ability to gain experiences and skills. See Pleeging et al. (2021a).

[7] Even though experienced time increases and remaining future time generally decreases with age, individuals of similar age can hold different contents and extensions or depths of future time perspectives, see Kooij et al. (2018).

[8] Qualitative studies confirm that well-being effects can be complex. For example, work on low-income Peruvian emigrants in London and Madrid demonstrates that benefits, such as sending remittances and status gains on return, may be offset by losses, discrimination, and problems in other well-being aspects. See Wright (2010, 2011).

mostly quantitative, cross-sectional comparisons between migrants and stayers (non-migrants), matched stayers, or natives at one point in time (Bartram 2015; Hendriks & Bartram 2019; Laczko & Appave 2013). Comparisons to matched stayers can reveal information that comparisons with natives may conceal due to intrinsic differences between the migrant and the local population (such as culture or language). Nonetheless, these cross-sectional approaches cannot unveil how migrants' present SWB develops over time, and may entail further problems. In comparisons with locals, ecological fallacy can be an issue; in comparisons with stayers (and for longitudinal studies), selectivity and endogeneity can be problematic (Bartram et al. 2013; Haindorfer 2019a). For example, studies cannot rule out that people who migrate are inclined to more or less happiness than stayers. Various studies try to control for selection bias through statistical methods such as matching, which cannot fully account for the problem (Hendriks 2015). A few natural experiments exist that avoid selection bias (e.g. Stillman et al. 2015), and longitudinal studies also provide robust insights (e.g. Chen et al. 2019)

To start with, the evidence highlights that migration conditions strongly affect SWB (Bartram et al. 2013; Hendriks 2015). The degree of voluntariness is one key factor (Bartram 2015). *Survival* or *distress* migration often challenges mental health for long, including through suffering and trauma (McMichael et al. 2012; Murray et al. 2008; Schwerdtle et al. 2017). Conversely, *free* or *improvement* migrants may have higher capabilities and better chances to meet their goals. However, they could also have greater expectations and thus be more likely to be disappointed after settling. The exact SWB effects depend on drivers, reasons, and events behind migration, and "[i]t would be desirable to investigate the happiness consequences of migration by migration motives" (Nowok et al. 2013: 999). Yet, SWB data on forced migration remains "virtually nonexistent" (Hendriks & Bartram 2019: 286). A meta-analysis finds that SWB effects are often positive for voluntary movements but results are unclear for involuntary cases (Luhmann et al. 2012). Gallup data suggests that refugees in Germany raised their SWB, but less so than other migrants (Helliwell et al. 2018b). By contrast, a longitudinal study in the UK (2002–2012) shows that voluntary migrants maintain high levels of well-being, but older internal migrants who move involuntarily (for example, due to health reasons or a split from the partner) also decrease the well-being decline that can be linked to ageing (Finney & Marshall 2018). Beyond voluntariness, the spatial, cultural, and linguistic distance covered by migrants are other key factors shaping SWB conditions. Thus, below, I first discuss results on *internal migration,* the focus of this dissertation, and complement them with findings on *cross-border* flows.

For *internal migrants*, the evidence is still limited for poorer countries (Helliwell et al. 2018b). Nevertheless, various high-quality longitudinal studies and cross-sectional analyses offer mostly matching results. To begin with, two *longitudinal studies* for poorer countries indicate negative effects. Research in Indonesia (2000–2007) highlights that people with higher aspirations self-select into internal migration, but even economic success may fail to raise their SWB (Czaika & Vothknecht 2014). Similarly, a study in rural Pakistan (1991–2013) finds that migrants are 12–14 percentage points less likely to feel happy or calm despite strong economic gains, even when accounting for selection effects (Chen et al. 2019). For richer countries, longitudinal studies render more mixed results. An analysis in South Africa (2008–2012) indicates that rural–urban migration raises incomes but reduces SWB by 8.3% four years after moving, even if controlled for self-selection (Mulcahy & Kollamparambil 2016). Similarly, a nationally representative study in Australia (2002–2016) finds that moving homes lastingly reduces cognitive satisfaction but not emotional balances (Kettlewell et al. 2020). Yet in other countries, results seem more positive. Data in Great Britain (1996–2008) documents that migrants' SWB strongly declines before moving, then increases back to initial levels after settling, but does not rise further (Findlay & Nowok 2012; Nowok et al. 2013). The authors control for selection effects and find no SWB differences due to gender or spatial distance. A study in Germany (1985–2016) identifies a causal SWB effect of migration, even when controlling for selection effects. Both genders but only long-distance migrants experience an anticipation effect of migration that reduces SWB before and shortly after moving (for example, due to preparation stress or prior overestimation of negative effects). Yet after settling, male migrants reach lasting SWB gains of 0.35 points on a scale from 0 to 10, whereas women return to initial set points. Urban destinations raise SWB more permanently than rural ones (Kratz 2020). Similarly, in a Finnish study (1966, '67, '80, '97), only rural–urban male migrants reported significantly higher SWB than non-migrants (Ek et al. 2008). Moreover, a *cross-sectional* analysis in China shows that migrants achieve higher incomes but lower SWB than *stayers* in rural areas (Knight & Gunatilaka 2010, 2018). Related, a small-N study in Germany accounting for selection effects finds that internal migrants have less SWB than *locals* (Hendriks et al. 2016), similarly as in China (Cheng et al. 2014) and Turkey (Aksel et al. 2007). Finally, *explicit questions on migration success* exist but are still rare; they may also be prone to various cognitive biases (Haindorfer 2019b). While most interregional Nordic migrants in Europe (1999–2001) self-reported satisfaction with migration outcomes (Lundholm & Malmberg 2006), in Thailand, a study with explicit before-after migration

questions finds that slightly more permanent migrants raise satisfaction than not, but results are worse for temporary migrants (de Jong et al. 2002).

Additionally, studies on *cross-border migration* provide partly transferable insights for internal migration.[9] One *natural experiment* study of a visa lottery for migrants from Tonga to New Zealand finds that despite large gains in OWB, migrants' SWB declined and was "0.8 points lower than they would have been in Tonga, about four years after migrating" (Stillman et al. 2015: 11). *Longitudinal data* are scarce. One study of Russian migrants in Finland (2008–2013) finds that SWB rose half a year after migration, but then stabilized, while self-esteem declined (Lönnqvist et al. 2015; Mähönen et al. 2013). Other longitudinal data (1990–2014) exists for migration between former East and West Germany after reunification, which falls in between international and internal migration (Melzer 2011; Melzer & Muffels 2012, 2017). Most East-to-West migrants experienced a SWB decline around the first move and a sharp rise during the first year of settling, after which SWB plateaus, despite strong income profits. All migrants gain SWB compared to former East German peers (men more than women) but remain slightly below the level of locals. Conversely, West-to-East migrants' SWB decreases after settling but remains higher than that of locals. Furthermore, *cross-sectional* studies add mixed results. Gallup data of 156 countries (2005–2017) documents that many migrants moving to happier countries tend to increase happiness, unlike those reaching unhappier countries, even if figuring in selection effects (Helliwell et al. 2018a). Several studies also suggest that migrants fare better than similar *stayers* (Bartram et al. 2013). For example, migrants moving from post-socialist states to richer countries raise their SWB compared to matched stayers (Nikolova & Graham 2015). In a similar fashion, the SWB of most but not all immigrants in Canada and the UK increases relative to stayers, particularly strongly for migrants from countries with lower average SWB (Frank et al. 2016; Helliwell et al. 2020). In like manner, a study using Latin America Gallup data shows that international emigrants became modestly happier than comparable stayers once living abroad, while before moving, they had used to be unhappier (but wealthier) than those wishing to stay. SWB gains were greater for Latin American than non-Latin American destinations and highest for middle-aged migrants in their working years (Graham & Nikolova 2018). However, conflicting data exists; specifically, older studies suggest that Latin American emigrants realize income gains but remain less satisfied than stayers

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[9] While internal and international migration conditions differ in some aspects, there can also be commonalities. Still, the results here on cross-border movements can only be transferred in part to internal migration.

(Graham 2016; Graham & Markowitz 2011). On the contrary, studies agree that only few international migrants reach similar SWB levels as *locals* (Bartram et al. 2013; Hendriks & Commandeur 2018). In Canada and the UK, migrants' SWB approaches that of natives but remains slightly lower (Helliwell et al. 2020) and in thirteen European countries, it stays below that of natives (Safi 2010; Vroome & Hooghe 2014). Scholars suspect that the context influences outcomes, and that migrants remain unhappier than (even comparable) natives in richer countries, while they have more comparable levels in poorer countries (Bartram et al. 2013; Safi 2010). Lastly, regarding the question of adaptation, data suggests that international migrants' SWB plateaus over time and the second generation may not be more satisfied than their parents (Helliwell et al. 2018b; Safi 2010). However, studies on SWB adaptation after migration are rare and more conclusive findings on long-term effects are "clearly needed" (Luhmann et al. 2012: 610).

All things considered, theory and data point to several *determinants of migrants' present SWB*. Theory holds that SWB can be shaped by (a) adaptation to new situations, (b) social comparisons, or (c) altered aspirations after settling (see Section 2.2.3). Existing data illuminates that these three mechanisms can but do not necessarily overlap (Haindorfer 2019a; Melzer & Muffels 2017). Gains compared to own past living standards seem key, followed by comparisons to peers in home villages and destinations as well as self-ranking in society at large (Bartram 2010; Clark & Senik 2010; Gelatt 2013; Melzer & Muffels 2017; Senik 2009). Along the same vein, several empirical studies explain migrants' worse SWB compared to stayers—or the lack of full SWB convergence—by false expectations, lacking information, unrealized or rising aspirations, shifting reference groups, and relative deprivation (Chen et al. 2019; Czaika & Vothknecht 2014; Knight & Gunatilaka 2018; Mulcahy & Kollamparambil 2016). Many of them focus on how income changes affect migrants' SWB (Haindorfer 2019a), although income is not the major driver of SWB and may thus have limited explanatory power (Hendriks & Commandeur 2018). Some studies link migrants' SWB gains to income increases and find no evidence for hedonic adaptation (Melzer & Muffels 2017), but others argue that even high-income gains do not raise SWB (Chen et al. 2019; Stillman et al. 2015). One well-established explanation could be that comparison effects result in complex SWB effects.[10] Social comparisons and footprint effects seem to influence SWB simultaneously. On the one hand, the SWB in migrants' areas of origin—and thus the conditions into

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[10] Especially in richer (less so in poorer) countries, once people become wealthier beyond a threshold, they adapt and their aspirations or reference groups can change; relative rather than absolute gains become key, and accordingly, more income does not necessarily yield higher SWB, see Easterlin (2001); Easterlin & O'Connor (2020); Easterlin et al. (2010).

which they were born—have "small but significant footprint effects" for their SWB even years after settling (Helliwell et al. 2020: 1637). On the other hand, migrants' SWB also depends on the average SWB of locals, to which they tend to converge to a certain degree. Data suggests that "on average, a migrant gains in happiness about three-quarters of the difference in average happiness between the country of origin and the destination country" (Helliwell et al. 2018b: 6). Lastly, SWB also depends on macro conditions in destinations, including socioeconomic and governance variables (Hendriks & Bartram 2016). For instance, hurdles for migrants' SWB include adverse living conditions, social and emotional costs of adjusting to a new life, discrimination, language difficulties, and less time spent on SWB-lifting activities (Chen et al. 2019; Helliwell et al. 2018b; Hendriks et al. 2016; Safi 2010; Texidó & Warn 2013).

Moving also influences the SWB of migrants' kin who live elsewhere. The effects are context-dependent, but studies suggest that costs of moving (such as emotions related to family separation) can be high even when compared with the benefits (such as receiving remittances) (Laczko & Appave 2013). For example, a Gallup survey in 156 countries (2015–2017) shows that partial household emigration creates mixed SWB effects for remaining family members: on average, they improve life satisfaction and positive feelings, but simultaneously feel more negative emotions such as sadness, worry, and anger, especially due to temporary migration (Hendriks et al. 2018). Likewise, a study using Gallup data for 114 countries (2009–2011) finds that stayers experience higher satisfaction and positive emotions and yet also report more stress and depression. Remittances can enhance SWB gains—especially in poorer and more unequal societies and for poor respondents—but do not offset adverse effects, and impacts are less negative in areas where migration is common (Ivlevs et al. 2019). Results seem consistent in Latin America, where families with migrant members benefit from remittances and make modest satisfaction gains, but also report more depression than others (Graham & Nikolova 2018). By the same token, an earlier study finds that cross-border migration from Latin America raises satisfaction of family members staying (probably linked to remittances) but decreases nutritional security at the same time (Cárdenas et al. 2009). Other studies identify mostly negative effects: one systematic review with studies mostly on internal migration in China and in 15 other low- and middle-income countries highlights that children, adolescents, older parents, and spouses left behind suffer from physical and mental health issues (Paudyal & Tunprasert 2018). Certain effects can be gendered; a study in Central Asia documents that after male emigration, women can suffer from added care burdens and may feel isolated, deprived, and sad (Abdurazakova 2013).

4.2.2.3   Migration, Climate Change, and Views of the Future

The links between migration and time have only recently gained more attention (Baas & Yeoh 2019; Cwerner 2001; Griffiths et al. 2013), however, especially *migrants' views of the future* remain "quite understudied" (Boccagni 2017: 2). A small number of studies exist on the objects and the subjects of migrants' imagined futures; the determinants of baseline hopes and fears, their changeability after migration, and relevant mechanisms; their functions; and the heterogeneity of outlooks to the future.

First, the *objects* of imagined futures after migration are diverse but tend to include employment, income, education, better living conditions, upward social mobility, safe return and investment, or legalization (Boccagni 2017; Portes et al. 1978; van Meeteren et al. 2009; Wake et al. 2019; Yeboah 2021). Migrants do not only imagine a future for themselves, but *subjects* of their views of the future frequently involve peers. Primarily, views of the future tend to involve other generations. Even when migration displaces or postpones migrants' own hopes over time, many of them still hold externalized hope for their children (Boccagni 2016, 2017; Pine 2014; Wake et al. 2019).

Next, migrants' initial views of the future depend on socioeconomic and demographic factors as well as personal factors. Often, people with high aspirations self-select into migration (Czaika & Vothknecht 2012), but a lack of information can bias their expectancies (Knight & Gunatilaka 2010). Still, views of the future are not static during migrants' life course: imagined futures often appear open, blurred, and accessible early after moving but over the course of migration, relative deprivation and worsened social status can gradually flatten these imaginations and make them more uncertain, ambivalent, and closed (Boccagni 2017). Other studies confirm that risks and uncertainty created by migration can alter views of the future (Wake et al. 2019; Williams & Baláž 2012), sporadically creating oscillations between hope and despair (Pettit & Ruijtenberg 2019). Notwithstanding, even forced migration can create hope if refugees feel safe and welcome and improve their living conditions (Siriwardhana et al. 2014). Finally, rural-to-urban migrants may increase their aspirations for the future, for example, regarding asset wealth, once they become established (Chen et al. 2019).

Migrants create future expectations through various mechanisms, which include chances and problems in the present, such as poverty, inadequate living conditions, discrimination, and exclusion (Koo 2012; Ming et al. 2021; Pettit & Ruijtenberg 2019; Wake et al. 2019). Views of the future also depend on personal-level processes, such as evaluations of past accomplishments and skills (Portes et al. 1978), as well as comparisons between migrants' present utility of life and

the socially-expected utility in life course stages (Hu et al. 2020). Moreover, a 'stress-is-enhancing' mindset and the belief in upward social mobility are coping mechanisms that can mitigate hopelessness in deprived rural-to-urban migrants (Ming et al. 2021). In a similar fashion, climate relocatees who trust in god's provision or protection often hold hope and determination for a better future (Yates et al. 2021).

Critically, views of the future have varied functions for migrants. Hope often motivates action, although not always in ways stringent with desired outcomes (Boccagni 2017). Moreover, hope can provide consolation. Many low-wage migrants endure hardship in the present and near future only because they are oriented toward hopes for the long-term future (Pine 2014), and hope helps forced migrants to navigate post-displacement challenges (Umer & Elliot 2021; Yohani & Larsen 2009). Nevertheless, being hopeful is not unequivocally positive. For example, detained asylum seekers often suffer from extreme uncertainty and despair, yet overfocusing on the unrealistic hope of moving to safety can further diminish daily functioning (Turner 2017). In general, uncertainty or unpredictability—for example regarding duration of migration, employment or legal status—can also affect migrants' decisions, such as if to enter serious social relationships (Griffiths et al. 2013).

Overall, the limited existing literature suggests that migrants' hopes and fears regarding the future are heterogeneous. For example, studied Rohingya refugees in Bangladesh were "cautious and constrained" regarding future expectancies (Wake et al. 2019: 10); rural-to-urban migrants in China suffered from low expectations, high hopelessness, and high uncertainty for their futures (Knight & Gunatilaka 2010; Koo 2012; Ming et al. 2021); and in Ghana, young rural-to-urban migrants' held hopes despite constraints (Yeboah 2021). A review of climate relocations in the Pacific documents this heterogeneity. It finds that relocatees frequently suffered from anxiety due to the uncertainty of their futures and the unfamiliarity of their new environment as well as from fear of near hazards and concerns about intensifying climate change. Simultaneously, some relocatees gained a sense of safety after relocation, and many held hope and determination for a better future (Yates et al. 2021).

While few (climate) migration studies examine people's views of the future, increasing evidence highlights that climate change itself strongly affects future expectations (Doherty & Clayton 2011; Helm et al. 2018; Manning & Clayton 2018), and one can reasonably assume that some of the insights from this literature also apply to migrants from areas affected by climate hazards. Climate change shapes people' future expectations through various mechanisms. On the negative end, general concerns about uncontrollable, unpredictable, and uncertain

climatic changes can induce negative views of the future, perceived helplessness, and inaction (Albrecht 2011; Hayes et al. 2018). Moreover, approaching or already experienced climate impacts can create uncertainty, generalized anxiety, hopelessness, feeling of doom, resignation or fatalism (Bennett & McMichael 2010; Clayton 2020; Fritze et al. 2008; Hayes et al. 2018). As one example, despair can ensue when climate impacts destroy homes or cherished environments (Albrecht et al. 2007; Albrecht 2011; Tschakert & Tutu 2010; Warsini et al. 2014). On the more positive end, hope is possible as long as people perceive chances to take action (Fritze et al. 2008), and vice versa, active, constructive hopes can raise psychological adaptation or motivate action (Hayes et al. 2018; Ojala 2012). Even climate anxiety is not maladaptive per se, as long as it does not induce rumination or block action (Clayton 2020). Furthermore, climate threats can raise cooperation, compassion, and bonding that ultimately contribute to optimism (Edwards & Wiseman 2011; Hayes et al. 2018; Ramsay & Manderson 2011). Lastly, optimism, hope, and faith protect against disaster trauma and help people to cope with related severe losses (Cherry et al. 2017; Hackbarth et al. 2012; Hirono & Blake 2017).

4.3   Summary and Implications for this Study

In this section, I briefly synthesize the main review findings on climate *migration* and infer implications for this study. Conversely, the effects of climate *immobilities* remain a key research gap.

The evidence on how migration can alter OWB is most robust for effects on livelihoods and health, while education, social ties, security, as well as hazard exposure and vulnerability are explored less. There are also few studies that comprehensively assess the interrelations of OWB variables and their links with SWB. These areas indicate research gaps that this study partially aims to bridge.

First, the existing evidence suggests that climate migration may facilitate *development from a secure base* only under certain conditions. Forced migrants and relocatees are more likely to suffer losses in income, education, and health than voluntary ones. Gains are smaller for internal than for cross-border migrants. Worldwide, many internal migrants make stepwise *livelihood* gains, but the conditions of moving, household vulnerabilities, intersectional social factors, and the context of reception determine if such migration is adaptive or maladaptive. Migration also implies major costs, and the risks of un- or underemployment, discrimination, and precarious jobs are high especially for workers with rural skillsets and women. While well-prepared migrants often improve *education* and

health through higher incomes and better services, catching up with locals is rare, and the accessibility of services depends on intersectional factors. Additionally, adverse living conditions can offset health gains. Migrants can face a high incidence of physical and mental diseases and unequal access to health care. Mental health issues are notably high for marginalized, unemployed, and female migrants.

Second, regarding *a space to live better,* this review shows that many migrants—especially forced ones and relocatees—live in unfavorable areas with constrained access to adequate *housing* or basic *infrastructure*, at least initially. Poor conditions are more likely for first-movers, low-income migrants, and those subjected to discriminatory structures. Cities can provide opportunities for climate migrants, but adverse living conditions can also create higher vulnerability to *hazards.* While some migrants succeed in reducing exposure to hazards by moving, especially poor people often have few choices but to settle in zones highly exposed to unfamiliar hazards. *Insecurity*, including interpersonal or organized violence, is frequent for climate migrants and often gendered.

Third, results on *social relatedness* are inconclusive. Studies find positive effects on family relationships for some climate migrants, whereas in other cases, exclusion and fragmentation of social networks or cohesion occur. In general, impacts depend on changing family and household dynamics, the circumstances of moving, and the experience of settling in a new place. The risk of losing social support is tangible for numerous migrants, especially as a result of forced and recurring movements.

Furthermore, climate migration also affects *sending communities.*[11] To begin with, economic impacts depend on the migration context and phase. They can be positive but are often unevenly distributed. How emigration influences labor markets at home depends on who and how many people leave. While remittances frequently reduce poverty and can contribute to health, food security, education, and adaptive capacities, positive effects are less likely for the poor and exacerbating inequalities are possible. Further effects of emigration on education and health are mixed and include threats of increased morbidity, such as mental illnesses for at-risk groups. Finally, migration may empower stayers but can also cause social strains; the impacts depend on the individual migration journey, intersectional factors, and the use of extended family networks.

Taken together, these complex findings illuminate why controversies on the adaptive potential and risk of migration have persisted (Bettini & Gioli 2016;

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[11] Since effects on *receiving communities* are not the focus of this study, they are not recapped here.

McLeman 2016a; Vinke 2019). This study aims to expand prior findings by analyzing objective *and* subjective dimensions of well-being in Peru.

The review synthesized that present SWB partially moves within a stable range defined by genes, personality, and proficiencies, but can change according to circumstances at the macro and individual levels. The evidence suggests that hedonic adaptation occurs in some but not all situations, yet how it arises and with which limits remains less clear. However, migration figures among those major life events that can shift SWB beyond adaptation. Similarly, people have a partially stable disposition for hope(lessness), but several processes can raise or reduce positive views of the future. Present SWB and views of the future seem to influence each other to some degree. Moreover, both can have significant downstream effects on people's health, social relationships, work, and other domains of life. However, while positive SWB and views of the future are generally beneficial, exceptions exist.

The empirical findings demonstrate that gains and losses of migrants' present SWB are not uniform and depend on the reasons for moving, the conditions of the journey, the migration corridor, the duration of stay, as well as the conditions in source and destination areas. The limited data suggests that forced migration likely generates most SWB challenges, although many studies only provide averages, which conceal changes for specific groups of migrants. For *internal migration*, the breadth and depth of the evidence are robust. Various high-quality longitudinal studies emphasize that even if migrants gain economically, rising or unrealized aspirations, relative deprivation, and factors such as emotional, social, and health costs reduce their SWB in all investigated poor countries. In richer countries, longitudinal studies also find an anticipation decline in SWB before migrants implement their moves. After this decline, some studies report a return to initial levels, while others find that (male) migrants can raise SWB enduringly. Cross-sectional studies, within the discussed limitations, reveal that many migrants remain behind the SWB of both stayers and locals despite income gains, for similar reasons as cited above. Studies on subjective migration success are rare and have their own biases but suggest that migrants may perceive their endeavors more positively than SWB data would indicate. Next, for *cross-border migration*, a natural experiment provides strong evidence that migrants' SWB can fall despite OWB profits, while the few available longitudinal studies suggest that SWB decreases before moving, then improves, and later plateaus. Cross-sectional analyses yield mixed findings and suggest that the direction of specific migration streams matters: migrants moving from countries with lower to higher average SWB often improve their SWB compared to that of stayers, probably due to OWB gains, unlike those migrating to unhappier countries. However, migrants

can concurrently lose SWB through social comparisons in destinations that induce relative deprivation. In happy countries, migrants' SWB converges with that of locals over time to some degree, but only few reach similar SWB levels, partially because they take footprint effects of lower SWB averages from their areas of origin with them. Conversely, in unhappy countries, migrants are often happier than locals. Few studies exist on long-term SWB effects of migration and hedonic adaptation; they suggest that SWB may remain flat over time even for the second generation, possibly due to changes in reference groups.

Next, the evidence of SWB effects on stayers is limited and inconclusive. Results seem to depend on specific migration experiences, structures in areas of origin, household characteristics, and intersectional factors. Most existing analyses suggest that emigration can raise cognitive satisfaction and positive feelings (although not in uniform ways) but simultaneously create negative feelings, such as anger, depression, sadness, and worry. Other studies, however, find mainly negative effects.

Lastly, the evidence on migrants' views of the future is limited. Still, it seems agreed that many migrants live orientated toward the future and that the subjects of their imagined futures can be relational and intergenerational. The objects of migrants' views of the future are frequently diverse—often revolving around upward mobility—and their aspirations high, but potentially biased. Imagined futures can strongly change across life course trajectories and phases of migration, but the direction of changes is neither linear nor predetermined because both external circumstances and personal-level processes influence these imaginations. Depending on the circumstances of moving and settling, the point in time, as well as individual factors, resultant views of the future can vary greatly. For climate migrants, climate change is likely a key influence on their views of the future. Linked general climate concerns, felt unpredictability and uncontrollability, as well as impending or past impacts can create pessimism. Conversely, hope can be a key catalyst for action against climate change while actions and linked outcomes, such as bonding, can on occasion create optimism. Finally, hope and optimism can buffer adverse psychological effects of climate change to a certain degree.

In brief, these findings have several implications for this study of climate (im)mobilities within Peru. The review yielded a breadth of evidence on migration, but implications on immobility are uncertain. First, the evidence suggests that internal migration can have mixed effects on people's OWB. Key determinants include how voluntarily and how prepared migrants can leave; under what conditions they move and into which contexts of reception they arrive; the time passed since settling; and how intersectional factors shape (dis-)advantages

throughout the process. Some gains seem possible under positive conditions of moving—which may be true for some of the more anticipatory migrants from Peru's highlands—but even then, high costs will likely accompany these gains. Enhancing *development from a secure base* and finding *a space to live better* may prove difficult for those climate migrants in Peru with preexisting vulnerabilities and those moving under *distress* or *survival* conditions. Here, the new case studies on flood-driven displacement in Peru's *Costa* and relocation in the *Selva* promise insights. Moreover, mixed effects on *social relatedness* are possible. Finally, the effects on sending communities depend on the strength of translocal ties; remittances are one central effect but should not detract from others, including those on social relationships. The case study in the Peruvian highlands includes both migrants and stayers and may thus render new insights.

Second, the review does not provide clear expectations for this study regarding SWB effects. Since context matters, it is valuable that the case studies performed in this dissertation cover different forms and distances of movement and considerably varied contexts of reception, ranging from large cities to previously uninhabited spaces. As in other poor countries, most involuntary migrants and rural-to-urban migrants are bound to lose present SWB. Only a few migrants—especially men and those moving under more positive conditions—might lose SWB shortly before migrating, but then make gains beyond the prior set range. It is possible that climate migrants' SWB will remain worse than that of stayers and locals. Additionally, negative feelings are likely for stayers, but may be accompanied by positive feelings and gains in satisfaction, especially for poorer recipients of remittances in areas where migration is common. The review also does not offer clear implications concerning climate migrants' views of the future. Strong stressors, including those related to climate change, could negatively shape outlooks to the future, but personal-level factors may create buffering effects. More positive views of the future are possible where migrants perceive opportunities, agency, and pathways to desired futures, including for next generations. Critically, if the affected people end up holding more hope or fear could have feedback effects on OWB.

Third, the review shows that migrants' OWB and SWB can converge or diverge, stressing the need to analyze both jointly. In this study, I will assess who among the affected people experiences (a) *true well-being*, (b) *deprivation,* (c) *dissonance*, and (d) *adjustment* and for which reasons (see Section 2.3). Comparison theory may offer one promising explanation for differences. Finally, present SWB and views of the future can also converge to varying degrees depending on external and personal-level factors, and this study intends to add insights into the array of possible outcomes.

Part　II
At Risk of Deprivation

Sierra: Rural-to-Urban Migration and Immobility Related to Water Scarcity in Peru's Highlands

5

> *"Toda la gente se va a las ciudades, pero ya no hay espacio donde vivir, … y el agua se va a escasear, y en las ciudades serán peor seguramente …"*
>
> *"Everyone goes to the cities but there is no longer space to live, … and water is going to be scarce, and in the cities, they will be certainly worse ..." (own translation, as in all the chapter).*
>
> Statement by a mestizo[1] man living in a village in the highlands that is experiencing glacier retreat. He was in his early 60s and in good health at the time of the interview and made a living as a civil servant and farmer (V1-1).

The research interest in the Lima Region in Peru's Central Highlands was in longer-distance, rural-to-urban migration from two villages, both harmed by two types of *gradual* climate impacts: glacier retreat and rainfall changes. The villages V1 and V2 were the starting points to trace migrants in the Regional and national capitals Huancayo and Lima.[2] This dynamic is of interest for two reasons: first, water scarcity due to glacier retreat and rainfall changes is already salient across the highlands (*Sierra*) (Heidinger et al. 2018; Seehaus et al. 2019). Migration from the *Sierra* can be shaped by both such rainfall changes (e.g. Hook & Snyder 2021; Lennox 2015; Milan 2016; Milan & Ho 2014) and glacier retreat (e.g. Alata et al. 2018; Altamirano Rua 2021; Figueiredo et al. 2019; Heikkinen 2017; Wrathall et al. 2014). Second, while rainfall projections are uncertain, future

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[1] *Mestizo* refers to a person of a combined European and Indigenous American ancestry.

[2] For privacy protection, I specify neither the names of the study sites nor of respondents. Quotes by villagers from Village 1 and 2 are marked with V1 and V2, respectively, and those from migrants in Lima or Huancayo with L or H, respectively. The codes include an individual identifier, for example, V1-1 or L-15.

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glacier loss will be severe even for low emission scenarios (Adams et al. 2014; Marzeion et al. 2012; Radić et al. 2014; Schauwecker et al. 2017), with likely strong impacts on water security and migration. In the first section below, I provide information on the geographical context, measured and projected climate change trends and impacts, exposure, vulnerabilities, local coping and adaptation, and hazard-related migration in Peru's highlands. Afterwards, I describe the empirical results of the new case study, discuss them, and induce propositions on broader well-being impacts of climate (im)mobilities.

5.1   Context

28% of Peru's population resides in the *Sierra* (INEI 2018c), a share that has significantly decreased over the past decades, similarly as in other Andean regions and highlands worldwide (de Sherbinin et al. 2012; Valdivia et al. 2010). The study sites V1 and V2 are in one of the mountainous Provinces of the Lima Region (Figure 5.1). In 2017, one year before I collected the data, 0.91 million inhabitants lived in this Region, not counting the Metropolitan Province of Lima. V1 was home to about 200 residents (56% male / 44% female) and had 200 houses (INEI 2018c).[3] It was connected to the public water network, electricity grid, and drainage system, and hosted a health post as well as small primary and secondary schools. By contrast, V2 had only 70 houses home to about 40 villagers (49% m / 51% f). It had access to electricity, but not to the water network or drainage system, and only a primary school with one pupil left. In both sites, villagers speak Spanish and consider themselves as *mestizo*. V1 is a district village whereas V2, as V1's administrative annex, lacks an independent budget.

The Andes, home to V1 and V2, feature an alpine Tundra climate with wet and dry seasons (Beck et al. 2018; Mächtle 2016).[4] Humid air masses from Amazonia travel westwards over the high mountain chains (*Cordilleras*) that are separated by deep valleys, and bring summery rainfall from December to March. Precipitation gradients and topography-related temperature differences shape vegetation and agricultural potential: western Amazonia features open mountain forests, followed by humid grassland highlands in the north, and arid desert *puna* in the south. Between 2,000 and 3,500 m.a.s.l., the cold land (*tierra fría*) and cloud

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[3] The exact number of inhabitants is known but not specified here for privacy protection.

[4] The following sections draw in part on my previous work published in Bergmann et al. (2021a).
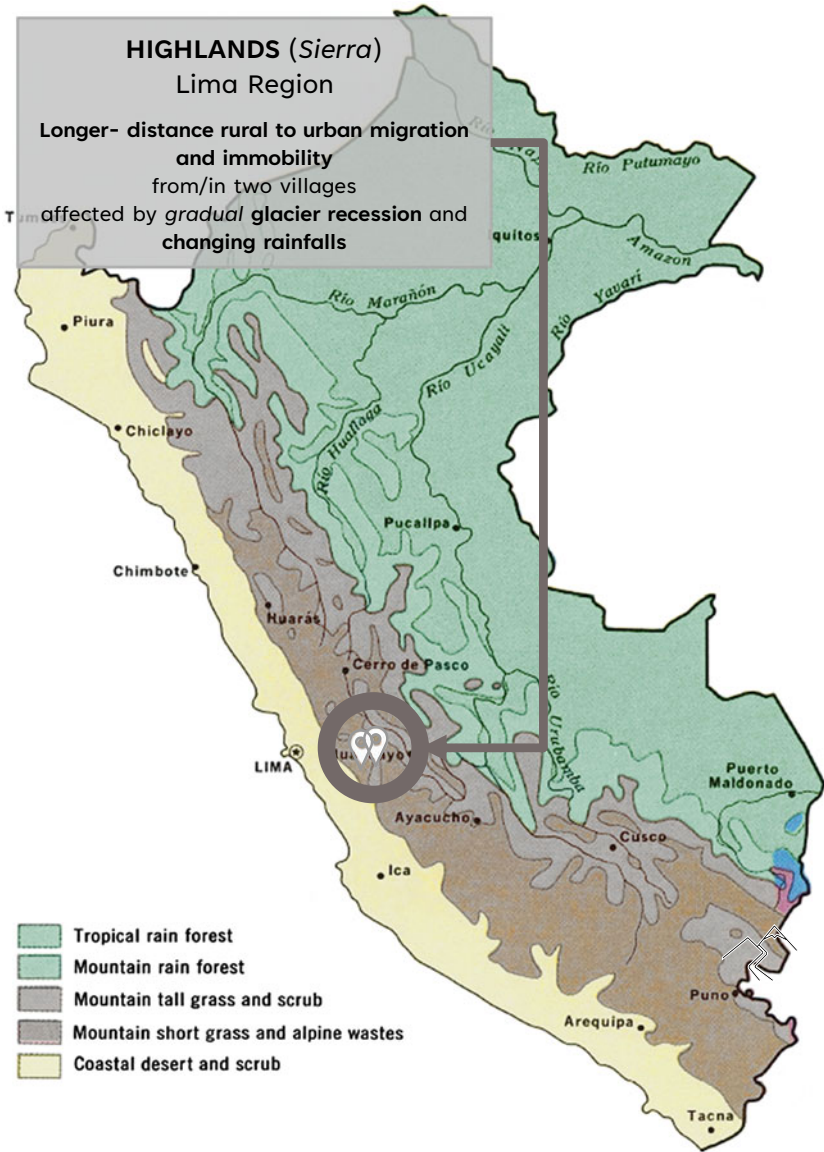
Figure 5.1 Sites for qualitative data collection in Peru's highlands. (Note: To protect the respondents, the pins indicate approximate locations only. Created by the author, based on CIA (1970))

forests allow for livestock farming and field crops, such as corn and quinoa. Above the timberline, in the frosty land (*tierra helada*), few crops such as potatoes and pastures such as alfalfa grow. Vegetation in the *puna* consists of grasslands that provide forage to camelids such as alpacas. Above 4,500 m.a.s.l., vegetation is scarce.

The river basin in the *Cordillera Central* that is home to both V1 and V2 has around 500 lagoons and 15 km^2 of mostly small, glaciated surfaces higher than 3,700 m.a.s.l. (Proyecto Glaciares 2018). Figure 5.2 shows the glaciated surfaces. Rainfall and glacial meltwater feed a high-altitude dam lake, which supports the water regulation in the basin; during the dry season, up to 80% of the water in the dam lake is from glaciers. 85% of its water is used for hydropower generation and 15% for agriculture.
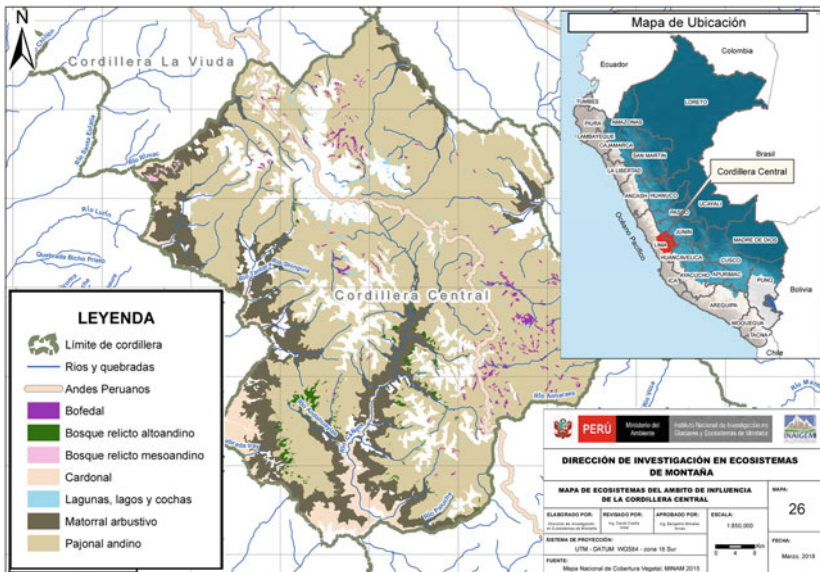
Figure 5.2 Ecosystems in the Cordillera Central and glaciated surfaces. (Note: Cropped from INAIGEM (2018: 156) and adjusted by the author)

Within the basin, V1 and V2 are in a remote, protected natural area at an altitude of around 3,600 m.a.s.l. The next larger cities are several hours away by

car. Pulgar Vidal (1972) coined this ecological floor as *Suni*.[5] The cold subalpine climate here has distinct dry and rainy seasons and low average temperatures (INAIGEM 2018) (Figure 5.3). Rainfall occurs mostly from October to March and is the main source of water in the basin (Proyecto Glaciares 2018; SERNANP 2006).
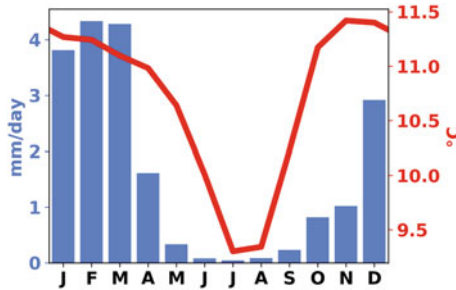
Figure 5.3 Temperatures and rainfall close to V1 and V2. (Note: Average temperatures and rainfall per month from 1982-2016. Produced by Stephanie Gleixner with PISCO data, edited by the author. The station name here and in the following figures is concealed to protect the privacy of respondents)

However, for some rural zones in the Andes, glacial meltwater is key during the dry season (Buytaert et al. 2017). In the mountainous Lima Region, the focus herein, meltwater contribution to river flow can reach between 50% to 100% during the driest months of a drought year (Figure 5.4, right). Similarly, the villages V1 and V2 have an increased dependence on meltwater during dry months.

Most highland areas in Peru are exposed to various natural hazards, climatic changes, and non-climatic stressors, such as soil degradation and overgrazing (Dourojeanni et al. 2016; MINAM 2011, 2016b; SERNANP 2016). Many inhabitants in the *Sierra* must confront multiple hazards, sometimes concurrently or in short subsequent periods (Cavagnoud 2018; Perez et al. 2010). Hazards often revolve around water (droughts, floods, hail, snow, glacier retreat, rainfall changes) and temperature (daily and seasonal extremes, average increase) (e.g. Alata et al. 2018; Aragón et al. 2018; Koubi et al. 2016). Highland villagers perceive that climate change has multiplied hazards (Oft 2009), especially glacier retreat and rainfall changes (Heidinger et al. 2018; Seehaus et al. 2019).

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[5] From *Quechua*, meaning "wide" or "high".
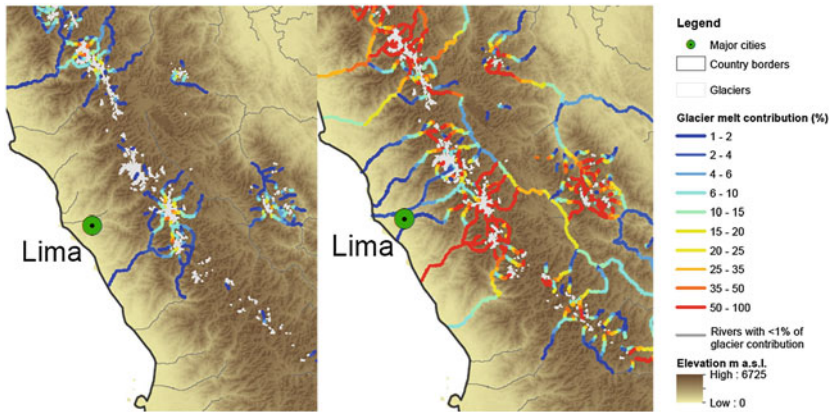
Figure 5.4 Contribution of glacier meltwater to river flow in the Lima Region. (Note: Spatial propagation of the contribution of glacier melt water [%] to river flow; yearly average for a normal year (left) and monthly maximum for a drought year (right). Cropped by the author from Buytaert et al. (2017: Supplementary Materials S4, S7))

For V1 and V2 specifically, a trend analysis is possible with gridded satellite and station data from the PISCO dataset (Lavado-Casimiro et al. 2016).[6] Figure 5.5 displays that average monthly temperatures have increased by up to 0.5 °C when comparing 1997-2016 with 1982-2001. Annual mean average, minimum, and maximum temperatures validate this warming trend. Maximum daily temperature ranges show strong interannual variability but are overall decreasing. Despite the low temperatures, cold spells of several days are rare and their length has decreased over the past years.

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[6] In Peru, with its complex topography and climate, weather stations only tell a part of the full story and the limited long-term weather data introduces uncertainties into trend analysis, see Bergmann et al. (2021a). Modern satellites facilitate more complete monitoring, but the data is less reliable. Observational datasets with data from satellites *and* weather stations offer comprehensive information with a greater reliability. The Peruvian meteorological service (SENAMHI) has produced such a dataset called PISCO, see Aybar et al. (2020). My colleague Stephanie Gleixner kindly produced graphs with PISCO data for the results chapters on *Sierra* and *Costa*, and with station rainfall data and PISCO temperature data for the *Selva* chapter. For trend analyses, she split the longest available time series in the data set split into two even parts.
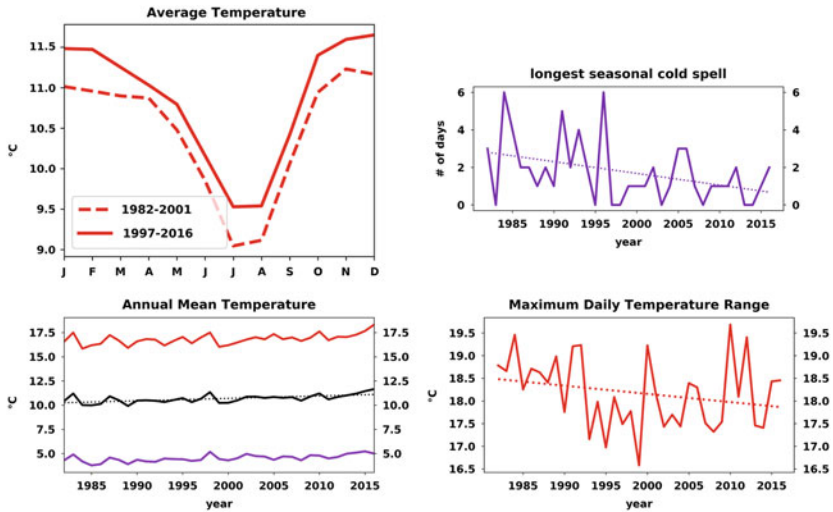
Figure 5.5 Temperature trends close to V1 and V2. (Note: Average monthly temperature 1982-2001 compared to 1997-2016 (top left) and annual mean, maximum, minimum temperature (bottom left); cold spell analysis (top right) and daily maximum temperature range (bottom right). Produced by Stephanie Gleixner with PISCO data, edited by the author)

Previous studies do not find significant rainfall trends in the tropical Andes in the 20th century (Rabatel et al. 2013). For V1 and V2, the data in Figure 5.6 seems to suggest an upward trend in annual precipitation, but with strong interannual variability. The rainy season has ostensibly intensified, whereas dry months have become marginally drier. While the frequency of dry spells seems to have decreased, their length might have increased. For rainfall extremes, the data displays no clear trend.

Rainfall changes and glacier retreat—the hazards in focus here—often affect people in the *Sierra* in parallel (e.g. Charbonneau 2008; Heikkinen 2017; Magallanes 2015). In prior studies of climate migration, people reported changes in seasonal rainfall patterns (Milan & Ho 2014), such as delays in the seasonal onset (López-i-Gelats et al. 2015), changes in seasonal length (Alata et al. 2018), and abrupt seasonal turns (Adams 2016). Altered rainfall availability was also reported, such as periods with more or less precipitation than usual (Cometti 2015a), reduced water availability (e.g. Adams 2016; Alata et al. 2018; Milan & Ho 2014), and droughts (Cavagnoud 2018; Koubi et al. 2016; Kuznar 1991;
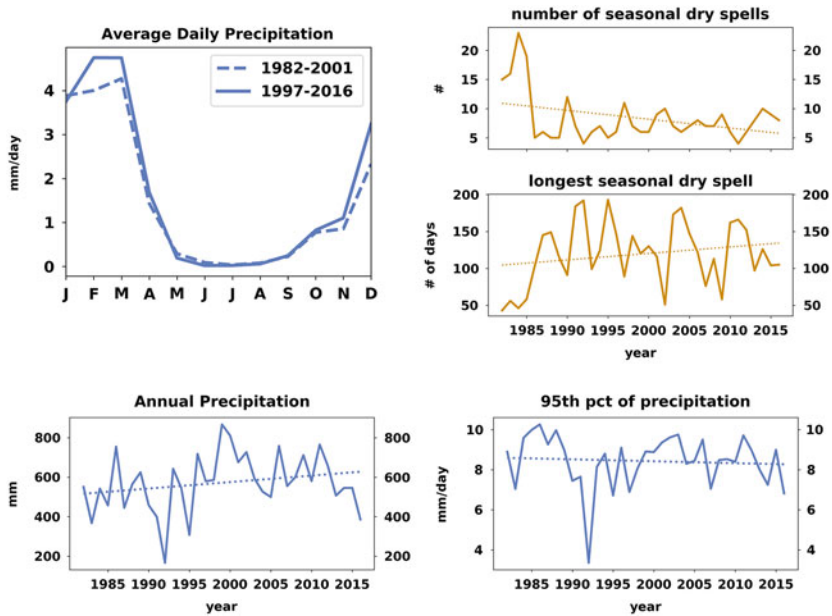
Figure 5.6 Rainfall trends close to V1 and V2. (Note: Average daily precipitation (top left) and annual precipitation (bottom left); dry spell and 95th percentile trends. Produced by Stephanie Gleixner with PISCO data, edited by the author)

López-i-Gelats et al. 2015; Oft 2009). Studies also document changing rainfall intensities (e.g. López-i-Gelats et al. 2015), such as more frequent and extreme events (Oft 2009; Wrathall et al. 2014), which can contribute to mud- and landslides (e.g. Adams 2016; López-i-Gelats et al. 2015). The studies above conclude that rainfall changes can have widespread impacts on people's lives and livelihoods in the highlands, including losses or reduced crop and fodder yield, crop diseases and pests, reduced quality of products, losses and diseases of animals, a decline of biodiversity, damages to infrastructure and assets, food insecurity, and other health challenges.

The severe glacier retreat in Peru is due to warming and changing El Niño events (Rabatel et al. 2013; Vicente-Serrano et al. 2018; Vuille et al. 2018). The retreat has accelerated since the mid-twentieth century (Bury et al. 2011; Georges 2004; Hastenrath & Ames 1995; Racoviteanu et al. 2008). Today, surface losses are at least 40% for all glaciers and various smaller ones are about to disappear

with below 10% to 30% surface remaining (INAIGEM 2018). From 2000 to 2016 alone, close to 30% of Peru's glacier area was lost (Seehaus et al. 2019). In the *Cordillera Central*, where V1 and V2 are located, data indicates that the glaciated surfaces decreased by 64% from 1962-2016 (Figure 5.7). Once a peak is crossed, glacial meltwater flows decrease, which is especially problematic for agriculture during the dry season (Orlove 2009; Wrathall et al. 2014). Glacier retreat also frees contaminants stored in the ice (Alata et al. 2018), has started to create water conflicts, and is affecting spiritual and cultural dimensions of people's lives in the *Sierra* (Altamirano Rua 2014).
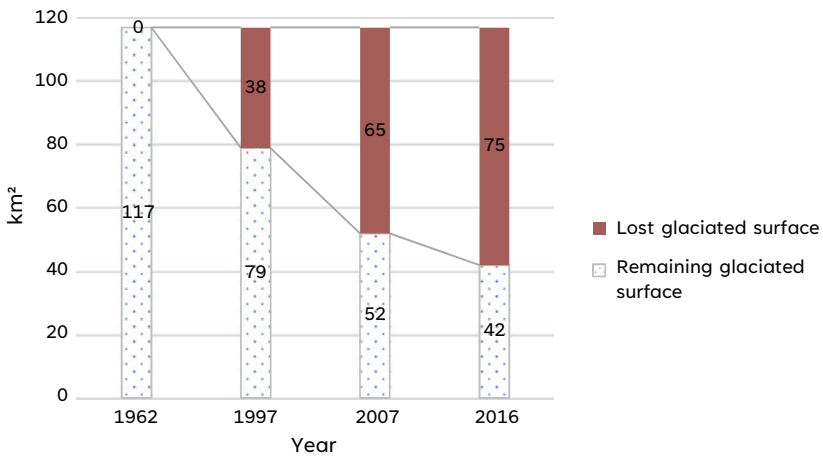
Figure 5.7 Loss of glaciated areas in the *Cordillera Central*. (Note: Reproduced and edited by the author from INAIGEM (2018: 166))

Even in a low emission scenario, future average temperatures in the *Sierra* could increase between 0.75 and 1.5 °C by 2050 and between 1 and 1.75 °C by 2100 compared to 1985-2005;[7] in a high emissions pathway, they could rise by

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[7] Climate models in the IPCC's Fifth Assessment Report used four representative concentration pathways (RCPs) to cover possible future emissions, see van Vuuren et al. (2011). RCP8.5 (*high*) assumes the highest CO_2 concentration, leading to a global surface temperature increase of 2.6 to 4.8 °C for the end of the 21st relative to the end of the 20th century. RCP2.6 (*low*), the most optimistic scenario that requires strong mitigation suggests an increase of 0.3 to 1.7 °C. RCP6.0 and RCP4.5 (*medium*) fall in between with 1.1 to 2.6 °C and 1.4 to 3.1 °C warming. See IPCC (2014).

as much as 1 to 2 °C and 3.5 to 6 °C (Bergmann et al. 2021a).[8] Specifically in the Province home to V1 and V2, in a high emissions pathway[9], the 50th percentile of mean air temperature would rise from ~7.5 °C in the 2010s to above 11°C in the 2080s, and maximum temperature would rise from 20.5 to 24 °C (Figure 5.8). These changes lead to ample risks for crops (Sanabria et al. 2014). 1.3 °C and 2.6 °C higher mean temperatures over the coming 35–70 years could reduce maize and potato production in Peru by more than 87% in current elevations (Tito et al. 2018).

Rainfall projections are less certain; Peru may see fewer rainy days but with more intense rainfall (Christensen et al. 2013; Giorgi et al. 2014). For the Province home to V1 and V2, a high emissions pathway could lead to fluctuating but rising average rainfall and more wet days by 2085 (Figure 5.9).

Future glacier volume losses are projected between 78% and 97% for the Central Andes, home to V1 and 2, for low and medium emission scenarios (leading to 2 ° or 3 °C warming above pre-industrial temperatures by 2100). By contrast, the loss would be close to complete with 93% to 100% in a high emissions scenario (inducing 4 °C warming) (Adams et al. 2014; Giesen & Oerlemans 2013; Marzeion et al. 2012; Radić et al. 2014). Lower-lying glaciers are most at risk (Rabatel et al. 2013). If the current trend in the Central Andes was to continue linearly, its glaciers would disappear in 2048 (INAIGEM 2018). Runoff will decrease once peak flow is crossed (Seehaus et al. 2019; Veettil 2018; Vuille et al. 2018), which is projected in 20-50 years for most tropical glaciers (Adams et al. 2014).

The projected retreat of Peru's glaciers will heavily affect downstream ecosystems and users. Future glacier reductions would not necessarily reduce total water yield in Peru, but dry season runoff and seasonal buffering capacities may sink, especially as rainfalls may become even more seasonal at the same time (Buytaert et al. 2017). Projections show reductions of dry-season runoff and increases of wet-season discharge for the 2050s and 2080s (Andres et al. 2014; Juen et al. 2007; Lavado-Casimiro et al. 2011), including for a basin in the Lima Region close to V1 and V2 (Olsson et al. 2017). Meanwhile, rising populations, especially in cities, and more usage by industries, hydropower generation, and intensive irrigation on the coast increase the demand on already stretched

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[8] Average of four Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) models.

[9] The Shared Socioeconomic Pathway (SSP) 3 (Regional Rivalry) is combined with a forcing level of 7 Watt per square meter in 2100, leading to above 4 °C mean global temperature increase by 2100.
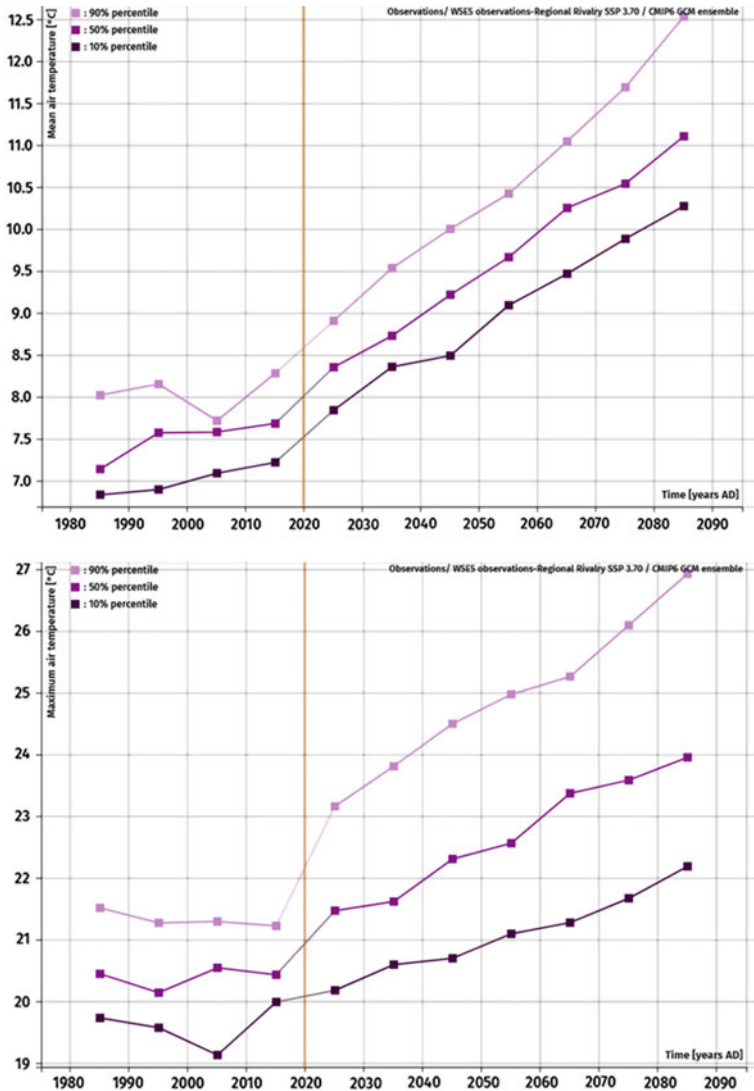
Figure 5.8 Observed and projected temperature in the Province where V1 and V2 are sited. (Note: Mean air temperature (top) and maximum air temperature (bottom), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3, 7.0 W/m^2 / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsda m.de)
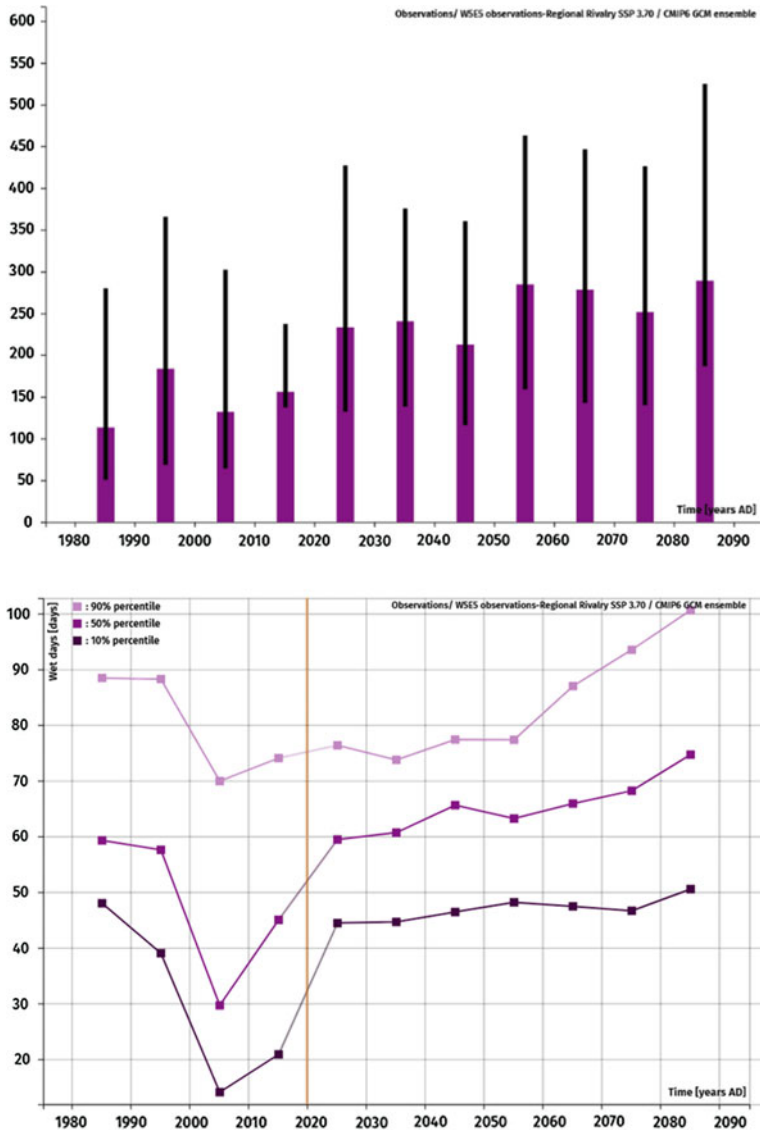
Figure 5.9   Observed and projected rainfall for the Province where V1 and V2 are sited. (Note: Precipitation (Top) and number of wet days (Bottom), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3 7.0 W/m^2 / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsdam.de)

resources (Buytaert et al. 2017; Buytaert & de Bièvre 2012). Moreover, meltwater can accumulate in glacial lakes that carry the risk of potentially destructive outburst floods (GLOFs) (Emmer et al. 2018). Such GLOFs threaten Huancayo, Huaraz, and other large cities in the *Sierra* (Frey et al. 2016; Haeberli et al. 2016; Huggel et al. 2020; Stuart-Smith et al. 2021). Rapid deglaciation will also result in water quality issues and severe non-economic losses, including the disruption of moorlands (Adams et al. 2014) alongside the loss of aesthetic and spiritual ecosystem services key to people's identity (Adams 2016; Paerregaard 2013, 2016). Because glacier landscapes are also key destinations for tourism, their loss might threaten jobs in the tourism sector (Altamirano Girao 2012).

Vulnerabilities to the discussed climate hazards are significant in the *Sierra*. They depend on the extent, quality, and location of household resources, including land and livestock, and factors such as age, family size, and health (Heikkinen 2017). In many areas, poverty, insufficient property and resource rights, poor soil quality, poor basic infrastructure and services, a lack of quality education, food insecurity, as well as a lack of savings and access to credit raise vulnerabilities (Koubi et al. 2016; Oft 2009; Oliver-Smith 2014; Sperling et al. 2008)). For example, a large-scale survey across the Peruvian *Sierra* finds a high poverty incidence of 55% (Aragón et al. 2018). Vulnerabilities are differentiated within households; for example, illiteracy is especially high among women and malnutrition particularly affects children (Oliver-Smith 2014). Constrained livelihood options also raise vulnerabilities: many households depend heavily on few agricultural activities, with limited diversification options and a small number of income earners (Cavagnoud 2018; Oft 2009, 2010). They are often subsistence crop and livestock farmers (Oft 2009, 2010; Perez et al. 2010), and as smallholders who use traditional practices, they are mostly dependent on rain-fed crops and have limited means to irrigate (Aragón et al. 2018; Heikkinen 2017). Some villages hold lands in various ecological floors to diversify livelihoods (Crespeigne et al. 2009), yet options are more limited the higher the altitude. Crop farming becomes less viable as elevation increases (Magallanes 2015; Milan & Ho 2014; Oliver-Smith 2014), and in the highest altitudes, pastoralism is often the first and, in some cases, the only option (Alata et al. 2018; Oliver-Smith 2014; Orlove 2009). Off-farm options can decrease vulnerability; for example, some farmers work complementarily in coffee harvest areas or in urban activities, such as construction (Milan & Ho 2014). However, additional non-farm incomes are only available where spatial proximity permits (Adams 2012, 2016; Adams & Adger 2013; Cavagnoud 2018; Cometti 2015a). Remoteness, land tenure, market competition, globalization, rural population changes, renunciation of traditional practices and institutions, as well as a lack of state presence and public services

further heighten people's vulnerabilities (Lennox 2015; Lennox & Gowdy 2014; López-i-Gelats et al. 2015; Oliver-Smith 2014).

Such vulnerabilities—especially those related to poverty and constrained livelihood options—also limit people's range of strategies to deal with hazards. Generally speaking, people in the *Sierra* react to variations in precipitation and glacier retreat through changes in crop management and crop varieties or changes in animal raising, care, and derived goods (Alata et al. 2018; Heikkinen 2017). To anticipate extreme heat, farmers use different plants and expand land use; once heat creates income losses, they sell livestock, make children work, and invest extra time in off-farm activities (Aragón et al. 2021). Yet, vulnerable groups usually have limited adaptation options: in one study, wealthier pastoralists accumulated livestock, less wealthy factions diversified assets, and the poorest groups reduced participation in pastoralism and sometimes completely abandoned it (López-i-Gelats et al. 2015). Moreover, climatic and non-climatic stressors often already exceed the adaptive capacity of mountain villages and threaten to create downward spirals of poverty (López-i-Gelats et al. 2015). Some practices, such as giving up traditional crop rotations, can further deteriorate soil quality and impair future production, and others may increase vulnerability, for example, if they raise dependency on single products (Lennox 2015; Lennox & Gowdy 2014). Recovery from shocks is often incomplete. In one study, surveyed households could only recover 76% of losses after droughts and floods (Oft 2009, 2010). In addition, today's practices come with limits—such as the availability of land—and may be insufficient to meet the magnitude of future changes (Aragón et al. 2018). For example, in one study, many highland villages struggled to cope with water scarcity in the short term, mostly asking peers for help, and reportedly lacked long-term options to adapt (Oft 2009, 2010).

Several prior studies observe migration for coping or adaptation, both due to rainfall changes and glacier retreat. For contextualization, it is key to know that Peru has experienced strong demographic changes and migration patterns are long established, as I analyzed in detail elsewhere and only briefly outline here (see Bergmann et al. 2021a). Over the past decades, Peru's population has grown at a flattening rate, moving the country toward a low transitionary state with a rising life expectancy in a population that is still young, but has a greater share of older people than before (INEI 2018c; UNDESA 2019; World Bank 2021c). This shift may have raised migration potential, as younger people tend to be more mobile (Millington 2000; Plane 1993; Rogers & Castro 1981). The focus of this dissertation is on internal migration, which outweighs cross-border migration in

Peru (INEI 2018b; Sánchez Aguilar 2012a; UNDESA 2016).[10] About one fifth of Peru's population are internal migrants, with slightly more men than women (Sánchez Aguilar 2012a). They tend to be relatively young and educated above the average. Many internal migrants work usually outside of agriculture and seem to earn more than non-migrants, although data on available *net* income is limited. Internal migrants remit some of their income to support family members—mostly women and economically inactive relatives—in their home communities, which could contribute to climate adaptation.

This internal migration is a major driver of Peru's population redistribution: between 1940 and 2017, the share of the population living in the highlands has dwindled from 65% to 28%, while the share of population on the coast has increased from 28% to 58%, and that in the rainforest from 7% to 14%. Prior research confirms that migration is part of the social fabric in the *Sierra* (Cavagnoud 2018; Skeldon 1977, 1985). Both permanent and circular migration is common.[11] Demography, lack of land or educational opportunities, poverty, and unequal market access are among the main drivers (Crespeigne et al. 2009; Heikkinen 2017). Increasingly, disrupted lifecycles of many rural highland families also drive migration (Alata et al. 2018), so that many Andean and other mountainous villages have become skewed toward older adults (de Sherbinin et al. 2012; Valdivia et al. 2010).

Existing internal migration patterns are deeply embedded in Peru. They involve relatively stable shares of the population and reproduce disparities between receiving and sending areas. Rural–urban migration is high but urban–urban and intra-metropolitan flows are increasing (INEI 2011, 2018c). Metropolitan Lima and Huancayo are hubs for migrants from the rural *Sierra* given perceived opportunities for education and jobs (Sánchez Aguilar 2012a). They are also two of the main destinations for V1 and V2. Lima is the primary hub of migration in Peru; by 2017, a net number of close to 2.8 million lifetime migrants had moved there. Both cities have doubled their inhabitants since the 1980s; Lima

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[10] International emigration from Peru has mainly involved people from professions outside of agriculture and been relatively modest (around 3 million cross-border emigrants since 1990), see INEI (2017b, 2018b). Nevertheless, surveys indicate large future desires to emigrate, see Gallup (2017); Latinobarómetro (2018). More people have left than entered Peru, but recent arrivals of Venezuelans have also made Peru an important destination. see UNHCR (2021). International remittances are comparable to peer states, and most recipients in Peru are urban dwellers, see INEI (2016a, 2017b).

[11] For some highland areas, transhumance is also an inherent feature of lifestyles, see Cometti (2015a, 2015b, 2018). Additionally, where proximity permits, commuting to cities can be common, see Adams (2016); Milan & Ho (2014).

has become home to about a third of Peru's population or 10.5 million people, while Huancayo has reached 0.46 million inhabitants (INEI 2018c). Both cities have witnessed attendant urban restructuring and problems related to infrastructure, basic services, social cohesion, and livelihoods (Carpenter & Quispe-Agnoli 2015; Haller & Borsdorf 2013; Ioris 2015; MML 2021).

Among other drivers, migration is also a traditional diversification strategy for subsistence farmers in the *Sierra* to anticipate or react to hazards or crop failures in general (Heikkinen 2017; Perez et al. 2010; Sperling et al. 2008). Such migration is especially frequent after abrupt and rapid-onset hazards, whereas gradual climatic changes, such as droughts, can make migration less likely because people tend to invest first in local adaptation efforts (Koubi et al. 2016). When affected by environmental change, it is often the young, poor, and males who leave, at least initially, because they tend to lack livelihood options in-place, sufficient quality land, and support systems or risk-sharing strategies (Crespeigne et al. 2009; Lennox 2015; Lennox & Gowdy 2014; Milan & Ho 2014; Sperling et al. 2008; Wrathall et al. 2014). In some areas, climate impacts add to but remain behind other main drivers of migration, such as demographic and aspirational changes in high-altitude pastoralist communities (Alata et al. 2018). In other zones, migration is strongly driven by frost, freezing, and hail (Cometti 2015a; Sperling et al. 2008), cold spells (Crespeigne et al. 2009), and coping with floods (Oft 2010; Sperling et al. 2008). One survey in five highland communities identifies "environmental problems" as the second-most important motivation for migration (Cavagnoud 2018). The two hazards of focus here—glacier retreat and rainfall changes—also figure among the drivers of migration. Rainfall changes, drought, and food security stressors are key drivers of migration in various studies (Altamirano Girao 2012; Oliver-Smith 2014; Sperling et al. 2008), especially for agricultural communities in the high mountains (Milan & Ho 2014). Migration is used both for short-term coping with and long-term adaptation to these hazards (Oft 2010). When glaciers retreat, many variables shape adaptation decisions. Smallholders rely more on migration in later stages of retreat, when peak flow has been crossed and water levels have sunk during the dry season (Wrathall et al. 2014). Family members—often young adults—are asked to migrate to cities to send remittances back home to support their families. Often, rainfall changes and glacier retreat jointly drive migration of small-scale farmers (Altamirano Girao 2012; Altamirano Rua 2014; Cometti 2015a, 2015b, 2018; Orlove 2009). Low stream levels due to glacier retreat also harm pastures and complicate herding for pastoralists, making migration of these already mobile people to other regions more likely; at most, some of them may be able to stay in the *Sierra* during the rainy season (Orlove 2009). Glacier retreat can also drive migration of tour

operators and their employees who lose income opportunities due to deteriorating environments (Altamirano Girao 2012; Oliver-Smith 2014).

Simultaneously, people's reasons for staying despite such hazards are diverse. In one survey in the highlands of the Lima Region (the home to V1 and V2), many people were strongly affected by hazards, and every second respondent had considered migration in the five preceding years but stayed (Adams 2012). Most chose to remain because of high levels of satisfaction. To a lesser extent, respondents stayed because they feared or were not interested in leaving or had obligations that tied them to their communities. The smallest share of respondents who stayed did so because of resource constraints. The study highlights that instrumental *and* affective bonds can bind people to places that are already imperiled; these bonds continue to be a strong link even when climate change increases the risks for these places. However, thresholds of place satisfaction may be crossed eventually.

The climate projections discussed above may have several consequences for future migration patterns in Peru's *Sierra*. Emigration is a common trend from the highlands and will likely be amplified because of rising climate impacts and demographic changes that increasingly disrupt the villages lifecycles. Available models indicate that water scarcity driven by glacier retreat could continue to amplify emigration, especially for less resilient rural households and people born in the cities in Peru's highlands (Magallanes 2015; Milan 2016).[12] The projected warming could create high crop and animal losses and food insecurity risks, which could coerce migration. Rainfall projections are uncertain, but glacier losses will certainly be extreme in all emissions scenarios and raise water scarcity especially during the dry seasons. This glacier loss could result in more seasonal migration during the dry seasons as an attempt to spread risks to livelihoods and generate remittances. Conversely, where dependency on glacial meltwater for agriculture and glacier-related tourism is high, losses of glaciers could also lead to gradual settlement abandonment and conflicts between water users. In addition, people derive a sense of well-being from the many non-economic ecosystem services where they live, yet climate impacts are threatening these services. Their degradation could drastically decrease place utility and thereby shape the migration decision processes of more people than usually assumed (Adams 2016). Finally, growing glacial lakes will pose risks of outburst floods and could spark relocation discussions in several highland cities. After this contextualization, I examine climate (im)mobilities from and in V1 and V2 in detail in the next

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[12] The applied agent-based models (ABMs) try to model the behavior of autonomous individuals confronted with changing surroundings, see de Sherbinin & Bai (2018).

section and explain how the affected people evaluated the well-being impacts associated with these (im)mobilities.

5.2   Empirical Results

In November 2018, I interviewed eleven people (4m / 7f, see Table 5.1) affected by climate hazards within the villages of origin V1 and V2. The age range of the eight migrant family members and three returned migrants was 18–81 years with an average of 55 years. Because the age structure in both villages was inclined toward older adults, I also convened a focus group of twelve pupils aged 14-16 in V1 (3m / 9f) to represent the views of the small young population appropriately. Some older dwellers had only primary, later generations usually secondary education. Having lived for some days in village V1, I also took field notes, observed participants, and engaged in less formal conversations and community meetings with various other farmers (see Figure 5.10).

Table 5.1 Basic data on interviewees in the mountain villages V1 and V2

Location of interview & alias	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
V1-1	M	61	Providing services (civil servant)	Crop farming	*Mestizo*
V1-3	F	74	Retired	Crop farming	*Mestizo*
V1-4 (returned migrant)	M	18	Unemployed	–	*Mestizo*
V1-5 (returned migrant)	F	30	Providing services (civil servant)	Crop farming	*Mestizo*
V1-12 (returned migrant)	F	55	Crop farming	Providing services (hotel owner)	*Mestizo*
V1-16 (focus group of pupils)	3m/ 9f	14-16	Pupils	–	*Mestizo*
V2-1	F	69	Crop farming	–	*Mestizo*
V2-2 (migrant from V2, in V1)	M	35	Providing services (aquafarm)	Crop farming	*Mestizo*
V2-3	M	52	Crop farming	Providing services (civil servant)	*Mestizo*

(continued)

Table 5.1   (continued)

Location of interview & alias	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
V2-4	F	67	Crop farming	Livestock farming	*Mestizo*
V2-5	F	81	Retired	–	*Mestizo*
V2-7	F	63	Crop farming	Livestock farming	*Mestizo*

Figure 5.10   Impressions of the field work in the highlands. (Note: Community meetings with farmers in V1 (left, photo by the author) and in V2 (right, photo by the Mountain Institute))

   Table 5.1 details that most interviewees were farmers who mainly worked in smallholder crop cultivation. Some had additional livestock farming in the upper elevations, including sheep, cows, and few alpacas in V1. In the basin's sections where the interviews took place, subsistence farmers mostly rely on rain-fed agriculture.[13] In V1, people additionally use basic flood irrigation techniques with water from an adjacent river fed by glacial meltwater and rainfall. In V2, only a small spring was left for limited irrigation (see section 5.2.1 for more details). Farmers produced typical Andean transient crops such as corn or potatoes and cultivated pastures such as alfalfa. Their fields extended across various ecological floors and were maintained in a rotational system. Given their isolated locations,

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[13] In very high elevations of the basin, only animal husbandry is possible. The lower part of the basin is to a large extent dry and home to intensive agriculture and a hydropower plant. In these high and low areas, no interviews took place.

interviewees had limited income sources. Even the few ones who offered services, such as municipality staff, still sowed their crops and had a few animals, similarly as most retired villagers.

To gather background material, I also talked to several experts at the village level, including the two respective presidents of the farmers' associations (*comunidades campesinas*). Further discussions were held with the mayor, the alderman (*regidor*), the peace justice, the health post worker, and the secondary school director in V1, as well as the teacher in V2. For further context, I visited two additional villages in higher elevations to discuss informally with farmers and local experts.

As a next step, I traced and interviewed 20 migrants (11m / 9f) from V1 and V2 mainly in Lima and Huancayo (Table 5.2), often at sports events organized by migrant hometown associations (Figure 5.11). Migrants were between 18 and 77 years old with an average age of 47. All had left as young adults, and some had migrated decades ago. Three of the migrants had returned to the *Sierra* after having spent time in the cities. Most interviewees provided services in the cities and remained in informal or low-wage positions, whereas a small number had entered better-paid jobs (see section 5.2.3: Decent livelihoods). All migrants identified as *mestizo* and spoke Spanish.

Table 5.2 Basic data on migrant interviewees originally from the mountain villages

Location of interview & alias	Hometown	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
Huancayo (H-8)	V2	M	59	Retired	–	*Mestizo*
Huancayo (H-13)	V2	F	77	Retired	–	*Mestizo*
Huancayo (H-14)	V1	M	53	Providing services (engineering)	–	*Mestizo*
Huancayo (H-15)	V1	M	30	Providing services (engineering)	–	*Mestizo*

(continued)

Table 5.2 (continued)

Location of interview & alias	Hometown	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
Lima (L-15)	V2	M	70	Retired	–	*Mestizo*
Lima (L-16)	V1	F	38	Providing services (teacher)	–	*Mestizo*
Lima (L-17)	V1	M	53	Providing services (accounting)	–	*Mestizo*
Lima (L-18)	V1	F	52	Housekeeping	–	*Mestizo*
Lima (L-19)	V1	F	40	Housekeeping	–	*Mestizo*
Lima (L-20)	V1	F	40	Providing services (teacher)	–	*Mestizo*
Lima (L-21)	V1	F	77	Retired	–	*Mestizo*
Lima (L-23)	V2	M	54	Livestock farming	–	*Mestizo*
Lima (L-24)	V2	M	69	Providing services (dressmaking)	–	*Mestizo*
Lima (L-25)	V2	F	32	Providing services (sewing)	Housekeeping	*Mestizo*
Lima (L-26)	V2	M	41	Providing services (carpenter)	–	*Mestizo*

Table 5.2 (continued)

Location of interview & alias	Hometown	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
Lima (L-27)	V2	M	24	Providing services (administration)	–	*Mestizo*
V1 (V2-2, from V2)	V2	M	35	Providing services (aquafarm)	Crop farming	*Mestizo*
V1 (V1-4, returned migrant),	V1	M	18	Unemployed	–	*Mestizo*
V1 (V1-5, returned migrant)	V1	F	30	Providing services (civil servant)	Crop farming	*Mestizo*
V1 (V1-12, returned migrant)	V1	F	55	Crop farming	Providing services (hotel owner)	*Mestizo*

Figure 5.11 Impressions of the field work in Lima and in Huancayo. (Note: The photo on the left displays a sport event in Lima organized by the migrant hometown association; the interviews partially took place at these regular sport events. On the right, the head office of the Regional government in Huancayo. Photos by the author)

In addition, I interviewed several experts at the municipal level in Huancayo for background information, including the responsible officials for rural development, urban development, communal kitchens, civil defense, and environmental management.

5.2.1 Climate Change Dimensions

In the interviews, young and old villagers alike reported a wide range of climatic changes, often talking spontaneously about them and without specific prompting. Figure 5.12 exposes that the main observed impact was water scarcity related to glacier retreat and rainfall changes, and views on these changes converged across sex and age groups. Impacts were felt on crops, pastures animal and human health, as well as on people's lifestyles and traditions. Villagers said that climate impacts were already undercutting livelihoods in the zone and anticipated that they would continue to increase. While many farmers linked these alterations to climate change, few knew about underlying mechanisms. Among the interviewed young pupils, for example, only a small number correctly connected climate change to greenhouse gases. Especially the young people also observed additional non-climatic stressors such as contamination, deforestation, overgrazing, solid waste problems, and soil degradation.
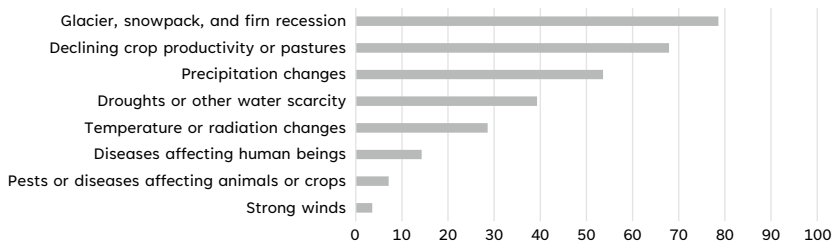
Figure 5.12 Hazards affecting interviewees in the highlands. (Note: Depicts the percentage of interviewed affected people from the highland villages who mentioned different types of hazards affecting them at least once during the interviews. Created by the author)

When asked about changes in their environment, most dwellers first mentioned the drastic losses of their *nevados* (snowcapped mountains), which have caused gradually rising water stress in V1 and severe scarcity in V2. The glaciers, firn, and snowpack in the higher elevations—connected to the villages by lagoons

and rivers—are key for people's identity and for their water supply, especially in the dry period. In V1, the firn used to almost touch a river close-by the village. However, respondents claimed a surface reduction by at least half since the 1950s, which they explained by reduced rainfall and warming that prevented snowfall. As the village's alderman observed:

> *The water has also gone down, don't you see that the mountain range is already thawing, the weather is not as before, that hail no longer falls now, it rains pure water. … Yes, there is not much snow, pure water no more, that's why the snow does not accumulate. … There is no longer much water we can use to irrigate …. (V1-1)*

As a result, the once abundant meltwater has decreased. Although the glacier retreat was still manageable, it affected irrigation, production stability, and crop yields in the dry season. Moreover, water scarcity and declining pastures have made livestock raising less profitable, so that farmers have had to reduce their herd sizes and the remaining healthy pastures are increasingly overexploited.

Although adjacent to V1, V2 suffered from more severe impacts of a later stage of glacier retreat. The village was once fed by canals to artificial meltwater lagoons in the higher elevations. Yet, villagers noticed how glacier retreat starting in the 1970s had gradually reduced meltwater from the 1990s onward until ten to fifteen years ago, when the meltwater disappeared completely. All farmers openly worried about the resulting *"water crisis"* (V2-1). The president of the peasants observed that,

> *The first thing that the global warming of the Earth has eliminated was the mountain range, the snow-capped mountains… It dried up completely. [Before], the water just came from that hill, the one that is here … Well then, it was nothing left … Little by little, with the heat it melted ... The water was no longer advancing… The land has become dead and there is nowhere to put crops. (V2-3)*

The loss of meltwater has gradually reduced crop yields. Villagers had to switch mostly to temporary rain-fed crops and pastures. The remaining water from a small spring was scarce even for the now much reduced village size: *"As I say, we are few and for that it suffices. Of course, it is not enough, and sometimes we are struggling …"* (V2-2). Farmers reported misery especially during the dry season. The glacier loss has made the land desertic and people who once had sold their produce now could only produce for subsistence. Animals suffered from thirst and sometimes died because of the lack of pastures, as for example in 2017, a sad event in people's collective memory.

In both villages, respondents mentioned rainfall changes second-most often. Since 2000, they have seen more erratic rainfall seasons, with both unexpectedly more and less rain: *"Right now, here it has changed a lot and it is varied, … when it should rain in its period, it doesn't"* (V1-1). It is *"a total change …, before [the rain] had its periods, … now it rains anytime"* (V2-7). Farmers reported that they sowed less because, *"Sometimes the rains delay, and the food is spoiled; in previous years that was not seen"* (V1-16). They also described diminishing rainfall quantities but greater intensities, which aggravated crop losses. Young people were saddened that the rain was occasionally so scarce that animals died due to a lack of fodder. Many interviewees also noticed more warming and heat periods that have become *"unbearable"* (V1-16). The heat affected health and crops and resulted in higher irrigation needs while water resources have kept declining. Moreover, cold waves have caused diseases, animal losses, and crop damages, and people noted more weather-related pests and diseases.

Adaptation efforts and options differed considerably between V1 and V2. In V1, where glacier retreat was still less severe, a local NGO project supported people in conservation and water harvesting techniques to optimize their resources and adapt to declining water availability. Due to the project, farmers perceived some progress and that they had learnt new agrarian skills. Yet, some of the more educated villagers worried about the lack of external help, expertise, technology, and market networks to mitigate the declining yields. Looking to the future, farmers worried that surviving only with erratic rainfall for irrigation would be difficult. For example, two well-educated men worried that their glaciers might disappear over the coming two decades. A woman in her mid-70s voiced concerns about the disappearing water and the lack of good governance, fearing that V3 may turn into a *"ghost village"* in twenty years: *"I don't see how it's going to improve, how? … What will we do if there is no water? All lies. There is no water, no"* (V1-3). Village leaders were also aware that they were still better off than V2 but could face a similar future. Nonetheless, some of the younger residents were hopeful that people were finally waking up to the change, as illustrated by the election of a young agronomist as the new mayor. Some put hopes for adaptation into unrealistic ideas, such as painting the glaciers with sun-reflective color; such hopes seemed to be a sign of cognitive dissonance or denial that the situation could become as severe as in V2. A few other respondents downplayed the possible effects and completely discounted the probably challenging future for V2.

Foreshadowing possible future challenges for V1, the situation of V2 demonstrates how difficult adaptation to a complete loss of glacial meltwater is for poor, remote, and marginalized villages. Farmers made some adaptation efforts, such

as changing cropping techniques and cementing the water canal to maximize the decreasing streamflow to the village. Yet, the attempts failed because the farmers lacked needed finances, resources, and skills. Given their remote and marginal location, they had no market access or diversification options; the only attainable adaptation was reliance on rain-fed agriculture and the limited water provided by a local spring, which offered less cropping and pasture potential for substantially fewer people. Bad governance and a lack of voice also limited adaptation possibilities. As an administrative annex, farmers lacked a proper budget and needed to ask the district authorities in V1 and the Ministry of Agriculture in Lima for help. However, the promised support never arrived, and interviewees suspected that the authorities did not care enough about their misery or did not possess enough resources. Several villagers perceived themselves *"in a system of abandonment by the government"*; they alleged corruption and that the authorities *"cheat the people"* and *"only want the money"* (V2-1). Eventually, farmers resigned, *"praying to God for rain"* and hope (V2-7). Several migrants, discerning the situation from afar, hoped that adaptation might still be possible. Yet farmers in V2 did not seem to hold any hope for a better future absent water and resources or state support to address the crisis. For example, a woman almost 70 years old asked:

> What state have we come to? To a very sad life, a water crisis. Why do we lose both our youths and our children? Because there is nothing good here for how to survive. There is no work, there is no water! We, the older adults, are the only ones to stay in this village. There are no more young adults, we cannot sow anymore given the lack of water. We only have one life but are in a time of crisis in [V2]. (V2-1)

In both villages, farmers observed migration related to these changes (see next section 5.2.2). Farmers also reported more quarrels around water than in the past. Some considered more conflict possible in a future with less water, but beyond the call for more climate adaptation measures, local-level institutions or mechanism preparing for such conflicts were missing. In the depopulating village V2, the community seemed to partially disintegrate into disunity and withdrawal with quarrels among themselves, which were driven by the emigration related to the water scarcity (see section 5.2.4).

5.2.2   Migration Dimensions

The cases of V1 and V2 offer a detailed view of migration decisions in the context of slow-onset hazards and their interplay with other drivers. Interviews

indicate that temporary and permanent migration have been common for long in the villages, whereas transhumance or commuting to urban areas is rare to the spatial setting. In the second half of the 20th century, agrarian crises and violent conflict triggered substantial emigration. Later, some migration continued for social reasons, to establish a family or join relatives. In addition, more villagers have left yearning for a new urban lifestyle instead of rural agricultural lives. Yet, the major driver of migration has been the lack of jobs and income possibilities; traditionally, many youths have left to find urban jobs, aiming for higher and more stable incomes to support their families, and sometimes returning later to their birthplaces.

However, over the past two decades, climate impacts have exacerbated the economic situation in V1 and V2 and raised migration rates. In V1, the village alderman observed that more peasants have migrated for work since the glacial meltwater has decreased and the rains have started to be more erratic ten to 15 years ago, because there is *"not enough to provide for yourself anymore"* and farmers cannot *"produce as much anymore, so people leave to search for jobs"* (V1-1). Around five families were leaving the village every year because they could only sow few crops. After V2 had completely lost its glacial meltwater for irrigation, agricultural production went down drastically, and much more young adults than usually had to leave to the cities for work, while fewer returned. A woman in her late 60s mourned that they *"lost their youths and children"* who *"cannot survive here anymore - there is no work or water to sow anymore"* (V2-1). Migrants remarked that they had had to leave as there was *"no more life"* or work (L-25), and, *"Farming did not render enough, there is nowhere to harvest, and livestock does not give good results anymore"* (H14). A migrant in Huancayo explained:

> *People left as the animals… had nothing to eat, they got thinner, and died… The village is depopulated, there are no more people, a few no more. All are leaving as there is no more water. A lot of dryness, for this reason the young people have left… In some rooms are still the older adults, who are now dying. (H13)*

Increasingly, water has become a main *"motivation for people to leave … since the land is all powder"* (L23). The president of the migrants' hometown association in Lima indicated:

> *Principally, people left because there is no water anymore, there is no more future in the Andes… They cannot produce anymore… Mainly, they came for work because in the village, there is no income, there is no work, and there is also no water. (L15)*

These climatic drivers interacted with other economic, educational, and lifestyle drivers. For example, a final economic push for migration was when a small mining site near V2, in which ten to fifteen young dwellers used to work, closed some years ago. The general lack of jobs also combined with a lack of educational opportunities, the second-most reported driver. While V1 had a secondary school, higher education was only possible in the cities and continued to pull migration. Some feared that climate impacts might indirectly exacerbate this pull: as more people leave the villages (partially due to climate impacts), schools might close soon, which could propel further migration of families with children. Several other feedback mechanisms also accelerated migration. First, urban migrant networks have reduced the social and financial costs of moving for migrants, while remittances and stories of urban lifestyles provided additional pulls. Second, migration has deprived the village of workers required for manual agriculture; as a result, rising salaries for the limited workforce have reduced agricultural profitability, and thus made migration more likely. Third, depopulation removed social resources that were key for place satisfaction. A migrant from V2 said that he had wanted to stay but moved for the good of his son, who aspired to leave as most of his peers had already gone.

While advancing glacier retreat has thus been a *mostly emerging driver* in V1, in V2, complete glacier loss has been *a major driver* of an exodus. Among the remaining villagers, migration aspirations differed between generations. Most of the older remaining dwellers in V1 wanted to stay. Some were *voluntarily immobile* and stayed as they enjoyed the calm natural surroundings and their customs. Others were *acquiescently immobile*, as they worried to fall sick in the cities or could not grow used to city lives, which they linked to physical insecurity. By contrast, a few villagers felt *forced* into *immobility:* for example, a poor woman in her 80s suffered from serious health issues and aspired to leave V2, but her two migrated children in Huancayo and Lima refused to take her in. Conversely, young villagers in V1 and V2 usually strongly aspired to leave and considered migration as their best option, although they liked the quieter highlands and were aware of the urban stressors. The construction of a road, better access to markets, internet, media, and mobile phones have raised the knowledge and attraction of city life. This city life pulled those who preferred jobs outside agriculture, especially *"The youths who do not want to live off the fields anymore, they dislike it"* (H-13). In the past, pupils used to work in the fields after secondary school, but nowadays, all interviewed pupils who were about to graduate desired to migrate to continue their studies, find off-farm jobs, and move out of poverty (*voluntary improvement* migration). Many established migrants also confirmed retrospectively that they had had strong aspirations to

leave. However, other recent migrants from V2 had moved against their will to survive (*anticipatory, forced survival* migration); they missed their homes and still felt the pain of leaving and seeing their village decaying.

Few people from V2 had sufficient resources to implement their migration decisions fast. Once the glacial meltwater had disappeared, the few relatively better-off households with resources to settle elsewhere left first, whereas most poorer households faced limitations and depended on the support of relatives. Family networks helped with information, finances, food, and housing to the extent they could. However, poor families could only offer limited support for migrant members. Related, initial settlement often depended on where relatives lived who could host newcomers and was therefore dispersed. Gender and age also played a role: when V2 lost its glacial meltwater, young men tended to leave first to the cities, while their wives and children, if applicable, joined later. Overall, many migrated at a young age. The main destinations for migrants from V1 and V2 were Huancayo and Lima.[14] While many of them went directly to these cities, some first moved to the surrounding, larger villages or provincial towns, and then eventually on to the Regional and national capitals. Since V1 and V2 are in remote locations with difficult access, migration was often permanent.[15]

Few migrants returned permanently; only some younger migrants aimed at gaining new skills in the cities, hoping that they would enable them to return and help their home villages. Nevertheless, close to all migrants preserved emotional, social, cultural, and material links to their home villages. They routinely visited for traditional celebrations or to see relatives. For example, one woman in her late 70s had moved to Lima at the age of 16 to study for two years, then went back to V2 to work, and eventually moved to Huancayo when she was 50, where she opened a small shop, but still returned sporadically to V2. Visits were a two-way street: people staying in the villages also visited their migrant children in the cities, for example to skip the rainiest highland months. Many migrants kept their highland properties, and a few admitted that not selling them to the young adults in their birthplaces may break the villages' life cycle and render agriculture more difficult. Some soils were already eroding. Moreover, migrants in the cities sent a limited amount of remittances (see section 5.2.4). Finally, translocal links were also institutionalized through hometown associations (HTAs). Both V1 and V2 had founded associations decades ago, with more than 200 migrant members

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[14] Interviewees stated that as these cities have gotten more saturated, the attraction of other coastal cities has also risen.

[15] Circular or temporal migration concerned mainly pupils who worked in the cities during vacations to earn money for school supplies, to support their families, and to build urban job networks.

from V1 in Lima and 80 in Huancayo. The much smaller village V2 has around 50 members in these cities. The organizations provide mostly non-material support to newcomers, who can participate in sports games, celebrations of Andean traditions, and social media communication. The presidents of the HTAs reported that they had tried to help V1 and V2 economically, providing technical support, infrastructure investments, and food and income support. While their help has not alleviated the impacts of glacier loss in V2, it might back adaptation to future impacts in V1, if channeled suitably.

5.2.3   Well-Being Dimensions: Migrants at Their Destination

In this section, I explore how migration from the two highland villages threatened by water scarcity has affected people's well-being. I apply the well-being axes explained in chapter 2: *development from a secure base, a space to live better,* and *social relatedness* (objective well-being, OWB), as well as *subjective well-being* (SWB). The analysis is based on migrants' retrospective assessments of how their situations have evolved after arrival in the cities. Future work on intergenerational processes would be desirable, which could not be examined in detail due to due to time and resource constraints.

5.2.3.1   Development from a Secure base
5.2.3.1.1   Decent Livelihoods
Settlement in the cities affected people's livelihoods differently, although many migrants from V1 and V2 had had similar starting conditions. Most arrived after leaving school or with agricultural skills not in demand in cities. On one end of the spectrum, the majority and especially young migrants struggled to make a decent living. They worked long hours in informal, unstable, and low-paid jobs to survive—often in addition to family and housekeeping obligations—but were unable to advance. In some deprived situations, children had to work to support the family. Typical work included ambulatory sales, construction, day labor, manufactories, or small trading. Competition was high. For example, a young woman had left V2 after the glacial meltwater had disappeared and experienced a *"very shocking start"* in Lima; only after years, she had gotten *"used to it … more than anything else out of necessity"* (L-25). She and her husband worked in dressmaking and transportation, noting that

> … [Y]ou must work here, both spouses have to work, otherwise the money is not enough… Yes, all day, so much sun, and sometimes all night, and there is a lot of

competition here now… Yes, it is not easy, we must continue working, that's it. You
must work hard, to survive more than anything else…. (L-25)

According to the presidents of both hometown associations, migrants coming to
Lima and Huancayo ended up two times more often in precarious than in decent
jobs:

Look, here the people who arrive have mostly no income, it is just enough for getting
by… [T]hey do not have good jobs… Of course, the vast majority are small business-
men, as well as street vendors, they work in factories ... Dad and mom both work and
with that they sustain their household…. (L-15)

Municipal and NGO experts agreed that although a few migrants improve after
moving to Lima and Huancayo, many suffer from multiple deprivations and
frequently fail to escape poverty.

On the other end of the spectrum, a few migrants did profit from their transi-
tion. Especially some of the older interviewees who had arrived decades ago had
tapped into urban education opportunities to switch into higher wage positions
in services, such as accounting, administrating, engineering, and teaching. For
example, a migrant now in his early 70s reported about his strenuous but even-
tually successful journey in Lima, and the dual burden of working precariously
while studying:

I left [to Lima] at the age of ten ... and finished my primary school, but as my father
had no financial solvency, I could not study, ... as my father was a farmer ... I stopped
studying for at least six years… I worked in the field, I even worked in construction…
My life has been work ... Ever since I use reason, I thought I cannot be like this, I go to
Lima. I had a brother who was here ... When I was in Lima, I first started working as a
waiter ... The next year, I started studying, ... for six years I studied at night ... I worked
during the day and at night I studied… I worked in factories, later as a baker, that's
how it was, tough sacrifice… [Now], look, I am a professional, I studied engineering….
(L-15)

Some also improved their incomes without studies. For example, one female
migrant first was a street vendor, then took a credit from relatives to start a small
market stall, and eventually gained well. Yet, income gains compared to prior
rural lives did not automatically make for a decent live. For example, a man said
that working with his disability had been impossible in V2, whereas in Lima he
"dedicated myself to sewing, and with that I am living more or less because I do
not want to be a burden on the family". Despite the improvement, his livelihood
in Lima was still *"very tiring, a lot of stress because we really can't stop working,*

as we have to survive in some way" (L-24). Intersectional factors, such as health status, thus also shaped livelihoods. As another example, most male migrants provided services, while women were said to work more often in housekeeping and lack individual incomes.

5.2.3.1.2 Health and Food Security

On the negative end, financial resources were the major constraint to access health services. Various poor migrants became more food insecure in the cities. One claimed, *"Everybody wants to go …* [to the] invasiones *and* cerros *[human settlements on the city hills] although they do not have enough to eat* [there]*"* (V1-4), whereas in the *Sierra*, people had produced their own food. A few better educated migrants were concerned that indirectly, climate impacts also affected the prices for and quality of agricultural products, which could in turn worsen urban food security. The alderman in V1 stated:

> Everyone goes to the cities but there is no longer space to live, … and water is going to be scarce, and in the cities, they will be certainly worse. I think that rather with time, people will return to their land… in Lima, on a daily basis, [basic necessities] have to be bought. Instead, here we sow a piece of land, and we already have to eat all year round. (V1-1)

Especially recent migrants suffered from a lack of basic services that might contribute to healthy lives, such as water, sanitation, and drainage systems. These gaps were often due to the lack of landownership or housing titles. Moreover, urban pollution and contamination worried many migrants and caused diseases for some. For example, one migrant reported that *"we are crying because of the contamination here"* (H-14). Another young migrant strongly suffered from the economic and social challenges in Lima, exhibited mental health issues, and, after getting asthma in the humid and polluted city, eventually had to return home. Similarly, various migrants reported high stress levels due to long working hours, intense traffic, and multiple parallel burdens through jobs, education, or caregiving. Younger migrants also observed ill-being due to the separation from their families. On the positive end, a few migrants improved their health in the cities, if they could afford to access the better health system and thus to receive the specialized attendance they required.

5.2.3.1.3 Educational Opportunities

Migrants' educational opportunities frequently improved in the cities, but sometimes at a high cost. The cities offered more opportunities to study, which,

constituted strong motives for migrants to stay, according to parents who hoped their children could become professionals one day. Vocational training and evening schools enabled migrants to work during the day and still improve their skills. For many, this setup was a necessary but challenging one, given the relatively high costs for urban education. They described the triple burden of working during the day, going to school in the evening, and studying during the night, which led to health problems and self-exploitation that hindered learning. For example, one young man had moved to Lima for education, but pollution and the stress of studying while working in a gas station to pay for his expenses forced him to return:

> *Unfortunately, … we have to work to start studying… The truth is that at first it was shocking… [S]ometimes, I had to work at night and study during the day, in class I fell asleep. Sometimes, I attended and sometimes I didn't. This way, I suffered a couple of months… [Studying] is costly, life becomes difficult for a poor person to progress… Then, because my finances were not enough, I had to leave my second semester… The minimum salary at that time was 850 soles and my institute costed 500. Paying for food and tickets, everything was gone…. (V1-4)*

He also felt that the generally worse education situation in rural areas led to a disadvantaged start for migrants from the highlands compared to city natives.

Other migrants spoke of tough sacrifice, but a worthwhile one. As one example, a male migrant who had gone to Lima at the age of ten to study had to return as his parents could not afford the costs. Several years later, he went to Lima again, working precariously during the day and studying at night, but through *"tough sacrifice"*, he progressed: *"[Now] look I am professional, I studied engineering"*. While he felt content, these taxing years also *"have marked"* him (L-15). Another female migrant remembered the *"hard"* and *"sad"* separation from her family when she came to Lima to study, but in retrospect, saw the greater good of her studies, which enabled her to become a teacher (L-20).

5.2.3.2   A Space to Live Better
5.2.3.2.1 Adequate Housing

Migrants' quality of housing depended on their available resources and social contacts. A few of them were fortunate to move in with relatives who lived in decent houses. However, most of the poorer migrants needed to settle in the outskirts of the cities, in new and frequently irregular settlements:

> *It was not easy, if you don't have a place to stay here, you don't have an income or you don't work… Over there, they have gone, outside of Lima because here in Lima,*

they have not been able to get homes. Further on the side of the hills, in asentamientos humanos [new or irregular settlements]. (L-15)

Many needed to move into crowded homes of relatives or rent precarious houses at a high price: *"It is not easy in the city, [even] to have a small house here, it costs much to rent it"* (H-13). Others had to build their houses from nothing, and some achieved gradual upgrades. For example, a woman in her 70s reported how today, she felt content with her home, but it had required years to obtain a small terrain and only then, she said, *"I was able to make my little house little by little … Years, years, and years we have built, until finally now, we have the little house finished"* (L-21). Financial resources, networks, and titling efforts were key for achieving progress regarding housing and landownership.

5.2.3.2.2 Basic Services

The principal determinant of migrants' access to basic services was where they could afford to settle in the city. The president of the hometown association of V2 described how fellow migrants in Lima

are quite dispersed, they are in different places, some of them who earn well are in urbanizations… Many live in places, asentamientos humanos, invasiones [irregular settlements], well away from the city center … You do suffer there, it takes several years for them to have electricity, water. (L-15)

The many poorer migrants who moved to new and irregular settlements lacked access to basic services, and many failed to receive titles or to have water, sanitation, and drainage systems installed for years. In the meantime, migrants had to buy water from car distributers or walk long distances to distribution points. For example, one female migrant in her early 40s moved to an *invasion* that she described as a *"desert"*; lacking a property title, she had to petition and wait for fifteen years until the settlement was eventually regularized and she and her family received access to water and other services, whereas *"those who live on the hill still receive water from the* aguateros *[small-scale water providers]"* (L-19). Another woman now in her late 70s described the struggle upon arrival:

[My children] looked at me as I suffered and there was no water. We carried water from afar, from the park, far, far from the house, to cook at home here… In a wheelbarrow I have carried it, with a bucket. (L-21)

In Huancayo, unlike years ago, even the few better-off migrants had only water by the hour and worried that climate change would increase water stress: *"There is no water, here we suffer"* (H-13).

5.2.3.2.3 Pleasant Surroundings

Most migrants depicted their urban surroundings as dissatisfying. They perceived great differences between their prior rural villages, with fresh air, clean water, appealing natural landscapes, and recreational areas, and their current arid, hectic, and congested city neighborhoods: *"We lived there, where my sister was, it was like a desert … all just gasoline, smell of smoke"* (L-19). With the rising saturation of the city, pleasant areas have become less accessible for poor migrants. This view held across age groups, but some older migrants seemed especially dissatisfied; they described how Lima had become more polluted and congested with traffic. Even those who enjoyed urban commodities stated they missed the tranquility of the countryside, including the farm life with physical outdoor work. Only few migrants in relatively wealthier areas of Lima were more content. Some also felt more satisfied with their urban surroundings since the climate was warmer than in the highlands.

5.2.3.2.4 Safety from Hazards

While migrants had left rural areas that faced climate hazards, such hazards also threatened Peru's cities. In Huancayo, cited concerns included flooding from torrential rainfall and from glacial lake outbursts. Migrants in Lima struggled with the temperature difference to the highlandy and the city's seasonal humidity. Water quality and quantity—one driver of migration from V1 and V2 to the cities—also constituted a main urban concern. Migrants worried that Huancayo and Lima partially depended on glacial meltwater that would eventually disappear, thus exacerbating water stress. In Huancayo, unlike years ago, many migrants had only water by the hour. Experts explained that diminishing water resources, the slow exploration of new sources, and simultaneously increasing demand made higher water prices and more rationing likely. Given this situation, a migrant asked:

> Eventually, where will people go? It will start in the small villages, but from Huancayo, where will they continue to go, as there will be no water? From what will we live if agriculture decays? (H-14).

5.2.3.2.5 Security

Most migrants lived in *"movidos [dangerous]"* zones of Lima (L-15), which are *"very hectic, with a lot of crime"* (L-17). As one migrant said, *"There are so many thieves and criminals and all. They all come to Lima and the big cities"* (H-13). Established migrants described that insecurity had increased. Similarly, a returned migrant in V1 worried about her migrated children because

> In the year 1980, Lima was not like now, it was calmer. At least for me it was nice to be in Lima, there was not much violence, there was no robbery like now… [N]owadays, there is too much theft, it is already too much, too much in Lima. (V1-12)

Few migrants were able to move to more secure areas or described that the security in their neighborhoods was improving. For example, two migrants felt lucky to live in a place with *"sufficient security"*, *"a little bit more peaceful than other places"* (L-27; L-25). Similarly, a carpenter in his early 40s, who had come to Lima in the 1990s, observed that, *"Where I live it is quiet, I hardly see any theft, or it goes unheard, but in the nearby neighborhoods, yes there is a lot of crime"* (L-26).

5.2.3.3 Social Relatedness

Several migrants struggled with the separation from their relatives. Especially young migrants often lived with urban relatives they seldom knew well; one of them lamented that, *"Indeed, a separation from parents is always sad"* (L-16). The initial lack of support networks caused hardship:

> There [in Lima], I lived alone. Sometimes with my uncle, but it's not the same, it's not like mom or dad ... [I felt] alone, alone, I felt that everything was coming over me. Away from home, away from grandparents ... It is difficult to be alone and not have the support, no one to talk to … I thought of leaving everything. I was alone ... When you're away from home, it's shocking ... There, no one gives you a glass of water if you are ill, if you are sick. I don't know, they don't care, you must look after yourself. Even family members do not look after you, much less strangers. The change was quite hard. (V1-4)

Some migrants felt that unfamiliar social codes in the cities also hampered relationships initially.

However, with time, many migrants had gotten to know partners and spouses in the cities, founded families, and started to raise their own children, with whom they usually described good relations. For example, a now retired migrant in his late 50s said his social relations were *"slightly better"* in Huancayo than in

V2 because he had married and founded a family (H-8). Many reported *"good connections with neighbors"* (L-26) and peers, partially facilitated by hometown associations.

5.2.3.4   SWB Dimensions

5.2.3.4.1 Emotional Balance and Cognitive Satisfaction

Many migrants described sadness and stress especially at their arrival, due to the separation from loved ones and their cherished highland environments. In addition, the dual burden of working and studying in the cities to fulfill migrants' own and their family's expectations caused anxiety in several respondents. Migrants were anxious in some cases despite improvements in material conditions. For example, a migrant in his 50s described the past sacrifices of working as a mechanic while studying during the night. Although he had met his wife in the city, had children, had tapped into educational opportunities, and has improved living standards, he concluded that, *"Well, I wasn't happy… [but] a little more anxious"* both at arrival and later in his life (H-8). He did not grow accustomed and considered return, claiming that various other migrants were in a similar state. In addition, many described tension and stress due to precarious livelihoods. Various migrants were also frightened due to urban insecurity. Moreover, some felt fatigue due to the city environment: *"Life is more tiring now … very tiring indeed"* (H-8). A few expressed feelings of being overwhelmed, saying that they liked *"almost nothing"* in Lima (L-25). For example, a young student had strongly aspired to leave the highlands and had considered migration as his best option at the time but regretted his decision to migrate in retrospect. In Lima, without sufficient networks and finances, his income *"improved a bit"*, but he faced higher costs of living. Although he gained valuable skills, he *"suffered"*: *"It was bad for me, not only in the part of trying to progress, but also in health ... To be honest, almost nothing makes me happy because I am full of problems"*. He retrospectively assessed his urban situation with dissatisfaction, *"Because I did not have the emotional support of my family"*, and also felt *"more anxious … much more, because of the surroundings and the social change"* (V1-4). Migrants were also angry and frustrated due to corruption and governance failures, and stated, *"Over there [in Lima], you must learn the reality of your country, where you live, the corruption"* (V1-4).

On the positive end, the fewer migrants who had succeeded in leveraging educational and income opportunities were satisfied with their urban lives. A retired engineer reported that, *"The life I live, well, I like it, it does not preoccupy*

me, I like having a cheerful life …" (L-15). Others in less well-paid but still formal jobs or their own businesses were also more satisfied. They were grateful for the chance to advance economically and that their children would be better off. In addition, those living in quieter areas reported more positive feelings. Moreover, new family ties and lifestyles influenced satisfaction; for example, when asked if she had gotten used to Lima, a female teacher replied:

> *Uy! We no longer want to know about my land [in the Sierra] … Due to the cold there, and we also don't want agriculture anymore. We also don't have family there anymore, everyone is here. (L-20)*

5.2.3.4.2 Outlook on the Future

Many migrants who answered questions about their future expectations were more anxious than hopeful. The challenges back home in the highlands were one key concern. As one migrant said exemplarily: *"I suffer for my land, for my town, I would like to have water so that my countrymen and the youth can return* [to the village of origin] ... *That makes me worry a lot"* (H-13). Migrants *"really worried"* and felt *"much more fear [than hope]"* as *"the water does not come anymore, and the mountains are drying"* in the Andes, which, in their view, foreshadowed future problems in the cities: *"The hills dry up, well, in some time. Where will we get water from?"* (H-8). One worried, *"From what will we live if agriculture decays?"* (H-14). Others in the city seemed resigned given their own deprivation and economic fears, especially if in low-wage temporary jobs or informal positions. Partially due to such resignation, various migrants did not hold hope for themselves but only for their children's advancement. This hope for the next generation was a main driver and motivation for them to endure hard work. By contrast, others expressed anxiety that the younger generation had few perspectives in the cities. For example, a migrant in Huancayo stated, *"My daughter is 32 years old and so I say to her, 'You don't want to have a son?' She replies, 'For what, only so my children suffer?'"* (H-8).

A small number of migrants who had objectively good prospects, religious faith, and personal resilience in the face of adversity were more hopeful. For example, a migrant in his mid-twenties worked as an administrative assistant in Lima and saw more possibilities in the city than in V2, where the glacier was lost: *"Well, yes, there are more opportunities to have something, perhaps to progress more"* (L-27). Some migrants retained hope despite *"so many obstacles"*, like a

young man who had to return from Lima to his village after he had gotten sick and could not finance his studies anymore: *"I do not lose hope that there is more, … that I can achieve my goals ... Faith and hope is the last thing I will lose"* (V1-4). Another returned migrant recognized *"the deprivation of the people"* in V1, but still felt good about the future, *"Because we talked and agreed that we must make a change among the youth … There is much potential here … [W]e'd like to return and bring in ideas"* (V1-5).

5.2.4   Well-Being Dimensions: Stayers in Source Areas

While not the focus of this study, I briefly explore the well-being of families staying in V1 and V2 in this section. Migration affected the home villages by changing their sizes and compositions, alongside people's economic, health, educational, social, and cultural situations, as well as their SWB.

5.2.4.1   Demographic changes

Family planning and rising emigration have decreased population sizes in V1 and V2 in a mutually reinforcing process, leaving many homes abandoned (Figure 5.13). Because families have significantly fewer children today than some decades before, the migration of teenagers more strongly affects population sizes. V1 had had reportedly about ten births per year until the 1990s but now, only one child was born per year, so that the migration of the fewer young adults could not be offset in the same way as before. At the same time, climate impacts (together with other drivers, see 5.2.2) have increased the flows from V1. As a result, V1 has gradually shrunk: between the 1960s and 80s, it had been allegedly home to more than 150 families yet in 2018, only 40 families with mainly older adults were left, who worried that the village might become depopulated. V2 was reportedly home to 60 to 80 families in 2000. Yet, as the glacial meltwater disappeared, more and more youths left. In 2010, only 25 families remained and by 2018, fifteen more had left. In contrast to previous decades, most migrants left permanently since they lacked water and jobs in V2. Because mostly older adults stayed behind, no more new children were born and the life cycle in V2 was disrupted.

Figure 5.13   Situation in the highland villages of origin. (Note: The photos present abandoned houses of migrants in V1 (left) and V2 (right). Photos by the author)

5.2.4.2   Economic, Health and Educational Changes

Economically speaking, emigration subtracted labor force from the villages but also generated some remittances. For V1, the economic effect was noticeable but still less severe than for V2. For example, one father in V1 reported how his children had migrated to Lima and how he struggled to compensate for the loss of their labor support on his fields. Conversely, in V2, the economic situation deteriorated severely because many residents had left. Mostly older adults stayed behind, and they had limited resources or physical abilities to make a decent living. These stayers observed that glacier loss and ensuing migration had ruined their economy. For example, a woman in her early 80s remained back alone in V2 in deprived conditions and with serious health problems, mostly dependent on the few remittances sent by her children in the cities. Migrants from V1 and V2 now living in cities also worried about the economic downturn, constrained resources, and decaying houses in their home villages. The migrants and hometown associations from V1 and V2 would send support to their relatives at home, but not enough to buffer the lack of water and labor force.

In V2, the remaining mostly older residents suffered from typical health problems of their age, yet climate impacts and emigration have aggravated these problems. Since the village was shrinking, health workers would visit less regularly so that inhabitants lacked needed medical care. Hunger and despair, loneliness, and social disintegration further threatened people's health. Conversely, in V1, emigration had not yet had the same extent of adverse health

effects. Because sufficient dwellers have remained in the village, it still disposed of a medical post with semi-regular attendance.

Emigration—in combination with other factors that have reduced population sizes in V1 and V2—has also affected education. In V1, the director of the secondary school worried that the service might close soon due to the low birth rate and ever fewer incoming pupils. For the few remaining younger families, such a closure would create additional emigration pressure, as the next schools are too far for daily commuting. In V2, the school was about to close with only one pupil left. The vanishing educational opportunities have exacerbated the already difficult prospects for the village.

5.2.4.3   Social Changes

Emigration also has affected social relationships at home. The effects were especially severe in V2, where the president of the farmers' association worried about social disintegration. He observed increasing fights, grudges, and egoism among the stayers, which resulted, for example, in one episode where they failed to take the needed logistical steps to accept help offered by a local NGO. A female farmer in her late 60s remarked that the village had disintegrated due to the emigration and resultant losses of markets and community organization. People used to be caring and compassionate but now mostly remained within their houses. Remaining connected with migrated relatives was difficult because the remote village had limited mobile reception. Another woman in her early 80s deplored that her children would only rarely come to visit. She felt on her own and abandoned, missing the unity and mutual help she had experienced before the exodus. Migrants in the cities also worried about the decay of social relationships in V2 and the resulting loneliness of the remaining dwellers.

In V1, social ties still seemed more intact thanks to the larger remaining population. Village associations and religious celebrations continued to bring people together. Families stated that their children's migration was usually emotionally challenging in the beginning, especially when the first child left. However, they also said that they had tended to grow accustomed to emigration and were able to adjust slightly easier to subsequent departures of further children. Many stayed in constant contact through mutual visits and their phones, the latter facilitated by a decent mobile reception.

In both villages, older household members lamented that migration had resulted in losses of traditional knowledge and customs. However, these changes may be part of a larger social change that migration has only accelerated; a focus group with pupils who still lived in the villages but aspired to migrate revealed that many were disinterested in maintaining such customs and traditions.

5.2.4.4   Changes in SWB

People in V2 felt depressed and desperate due to the decay of the village, the exodus of relatives, and the lack of social contacts. One stark example was a woman in her early 80s: her husband had died decades ago, and her migrated children were not taking care of her regularly. She struggled to walk, was blind and almost deaf, and lived by herself. She suffered hunger, seemed distressed, fearful, and exhausted, and lacked medical care. Moreover, most villagers were resigned and tired due to the loss of water and jobs. For example, a woman in her late 60s saw, *"No future; rather we need, we live in great need… I will die this way, without seeing the water [again]"* (V2-4). Another old woman asked,

> *So, how will I spend my life now, how will I eat when my belly asks for food when I go to sleep, as a poor person? … I don't know how I will spend my life, young man [sighs]… I'm already [in my early 80s], I can't anymore, I can't anymore. (V2-5)*

Similarly, the president of the farmers' association asked,

> *[W]hat are we supposed to do without water? The water is essential. If we do not have water, we will remain the same here, more and more people of the few ones left will migrate … Even I think, 'what to do if there are no resources to make a living?'. (V2-3)*

In their misery, a small number of villagers held on to religious faith. For example, a farmer asked, *"Do you see how the town is? A desert, it is a desert … There is no future, with nothing but the grace of God we live"* (V2-1). Some farmers kept hopes that their children would be able to advance, such as one young man who stated that, *"Well, for the future I only think about my son, to educate him, give him the best possible"* (V2-2). One woman in her mid-60s, when asked about the next five to ten years, expressed a grim sense of humor by noting, *"I will have died by then [laughs]"* (V2-7).

In the less-affected V1, especially some of the older villagers perceived that migration had caused partial but limited social deprivation. They also worried about the well-being of their migrated relatives due to the insecurity and criminality in the cities. For example, a woman in her mid-70s felt saddened and alone after her children had migrated. After their migration, she was by herself, lacked support, and felt less satisfied with life, a situation captured in a traditional song (*huayno*) she recited:

> *[The relatives] only come a little while, and then they leave again; we remain behind, sad. What will we do? … As I say, I keep crying. There is a huayno that goes like*

this [sings]: 'whoever leaves is happy seeing new horizons, whoever stays is sad, heartbroken [crying].' It is sad, sad [crying]. (V1-3)

Yet, others described that they were more contented knowing that their children were advancing and becoming professionals in the cities. A few held hopes that adaptation to future climate impacts would be possible (see section 5.2.1), but such views were mixed with strong concerns about more hazards, deprivation, and economic insecurity. For example, a woman worried that in the long term, V1 would become a *"ghost town, because there are no people"* (V1-3). The focus group of young pupils, many of whom aspired to leave, were afraid that climate change would imperil their futures. One pupil was

Sad for what has happened. Our children will not have the privilege of living everything we have lived, in a healthy environment, the river by your side. It seems that our children will no longer have water, they will suffer many things. It is very sad, disappointing. (V1-16)

5.3   Discussion

These findings in the *Sierra* case study can contribute to the understanding of the nexus between climate (im)mobilities and well-being in several ways. In this section, I interpret the observed hazard-(im)mobility links and ensuing effects along the studied four well-being axes, situate them in the broader literature, and analyze relevant mechanisms and structural conditions.

5.3.1   Hazard-(Im)mobility Links and Pathways

The poor agricultural villages V1 and V2 have long histories of migration to cities driven by multiple reasons, similar to the historical trends in mountain areas worldwide (de Sherbinin et al. 2012). Traditionally, mainly younger people have left the study sites seeking jobs, education, and lifestyle changes, an age-specific pattern known worldwide (Millington 2000). Changes in family planning and family sizes have further reduced populations, as statistics indicate (INAIGEM 2018; INEI 2018c). *Hazard-related* migration specifically is also common in Peru's highlands (Milan & Ho 2014; Vidal Merino et al. 2020). In the study sites, strong glacier retreat and rainfall changes have caused water stress and

thereby gradually gained importance as migration drivers over the past thirty years. Simultaneously, these *gradual* climate impacts have made migration conditions more difficult and return less likely. The most direct climate effect on migration from the mainly ecosystem-dependent V1 and V2 was the loss of agricultural productivity; similarly, climate effects on economic migration drivers are also most salient worldwide (Foresight 2011). In V1, the mid-stage glacier retreat and rainfall changes have only gradually intensified preexisting migration because an NGO helped to mitigate the water stress to some extent. Likewise, many rural Peruvians tend to stay at the beginning of slow-onset climate impacts to attempt local adaptation (Koubi et al. 2016). By contrast, in V2, the fast and near-complete loss of meltwater caused an exodus because remoteness, poverty, lack of diversification options or necessary skills, and an absent state apparatus strongly limited capacities for adaptation in place. Increasingly, whole families have left for good, mainly to Huancayo as the Regional and Lima as the national capital. Such accelerating effects of advancing stages of glacier retreat on migration are also described in other Andean villages in Peru (Wrathall et al. 2014). In the future—when glacier loss will intensify, and adaptation limits may be reached due to insufficient state support, skills, technology, and market networks—V1 will therefore likely be at risk of a similar exodus as V2. Other studies confirm that because many people in highlands worldwide are poor and depend on ecosystem-based livelihoods, they frequently move to smooth income shocks, and degrading ecosystems make emigration from such areas more likely (Kollmair & Banerjee 2011). The cases here also corroborate that feedback mechanisms can enlarge emigration; such mechanisms include shortage of labor force, closure of critical infrastructure, and removal of social resources in villages of origin as well as expanding migration networks in cities and chain migration effects. When tipping points are crossed and life cycles are compromised—as seen in other Peruvian pastoralist communities (Alata et al. 2018)—gradual settlement abandonment can become a real threat. Such abandonment processes are known from historical cases (McLeman 2011). Simultaneously, the case of V2 emphasizes that gradual hazards can reduce the ability of people with limited prior resources to move out of harm's way and thus forcibly trap them, as suspected by other studies (Kollmair & Banerjee 2011). Even more so, place attachment and health limitations can make people stay despite rising climate hazards, a dynamic also observed in other Peruvian highland zones (Adams 2016).

Among those who left, agency varied (de Haas 2021). Most migrants disposed of limited, but sufficient *capabilities* to implement their choices to move. Men and wealthier families left first, which validates that gradual climate migration is often gendered in Peru (Milan 2016; Sperling et al. 2008), and that vulnerability

and capacities to move are inversely correlated (Adger et al. 2014). Conversely, the findings here provide nuances to another study of Peru which holds that gradual hazards first push those with least assets and skills to migrate (Koubi et al. 2016); such a dynamic is probable when impacts are still more manageable in place (V1) but once habitability is threatened (V2), most affected people will be compelled to leave, and the wealthier have better chances for doing so faster. Migration ranged from more *voluntary* to more *forced* instances, as some people had *aspired* to leave but others hoped to stay. In Kunz's terms (1981), migration was *anticipatory* at first, as people increasingly worried about the climate-related, gradual loss of jobs and educational opportunities; yet, it had *acute* elements later on, especially once the meltwater was entirely lost in V2 and people were forced to react. This underscores that the lens of *mixed migration*, which has recently gained traction in migration policy debates (Sharpe 2018), is also relevant for climate migration (e.g. Sow et al. 2016).

While much fewer migrants from V1 have opted to return permanently than used to be common decades ago, all migrants have maintained translocal links with their birthplace, which underlines the merit of studying climate migration through translocality lenses (Greiner & Sakdapolrak 2016; Rockenbauch & Sakdapolrak 2017). Due to V2's remote location, limited mobile reception, and the few stayers left, translocal ties to the village were weaker than to V1. In the cities, hometown associations were key actors for migrants' new pursuits (Pairama & Le Dé 2018), yet such HTAs and other collective actors, such as faith-based organizations or NGOs, have still received limited attention in the literature on internal climate migration.

5.3.2 Well-Being Effects, Structural Conditions, and Mechanisms

5.3.2.1 Migrants' Development from a Secure base

Mechanisms conducive to decent livelihoods included vocational trainings or studies in the cities that enabled a small number of migrants to take up better positions; networks permitting access to credit and jobs; entrepreneurship and innovation to find niches or make use of urban opportunities; as well as sacrifice and hard work, often at the cost of other well-being elements, such as health. Conversely, especially the case of V2 corroborates findings from other highland studies that migration becomes "more of an imperative to maintain livelihoods than a way to enhance well-being" when climate impacts cause severe harm and exacerbate unequal access to resources or power (Lennox 2015: 793; Wrathall

et al. 2014). This dynamic was evident in the heavily harmed, spatially and administratively isolated V2. When farmers from V2 had to migrate to the cities, they lacked transferable skills and often ended in precarious jobs, which confirms a concern raised before in Peru (Sperling et al. 2008). Interviewees with prior vulnerabilities suffered from urban livelihood stress, which inflicted further harm such as food insecurity, in line with the larger internal migration literature (Lagakos 2020; Selod & Shilpi 2021), other climate migration studies (e.g. Melde et al. 2017), and a study in Peru's *Selva* (Sherman et al. 2015). Most migrants' urban occupational quality did not greatly improve, contrary to global findings (World Bank 2018). This observation substantiates the warning that *distress* migrants are at risk in labor markets split into high- and low-wage jobs (Waters et al. 2010), as is the case in Peru (Carranza 2016). The lack of skills transferable to the cities or the inability to acquire new skillsets, for example due to the high costs of education, were a first major obstacle for decent job and income situations. Second, additional barriers included baseline health problems or worsening health conditions due to migrants' new urban lives. Third, limited social networks posed further obstacles. Fourth, structural factors also obstructed advances: due to population growth, labor market segments of interest have gotten more saturated and highly competitive while occasionally, the rising costs of urban living nullified relative income gains compared to migrants' previous lives. Furthermore, weak governance and alleged corruption issues as well as a lack of adequate resources and personnel in municipal service provision hindered economic advances.

For education, several mechanisms worked in different directions. Migrants started with disadvantages in the cities because education in the *Sierra* lagged. Nevertheless, many appreciated the better availability of educational institutions in the cities with more programs, better staff, and greater market recognition. Flexible options such as evening schools were key resources for migrants. However, these options were also expensive; migrants had to study, learn, and work simultaneously to pay the costs, and this burden prevented several of them from accessing or progressing in education. Hence, few migrants had access to this educational gateway to better jobs and health, which echoes UNESCO's (2020) concern about educational vulnerabilities in climate migration, but contradicts the gains found by prior studies on climate (Melde et al. 2017) and general migration (UNDP 2020).

Additionally, many interviewees suffered from several of the health challenges common in climate migration (see review in Schwerdtle et al. 2020), which contradicts the more positive results by Melde et al. (2017). A first, major constraint for food security and access to the health care system was migrants' lack

of income. Second, deficient basic services, often due to a lack of land- and homeownership, aggravated health problems. Third, stressful lives, pollution and contamination, and precarious livelihoods also affected health, as did family separation. Finally, partial health gains were often offset by higher costs of living and adverse living conditions, as can be the case for internal migrants worldwide (Selod & Shilpi 2021). Conversely, the few migrants with the necessary resources to access urban health services, staff, and infrastructure tended to profit from moving.

All things considered, the new cases substantiate results of prior studies in Peru's highlands (Afifi et al. 2016) and the general literature (see chapter 4), which stress that well-being effects of rural-to-urban climate migration vary: the higher prior vulnerabilities are, the more likely adverse results. More voluntary, *improvement* migration under tolerable conditions made it possible for a small number of migrants to advance in their *development from a secure base.* Conversely, those with little prior resources moving forcibly and under *distress* conditions experienced hardship.

5.3.2.2 Migrants' Space to Live Better

Achieving *a space to live better* depended on migrants' resources, social networks, land availability, and administrative decisions regarding titles and basic services. A small number of migrants was privileged to move in with established relatives who lived in decent houses, which stresses the key role of family networks to mitigate some of the possible hardship in cities (OECD & EU 2015). Better situated migrants were generally content in the nicer and safer areas of Lima, and some preferred the warmer climate compared to the *Sierra*. By contrast, for most of the poorer and more recent migrants, the oversaturation of the rapidly growing destinations Lima and Huancayo has created challenges. Vertical, horizontal, and informal growth has led to problems related to land acquisition, infrastructure, basic services, social cohesion, and urban livelihoods (Carpenter & Quispe-Agnoli 2015; Haller & Borsdorf 2013; Ioris 2015). Many interviewees had to move gradually more toward the outskirts, often to precarious and unsafe housing in new settlements. Because few of the attainable settlements were legal, many migrants lacked titles and therefore access to basic services for long and some for life. Most poorer migrants also described their new urban surroundings as arid, hectic, and congested, and thus as dissatisfying compared to their previous rural environments, confirming that the lack of green spaces and connections with nature can heavily reduce well-being (Wolsko & Marino 2016). The observed loss of place satisfaction compared to rural homes also supports the prediction by Adams (2016) that climate migrants who suffered non-provisional

losses in their birthplaces face well-being risks in the cities, because they cannot recover these losses. A growing literature on distress caused by environmental change refers to this phenomenon as *solastalgia* (Albrecht et al. 2007; Tschakert & Tutu 2010; Warsini et al. 2014). Most poor migrants also had to live in urban zones that were insecure and dangerous, such as riverbanks or hills surrounding Huancayo, and the arid, hilly outskirts of Lima. While they managed to escape from primary hazards in the *Sierra*, many suffered from secondary hazards in the cities, a concern also stressed by the climate migration literature (Adger et al. 2014; de Sherbinin et al. 2012; Foresight 2011). In Peru specifically, studies indicate that rural-to-urban climate migrants from the *Sierra* (Oliver-Smith 2014), *Selva* (Langill 2018), and *Costa* (Rubiños & Anderies 2020) often end up in hazard-exposed zones due to structural and intersectional factors (Erwin et al. 2021). In both Huancayo and Lima, numerous interviewees worried about water scarcity, and the literature substantiates this concern. Water is already scarce, but demand is increasing in many growing cities in Peru; simultaneously, the projected vast glacier loss further threatens highland cities that depend on meltwaters and coastal cities' inter-annual water buffering systems, and thereby exacerbates the competition for water between human use and agriculture (Buytaert et al. 2017; Buytaert & de Bièvre 2012).

To summarize, *a space to live better* was unreachable for most poor climate migrants who had moved under *distress* to disadvantaged urban zones characterized by tenure insecurity, deficient housing, poor basic services or infrastructure, as well as insecurity, pollution, and hazards. These results substantiate the risks for climate migrants in rapidly urbanizing areas with adverse structures identified in other climate migration studies (e.g. Adger et al. 2020; Melde et al. 2017).

5.3.2.3 Migrants' Social Relatedness

The review in chapter 4 led to mixed expectations regarding the effects of rural-to-urban climate migration on *social relatedness*, ranging from gains (Melde et al. 2017) to losses, especially for forced migrants (Schwerdtle et al. 2020). The limited information for Peru also suggested negative impacts (Sherman et al. 2015; Sperling et al. 2008). This study adds nuances to this literature by demonstrating that the quality of migrants' *social relatedness* was in part a function of time. Initially, different social systems and codes, family separation, and losses of strong prior ties often reduced migrants' *social relatedness*, in line with results of general migration studies (Selod & Shilpi 2021). However, consolidated migrant structures in the large cities reduced social costs for newcomers by allowing them to *acculturate selectively,* namely, to gradually adopt new ways while nurturing partial roots in their co-ethnic communities (Waters et al. 2010). Over time, migrant

networks therefore created social gains. The more established migrants became, the more often they also met partners and spouses in the cities, founded families, and started to raise own children, with whom they usually described good relations. Many also experienced positive social cohesion in their neighborhoods. This value of primary relationships and community support in destinations is consistent with findings of general migration reviews (Munshi 2020; Selod & Shilpi 2021).

5.3.2.4 Migrants' SWB

No previous study had explored the SWB of climate rural-to-urban migrants in Peru.[16] On the negative end, the findings here reveal that most of those moving under structural *distress* conditions and settling in places with relatively *hostile modes of incorporation* suffered from *deprivation*[17] due to multiple unfulfilled needs and limited development prospects. Many migrants described negative feelings especially at the beginning of their time in the challenging urban areas. A first burden was sadness due family separation. Second, anxiety, stress, and tensions frequently persisted due to the demanding city life, precarious livelihoods, the dual burden of working and studying, and insecurity. Various migrants were overwhelmed by these dynamics, exhausted, and dissatisfied with life. Third, migrants were also angry and frustrated due to corruption and governance failures. Fourth, negative feelings often related to adverse material conditions, and even some migrants whose conditions had improved reported negative emotions. Nevertheless, other than predicted before (Koubi et al. 2018; Magallanes 2015), the interviewees' experiences of hazards, grievances, and deprivation did not (yet) seem to make conflict more likely in the cities.[18] Over time, several but far from all migrants experienced partial hedonic adaptation to the surrounding urban risks. These results corroborate that migration voluntariness, resources, and conditions strongly determine SWB (Bartram et al. 2013; Hendriks 2015) and that most rural-to-urban migrants in poorer countries stand to lose SWB (e.g. Chen et al. 2019; Mulcahy & Kollamparambil 2016). Various of the mechanisms identified in the review chapter 4 are plausible. First, it is known that migrants' SWB partially converges to the average SWB of locals (Helliwell et al. 2018b), and

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[16] At most, studies on displacement and relocation have identified associated mental health burdens, see for example Espinoza-Neyra et al. (2017); Rojas-Medina et al. (2008).

[17] For terminology, see section 2.3. *Deprivation* refers to adverse objective conditions accompanied by low cognitive satisfaction and negative emotional balance.

[18] Neither did conflict emerge due to increased pressures on natural resources at their destination, as for example identified after climate-related migration by fishers on Peru's coast, see Badjeck (2008); Badjeck et al. (2009).

most interviewees lived in poor zones with expectedly low SWB. Second, *relative deprivation* compared with better situated segments of the cities may have further reduced SWB because the more migrants integrate, the more they tend to take residents in their new homes as reference points (Melzer & Muffels 2017). Third, the difficult macro conditions in the cities may have further decreased SWB (e.g. Hendriks & Bartram 2016). And finally, a part of migrants' low SWB in the cities may relate to *footprint effects* from source areas (Helliwell et al. 2020), especially for migrants from the SWB-deprived village V2.

On the positive end, the small number of *improvement* migrants who had achieved urban upward mobility seemed to experience *true well-being*. This result contradicts most other studies on internal migrants in poorer countries (for whom SWB losses are common even despite high OWB gains (e.g. Chen et al. 2019; Czaika & Vothknecht 2014)), but is closer to results in a few richer areas (where some male migrants make lasting SWB gains (e.g. Ek et al. 2008; Kratz 2020)). Advantageous mechanisms included successfully leveraging educational and income opportunities, working in formal jobs or in own businesses, living in quieter areas, and having good family ties. Therefore, the reasons behind these rare SWB gains in this study may be large *relative* OWB *improvements* compared to migrants' own prior lives, combined with *relative improvement* compared to their many often-poor urban peers. Prior studies also find that OWB gains (especially in income) compared to migrants' previous lives can drive lasting SWB increases beyond hedonic adaptation (Melzer & Muffels 2017). By contrast, the mechanisms most commonly stressed in the field—rising or unrealized aspirations, lacking information, *relative deprivation*, and migration costs (Haindorfer 2019a)—ostensibly had limited influence on this small number of migrants. Even so, the reviewed literature suggests that most interviewees will likely remain unable to catch up with the SWB of city natives (e.g. Hendriks et al. 2016), a prediction that future studies could assess.

Beyond their emotional balance and cognitive satisfaction in the present, most migrants' views of the future were negative (*enforced* and *dramatized fear*)[19] due to various mechanisms. First, migrants in low-wage temporary positions in the city suffered from deprivation and economic fears and had often resigned. This result contrasts other cases where hope aided low-wage migrants to endure present hardship (Pine 2014) but is in line with cases where migrants' hopes wane over time (Boccagni 2017). Second, several migrants worried about the observed challenges in their highland villages of origin and third, various of them felt anxious for the coming generations due to their lack of development prospects

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[19] For terminology, see section 2.3.

and the rising magnitude of climate impacts. These findings stress how salient climate anxiety can be for climate migrants (Clayton 2020); they also suggest that migrants may not be able to escape this anxiety by moving, since they are linked to stayers in still-exposed hometowns and often remain affected themselves by hazards out of their control in cities. Conversely, those who held hopes did so due to relatively good economic prospects, religious faith, or personal resilience in the face of adversity, occasionally despite deep poverty, which reveals that circumstantial and personal factors interact to create hope (see chapter 4). Other migrants only held hope for their children's progress, a finding consistent with other studies (e.g. Boccagni 2016). However, as noted above, still other migrants despaired over impending challenges for their children.

5.3.2.5 Stayers' Well-Being

As a secondary interest, this study also led to insights into several mechanisms through which emigration affected the social systems and well-being of stayers in the *Sierra*. Migration together with changing family planning have reduced population sizes in migrants' birthplaces toward (V1) or below (V2) critical thresholds that have started to threaten village life. Economically speaking, emigration subtracted labor force from the shrinking villages, which complicated labor-intensive agriculture. It also generated remittances, but their extent depended heavily on the urban jobs attainable for migrants. Many of the interviewed poor migrants in precarious and informal jobs had limited resources for remittances, similar as in Peru's *Selva* (Sherman et al. 2015) and other contexts (Le Dé et al. 2013; Schade et al. 2016). Adding insights to a still-open debate (Banerjee et al. 2017; Bendandi & Pauw 2016), in this study, financial remittances did not seem to buffer the loss of water and labor force and thus failed to support climate adaptation. As a result, in V2, many economically inactive and physically limited older adults suffered economic hardship due to emigration. Interviewees also did not report large benefits from remittances on health and education, contrary to a study of climate migration on Peru's coast (Badjeck 2008) and to general reviews on migration (Obi et al. 2020; Ratha et al. 2011). Social remittances, another possible development catalyst (de Haas 2009), were also limited due to migrants' economic struggles and the remoteness of their birthplaces. Hometown associations from V1 and V2—another potential supporting actor for climate adaptation in source areas (ADB 2012; Webber & Barnett 2010)—mainly focused on sociocultural events and support for migrants in the cities. Nonetheless, general statistics indicate that internal remittances hold potential to support at-risk stayers in rural source areas in Peru, as almost one third of the recipients are women, 65 years or older, and 47% of them are economically inactive (Sánchez Aguilar 2012a).

However, this study suggests that limits apply; once thresholds toward settlement abandonment are crossed, remittances cannot counterbalance the ensuing threats to the survival of critical infrastructure, services, and social stability. Similarly, extended family networks can help mitigate some of the social effects of emigration (Bedford et al. 2009), but only to a certain degree. These networks gradually failed in V2, where too many entire families had already left, and the few remaining villagers suffered from a disrupted social system. Overall, the socio-cultural effects of emigration depended on who left, their numbers, the pace of departures, and the possibilities to maintain contact. In V1—with its still lower pace of emigration and better mobile reception—social relationships were less affected than in V2. The exodus from V2 also aggravated existing health issues by deteriorating health service provision, food insecurity, and psychosocial issues, which confirms the concern by general reviews that emigration can raise morbidity for stayers (Abubakar et al. 2018; Paudyal & Tunprasert 2018), especially for older adults (Ao et al. 2016). By contrast, increasing emigration has had few effects on health in V1 so far, where more people have remained in place. Regarding education, the increasing departure of the youth and young families has led to ever fewer pupils in both villages, which has threatened the continuance of the educational infrastructure. In summary, the findings on the OWB of stayers stress that emigration can induce losses of labor force, critical infrastructure or services, social networks, and traditional knowledge, which corroborates findings of prior studies of climate migration in Peru's highlands (Altamirano Rua 2021; Lennox & Gowdy 2014; López-i-Gelats et al. 2015) and the general literature (Obi et al. 2020).

Finally, emigration also affected *SWB* in the villages. Key mechanisms were the severity of climate impacts and related magnitudes and conditions of emigration; the well-being of migrated relatives; the possibility to maintain contact; and stayers' social and material prospects. The entirely negative SWB effects of emigration in V2 are consistent with results of a prior review study (Paudyal & Tunprasert 2018), and the cases suggest that the reasons behind this decline are losses of identity, community organization, and critical infrastructure due to emigration. By contrast, migration has had more mixed SWB effects in V1, confirming that gains in some SWB factors can occur simultaneously with losses in others (Graham & Nikolova 2018). Future outlooks in V1 were mixed given concerns about livelihoods and climate change, yet still more positive than in V2, where personal coping mechanisms like faith or humor could not offset the salient stressors. These findings confirm the expectations from the review in chapter 4 that climate change can worsen views of the future through various pathways, including past and expected climate impacts, and that rising despair can deepen

perceptions of vulnerability, uncontrollability, and unpredictability, which may ultimately block action or engagement (e.g. Carver & Scheier 2014; Forgeard & Seligman 2012).

5.4   Summary and Induction of Propositions

In this section, I summarize the key structural conditions, mechanisms of action, and well-being dynamics in this case study of rural-to-urban migration related to gradual hazards in the *Sierra*. In a final step, I then induce broader propositions on the well-being impacts of climate (im)mobilities.

Figure 5.14 displays the identified well-being outcomes for climate migrants as well as significant structural conditions and mechanisms shaping these outcomes. Stayers are not depicted. The figure illustrates that the migration in the context of gradual glacier loss and rainfall changes occurred with average to low structural opportunities, including freedom of movement within Peru and established translocal networks. However, structural constraints were larger and included severe climate risks and limited adaption possibilities, poverty and inequality, limited livelihood options, spatial insularity, tenure insecurity, poor basic infrastructure and services, weak governance, lack of political voice, and population growth. Given these structural conditions, the flows from the rural areas to the large cities were situated on a spectrum between *improvement* and *distress* migration. Regarding agency, most migrants had limited but sufficient migration *capabilities* to implement their decisions, yet *aspirations* to leave varied, and movements thus ranged from more *voluntary* to clearly *forced* instances. Most remaining adolescents aspired to depart to the cities. Among those staying in V1, many older adults were *voluntarily immobile*, whereas others, especially those in V2, were *trapped*.

Migrants' well-being results in Lima and Huancayo were on average more net-negative than net-positive. For finer analysis, the figure below differentiates between two factions. The first group covers most of the interviewees who had left the increasingly adverse situations in their home villages in recent years under *distress conditions* and arrived with limited baseline resources and skills in the oversaturated, large urban agglomerations. These migrants experienced great challenges for their *development from a secure base* and *a space to live better*, while gradually reaching similar or better *social relatedness* as before migration. Although they were subsisting in the cities, multiple deprivations restricted their development prospects. These migrants with multiple unmet needs subjectively suffered from *deprivation* in their cognitive satisfaction and emotions; only few
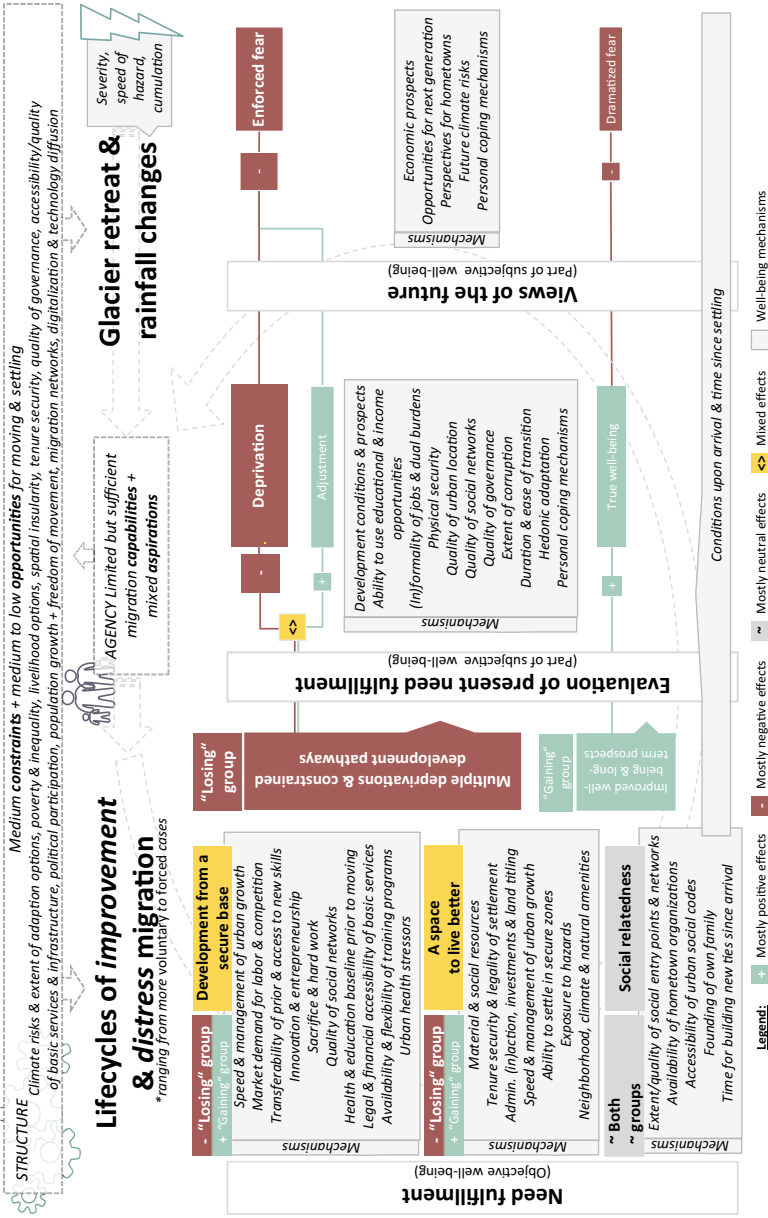
Figure 5.14 Main well-being effects for migrants from V1 and V2, structural conditions, and identified mechanisms of action. (Note: Created by the author)

reported partial and gradual *adjustment*.[20] In the figure below, they are marked in red as the "losing" group. By contrast, the second group comprises a small number of migrants who achieved urban upward mobility, in particular those who had moved voluntarily and a longer time ago. In often-arduous processes, they have used urban education and job opportunities to improve their well-being and long-term prospects. This small group evaluated its needs as mostly fulfilled (*true well-being*). In Figure 5.14, this faction is highlighted in green as the "gaining" group. Nonetheless, both the large number of migrants losing OWB (*enforced fear*) and the few ones gaining OWB (*dramatized fear*) held mostly negative views of the future. The light gray boxes in the figure synthesize the key structural conditions and well-being mechanisms explained above that may be applicable to other contexts.

These empirical findings on *improvement* and *distress* climate migration from Peru's highlands, ranging from *voluntary* to *forced* cases, make it possible to induce broader propositions on the well-being of climate migrants in cities and stayers in rural source areas.

Foremost, when severe and irrevocable climate impacts threaten the means of existence of remote and poor agricultural communities with constrained on-site adaptation options, migration likely gradually becomes an imperative. Self-accelerating migratory feedback mechanisms then can reduce population size at an exponential pace, pushing settlements to points of no return and toward eventual abandonment. This is particularly likely when village life cycles are disrupted because the youth and young families leave, as is common in many small mountain towns worldwide with deeply rooted cultures of migration, which can raise the pace and volume of departures. If land and livelihoods are not entirely lost, increasingly smaller shares of the residents may be able to apply the limited in-place diversification options to carve out a living in the original site. Yet, absent strong support from the state or translocal networks, these remaining villagers are at risk of progressively more severe OWB and SWB declines due to the losses of labor force, knowledge, social networks, and key infrastructure or services, which can endanger their self-organization, identity, and survival.

If enough freedom of movement and migration networks exist, two internal migration paths are possible for such former subsistence farmers who leave areas with progressively worsening slow-onset impacts. First, if impacts are still more manageable in place, they are likely to emerge as one factor among many that

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[20] For terminology, see section 2.3. *Deprivation* refers to adverse objective conditions accompanied by low cognitive satisfaction and negative emotional balance. *Adjustment* is subjective well-being despite adverse objective conditions.

jointly drive gradual, anticipatory *improvement* migration. People engaging in this type of migration have a chance to experience improved OWB in the cities, albeit with taxing and laborious processes. Second, OWB is likely at risk if climate impacts reach critical thresholds and increasingly force *distress* migration, and if such migrants arrive with limited baseline resources and untransferable rural skills in overcrowded zones of large cities. Such migrants may subsist in their new urban lives, but multiple deprivations will significantly restrict their development prospects. The well-being results of these two groups will likely diverge strongly in the four studied dimensions:

(1) Most of the poor farmers who must move to irregular, peripheral zones marked by high job competition, limited state presence, and deficient basic services will have almost no chance to transform their skillsets to meet urban demands. They will likely continue with limited opportunities for *development from a secure base* while they struggle to achieve decent livelihoods, education, or health and food security. A few migrants may see progress if they arrive in the cities during periods with more favorable labor, land, and housing markets as well as receptive policies. However, making such advances additionally requires strong educational and social entry points and migrants' entrepreneurship, hard work, or sacrifice.

(2) *A space to live better* is likely out of reach for many poor climate migrants who move under *distress* conditions to irregular urban settlements at the margins of oversaturated cities, where they lack state support, tenure security, as well as basic infrastructure and services, and may be exposed to insecurity, pollution, and unfamiliar climate hazards. In the rarer cases where positive conditions work together—such as sufficient migration resources, strong social networks, state support, and urban livelihoods gains—migrants may start with or gradually achieve more decent living conditions.

(3) If a strong diaspora provides climate migrants with time and support so they can gradually blend into segmented, co-ethnic urban social systems and learn new social codes, they may, gradually, reach similar *social relatedness* as before, especially as they build new ties and found families.

(4) As a result of multiple unfulfilled needs, many climate migrants are likely to suffer from subjective *deprivation*. Such *deprivation* threatens to be especially salient when migrants start to settle in, a time when several negative factors such as family separation, parallel burdens, insecurity, weak governance, and unfamiliarity with the new social system are common. If people's attained human development state as well as the quality of their urban locations and security remain low, even expectable social gains made over time

and personal coping mechanisms are unlikely to raise their *evaluation of need fulfillment* in the present. Few of these migrants may gradually and partially experience *adjustment* through hedonic adaptation. By contrast, a smaller group of migrants with urban upward mobility can experience *true well-being.* Nevertheless, most of the internal climate migrants moving, settling, and living under the conditions described above are likely to experience *enforced* (and some *dramatized*) *fear* regarding the future, given economic problems and lack of progress, anxiety regarding uncontrollable climate impacts, concerns about the future of their children, and worries about their rural hometowns, which personal coping mechanisms may moderate only to some degree.

Selva: Flood-Driven Entrapment and Planned Relocation in Peru's Rainforest

6

> *"Para mi igual no más ha sido, porque cada vez que inunda igual sufrimos, no hay cambio. Cambio puede haber cuando nosotros salgamos de aquí, cuando nos reubiquen."*
>
> *"For me, it has stayed the same really, because every time it floods, we suffer the same, there is no change. Change can happen when we leave here, when they relocate us" (own translation, as in all the chapter).*
>
> Statement by an Indigenous subsistence farmer, in her early 40s at the time of the interview, and mother of two children. She aspired to relocate but has been trapped since a major river flood in 2015 (V4-14).

In Peru's rainforest (*Selva*), the research interest was in two cases of flood-driven, short-distance, planned relocation (community-wide migration) in the Region of San Martín. After having requested relocation, both villages first became forcibly immobile for years and only one relocation was eventually accomplished. These cases are of interest for two reasons. First, the evidence demonstrates that the annual flood cycle in the rainforest and extreme floods periodically drive individual migration (e.g. Hofmeijer et al. 2013; Langill 2018; List 2016; Sherman et al. 2016). When habitability is threatened, the state has occasionally attempted to relocate entire communities (Bernales 2019; Desmaison et al. 2018; Estrada et al. 2018; Lavell et al. 2016; Lopez 2018; Pittaluga 2019). Second, extreme floods have already increased in the rainforest (Barichivich et al. 2018; Gloor et al. 2013; Marengo & Espinoza 2016) and are projected to rise further due to climate change (Castellanos et al. 2022; Zulkafli et al. 2016). Without attribution analysis, it remains difficult to know how much more likely climate change made the specific floods analyzed in this dissertation. Yet, since extreme floods have

increased in this region overall, and climate change is projected to intensify them further, the case studies do provide valuable insights into a dynamic with rising importance for (im)mobilities.

In the first section, I explain the geographical context, measured and projected climate change trends and impacts, exposure, vulnerabilities, local coping and adaptation, and hazard-related migration in Peru's *Selva*. Afterwards, I describe and discuss the new empirical results before inducing propositions on well-being impacts of climate (im)mobilities in the last section.

6.1   Context

Peru's share of Amazonia—the second-largest after Brazil's—comprises 58% of the its landmass but is home to only 14% of the population (INEI 2018c; Mächtle 2016).[1] The study sites V3 and V4 are located in the San Martín Region (Figure 6.1), where 813,000 people lived in in 2017, 68% of them in urban zones (INEI 2018c).[2] V3 and V4 are two small but growing villages without district status. In 2018, V3 housed 150 farmers who auto-identified as *mestizos* (Amerindian and other ancestry).[3] Due to high birth rates, V4 has more than doubled its size since 1990 and is now home to 700 *Indígenas* (Indigenous people) (INEI 2018c). The population in V4 is young, with almost every second villager being at school age. It has retained Indigenous ancestral customs such as music, dances, and handicraft, and special relations to the surrounding nature. In both sites, slightly more inhabitants are male than female, and all villagers speak Spanish.

Amazonia contains much of the remaining rainforest on Earth, which provides key ecosystem services to people in Peru and worldwide. The tropical rainforest still covers about two thirds of the *Selva* in Peru, with transitions into forest and savanna on the northern and southern extremes, and into montane and cloud forest in the Andes to the west (Encyclopædia Britannica 2018; Mächtle 2016). Some of Peru's rainforest is protected or belongs to Indigenous people, but an increasing share is exploited for agriculture, agroforestry, and resource extraction. Deforestation is a serious problem and mainly driven by agricultural migration, logging,

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[1] This section partially draws on my previous work published in Bergmann et al. (2021a).

[2] For privacy protection, I neither mention the names of the specific sites of investigation nor of interviewees. V3 stands for interviews from the completed relocation and V4 for interviews from the stalled relocation case (*forced* immobility).

[3] The exact number of inhabitants is known but not mentioned here for privacy protection.
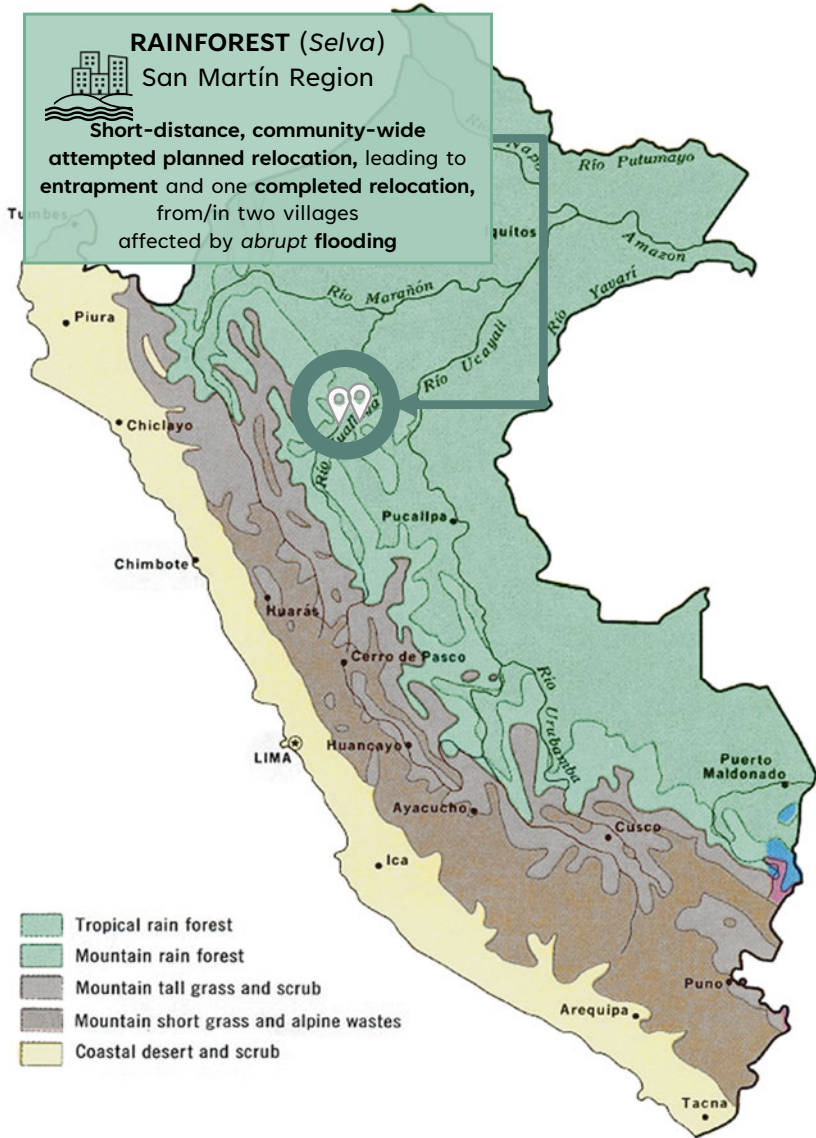
Figure 6.1 Sites for qualitative data collection in Peru's rainforest. (Note: To protect the respondents, the pins indicate approximate locations only. Created by the author, based on CIA (1970))

illegal wood extraction, and climate impacts (MINAM 2016b; USAID 2014). Humans have caused vast biodiversity losses and species extinction in Peru, one of the world's seventeen megadiverse countries (CEPLAN 2011; USAID 2014).

Besides rainforest cover, vegetation in the *Selva* depends on elevation-related temperatures (Encyclopædia Britannica 2018; Mächtle 2016). Land below 1,000 m.a.s.l. is suitable for producing bananas, cacao, and similar crops. These lowlands feature two landforms, the wide surfaces above highest flood levels (*terra firme*) and alluvial floodplains by the river (*várzeas*) with annual floods. Above 1,000 m.a.s.l., more moderate temperatures allow for crops such as coffee and corn.

Peru's rainforest and its pre-mountains feature a humid and tropical climate (Mächtle 2016). Seasonal temperatures vary slightly, but daily ranges between maximum and minimum temperatures can be high in the lowlands and even higher in the mountainous zones. In austral summers, the South American Summer Monsoon brings abundant rainfall with yearly averages of 1,500–2000 mm. Maximum rainfall develops along the north-eastern Andean slopes. As a result, the Atlantic drainage basin, which includes Amazonia, accounts for more than 97% of the total available water in Peru (ANA 2018). While the rainforest has high temperatures and rainfall rates nearly all year long, the seasonality of rainfall regimes varies across zones. The study sites V3 and V4 are located at approximately 250 and 200 m.a.s.l on the ecological floor coined *Omagua* (Pulgar Vidal 1972).[4] Temperatures here are high all year and the region has a bimodal rainfall regime. V3 experiences rainfall peaks from February-April and September-November. The rainy season in V4 lasts from September-May, whereas the drier period is from June-August (Figure 6.2).[5]

In Peru's already warm rainforest, temperatures have risen by up to 0.25 °C per decade from 1981 to 2016 (Bergmann et al. 2021a; Lavado-Casimiro et al. 2016). Extremely hot days during the warm months have increased at least by a factor of two over recent decades in northern South America (Feron et al. 2019). Abrupt temperature falls (*friajes*) also threaten people, fauna, and flora in Peru's *Selva* six to ten times per year (MINAGRI 2012; SENAMHI n.d.; SINAGERD et al. 2014), and San Martín has the second-highest exposure to *friajes* in Peru (SINAGERD et al. 2014). For V4 specifically, the analysis of gridded satellite and station data reveal that 1997–2016 temperatures were up to 0.2 °C higher

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[4] The term *Omagua* is derived from the name of an Indigenous people in the *Selva*.

[5] I would like to thank my colleague Stephanie Gleixner, who kindly produced these graphs. Because the PISCO dataset does not perform well in the rainforest, she also used weather station data for graphs in this chapter.
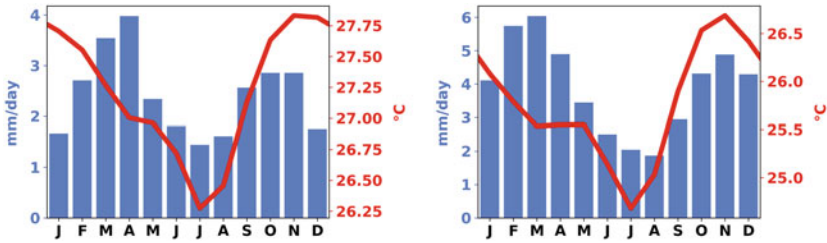
Figure 6.2 Temperatures and rainfall close to V3 and V4. (Note: Average temperatures and rainfall per month 1982–2016 for weather stations closest to V3 (left) and V4 (right). Produced by Stephanie Gleixner, using station and PISCO data (Lavado-Casimiro et al. 2016). The station name here and in the following figures is concealed to protect the privacy of respondents)

compared to 1982–2001 (Figure 6.3). The maximum daily temperature range has declined, while the absolute maximum temperatures and the number of hot days have been rising.

Rainfall trend analysis for Peru comes with uncertainties. Several studies find no significant average trends in the Amazon (Haylock et al. 2006; Heidinger et al. 2018), but specific basins show significant increases (for example, the southern Ucayali basin in the south) or low significant reductions (for example, the northern Ucayali basin in the central rainforest) (Da Paca et al. 2020). While Da Paca et al. (2020) find insignificant increases in the northern rainforest, Lavado-Casimiro et al. (2012b) document significant decreases. Runoff for the Amazon basin has significantly decreased (Espinoza et al. 2006; Lavado-Casimiro et al. 2012a). Data analysis for V4 specifically indicates that daily mean rainfall has increased throughout the year for the period of 1997–2016 compared to 1982–2001, particularly during the rainy season (Figure 6.4). Annual rainfall also indicates an upward trend after a dry period in the second half of the 1990s. While the number of dry spells seems to have decreased and shortened, the intensity of extreme precipitation events (95th percentile) has increased.

The exact direction of future changes in mean and extreme rainfall in the Amazon is unclear (Christensen et al. 2013; Cook & Vizy 2008; Giorgi et al. 2014; Sörensson et al. 2010), as is the case for the Province home to V4 (Figure 6.5). Peru's rainforest may see fewer rainy days but more intense rainfall events (Castellanos et al. 2022; Christensen et al. 2013; Giorgi et al. 2014). While the mean runoff in main Amazon river basins is not projected to change significantly (Lavado-Casimiro et al. 2011; Zulkafli et al. 2016), the wet season
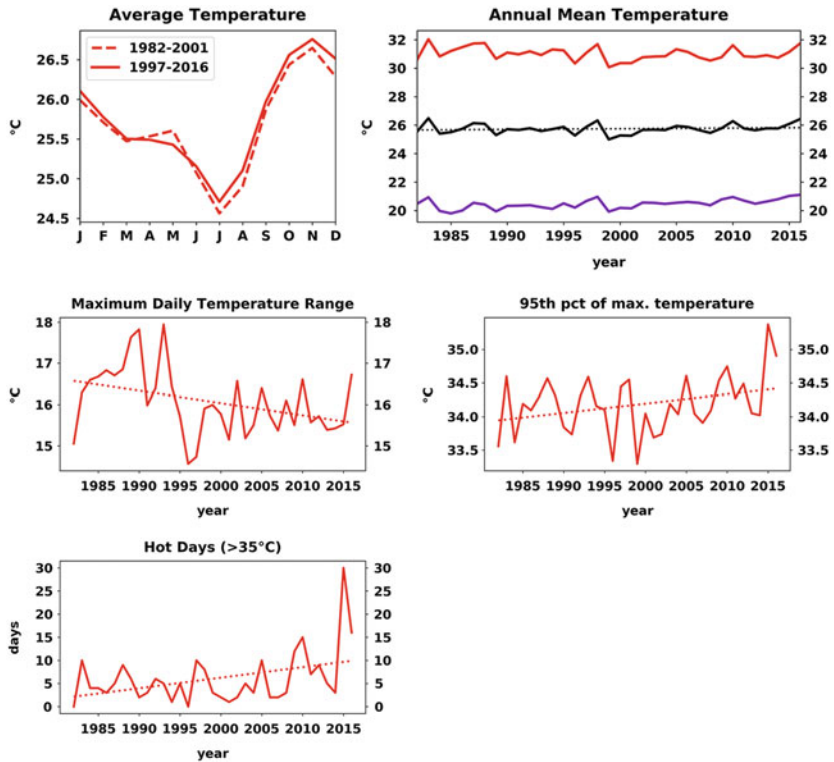
Figure 6.3 Temperature trends close to V4. (Note: Average monthly temperature 1982–2001 compared to 1997–2016 (top left) and annual mean, maximum, minimum temperature (top right); daily maximum temperature range (middle left), 95th percentile of maximum temperature (middle right), and hot days >35 °C (bottom left). Produced by Stephanie Gleixner, edited by the author)

flood pulse (Zulkafli et al. 2016) and wetness extremes (Duffy et al. 2015) will intensify. Mild and severe multiyear droughts are projected to increase for the whole Amazon region (Duffy et al. 2015; Parsons et al. 2018).

Already today, temperatures and humidity are high in the *Selva*, which creates occupational heat stress even in the shade. However, climate change will intensify heat stress and lead to deadly heat conditions—too hot, too humid, or both, for human thermoregulation (Mora et al. 2017b)—that threaten work and survival (Andrews et al. 2018; Feron et al. 2019; Mora et al. 2017a). In a high emissions
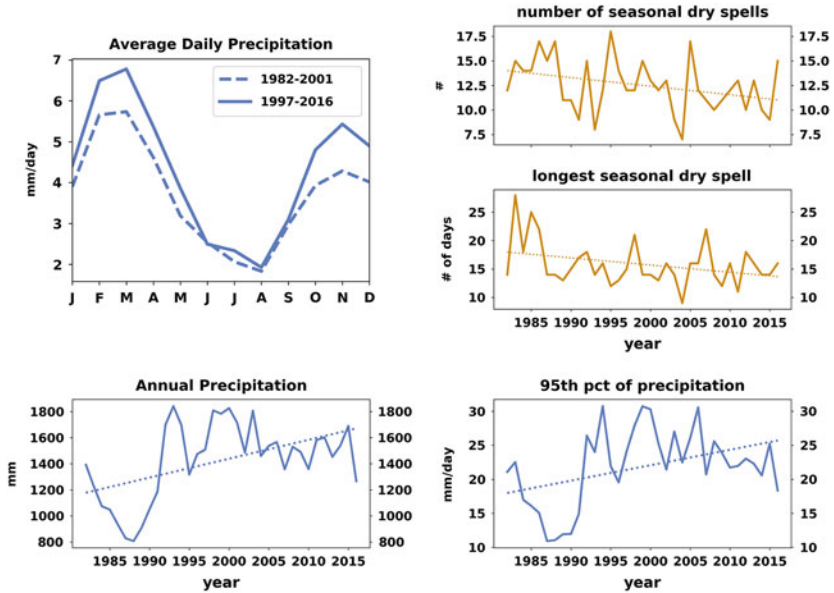
Figure 6.4   Rainfall trends close to V4. (Note: Average daily precipitation (top left) and annual precipitation (bottom left); dry spells (top right) and 95th percentile trends (bottom right). Produced by Stephanie Gleixner, edited by the author)

pathway,[6] the 50th percentile of mean temperature for V4 may rise from 26.5 °C in the 2010s to 30.5 °C in the 2080s; by then, the whole year may consist of hot days (Figure 6.6, see also Mora et al. (2017a)). In some rainforest zones, even limited global warming of 2 °C would sharply increase the days per year when temperature is above the deadly threshold. Across Peru, such conditions would expose more than 10 million people to extreme heat stress (Andrews et al. 2018).

Moreover, the rainforest could reach a dieback tipping point at which large extents of biomass would be substituted through savanna or grassland (Adams et al. 2014; Borma et al. 2013; Lenton et al. 2008; Lyra et al. 2017; Nobre et al. 2016; Staal et al. 2020). Such a dieback could be driven by deforestation, climate impacts, or a combination of both. 75% of the Amazon rainforest has lost resilience since the start of this century and may already be approaching a

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[6] SSP 3 is combined with a forcing level of 7 W/m^2, leading to above 4 °C mean global temperature increase by 2100.
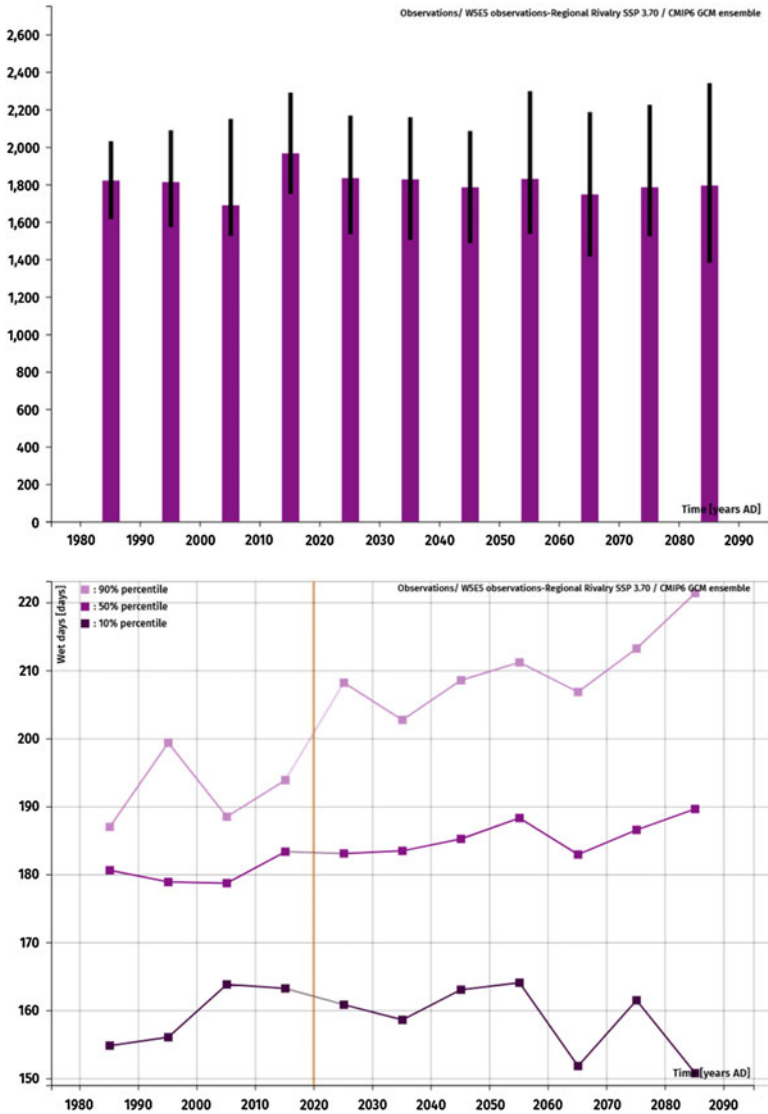
Figure 6.5 Observed and projected rainfall in the Province home to V4. (Note: Precipitation (top) and number of wet days (bottom), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3 7.0 W/m² / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsdam.de)
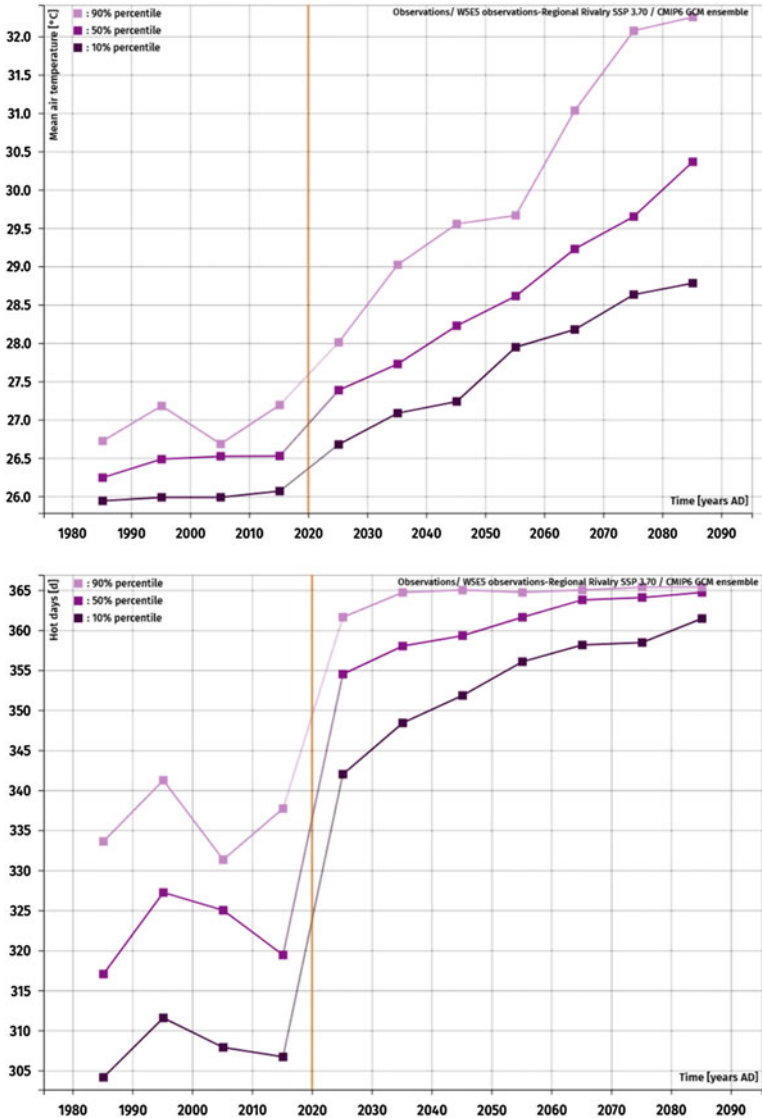
Figure 6.6 Observed and projected temperature in the Province home to V4. (Note: Mean air temperature (top) and number of hot days (bottom), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3 7.0 W/m^2 / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsdam.de)

dieback threshold (Boulton et al. 2022). In Peru, agricultural expansion and other factors had already destroyed more than 7% of the rainforest by 2014 (MINAM 2016b). A dieback would disrupt hydrological cycles, biodiversity, and carbon storage. Forest resources and agriculture would also greatly decline and thereby erode linked livelihoods (Boulton et al. 2022; Lyra et al. 2017; Masson-Delmotte et al. 2018).

In line with the data above, prior studies find that people in Peru's *Selva* are recurrently exposed to multiple hazards that often relate to erratic, deficient or excessive rainfall, and resulting floods or droughts (Langill 2018; Marengo & Espinoza 2016; Zavaleta et al. 2018). Farmers are familiar with the impacts of an annual flood cycle, which can benefit lowland agriculture by leaving fertile alluvium (Sherman et al. 2015; Takasaki et al. 2004). However, periodically heavier rainfall can drive severe, exceptional floods (Langill & Abizaid 2020; Sherman et al. 2015), which have intensified over the past decades (Barichivich et al. 2018; Bodmer et al. 2018; Gloor et al. 2013; Marengo et al. 2013).[7] Such intense rainfall occurs mostly between September and May and can result in floods, mudslides, and erosion. Figure 6.7 shows that many of Peru's flood risk zones are in the *Selva*. Numerous rainforest dwellers experience at least one major flood in their lives (Coomes et al. 2010; Langill 2018; List 2016). Communities by main river channels can be more exposed than those by tributaries (Langill 2018). Flood exposure also depends on land type and elevation, increasing from upland over high levee to low levee and back slope land (Langill 2018; Takasaki et al. 2004). In 2014, 435,000 people were exposed to intense rains in San Martín, the Region home to V3 and V4 (SINAGERD et al. 2014). Conversely, droughts have not yet had strong effects in San Martín, but drought risk could increase.[8]

Temperature-related hazards such as heat (Hofmeijer et al. 2013; Zavaleta et al. 2018) and abrupt temperature falls (*friajes*) add to the problems (SINAGERD et al. 2014). As discussed above, climate change has intensified these hazards and is projected to further increase them extensively.

This high exposure to hazards in the *Selva* combines with substantial vulnerabilities. First, rural livelihoods in Amazonia mostly depend on ecosystem services

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[7] In the past, intense floods have frequently been linked to La Niña, see Marengo & Espinoza (2016).

[8] Drought risk in San Martín is low but could increase, see SINAGERD et al. (2014). Between 1981 and 2018, ten episodes of meteorological droughts occurred in Peru, see SENAMHI (2015, 2019). Droughts in the rainforest reduce flow discharges, increase ecosystem vulnerability, impair farming, health, and food security, raise forest fire risk, and affect hydropower generation as well as fluvial transportation networks, see Hofmeijer et al. (2013); Langill (2018).
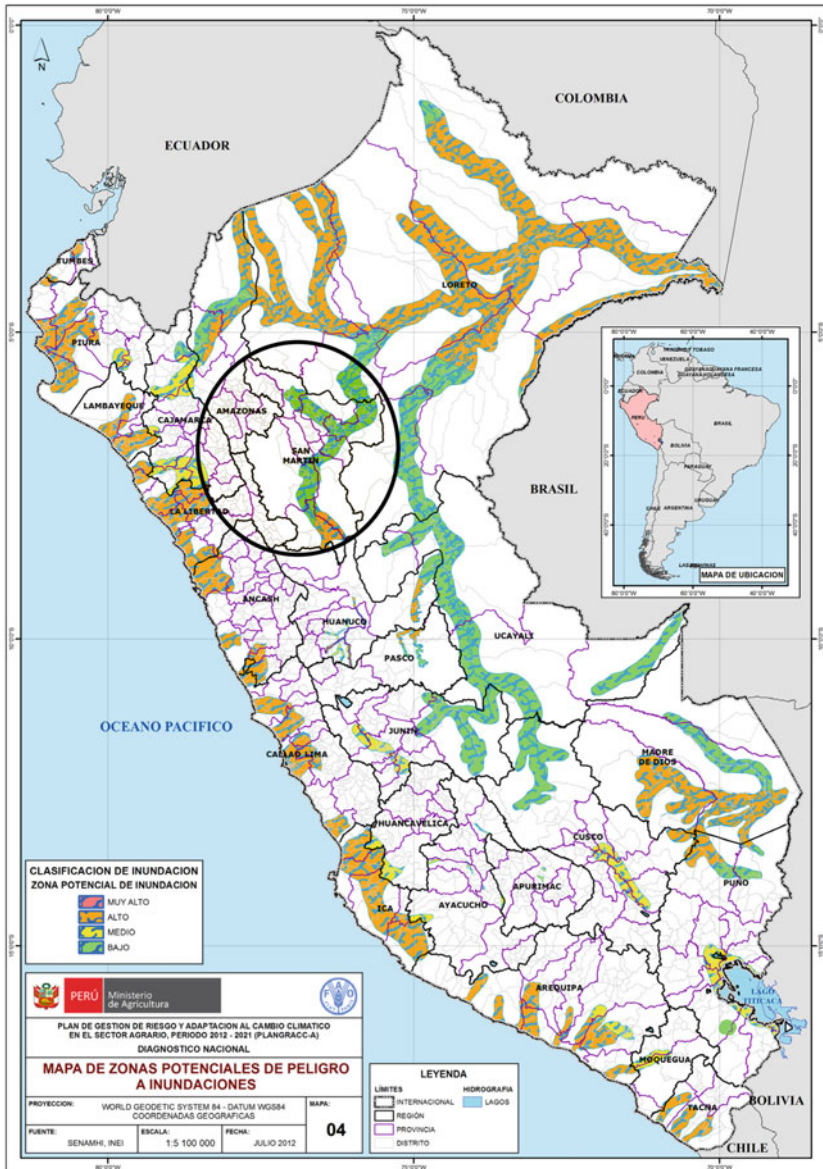
Figure 6.7 Flood risk zones in Peru. (Note: San Martín's location is circled. Red indicates very high, orange high, yellow medium, and green low flood risk. This map from MINAGRI (2012: 38) was edited by the author)

that are threatened by climate impacts. Villages not directly located by rivers use three food sub-systems (Coomes et al. 2010; Zavaleta et al. 2018): forest, farming, and external sources, such as seasonal migration and day or wage labor (Langill 2018)). If proximity to rivers permits, people also fish (Manzi 2005; Sherman et al. 2016). The relative share of these livelihood activities can differ considerably across villages (Coomes et al. 2010; Hofmeijer et al. 2013). Besides proximity to rivers, land elevation and flood cycles shape livelihood options (Langill & Abizaid 2020; Takasaki et al. 2004). Farmers use ecological zoning to exploit time-specific opportunities in growing seasons, and upland farmers whose fields are not affected by floods use different agricultural production than lowland farmers. Additionally, farmers rotationally adjust their livelihoods in floodplains to the flood cycle by raising agricultural production during flood recession and increasing fishing during floods (Langill 2018; List 2016).

Second, rural Amazonian households are often extremely poor. According to government data, 42% and 55% of the habitants in the two districts[9] where V3 and V4 are located are poor and 13% and 26%, respectively, extremely poor (MIDIS 2020). According to district-level data, 57% and 65% of the households, respectively, have only dirt floors, and many use fragile housing materials (INEI 2018a). In both districts, close to 80% of all households cook with wood, more than 60% of the people have only primary education or less, and around 15% cannot read and write.

Third, intersectional factors further heighten vulnerabilities (Hofmeijer et al. 2013; Langill 2018, 2020). Non-majority ethnic groups frequently face discrimination (Barrón 2008) and a disproportionately high poverty incidence in Peru (INEI 2016b). Age and sex also matter; for example, older adults often suffer disproportionately from floods because their health baseline tends to be worse and they have less capacity to move or work (Langill 2018; Takasaki et al. 2010). Single-headed female household are frequent in the rainforest and tend to be overloaded with labor (Langill 2021). After floods, women can also suffer more mental health issues than men (Rojas-Medina et al. 2008). Yet, gendered effects are not fixed. For example, when men migrate during the rainy season, women often become heads of household (Langill 2020). The place of birth can also shape vulnerabilities. Migrants often live in highly exposed areas, such riverbanks (MIMP & IOM 2015; Rojas-Medina et al. 2008), while knowledge about hazards and coping strategies can depend on the duration of residence (Langill

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[9] More granular data is unavailable. In the district where the *indígenas* live, there are 47 other villages and four urban areas. In the district where the *mestizo* community is sited, there are 34 other villages and four urban areas.

2018; List 2016). External factors can further increase vulnerabilities. Such factors may include demographic growth and resource degradation in areas with limited diversification options, or policies that undermine traditional Indigenous institutions, social cohesion, and disaster risk reduction and management (DRR/DRM) knowledge (Zavaleta et al. 2018).

The available evidence on strategies to manage rainforest floods is robust (whereas prior evidence on hazards outside this study's focus is limited).[10] Amazonian farmers usually can adapt to regular, annual floods, some of which can create benefits such as better access to fishing (Coomes et al. 2010).[11] However, exceptional floods often exceed people's capacities. In one study, 71% of respondents could not do anything to respond to flood shocks to agriculture, which stresses extant limits to adaptation (List 2016). Poor lowland farmers' strategies tend to be limited: they lack upland holdings which are usually spared by floods to diversify livelihoods; are too poor for precautionary savings; lack financial networks for credits; and their few assets which could be converted to money are often destroyed by floods (Coomes et al. 2010). Other strategies to mitigate food insecurity after floods include harvest delay and crop mix changes or shifts (Hofmeijer et al. 2013; Sherman et al. 2015). Engaging in off-farm work, including day labor, is also common (Langill 2018; Takasaki et al. 2004), although not in remote areas (Coomes et al. 2010). Some households invest in basic physical protection such as fortifying shelter, which can offer partial protection but also increase attachment to at-risk flood zones (Sherman et al. 2015). Finally, households in the *Selva* also cope with floods through migration, and occasionally, entire communities are relocated, as discussed next.

Individual and *household* migration is frequent after annual and exceptional rainforest floods. Since these flows are not the focus of this study, this section only briefly discusses them.[12] In many Amazonian settlements, inhabitants have migration experiences, especially if close to urban areas (Langill 2018). Floods

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[10] To react to drought, 58% of the respondents in one study did nothing, while 36% sowed again, see List (2016). Some Indigenous groups use dispersion into the forest and gathering of wild foods to adapt to drought, see Zavaleta et al. (2018). A small number of studies describes strategies to deal with river-related hazards, see List (2016); Manzi (2005).

[11] Flood waters can improve access to and opportunities for fishing, forest product extraction, hunting, and floodplain farming, see List (2016). Although all forms of floods can have positive side-effects, one large survey found that their negative impacts on health, safety, and food provision tended to outweigh positive impacts, see Langill (2018).

[12] These flows are reviewed in detail in my previous work published in Bergmann et al. (2021a).

strongly influence migration.[13] First, in standard flood years, rural dwellers, especially the youth, often migrate for seasonal harvests or urban work during the rainy season, when rainwater constrains subsistence food production (Hofmeijer et al. 2013; Langill 2018). These migrants often use extended family networks for jobs, shelter, and food at their destination (Sherman et al. 2015; Sherman et al. 2016). Consecutive floods shocks and the erosion of traditional livelihoods, however, can also induce permanent migration (Hofmeijer et al. 2013; Sherman et al. 2015; Sherman et al. 2016). Second, contrary to this anticipatory migration, moving can be an "almost-instantaneous response" to exceptional floods (Sherman et al. 2016: 561). After major floods, prior studies report that 6% to 22% of residents migrate temporarily (Coomes et al. 2010; List 2016; Takasaki et al. 2004), and others find that up to one third of residents left permanently to a close-by city for jobs (Sherman et al. 2015; Sherman et al. 2016). Simultaneously, these studies emphasize that many affected people lack social and financial resources to escape hazards (Sherman et al. 2015; Sherman et al. 2016).

In cases when entire poor villages are at risk, *community-wide* migration can occur, which is the focus of this study. While such relocations can improve human security in certain cases (Ferris & Weerasinghe 2020), experiences in South America and worldwide are rife with challenges (Arnall 2019; Bower & Weerasinghe 2021; Cernea 2004; Correa 2011). Past examples in Peru frequently harmed livelihoods and threatened well-being (see review in Bergmann et al. 2021a). Planners often paid insufficient attention to social, cultural, and land issues; infrastructure, livelihood, and transportation necessities; and people's place attachment. Many of the affected people declined to move, returned, or maintained dual residencies. In the *Selva* specifically, relocations, such as an attempted large-scale relocation of a neighborhood in Iquitos, have also had adverse effects (Bernales 2019; Desmaison et al. 2018; Estrada et al. 2018; Lavell et al. 2016; Vásquez et al. 2018).

Despite this conflicted past use, global "momentum is shifting towards planned relocation" (Farbotko et al. 2020: 703) and various Peruvian frameworks embrace planned relocation as a strategic solution to prevent that people settle in risk zones or remove them from such zones (French et al. 2020; Lavell et al. 2016). For example, the Regional Climate Strategies of Cusco and Junín consider it as a priority action.[14] In 2012, Peru adopted a law on relocation from areas with

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[13] Other hazards can also result in migration, yet fewer studies explore these links, see review in Bergmann et al. (2021a).

[14] Original Spanish names: *Estrategia Regional Frente al Cambio Climático Cusco* (Regional Strategy Against Climate Change Cusco, 2012); *Estrategia Regional de Cambio Climático Junín* (Regional Climate Change Strategy Junín, 2014).

"very high, unmitigable risk", one of the rare existing examples worldwide,[15] which covers most areas of action recommended by international guidance, from planning, participation, transfer, and livelihood restoration to monitoring and evaluation (see Bergmann 2021). However, the well-being analysis in section 6.2.3 shows that the road from well-meaning legislation to good practice is still long in Peru.

For future migration flows in Peru's rainforest, the climate projections debated above may have several repercussions. Fewer rainy days but more intense rainfall events, together with intensifying wet season flood pulses and wetness extremes, could create rising needs for relocations and displacements from the many poor villages along Peru's rainforest rivers. Simultaneously, the effects of increasing droughts for migration remain uncertain; people often attempt to cope on-site first but their adaptive capacities may become overwhelmed as impacts intensify (Koubi et al. 2016). People in the *Selva* will suffer from a high risk of occupational heat exposure and deadly heat over extended periods, with likely extreme health risks. Open-air manual labor, currently the norm, could become unbearable while indoor ventilation would be prohibitively expensive for most poor people (Dunne et al. 2013). In addition, the rainforest itself is at risk of dying back or degrading severely. If deadly heat and rainforest degradation combined, they would reduce the habitability of the *Selva* extensively and thereby displace gradually more at-risk groups, such as subsistence farmers. Many others could become trapped. The full migration repercussions of this extreme scenario are difficult to estimate.

In the next section, I analyze how the long-delayed but completed (V3) and the still-stalled (V4) flood-driven relocations from two rainforest villages have affected people's well-being.

6.2   Empirical Results

In May 2019, I interviewed 30 people (14 m / 16f) from V3, which had completed its relocation after years, and V4, which remained in limbo (Figure 6.8). The average (and median) age of respondents was 47 years, with a range of 22 to 62 years (Table 6.1). Most households were similarly poor. Focused on small-holder subsistence crop farming or day labor, they complementarily relied on

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[15] *Ley* N°29869 (Law, 2012); *Ley* N°30645 (2017, Modification); *Decreto Supremo N°115–2013-PCM* (Regulation).

forest and river products. In V3, interviewees produced corn, rice, yucca, plantains, and beans for auto-consumption. Approximately 10% to 20% sold parts of their outputs. Several engaged in day labor, either constantly or as a complementary, temporary activity. Women often worked in housekeeping, helped with farming and day labor, and raised free-range animals. Few households possessed cows for milk production or for converting them into money after shocks. A limited number of households had off-farm incomes, for example through work in transportation services or as civil servants. Similarly, most villagers in V4 were poor subsistence crop farmers with free-range animals. Various of them worked on small patches of land ranging from 0.5 to 2 ha because inheritance mechanisms have reduced field sizes in the growing village. Several farmers have started to produce organic cacao[16] and sugar cane, although their isolated location hampered market access for vending. A few farmers in V4 also fished or hunted, whereas day labor was less common in V4 than in V3.

Figure 6.8 Impressions of the study sites V3 and V4. (Note: The photos by the author depict decaying houses in the abandoned site of V3 (top left) and homes still under construction in the relocation site (top right) as well as a house in the stalled relocation in V4 (bottom left), located directly by a river (bottom right))

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[16] According to a village-level expert, until about 2000, people in the area also produced *coca* due to a lack of alternatives. The government eradicated this production and made agreements with farmers to substitute it with *cacao*.

Table 6.1   Basic data on interviewees from the rainforest villages V3 and V4

Alias	Sex	Age	Main Occupation	Secondary Occupation	Ethnicity or "race"
V3-1	M	54	Day labor	–	*Mestizo*
V3-2	M	61	Day labor	Crop farming	*Mestizo*
V3-4	F	47	Housekeeping	Crop farming	*Mestizo*
V3-5	M	59	Providing services (cab driver)	Livestock farming	*Mestizo*
V3-3	M	43	Providing services (civil servant)	Crop farming	*Mestizo*
V3-6	M	32	Day labor	Crop farming	*Mestizo*
V3-7	F	42	Housekeeping	Crop farming	*Mestizo*
V3-9	F	53	Housekeeping	Crop farming	*Mestizo*
V3-10	M	56	Crop farming	Day labor	*Mestizo*
V3-16	F	52	Crop farming	Selling produce	*Mestizo*
V3-17	F	49	Crop farming	Selling produce	*Mestizo*
V3-18	F	30	Housekeeping	Crop farming	*Mestizo*
V3-19	M	44	Day labor	Crop farming	*Mestizo*
V3-20	M	55	Crop farming	–	*Mestizo*
V4-2	M	37	Selling produce	Providing services (religious leader)	*Indígena*
V4-3	M	39	Selling produce	Providing services (civil servant)	*Indígena*
V4-5	F	46	Crop farming	Free range animals keeping	*Indígena*
V4-6	M	52	Crop farming	Free range animals keeping	*Indígena*
V4-7	F	39	Crop farming	Selling produce	*Indígena*
V4-9	M	35	Crop farming	Free range animals keeping	*Indígena*
V4-10	F	30	Crop farming	Selling produce	*Indígena*
V4-11	F	62	Crop farming	Free range animals keeping	*Indígena*
V4-12	F	29	Crop farming	Free range animals keeping	*Indígena*

(continued)

Table 6.1 (continued)

Alias	Sex	Age	Main Occupation	Secondary Occupation	Ethnicity or "race"
V4-14	F	40	Crop farming	Free range animals keeping	*Indígena*
V4-15	M	58	Crop farming	Free range animals keeping	*Indígena*
V4-16	F	38	Crop farming	Selling produce	*Indígena*
V4-17	F	56	Crop farming	–	*Indígena*
V4-18	F	67	Crop farming	Fishing	*Indígena*
V4-19	M	73	Crop farming	Fishing	*Indígena*
V4-20	F	42	Crop farming	Providing services (restaurant)	*Indígena*

To gather background material, I also talked to staff at San Martín's Regional Office of Security and National Defense (and at provincial and district levels); staff at the Regional Environmental Authority (ARA), its Executive Directorate of Territorial Management, and its Regional Technical Group on Climate Change; as well as mayors, religious leaders, and health post workers in the study sites.

6.2.1 Climate Change Dimensions

When asked which hazards affected their livelihoods, close to all interviewees cited floods (Figure 6.9). They said that V3 and V4 are located directly by two different rivers that cause fluvial flood risk; for V4, surrounding ravines compound such risk during intense rainfalls. More than two thirds also identified weather-driven diseases that harmed people, and about a quarter pests or diseases damaging animals or crops. Finally, about one fifth observed changes in temperature and rainfall.

Respondents in V3 and V4 experience varied types of floods. V3 was affected by single, large floods in 1963 and in 1999. The incident in 1999 was the largest flood the villagers had ever experienced; it caused unanticipated damage and triggered the relocation decision. Heavy rainfall inundated all houses in the village and adjacent fields by as much as 1.5 to 2.2 m:
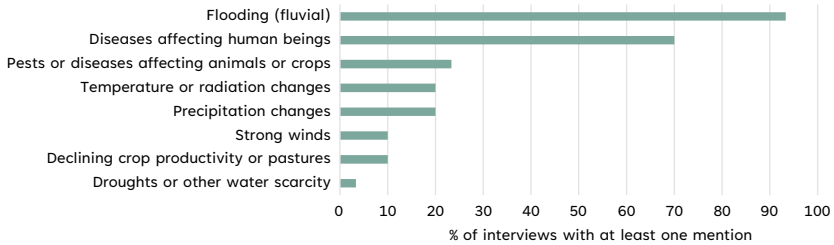
Figure 6.9 Hazards affecting interviewees in the rainforest. (Note: The graph depicts the percentage of interviewed affected people from the rainforest villages who mentioned different types of hazards affecting them at least once during the interviews. Created by the author)

Look, it was winter, the first flood came. We already know, as we have been living here for years, we already know what level the water reaches, what height, and the water came as it should be,… [but then] it has risen big.… The water has entered from above here and it was coming through the mountains, and the worst thing is that we did not see it coming… Yes, 2.2 meters more or less it was… and some houses have been knocked down, and from that time we began to plan to be able to leave, to find a place where we can relocate to, since 1999…. (V3-5)

Conversely, farmers in V4 suffer from partial floods below 0.5 m between one to three times every year, mostly in the rainy season. These annual floods cause damage mainly in low-lying parts of the village but usually develop slowly and leave time to react. Beyond, however, major floods inundated V4 in 1977 and 2015. In 2015, water flooded the entire village in the early morning from the river and two ravines, and the inundation reached 1.2 to 1.6 m:

Can't you see there is a ravine there, the river pushes that ravine over there, and on the other side there is another ravine; they both push each other, and the water comes here, it doesn't come from there but comes from behind… When it comes during the day at least you can move, but when it catches us at night there is no way out, it is not possible and so it has happened several times. I remember one time I was in my bed, and it was cold, and the water was already all over the bed and I was desperate, I couldn't even get out. (V4-11)

In addition, villagers observed rising intensities of rainfall and related mudslides and storms:

Too much rain, too, before it wasn't like that but now… [Y]ou never saw it spilling over the hills, but now yes, the hills are washed down with the rain, floods come from the ravines, from the river. (V4-17)

Moreover, villagers in V3 and V4 perceived changes in timing and intensities of rainfall seasons:

[M]ore or less before, there was what we used to call campañas*, seasons, but now we can't see* campañas *anymore. The weather is crazy, any time it can rain, or the sun shines. (V3-6)*

These shifts have harmed crops:

When the plant is blooming, there may be rainfall of no more than an hour and the next day massive sun, which then causes that plant to produce as if it was burned, and the production is spoiled. (V4-6)

Excessive humidity and more heat have increased pests and plagues, which have severely harmed crops. More heat has also worsened human health and possibilities for open-air labor in both villages:

… [W]e almost live in the agricultural fields, every day, and we feel that there is an immense change, and the rain sometimes exceeds, as well as the warming. There are days when heat arrives that cannot be endured; previously, 15 to ten years ago, we still worked eight hours, we worked normal. Now we only work six hours, we must get up early now, the routine is that we get up at 5am in the morning and we are already arriving at the farm, until 12pm and from there no more, the heat does not allow it… Before, it was minimal, it reached 30 °C, today it reaches 40, 45 °C…. (V4-6)

Further stressors included deforestation in the surroundings of both villages, which some farmers presumed to be the reason behind weather changes. Leaders in V4 reported pressure induced by migrants who extracted wood and cleared forests for agriculture. The village, aware of the importance of healthy ecosystems for their survival, has tried to defend itself against such agricultural expansion:

We say that it is our reserve, and we have to keep it as such… since in the end we are going to live here all our lives, until the day we are going to die… [M]ostly, what we want is to protect our forests as that's where the water springs come from. If we deforest there, we will see no more water. (V4-2)

The lowland, poor *mestizos* in V3 and the extremely poor *Indígenas* in V4 applied different preparation and adaptation strategies for these hazards. Yet, they had limited options for the latest, intensive floods in 1999 and 2015. To cope with the instant impacts, both villages used mutual assistance like food sharing. The few farmers who could rescue animals sold them to finance food:

> *We always raise animals and we had to try to protect them by doing everything possible so that they did not die in the flood… Then [selling] allowed us to sustain ourselves till all that was over. (V4-6)*

However, because many animals drowned, few farmers had assets to smooth income losses, and credits were widely unavailable. To alleviate food insecurity, farmers had to wait three months until the soil dried to sow again, and between three to twelve months to harvest again. Meanwhile, the *Indígenas* attempted to plant fast-growing crops, collected wild plants, and hunted animals:

> *Well, we dedicate ourselves to other activities, for example, fast short-term crops such as beans, corn, … vegetables are also short-term, and then we wait to recover the production that generates more income. (V4-6)*

Farmers in V3 and V4 also engaged in off-farm work, such as day labor.

Eventually, the severe flood damage and the lack of protection options claimed by the state led to the decision to request relocation to safer zones (see section 6.2.2), as a village leader explained:

> *The only option they gave us was relocation… The municipality, when civil defense came, never spoke of riverine protection… It is that the river has moved soil, in that part you can't make a riverine defense. You make a defense, the same flow of the river will eat the bases and it carries it away. (V3-3)*

In V4, after the 2015 flood and delays in the relocation (see section 6.2.2 below), households have started to invest in basic physical protection such as fortifying shelter. These measures may offer partial protection, but have also increased attachment to a dangerous flood zone, and they have drained scarce resources needed for a possible future relocation and rebuilding:

> *… [M]ost here are improving their houses with columns, they are no longer made of sticks, now they are pure concrete columns, so they are making it difficult to leave from one place to another. (V4-9)*

Regarding other hazards such as increasing heat, interviewees explained for example that they adjusted the hours during which they performed outside labor to avoid overheating.

6.2.2   Migration Dimensions

Several migration patterns from the villages are of interest: first, general flows; second, displacement forced by floods, especially in 1999 and 2015; third, return or onward migration after these floods; and fourth, ensuing immobility and relocation processes, as completed for V3 and still stalled for V4.

First, continuous, rural-to-urban migration from V3 and V4 has been mostly driven by economic and educational reasons. However, the number of such migrants has been small, to a large extent because farmers have not possessed required resources, networks, and education for moving.

Second, floods have been a main driver of migration. In V4, unlike in V3, annual floods can displace certain households from houses without second floors in low parts of the village. By contrast, major floods—the latest in 1999 and 2015—damaged many houses and threatened lives in both villages, thus causing widespread *acute* forced migration for *survival*. Even households with basic protection measures in place, such as houses elevated on stilts, were displaced. As the waters rose dangerously high, most of the highly exposed villagers had few choices but to leave:

> In the afternoon, it was the flood; [it was] the first time that the water has grabbed us like this, in a big way, those drains there, all those drains have grown and they have unified with the river and that river has grown very big, and the water has flooded us… my house has been knocked down by the water, we were on the trail for three months…. (V3-20)

Third, flood damages, residual waters, and concerns about more floods impeded return at first. Yet, most eventually returned to their houses because they lacked alternatives. Some older adults felt trapped due to obligations to children and limited job prospects elsewhere. Only 20 families from V3 migrated to cities after the flood due to the losses, hunger, and the lack of development prospects; the few residents from V4 who migrated farther did so temporarily for day labor to support their families.

Fourth, the forced migrants who had returned to V3 and V4 decided to request relocation soon after the latest major floods[17] due to the continued flood exposure and development challenges, the lack of physical protection options claimed by authorities, and the lack of aspirations or resources to migrate farther away. In response, the state declared the villages as areas of "very high, unmitigable risk", in line with Peru's relocation law. However, only V3 relocated in 2014, after having waited for 15 years, whereas the relocation of V4 has been stalled since 2015, as is explained next.

6.2.2.1 Initial Displacement, Entrapment, and Completed Relocation in V3

After the 1999 flood, the farmers' initial, *acute* displacement in V3 lasted between one to twelve weeks, depending on damages and related return possibilities. Poverty hindered movement to safer zones farther away and most fled over short distances to a nearby trail at first. Many villagers had no choice but to return and live in the damaged homes for weeks once the flood waters had receded.

Due to the experienced damage, fear of future floods, and the lack of physical protection possibilities, residents soon decided in community meetings that they needed to relocate to a nearby, higher area (*anticipatory* forced migration). The village and staff at Civil Defense made a relocation plan. While personal leadership of a governor helped initiate the relocation, later governance failures and poverty obstructed the aspired relocation greatly. Because the state did not provide land for the relocation, the poor villagers ended up trapped and struggled for over ten years to acquire needed land privately. Meanwhile, people suffered from continued hazard exposure, uncertainty, and mental health burdens. Subsequent movement depended on people's resources: only few wealthier families migrated to other places; those who had experienced moderate flood damages and had been able to rebuild stayed to wait for relocation; and the households most affected by the flood already moved to nearby zones out of necessity, often under *survival* or *distress* conditions:

> *…We have left little by little. Someone already built their house, from there, another one made one, and thus gradually one could see that [the houses] were forming and the largest share began to leave… They were already building their little houses here because they were the most affected…. (V3-15)*

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[17] Aspirations to change settlements due to the floods had existed for a long time. After major floods in 1963 (V3) and 1977 (V4), respectively, younger villagers had already argued in favor of relocation, but met resistance by older residents who favored the proximity to the river and the continuity of their habits.

After years in suspension, the villagers eventually succeeded in swapping land with a local agribusiness. Once the new land—around 700 m from the previous site and on higher grounds—was secured, movement again proceeded gradually in function of resources, and mostly under *distress* conditions. The first villagers moved in 2011 and slowly started constructing shelter. Others who lacked money for rebuilding relocated as late as in 2017. In mid-2019, when I collected the data, all residents had relocated. Although the state had still neither issued the final resolution to register the relocated site nor approved a land-use change, which caused problems, most farmers perceived the relocation as a *"good decision"* (V3-1) and aspired to stay in the destination (see section 6.2.3).

The relocatees have maintained limited connections back to their previous, nearby settlement. The houses on the land transferred to an agribusiness were decaying and a few farmers used them to raise small animals. Some reported that they still periodically visited the old cemetery. Others, especially older residents, still nostalgically spent time by the riverbed and used the river for bathing.

6.2.2.2 Initial Displacement, Stalled Relocation, and Prolonged Entrapment in V4

V4 has suffered from slow, annual floods that can cause short-distance displacement, typically from homes in low-lying zones to houses of unaffected relatives or to huts in uphill fields. While such floods can cause ample damage, they normally do not last long and only drive short displacements.

By contrast, the exceptional flood in 2015 *acutely* forced all villagers to flee. Most either walked or went by boat to their field huts or to the hills and spent between three to eight days there before returning. Several households also had to remain on the second floors of flooded homes for days:

> *We went upstairs, to my brother-in-law's house…, they have a second floor, there we go up with all the animals, like Noah [laughs]… [T]here were eleven [people] plus the animals [laughs]… [The floor is] more or less 32 square meters… [and we spent] eight days there. (V4-5)*

Most of the farmers stayed in the flood zone because they lacked resources to live elsewhere, or expressively desired to stay in their community and their native land. Few families left V4.

Instead, most residents aspired to relocate as a whole village to a nearby safer zone. In a meeting after the 2015 flood, villagers as well as district and Regional authorities agreed to relocate (*anticipatory* forced migration) to an envisaged territory that is elevated, safer, and close to the village and fields. Farmers decided

to relocate because they feared new major floods; suffered from annual floods which perpetually interfered with development; and hoped for a better future for their children:

> About the relocation, the idea emerged because this village floods a lot, so the idea came up of wanting to live better. And thinking about the children, to be able to put the children in a zone so that they no longer suffer as we have been suffering. How much have we suffered, since being children we have suffered with the flooding, that's why the idea came up. (V4-5)

Only a minority aspired to stay, noting that they would miss the proximity to the river where they had grown up. Others were afraid of the costs of moving; that it would take time to receive basic services; that the state would not support them; and that new lots would be too small. Some worried that diseases like dengue might be more common in the new zone, and that the area, although safer from river floods, could still be exposed to floods from ravines (see section 6.2.4: Outlook on the future).

However, governance failures and poverty have hindered the relocation so far. The *Indígenas* expressed frustration that the Regional government had promised the major share of funds for acquiring land for the relocation in 2015, but has not delivered since, seemingly due to changing staff and priorities in an ineffective bureaucracy. Further aggravating the problems, the owner of the most fitting land inflated prices to exploit the opportunity for government money. Authorities have not adopted the suggestion of technical experts to expropriate with compensation at real costs, as permitted by Peru's relocation law. The extremely poor farmers have been unable to afford to buy own land or to migrate individually to safer grounds, and most of them would only be able to move if land was free of cost. In the meantime, hardly any households could afford to buy lots in the envisaged destination individually, and even these households lacked money to build new houses.

Village leaders remarked their legally guaranteed participation rights in the relocation have been infringed. Simultaneously, they have lacked access to the political system to make their case, and regularly traveling to the capital was prohibitively expensive. In 2019, the *Indígenas* said, *"It's been four years now and we have hardly advanced at all"* (V4-2). They felt like *"going in circles, you are trapped"* (V4-3) and neglected: *"When there is a flood, they tell us that relocation is going to happen; when the flood has passed, they have already forgotten again"* (V4-10). Families complained about the lack of support from the authorities, whom they accused of indifference, cheating, and corruption:

> *As I say, here in Peru, the government has money to support us but the only thing they do is for themselves, they only think about themselves. Why do you think that several governments are in jail?… [T]hey steal more, clearly, and nothing more, little and nothing are they interested in the people here in the village. Many times you trust them, that that guy is going to become president and things are going to change; and that happens with many authorities who enter [office], even here in this very town. Compatriots, people from here, who know our reality, become authorities, only to suddenly make profit for themselves, for their own accounts. (V4-20)*

The accumulated obstructions ended in one incident where frustrated villagers refused to let go state representatives after a meeting to press the Regional governor to fulfil his promises. The act, which the state perceived as hostage taking, hardened lines. As delays in the relocation process have extended, more people have expressed doubts if an eventual relocation would guarantee acceptable outcomes. Although a few were becoming too frustrated to move, most retained hopes that relocation would improve their plight (see section 6.2.3: Outlook on the future). Many stated that, *"If the village tells us we are going to leave, we will leave"* (V4-11). A mother in her mid–50s explained, *"I already think about staying, but if they would all leave now, we would leave"* (V4-17).

6.2.3 Well-Being Dimensions: Migrants from V3 After the Belated, Completed Relocation

In the next subsections, I analyze how these two flood-driven entrapment and relocation processes in Peru's *Selva* have affected people's well-being and apply the four axes developed in section 2.3: *development from a secure base, a space to live better,* and *social relatedness* (objective well-being, OWB), as well as *subjective well-being* (SWB).

6.2.3.1 Development from a Secure Base
6.2.3.1.1 Decent Livelihoods
Climate change has severely harmed livelihoods in V3.[18] The major flood in 1999, in particular, destroyed most of people's agricultural assets: *"[A]ll the fields have been destroyed; animals, cattle, pigs, sheep, all have been washed away by the river"* (V3-10). Sowing new crops and harvesting again took up to one year and

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[18] While not the focus here, villagers said that changing rainfalls, humidity, rising heat, and greater intensity or new types of pests and plagues have also damaged crops, and more heat has restricted the possibility to perform outdoor labor.

meanwhile, residents had to switch their livelihood activities. They lamented the shortage of humanitarian assistance and alleged that corruption impeded recovery.

After the flood, the farmers requested to relocate and succeeded in doing so after a long time. In a lucky coincidence, they received access to jobs in a private canalization project when the relocation started, which temporarily lifted their incomes and supported the reconstruction (see section 6.2.3: Adequate housing). After the project had finished, most villagers returned to farming as they lacked alternatives.[19] Nonetheless, various farmers stressed that the relocation has improved incomes, because the new, nearby land was both close enough to their fields and directly by a street, which made it easier for them to sell their products and get hired for day labor (see 6.2.3: Basic services). Many perceived economic gains because the improved street access also enabled them to benefit from an overall increased labor demand:

> Well, we are happy because there is work, we do not lack work… [H]ere they look for [day labor for] corn planting, far from other places [they come] to look for peons, whereas there in [the old site in] the back, as it was in the back, people did not enter. (V3-17)

Although the relocation has improved access to jobs and markets for most farmers, agriculture and day labor still only yielded unstable and precarious incomes only just enough to survive or support their children. Purchasing power has not increased because higher costs of living evened out gains:

> Yes, since we have grown up until now, we have been day laborers… [A] small part has changed as down where we lived before, we lacked someone to come and invest, to be able to earn. Now there are investors in papaya, rice… [There is] a little more work, but not to earn enough, no, if not to support our children at least…. (V3-19)

> … [S]ometimes there are no jobs. Here we only work to eat no more, sometimes there is nothing, well … We have an adolescent who is studying, sometimes we have to send him his little money … because there is no job, you cannot get money together. (V3-12)

A minor challenge for livelihood restoration emerged from the relocation planners' limited attention to people's lifestyles (see section 6.2.3: A space to live better): the newly designated, smaller lots complicated traditional activities like raising free-range animals and producing vegetables.

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[19] A marginal number of villagers started new activities, such as driving small cabs, which improved household income.

6.2.3.1.2 Health and Food Security

The 1999 flood greatly affected people's physical and mental health and raised burdens of infectious diseases and trauma (see also section 6.2.3: Emotional balance and cognitive satisfaction).[20] For example, after the flood, villagers *"fainted in despair, they fell ill from the humidity"* (V3-19) and the *"children cried with fear, we have never seen [that before]"* (V3-7). Anxiety persisted for long:

> *… [O]ver there the river grew, we could not sleep, [thinking that] suddenly the water will carry us away, like we have seen before. Well, young man, the water has come, and that made us afraid. When it rained for weeks, we were frightened. (V3-17)*

The flood's destruction also harmed physical health and food security for long. The mayor detailed that the village had suffered two years of famine until the agricultural production recovered. In addition, the time-consuming rebuilding of shelter during the relocation challenged people's health (see section 6.2.3: Adequate housing). At the time of the interviews, various houses still lacked solid walls and exposed people to the weather. Views on the quality of health service provision in the new site were divided, but people perceived that basic infrastructure and materials had worsened compared to the old site. Unlike before, villagers could not afford to build a health post but only rented a shed for health services. On the positive side, the better road access simplified traveling for health services.

6.2.3.1.3 Educational Opportunities

After relocation, the villagers had to construct a new school in a community effort and with their own resources. When interviewed, they stated that the service quality had reached a similar (low) level as in their old site. Yet, because authorities had still not officially registered the physical relocation (see 6.2.3: A space to live better) and thus new funds were pending, the facilities remained inadequate:

> *The infrastructures down there [in the old site], initial, primary school: everything was well made, of noble material, and here today … we do not have a good infrastructure. We have done everything with the efforts of the people, like this, we have done it jointly by ourselves, to be able to have at least something… We have built it, but it is somewhat rustic… as I say, when the supervision of the UGEL comes [Directory of the Local Educational Management Unit of the Ministry of Education], the first thing they see is that the infrastructure of the facilities is not adequate. (V3-3)*

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[20] Hotter weather has raised further health challenges, for example when performing open-air labor (see section 6.2.1).

After relocation, improved street access eased commuting for pupils who attended schools in other towns (see 6.2.3: Basic services). Still, many farmers dreamt of a better future for their children (see 6.2.3: Outlook on the future) but could not afford costs for higher education. For example, a farmer hoped his children could *"progress* [salir adelante]*",* but also noted, *"Right now we don't have more options to enable them to study the careers they want, the economic means are just low"* (V3-11).

6.2.3.2 A Space to Live Better

Years after relocating, the state had still neither issued the final resolution to register the relocated site nor approved a land-use change from rural to urban. Both steps were prerequisites for receiving property titles and thus access to social programs, such as housing support, as envisaged by law:

> *In February 2018, we already made the full submission, all the documentation for the relocation plan, so that we can finally be registered. Almost a year and a half have passed and nothing… [T]he PCM [Presidency of the Council of Minister, responsible government entity] over there are messing up and we have nothing…. (V3-3)*

The interviewees cited a lack of political will, interest, and skilled personnel, rotating functionaries, as well as competing priorities of authorities in attending disasters as reasons for the delays. Lacking the means to make their voices heard, the villagers felt that, *"[We] are not recognized on the map, we are separated from the map, that is why we cannot have any support; … it is as if this village would not exist"* (V3-6). People were disappointed with the authorities who failed to support them:

> *Yes, they [the officials] have arrived but they have done nothing, they came to talk, talk no more, but we do not see anything, more than five years and we have no answers, there is no support for anything even though they know about the situation. (V3-6)*

6.2.3.2.1 Adequate Housing

The flood in 1999 severely and lastingly damaged shelter: *"At first it was uncomfortable, we had nothing, even now all we have is thanks to our sacrifice, we had no electricity, we had no water, and the houses were tents"* (V3-3). As the state cleared and plotted the relocation land but never delivered promised rebuilding support, many farmers could not move for long. In a lucky coincidence, they received access to jobs in a private canalization project (see section 6.2.3: Decent

livelihoods). The farmers used this income to slowly rebuild their houses without the legally promoted state support:

> … [F]rom there, we have started to improve our houses, make our houses bigger… and with better materials than before… Without [the construction jobs], now we would still be in tents…. (V3-3)

By the time of the interviews, most homes still had dirt floors, but other outcomes had diverged: various farmers had larger houses with improved materials such as bricks, whereas others lived only in makeshift housing, some of which consisted of scaffolding and blankets instead of walls. The inadequate shelter caused hardship especially for older, younger, sick, and pregnant villagers:

> First when we came, we went covered with blankets, when we arrived, as there was no money…. It costs a lot, two years ago we have just succeeded in building our house… We suffered like this, the wind was strong, even our mattress was wet… We cried, one suffered here. Little by little my husband has been fixing the house … Little by little then, you can't do things like that if there is no money. (V3-7)

Finally, the relocation design paid limited attention to people's lifestyle: the new lots are smaller, which complicated traditional activities close to the house, such as raising free-range animals.

6.2.3.2.2 Basic Services

At the beginning of their relocation, villagers lacked light, water, and other basic services, which complicated the transition. Some farmers needed more than a year to grow used to the new situation. Because promised service improvements were delayed, the community staged demonstrations to demand change. Over time, various services became available and some of them, such as light, improved compared to the previous site. Yet, the villagers were disappointed that they were still worse off than other *"modern villages"*, and said, *"We want to live as others live, to have what others have, basic services"* (V3-3). They felt that the state had lured them into relocation by promising better services but never delivered, and complained that progress resulted mainly from their own efforts:

> There we are still, just surviving. To us, they painted everything in bright colors in the relocation plan, to come and live here… They said they were going to build us our houses, that from the moment we make the relocation plan, they are going to give us our infrastructure, health post, kindergarten, education but… the grand people who came from CENEPRED [institution in charge of relocations], from the government,

they practically deceived us. Until now, it is a deception, young man… Then, seeing that we do not have support, the people took the reins of work, with the sweat of our forehead. All we have, what little we have, is thanks to ourselves. (V3-3)

Concerning water, the farmers had to use the river water for consumption in the previous site, which caused a small number of cholera cases. After relocation, they initially lacked water:

The first days, it really looked difficult when there was no water or light here, it felt uncomfortable, well, but right now we are calmer here. When there was no water and electricity, water was to be brought from afar, it is not like when you have water at home. (V3-7)

Tubes for river water were installed one year after relocation, but the quantity has occasionally been insufficient, and farmers needed to buy drinking water from costly external sources. Similar as in the old site, they lacked sanitation and sewerage systems, yet the new, smaller lots worsened the situation because people now lacked space for wastewaters and their bathrooms were susceptible to rainfalls:

The big difference was that down there we had very large lots, that is, we could build silos wherever we wanted. Currently our lots are only 10x20 meters and the smallest thing you can do for the bathrooms is 4x4 meters, not 3x3 meters, but with the rains the grounds are muddy, they currently are collapsing. Some residents have up to three catholes in their gardens, there is no more space. (V3-3)

In particular, the associated health risks have caused hardship for at-risk groups. Due to the lack of drainage, rainfalls also often created small ponds breeding mosquitos and infectious diseases.

Conversely, electricity has improved. In the old site, farmers had used candles and generators for a few hours of electricity and light per day. One year after relocating, they received electricity. Yet, they had to build much of the infrastructure for light themselves due to the limited state support:

Everything we want, we pressed ourselves… In 2014, when people began to come, there was no light here… [W]e put up the poles with the support of the people, we provided the labor…. (V3-3)

Next, the reduced distance from the street after relocating positively affected well-being. The close-by road facilitated traveling for health services (see section 6.2.3: Health and food security) and eased commuting for pupils who

attended schools in other towns (see 6.2.3: Educational opportunities). It also improved access to markets and jobs (see 6.2.3: Decent livelihoods):

> *Here, then, [we are] much better, do you know why? Because here they come to sell everything, we live near the track. Because living over there in the back, nothing was going to sell. (V3-17)*

Finally, street access also decreased perceived isolation and disconnectedness. As a farmer remarked,

> *It was different over there because the village was isolated, and now it can be seen… [We're in] a more visible part, because before we were like forgotten in the back, nobody saw us…. The town was isolated… [W]e are better located, closer to the road… Here it is already an 'urban' area. (V3-3)*

6.2.3.2.3 Pleasant Surroundings

The natural environment in the new site was largely unchanged apart, from a slightly larger distance from the river, which some villagers missed. The farmers seemed mostly satisfied with their rural surroundings and nature, noting that, *"They way we live, it seems fine to us"* (V3-15). After relocation, some villagers praised the more condensed design in the new site and stated, *"Now the town is more orderly, the houses, the streets are [well-]designed"* (V3-10). Yet others missed the proximity to their farmlands, free-range animals, as well as the previously larger, natural and recreational spaces:

> *We had more space, we were able to recreate, more than anything under the trees, in the gardens there … We no longer have that, we cannot plant trees here because it takes up space… So right now, here we have more heat… over there was fresh air, now not anymore… [It is] more closed, oppressed … The birds no longer come [laughs]. (V3-6)*

Yet even the unsatisfied farmers conceded to the change, *"Since that is how they have distributed us … but what are we going to do, if they have given us [lots] like this, we have to accept [it]"* (V3-18).

6.2.3.2.4 Safety from Hazards

The relocation achieved its central goal to move people out of the dangerous, low-lying flood zone directly by the river.[21] The destination site—higher and farther away from the river—remains largely unaffected by rainfall. A woman explained that, *"Well, compared to before we feel calmer now. At night, we no longer think that we are going to flood [nervous laughter], calmer we do feel here, yes"* (V3-7). According to the mayor, minor exposure to hazards resulted from smaller pluvial floods and overflowing canals due to drainage problems, but impacts had reduced thanks to new protection:

> *Floods? Not anymore, only when it rains too much it floods us, it floods us from here, from what comes out of a canal… [but] it is not the same as the river. When the river grows, it floods us all… It always overflows, but it doesn't reach us here…, yes, it overflows, to the [previous site of our] little town, but not over here. If we were still in that village, until now the river would affect us… Little by little we have been adjusting. When we came for the first time [to the new site] we had no drainage, the entire lower part was flooded again and we had no experience with that flooding; and we gave it a solution with drains but there is still much to do anyway, it always floods, but not in exaggeration. (V3-3)*

6.2.3.2.5 Security

In V3, the floods and the relocation did not lead to security threats and the farmers felt safer than before. As the old village had been *"quite isolated"* (V3-16) and farther from the road *"armed"* men had sporadically threatened them. Now, *"They no longer enter like that as we are close to the road"* (V3-7). A woman explained that the availability of light had also improved their security (V3-19).

6.2.3.3 Social Relatedness

The villagers observed that they had continuously lived in unity in their moderately-sized village and relocation has had marginal, positive effects on relationships. The social system has been conserved since all farmers relocated and they clustered in spatially similar ways as before. The villagers have maintained their customs, and most were happy about the continued good coexistence with neighbors and larger community: *"Yes, we live in peace, we do not have a bad life, here in this village, we live pure families. Over there, it was the same"* (V3-9). Neighbors were in closer and more regular contact due to the dense clustering

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[21] Moreover, farmers felt safer from wild animals, yet the proximity to car traffic meant more risk for their own animals.

of the houses compared to their prior scattered, larger lots. Additionally, the better availability of light (see section 6.2.3: Basic services) enabled more meetings and thereby contributed to relationships. The better road access also facilitated better connections with contacts in other cities. Assertiveness and solidarity have continued, and people have used established support systems like food sharing, mutual support for the sick, and reciprocal harvest assistance.

The challenging relocation process has further unified V3. Their unity and community action have been key drivers of progress: villagers had to make efforts to find land themselves (see section 6.2.2) and after relocating, they staged demonstrations to express their disappointment with initially missing infrastructure and services (see 6.2.3: Basic services). People's relationships also benefited from the need to work together as a community to reconstruct the village. With little external support, people across age and sex groups have given free labor for community tasks like earthworks and rebuilding the school and parish hall. Villagers have fought to realize the relocation and to avoid some of the worst possible risks with their own *"bare fist, with the sweat of their foreheads, all the residents collaborating … [while] the state has not given us any support"* (V3-3).

6.2.3.4 SWB Dimensions
6.2.3.4.1 Emotional Balance and Cognitive Satisfaction
In V3, respondents suffered for long from the losses and havoc wreaked by the flood in 1999. Many reported trauma and continued anxiety:

> *One lived with that fear, that at any moment water will flood us; suddenly, when one is sleeping, the river can flood us like this. We have lived terrified with that. (V3-16)*

By contrast, most interviewees reported relief and joy that the relocation had greatly reduced exposure (see section 6.2.3: Safety from hazards). For example, a female farmer in her early 50s and mother of three children explained, *"[W]e no longer live thinking that the river is going to flood us, we live more calmly, we sleep calmly, unlike before…"* (V3-16). Like her, most respondents named decreased exposure as a primary reason that they felt more satisfied with life and had more positive emotions. They also cited similar or better social relations, improving living standards, as well as reduced isolation. For example, a female farmer stated that she was *"well, much better here"* given the improved road access, and felt *"calmer"* as well as *"happier, now that there is more work"* (V3-17).

While some respondents felt pleased from the start, many others described initial sadness to leave their homes: *"I, from over there, from my little house, I came crying when I left my house, the work of my husband"* (V3-10). For many,

especially older adults, it took long to grow used to their new homes, often due to the arduous reconstruction and the delays in improving basic services (see 6.2.3: Basic services). They said *"leaving our home, living in another way"* made them *"worried"* initially, but they had come to feel *"now calmer, more amazed at life"* (V3-6). One respondent had been *"sad for more than eight months"* after relocating but now felt *"calmer, all of us are used to it"* (V3-20).

Conversely, other farmers reported that their cognitive satisfaction had not changed. For example, a mother of two remarked that it was *"almost the same, really"* as before (V3-14)), despite slight economic advances and better accessibility thanks to the relocation, which she welcomed.

However, people also voiced frustration, anger, and disappointment due to recurrent governance failures (see section 6.2.3: A space to live better): *"They have not given me any support, that is why I have said that I am resentful…"* (V3-16). The mayor criticized that, *"All entities have come—health, education, energy, transportation—each and everyone has made a commitment, but everything was pure blah blah blah"* (V3-3). They felt tired and upset by the delays and alleged corruption:

> *Three years is already too much. Sometimes, it seems to me that they give little importance to small villages; in large towns… they already have water, drainage, everything. Only here we are obstructed… we do not have any kind of support… There is a lot of corruption, that's why I say heck…. (V3-19)*

6.2.3.4.2 Outlook on the Future

Various respondents did not think about their own future but focused on the lives of their children, for whom they desired to receive a better education to progress (*salir adelante*) (see section 6.2.3: Educational opportunities). A male farmer and day laborer, father of two children, explained that,

> *Well, for me to have a future later? No. I [think] of my children, to make them study, to give them the studies they need. When a child wants to study, we have to give with what we can, even by selling my pants [laughs]. That's my idea, my thought, for my children. (V3-19)*

Others felt hopeful that they could progress and life well in the future because the relocation had decreased exposure and improved development prospects (in combination with the better overall economic situation). Especially the idea of progressing (*salir adelante)* thanks to the new location was omnipresent and appeared like a genuine hope. For example, a farmer stated he felt *"more hope"*

and more *"progressing"* compared to before, *"Not over there, they [the authorities] didn't even want to support us with anything, they told us as long as you don't leave from there, there won't be any support, so they told us"* (V3-7). Others were optimistic that the land issues would be resolved and receiving titles would then improve access to social programs, basic services, and development. Character and faith also influenced outlooks. For example, a buoyant farmer sighed due to the costly rebuilding of shelter without support yet still felt *"more hope for the future"* than fear (V3-16). Conversely, the continued economic insecurity worried many farmers and especially day laborers:

> Unfortunately, there is no such thing, there is no money. Here everyone is day laborer, they earn their 30 soles, 40 soles a day here… Nobody has more, we are all in the same condition. (V3-15)

6.2.4 Well-Being Dimensions: Aspiring Migrants from V4 in Prolonged Entrapment

6.2.4.1 Development from a Secure Base
6.2.4.1.1 Decent Livelihoods
In V4, annual floods have repeatedly strained livelihoods to a certain degree. By contrast, the major flood in 2015, which triggered the decision to relocate, resulted in severe and long-lasting damage, especially in lower-lying parts of the village. After the floodwaters had receded, many villagers returned to subsistence farming, but coping with the losses has proven difficult (see section 6.2.1):

> It [the flood] took all my belongings… The crops are lost, it is totally lost… All, all is lost because when the corn floods, it does not flower, nor does the corn plant appear, all of it is water… [B]ecause when you go to the land, you only see mud… We almost nonstop lose the crops… This is how it happens, we work, I sell my *juanes* [traditional food] anyway, the husband works daily, from there we gain money for food. (V4-20)

When interviewed in 2019, various farmers had still not recovered. Only the few, less exposed persons said that incomes had not changed much. Few villagers were pleased with the received state support, and many criticized that it was insufficient to relieve damage and enable recovery: *"They do not support us … they have given us nothing and a grain of sand, … they have forgotten us"* (V4-10).

Because the relocation was stalled, V4 has remained at risk of a new major flood and its lower-lying parts have continued to suffer from annual incidents. The repeated flooding has prompted a downward spiral of poverty that has left

households with minimal room for economic maneuver. Farmers feared having to trade off priorities—such as money for protection measures against money for education—and worried about the costs of rebuilding houses after a possible, future relocation.

6.2.4.1.2   Health and Food Security

Because many *Indígenas* lost their crops in the flood in 2015 and could not harvest or earn income that year, the flood triggered a prolonged period of hunger:[22]

> *Yes, we have suffered lots [sad]. When you find yourself like this, you can't even go grocery shopping, you can't do anything, not even cook… [W]e have been without eating all day….. (V4-11)*

Flood water puddles increased mosquito breeding and left *"a large quantity of diseases"* (V4-10), including: *"[F]lu, bone pain, infections… conjunctivitis, diarrhea, stomach pain… It is a depot of mosquitoes [nervous laughter]… [I]t was too much, you come and they finish you [laughs]"* (V4-6). Additionally, water contamination after spills of wastewaters and bathrooms led to diseases:

> *The impacts of the flood? That's what comes, well, diarrhea from the consumption of water that is not treated and from mosquitoes… [I]t is an area that is flat…, and there are many infectious puddles left there, of course mosquitoes reproduce there…. (V4-3)*

The flood also severely harmed mental health and led to anxiety, trauma, and sadness (see also section 6.2.4: Emotional balance and cognitive satisfaction): *"Sure, more than anything [we were] afraid, nervous. You do not know the amount of water that comes, well, how can you not be afraid?"* (V4-10). The health risks were most severe for children: *"Clearly, [I feel] anxiety of the diseases, it [the flood] leaves a terrible flu, we get sick a lot, much more than anything the children"* (V4-11).

Past floods also damaged the health post and obstructed service provision; after such events, needed travel to health centers elsewhere posed financial obstacles for the poor villagers. The stalled relocation has led not only to continued exposure to flood-related health threats but further aggravated them: after V4 was declared a high-risk zone in 2017, the state canceled planned upgrades for

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[22] In times without floods, residents assumed their food security was better than that of urban dwellers, since they had their own food production: *"In the city, if it is not for money, you don't eat; but here, we produce and eat"* (V4-19).

health and health-related infrastructure, such as sanitation, because Peru's reloca-tion law forbids public investments in such zones (similarly for 6.2.4: Educational opportunities, Basic services):

> *Now, I tell you this is the documentation that the district mayor gave us, declaring [V4] as an area of high, unmitigable risk… That's why now we don't have investments here in the village. (V4-2).*

> *Water, school infrastructure, the health post is not being built. In 2017, we were going to build our health post…, and it was not done… No investment, nor support; our water and sewerage was going to be done here in [V4] in 2016 and it has not been done due to relocation. (V4-3)*

The *Indígenas* hoped that once they would secure new land and relocate, health investments would become possible. Yet, a few farmers also feared that the new site might raise risks of infectious diseases such as dengue: *"[B]ecause according to what I hear, there are mosquitoes… more than here, where there is a season that mosquitoes arrive. But not there, there, it is every day"* (V4-10).

6.2.4.1.3 Educational Opportunities

The intense flood in 2015 seriously damaged school buildings and induced a closure for several days: *"Everything is muddy, we have to clean it up, that's why even the school on this side is already falling apart, it is already collapsing"* (V4-5). Villagers had to take their children to the cities for schooling. Due to the stalled relocation, flood exposure has continued, and lower annual floods still interrupt schooling for days to weeks. Moreover, infrastructure investments, including for education, stopped after V4 was declared a high-risk flood zone in 2017, while the young population has kept growing:

> *… [I]n 2016, we were going to build our educational center and it was not done either… What was removed is the investment that was going to be there, for… the improvement of the construction of the educational centers; that is what they took from us. (V4-3)*

Nonetheless, farmers hoped that a later relocation would improve education: *"Yes, it is decided to leave… for the safety for the lives of our children, because they need to have a good school"* (V4-3).

6.2.4.2   A Space to Live Better
6.2.4.2.1 Adequate Housing

After the 2015 flood, rebuilding homes proved difficult for the poor farmers, while inadequate housing caused health issues and exposed them to adverse weather. Given the delays in the promised land acquisition, a few more affluent households started to fortify their homes in the flood zone against future hazards (see section 6.2.1). Yet most farmers lacked such options; they kept hoping that an eventual relocation would reduce their exposure and facilitate a safer life in better shelter:

> *Well, over there, the houses will no longer be flooded… [I] even [have] a hope of fixing our home, living like in a city, having our bathroom, our nice shower. (V4-5)*

Yet the poor *Indígenas* also worried about the costly rebuilding after a possible, eventual relocation. Officials promised support once land would be secured and titled, but the weak governance experienced to date made farmers doubt if they would receive social support needed for reconstruction even if they relocated finally. Most also worried that the relocation would decrease the sizes of their lots and thus impede small-scale agriculture, such as raising free-range animals nearby.

6.2.4.2.2 Basic Services

After the state had declared V4 as a flood zone in 2017—a step required by Peru's relocation law—it stopped promised investments in basic services on-site but failed to acquire land after that. As a result, the prolonged entrapment has resulted in decaying infrastructure and increasing vulnerabilities.

Concerning water, the villagers continued to rely on tubed water from surrounding ravines and rivers. Water was always available but in insufficient quality and caused diseases if not treated for consumption. Entrapment worsened the situation, as a village leader explained, since the withdrawal of investments perpetuated unhygienic conditions and forced the poor farmers to rely on catholes:

> *Our water and sewerage were going to be done here in [village] in 2016 and it has not been done due to relocation…, that is what they took from us. (V4-3)*

Conversely, forced immobility did not change people's access to electricity, light, and transport. The village remained reachable mostly by boat as a nearby track

was in a poor state and impassable during the rainy season. People hoped that relocation would finally improve their market access:

> *Yes, [access] is a bit difficult because the road is lousy again … It complicates, the [selling of] products, more than everything…, it would also help us to get our products out… [S]ometimes in winter we cannot bring [them], the flood interrupts us…. (V4-2)*

6.2.4.2.3 Pleasant Surroundings

The farmers did not notice changes in their surroundings due to the prolonged entrapment. Most continued satisfied with their natural environment and agricultural activities, which they considered as safer, calmer, healthier, as well as more water- and food-secure than city life:

> *Yes, it is more peaceful than living in the city, it is better here… In the city, you see every day that they kill each other, they disappear, and here – calm. You go to your farm, you are on your farm in the afternoon, you return relaxed to your house, you rest at night, untroubled. (V4-9)*

> *I like the tranquility of the village, that silence at night, the pure air. We can't have [tap] water but we go to the ravine. On the other hand, in [the district town] there is no water, it was a desperation and it is hotter; not here, it is cool here…. (V4-20)*

However, villagers also stated that the beauty of V4 in the dry season was overshadowed by the dangers of the rainy season: *"Yes, it is beautiful. What happens is that here when it is summer, everything is beautiful, but when the flow of the river comes, it worries us a lot …"* (V4-2).

The opinions of the envisioned new site diverged. Most farmers looked forward to more safety and calmness; they hoped to *"make a modern community, more properly ordered, to be able to live a calmer life, we want to improve the quality of life"* (V4-2). Only a small number of older residents explained that they would miss living next to the river and related activities, such as fishing.

6.2.4.2.4 Safety from Hazards

The main goal of the envisioned relocation of V4 was to decrease people's exposure to annual and exceptional floods. Because their favored site was in an uphill area, sufficiently far away from the riverbed, most farmers expressed hope that a relocation would greatly reduce exposure: *"That [site] is higher… The flood does not get there … They told us that it is almost 700 or 800 meters high or something like that…"* (V4-2). Only few worried they could still be exposed to floods, stating,

"There is also danger, there are ravines that can flood, and there are two ravines over there too" (V4-17).

Still, due to the delayed land acquisition, flood damages have continued to undercut development and the risk of a new major flood has instilled fear. While many still hoped to relocate (see 6.2.4: Outlook on the future), others had resigned due to the constant delays and the recurrent misery:

> *You are afraid, every year it floods, that is my way of thinking. For me, it is as if I were already used to the losses… [We feel] less safe because any time, it can happen. (V4-20)*

6.2.4.2.5 Security
People reported that the prolonged entrapment has left their security situation unchanged. Security was mainly guaranteed through citizen patrols (*rondas*) and people felt safe in the village, where they enjoyed *"that we are at peace, there is not much corruption, there is no robbery"* (V4-9).

6.2.4.3   Social Relatedness
Social relationships in the small village were positive. Farmers appreciated the existing solidarity mechanisms and mutual support systems, such as food sharing, which allayed flood impacts.

> *… [A]ll the residents, the neighbors bring what is in the house, banana, rice, beans, it can be a fish, or it can be a portion of meat. All the residents who are typically affected in this village collaborate…, really all the people made an* olla commún *[common food pot]…. (V4-16)*

Farmers also provided labor for communal tasks, such as mutual help in sowing and harvesting. Their entrapment seemed to have left social relationships unchanged or marginally improved, because the *Indígenas* have had to coordinate and fight together for progress. As a village leaders explained, *"There is no divisiveness … of course, we are a united community and that is the objective … It has not changed [after the flood], it continues its course like that"* (V4-2). For the relocation process, farmers still used village-level decision-making mechanism and assemblies. They enjoyed *"to live well with my family, live well with my neighbors, and not to argue"* (V4-5). Most agreed that, *"Here, the coexistence is normal, one for another … we support each other at no cost"* (V4-9). Only a small

number of socially less embedded persons rued a lack of solidarity and support within the community.

6.2.4.4 SWB Dimensions
6.2.4.4.1 Emotional Balance and Cognitive Satisfaction

Most villagers continued to experience anxiety, fear, and preoccupation for long after the 2015 flood (see 6.2.4: Health and food security and Safety from hazards). Children suffered in particular: *"They are afraid, so when they were going to school it flooded, all the streets were ugly too, the children suffered …"* (V4-7). Some families had to transfer their terrified children to live with relatives in safer areas of V4. Farmers also felt sadness and pain because of the losses, noting that their conditions were *"difficult, life is very sad when the water enters"* (V4-11). A mother reported: *"We have suffered lots [sad]… The situation is not easy, it is not easy to live on water, young man, it is too tough"* (V4-11).

Simultaneously, the years of waiting to be relocated have frustrated and infuriated people. They felt treated like in *"a game"* and had gotten *"angry"* (V4-2) because *"there is no support"* (V4-5) by officials, whom the villagers accused of indifference, lies, and corruption: *"They don't stop cheating us"* (V4-14). The repeated frustrations culminated in an attempt to press the Regional governor to fulfil his promises by refusing to let go state representatives after a meeting. Besides anger, the delays have instilled fatigue, helplessness, and worries. One farmer felt like *"going in circles, you are trapped"* (V4-3). Another one rued, *"When there is a flood, they tell us that relocation is going to happen; when the flood has passed, they have already forgotten again"* (V4-10).

The farmers also worried about the phasing out of public investments after the state had declared the village as a high-risk flood zone, while it failed to provide new land for the relocation:

> *That is what worries, right: when are we going to leave, when does support come, and not to lose state investments because [this village] is not in a suitable place, no. When is it going to see an investment? That's why we would like to accelerate this process now, to be able to relocate…. (V4-2)*

Many dwellers were less satisfied with life in entrapment compared to before the flood because they lacked support from the authorities. Continued economic hardship also increased dissatisfaction, as a mother of six in her mid–60s remarked, *"When one works in the fields, everything is arduous…, one makes an effort to work, so we can sustain us"* (V4-17). Others explained that satisfaction had remained *"the same for the meantime, now we are still at peace"* (V4-11); they had adjusted

and felt better emotionally over time, either as a psychological survival mechanism or in display of resilience. A few farmers who had been spared the worse flood impacts continued to be satisfied with life.

6.2.4.4.2 Outlook on the Future

Asked about their views of the future, many farmers were *"between fear and hope"* (V4-11). Witnessing already preoccupying climatic changes (see section 6.2.1), they anticipated that the impacts would make life worse in the future. Since the villagers had to stay in the exposed zone, their major fear was the imminent flood risk (see 6.2.4: Safety from hazards): *"[People] worry about the flood because wintertime is coming and again there will be flooding, they say; psychologically it worries us …"* (V4-2). Some resigned due to the repeated suffering and the lack of options for change.

Several farmers also had worries related to deprivation and economic insecurity. Especially older adults were resigned or fatalistic concerning their own development prospects:

> *I can no longer think about my future because I am already advanced in age. About my future? Not anymore. I only work to support myself, you no longer work to have something, no longer… I don't think about the good life anymore, we're old now. (V4-17)*

Instead, some hoped that the next generations could improve through hard work and education:

> *I would like my children to have a good future because there is no future for us, right. Well, we want more for our children; that they also be good professionals, so that they can live from their profession… We are but farmers. (V4-16)*

For many farmers, religion provided hope during the difficult prolonged immobility: *"Yes, I have faith in God that we can achieve it"* (V4-16). Especially people who lacked economic perspectives clung to their faith for hope that god would allow them to progress. A farmer in her mid–40s stated:

> *Well, my optimism is this: thinking that yes, they will help us to get out of here, so we no longer live here with the floods… I'm hopeful. Maybe later. Or someone to help us, [one has to] leave it in the hands of God no more…. (V4-5)*

Despite the hurdles encountered so far, many villagers still hoped that they would be able to relocate out of the flood zone and to safety eventually: *"Yes, I don't*

lose hope. When there is support, yes, gladly we'll go and live there" (V4-14). Some were positive that a recent change of representatives at district and Regional levels could catalyze the process. Nevertheless, most doubted that relocation would occur swiftly. Asked if the relocation could still occur, a village leader replied:

> *Why not [sighs]… Yet it will not be tomorrow, nor the day after, but at some point it will happen, that is our faith, not to lose hope… [I]n these four years that we are doing the process it [has been] difficult, but yes, every project takes a long time, it is not overnight, worse for these types of projects…. (V4-2)*

Imagining an eventual relocation, many villagers hoped that it would facilitate a new, future "modern" village with improved livelihoods options and infrastructure shielded from hazards:

> *Now for safety, we want to go there, also to build our little houses with a view to the future, well, to allow our children that at some point they also enjoy themselves, that is, mostly looking at the living conditions. Well, so that one does not stay at high risk every year, suffering with this flood that we are just overcoming. (V4-2)*

Many saw no future without relocation, as the response by another farmer illustrates:

> *Our life would be a little better over there. We can already imagine that we will no longer suffer from the flood, when we are at the altitude–but here, if we continue here, we will suffer the same. (V4-16)*

However, repeated governance failures have also raised doubts how the relocation would affect people. Few had lost hope entirely, but many feared that they would not receive enough support for rebuilding, that the associated costs would be too high, and the new lots too small. Some dreaded more diseases in the new site, and not all were reassured that it would be safe from floods.

6.3   Discussion

The *Selva* case study offers new data for understanding the links between climate-related planned relocation, entrapment, and well-being. In this section, I interpret the observed hazard-(im)mobility dynamics and their well-being effects along

the four studied axes, situate them in the broader literature, and analyze relevant mechanisms of action as well as structural conditions.[23]

6.3.1   Hazard-(Im)mobility Links and Pathways

Floods were a main driver of migration in the study sites, as in many rural Amazonian areas (see review in Bergmann et al. 2021a). Only in V4, *annual* floods have occasionally coerced short-term and short-distance migration of the most exposed households. By contrast, in both V3 and V4, *major* floods have forced most villagers to flee in at least two instances. Afterwards, place attachment combined with poverty hindered follow-on migration and the majority returned to their homes, which confirms the inverse relationship between vulnerability and migration found in other contexts (Adger et al. 2014; Black et al. 2013; Warner & Afifi 2014), and the role of ties to land in decisions to migrate or stay, especially for Indigenous people (Yates et al. 2021). In both villages, only the second respective disaster triggered the desire to "exit" (leaning on Hirschman 1970), thus stressing the possible effects of cumulative shocks raised in other studies (Blocher et al. 2021b). Risk appraisal, fear and uncertainty, deprivations, and children's future prospects drove the communities' eventual decisions to request relocation, similarly as seen in other cases (Seebauer & Winkler 2020b). In response, the state declared both zones as areas of "very high, unmitigable risk" in line with Peruvian legislation on relocation, although the legislation's exact threshold of what constitute "unmitigable" hazards remains unclear (Venkateswaran et al. 2017). While both communities decided themselves to relocate—often a catalyst for success (Matthews & Potts 2018)—only V3 relocated in 2014, after struggling for 15 years to find land itself, whereas V4 has remained in limbo since 2015. Despite the perennial obstacles, most people in V4 still wished to leave; community decision-making, group dynamics, and social thresholds mattered for their decisions, similar to dynamics observed in other contexts of settlement change or abandonment (McLeman 2011).

For initiating and implementing relocations, the cases stress the critical influence of governance, resource availability, land issues, the influence of private actors, and community action. First, weak governance, especially state failure to acquire land, has delayed (V3) or stalled (V4) relocation, which confirms the critical influence of state institutions on relocation outcomes (Mortreux et al. 2018). Since relocations have complex, cross-cutting governance demands (de Sherbinin

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[23] This chapter is partially based on my previous work published in Bergmann (2021).

et al. 2011), weak structures and institutions can worsen results (Bronen & Chapin 2013; Connell & Coelho 2018), as seen in the cases here and others in the *Selva* (e.g. Pittaluga 2019). Both V3 and V4 struggled to receive sustained support from Regional authorities for their relocations. This is a common obstacle when relocations address a small and marginalized share of the electorate and states thus perceive a low benefit-cost ratio for action (Hino et al. 2017), especially in highly centralized states (Perry & Lindell 1997) that disregard rural development needs (Arnall 2019). Government inaction in the cases here also seemed driven by a lack of accountability, including inadequate institutional structures, and the lack of pressure to respond to hazards, to establish legitimacy, or to reap adaptation benefits, similar as in other relocations (Mortreux et al. 2018). People's witnessed lack of possibilities to express their needs and to participate meaningfully in the process is a challenge in many relocations that often relates to power hierarchies (Bertana 2020; Thaler et al. 2020; Wilmsen & Webber 2015).

Second, in both villages, poverty has been a major hurdle to circumvent these governance failures, for example, by purchasing land or migrating individually. The case studies therefore corroborate the inverse correlations between vulnerability and migration suspected in the general literature (e.g. Warner & Afifi 2014). While the state lacked incentives to deliver solutions, V3 and V4 was deficient in proper resources to purchase land on their own, as witnessed in numerous other relocations (Hino et al. 2017). Land has been one of the key obstacles here, as often in relocations in Peru (e.g. Sperling et al. 2008) and worldwide (Piggott-McKellar et al. 2020; UNHCR et al. 2017).

Third, and related, private actors influenced these land issues significantly. In V3, private landowners catalyzed eventual progress by accepting a land swap. However, in V4, landowners increased obstacles to the relocation by allegedly inflating land prices for the most fitting lot to exploit the opportunity for government money. The cases thus stress the influence of "complex networks of agents" in relocations beyond the state, which are often overseen (Rogers & Wilmsen 2020: 265).

Finally, people's agency and resistance have shaped trajectories, as seen in other cases (McMichael et al. 2019). In V3, mutual support systems, community tasks, and community action were essential to catalyze the execution of the relocation and to avoid some of the severest risks. People became the driving force for relocation through their own efforts to find land. They also staged demonstrations to express disappointment with initially missing infrastructure and services, pointing to the possible influence of resistance on outcomes (McMichael et al. 2019). The case confirms that some communities can be agents driving their own relocations despite government inaction (Iuchi 2014). Even when incentives for

concerned actors to implement relocations are low, bottom-up fights and strong community organization may result in reasonable outcomes (Hino et al. 2017). Yet, this is not always the case. The extremely poor farmers in V4 have been unable to secure land on their own when the state failed to deliver. This observation supports de Haas' (2021) argument that structural constraints can severely restrict agency and thus influence (im)mobilities and well-being. While *Indígenas* in V4 have also stood united in their fight for change, with increasing frustration, the means have occasionally created frictions, such as refusing to let go state experts after a meeting.

6.3.2 Well-Being Effects, Mechanisms, and Structural Conditions

The delayed (V3) and the stalled relocation (V4) have heavily affected the rainforest villagers. The state approached both cases "as a mechanical process" with little attention to people's well-being, a frequent risk in relocations worldwide (Perry & Lindell 1997: 57).

6.3.2.1 Development from a Secure Base

In both villages, the floods severely damaged livelihoods. Farmers returned to their previous subsistence activities, but recovery was slow and incomplete, partially due to insufficient assistance. Initial health challenges depended on the severity of damages experienced. Severe losses often caused mental health issues, and the damaged subsistence production also created severe, enduring food insecurity. Moreover, the lack of assets, inadequate shelter, contaminated waters, and mosquitos exposed people to new health threats. The results therefore confirm prior findings that rainforest floods can seriously damage infrastructure, shelter, assets, and agriculture (Takasaki et al. 2004), constrain livelihoods for long (Sherman et al. 2015), induce food insecurity (Langill 2018; MIMP & IOM 2015; Sherman et al. 2015), and severely harm mental health (Rojas-Medina et al. 2008).

The floods prompted both communities to request relocation. Yet, people's well-being declined during the lengthy, fragmented processes that resulted, which stresses the role of relocation duration for well-being (Thaler et al. 2020). Beyond the uncertainty if people would eventually relocate, other mechanisms also created hardship. First, the mired relocations trapped people in sites with recurring, severe floods, and, in the case of V4, also with damages from annual floods. Second, particularly in V4, health service provision worsened for two reasons

during forced immobility. At first, the major flood in 2015 damaged on-site health structures, while remoteness and poverty hindered people to travel for aid. Later, declaring V4 as a high-risk flood zone, as required by the relocation law, stopped public investments in the current site, while the state failed to acquire land for a new site and farmers remained exposed to the same flood-related health threats. Being unable to leave the risk zone also caused mental stress for at-risk groups. Third, similar effects and mechanisms apply to education in the trapped village V4. Floods have continued to interrupt schooling and damage buildings while withdrawn investments have further aggravated the situation. Such marginalization through discontinued state investments in public services threatens relocatees in many cases worldwide (Cernea 2004). Overall, the case study substantiates that trapped people are at risk of impoverishment (Ayeb-Karlsson et al. 2018), especially non-resilient groups confronted with cumulative damages (Mallick & Schanze 2020) and health shocks (Brubaker et al. 2011; Schwerdtle et al. 2017). Ensuing downward spirals of poverty might lead to trade-offs with expenses for other essential activities and reduce the eventual ability to relocate, given the costs for rebuilding lives in a new site.

After physical relocation, livelihood restoration is key for success but often difficult to achieve (Brookings et al. 2015; Cernea 2004). While hopes prevailed in V4 that livelihoods would improve after moving to the envisaged new land, Peruvian (Bernales 2019; Desmaison et al. 2018; Estrada et al. 2018; Lavell et al. 2016; Vásquez et al. 2018) and global cases caution about impoverishment risks in relocations (Piggott-McKellar et al. 2020; Wilmsen & Webber 2015); many at best improve infrastructure but threaten other key capitals. The case of V3 provides nuances to this literature. Here, relocation facilitated livelihood continuity while significantly improving the access to the road system and thereby to markets and jobs. The case demonstrates that livelihoods can recover under specific conditions (Ferris & Weerasinghe 2020), especially if people relocate voluntarily (Bazzi et al. 2016) and to a site that offers livelihood potential (which, absent state action over many difficult years, V3 had to obtain itself). V3's *community-wide* relocation also appears to have created more positive results than related cases of *individual and household* migration driven by floods in Peru's rainforest.[24] Nevertheless, most relocatees have continued in a milder version of their previous poverty trap due to the generally rising costs of living. Health effects have been

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[24] Studies stress that such migration can lead to precarious work and raise food insecurity. It may improve educational chances, but not for children compelled to move for work. See List (2016); Sherman et al. (2015); Sherman et al. (2016).

mixed at best, as seen in other relocations worldwide (Mazhin et al. 2020; Schwerdtle et al. 2020). Poverty and a lack of state support hindered the creation of appropriate health infrastructure after relocation. Conversely, the improved location decreased physical exposure to flood-related health threats and raised access to transportation for health services. Weak governance also contributed to adverse results regarding education. Because the final administrative registration of the relocation was stalled—which hindered public investments— villagers themselves had to shoulder the building of school edifices. The recurrent bureaucratic delays have deteriorated the infrastructure and deprived households of money required for other needs. Therefore, in line with concerns by the IPCC (Adger et al. 2014), despite some gains, truly improving *development from a secure base* has proved difficult for the relocatees from V3. The main obstacles were preexisting vulnerabilities, inequalities, and other structural factors such as weak governance that created *distress* conditions for moving and settling.

6.3.2.2 A Space to Live Better

The floods in V3 and V4 severely damaged houses and infrastructure, as seen in other zones in Peru's *Selva* (MIMP & IOM 2015; Sherman et al. 2015). Subsequent entrapment in hazardous zones has led to recurrent loss and damage. For V4, the relocation goal—safety from flood hazards—has not been achieved due to the state's failure to acquire land. While immobility has not changed people's views of their surroundings, basic services have worsened. Because the state declared the current village site as a high-risk flood zone, planned investments in water and sewerage were stopped, which raised vulnerabilities and perpetuated unhygienic conditions for the trapped farmers. Such challenged *spaces to live* during entrapment, for example through service discontinuation (Cernea 2004), are a shared global concern (Ayeb-Karlsson et al. 2018; Foresight 2011; Mallick & Schanze 2020). In the eventual relocation of V3, various mechanisms created mixed outcomes. On the negative side, delays in the relocation process and governance shortcomings slowed down the reconstruction of adequate shelter. Without receiving land titles, the poor farmers could not retrieve social programs to support the costly rebuilding. Only coincidental access to jobs in a private company facilitated the start of reconstruction; some, but not all households succeeded in slowly improving their homes, although with high expenses and sacrifices. Authorities initially failed to install or improve basic services after the relocation, which caused hardship and disappointment. Gradual improvements such as electricity and tubed water required high investments by the farmers themselves. Other promised upgrades, for example of sewerage and sanitation systems, never arrived, and the new, downsized lots made the associated impacts worse. Some

dissatisfaction also related to the size of their new, small lots, and the larger distance from natural amenities, but most farmers were pleased with their new surroundings due to similar recreational and aesthetic ecosystem services and the modern village design. On the positive side, two key well-being benefits of the relocation were more proximity to a street and less exposure to hazards. First, the improved access to the road system after relocation has had positive multiplier effects for livelihoods, education, and health. Second, the relocation effectively reduced primary hazard exposure due to the larger distance from the river and the higher elevation, which significantly enhanced well-being. The case thus substantiates claims of prior studies in Peru (Desmaison et al. 2018; Jarman 2020; Lopez 2018) and worldwide that relocations can, under specific circumstances, contribute to DRR/DRM (Ferris & Weerasinghe 2020; Melde et al. 2017). Secondary hazards were moderate and manageable for V3, although they are a recurrent concern in other relocations (Bower & Weerasinghe 2021). Finally, rising physical insecurity was not observed in the two cases, and V3's security even benefited from the relocation due to the closer proximity to the road system and the better availability of light, contrary to global results (Sow et al. 2016; Webber & Barnett 2010; Yates et al. 2021) and prior analyses in Peru (Bernales 2019; MIMP & IOM 2015). In summary, this study demonstrates that entrapment during relocation threatens people's *space to live better*. Eventual relocation under *distress* conditions can also imperil housing, basic infrastructure, and services adjusted to people's ways of life, as expected from global studies (Bower & Weerasinghe 2021; Cernea 2004) and those in Peru (e.g. Lopez 2018; Pittaluga 2019). Nevertheless, it may improve other dimensions of *a space to live better*, especially exposure to hazards.

6.3.2.3 Social Relatedness

The relocation processes have had mainly positive effects on *social relatedness* in both villages. After the floods and during entrapment, social cohesion has stayed robust due to ongoing community tasks, mutual support mechanisms to confront damages, and strong traditions that nurtured community relationships. Mutual support often occurs instantly after disasters (Braun & Aßheuer 2011; Drury & Cocking 2007), yet in both V3 and V4, support extended beyond the crisis moment and enhanced social relations. The experienced delays and challenges during entrapment have also increased unity because people have had to come together to coordinate their cause and fight for progress. The main factors that have enhanced V3's possibilities to maintain positive social ties after its eventual relocation were its moderate size, previous unity, the spatial continuity after moving, and effective self-organization. People's fight against perennial delays

and government shortcomings united them, including through joint rebuilding efforts or demonstrations to express their discontent. In addition, the relocation preserved spatial clusters of families, which enabled them to maintain social structures and relationships. In the new site, the closer spatial setting and better light facilitated more contacts between peers. Thus, this study confirms prior findings from the Pacific that community structure and relocation design influence the prospect of maintaining *social relatedness* after moving, and that community and social support are key to mitigate challenges or ease adjustment (Yates et al. 2021). Overall, the positive results in this case contradict findings in prior global (Bower & Weerasinghe 2021; Schwerdtle et al. 2020) and Peruvian studies (Desmaison et al. 2018; Lopez 2018; Sperling et al. 2008). The *community-wide* migration of V3 has also had more positive social effects than observed in other studies on flood-driven, *individual and household* migration in Peru's rainforest.[25]

6.3.2.4   SWB

The cases V4 and V3 (before its eventual relocation) highlight that *forced immobility* can cause similar SWB losses as those witnessed in *forced migration* (Bartram 2015; Hendriks 2015). Various mechanisms appear likely. First, in both villages, losses due to major floods (and subsequently annual floods in V4) have led to strong negative emotions and cognitive dissatisfaction. Second, the mired relocations, governance failures, and resultant entrapment have further worsened the SWB of many farmers. Third, trapped people's SWB was probably also reduced because they could not realize their aspirations and compared their plight with other, better-off villages, as comparison theory would suggest (Haindorfer 2019a; Schyns 2000, 2001). Finally, some trapped people in V4 experienced partial hedonic adaptation to their plight, either in display of resilience or as a survival mechanism. Most of the trapped farmers in V4 saw no future in their current location given repeated floods and poverty. Despite the lack of progress, many retained hope that a relocation could eventually occur and enable a modern, upgraded village shielded from hazards; they believed in a modernization narrative that is known from other relocations (Arnall 2019). While some respondents appeared intrinsically optimistic—and optimism has dispositional elements (Carver & Scheier 2014)—for others, hope was anchored in faith or in external circumstances, such as the change of functionaries in charge of the relocation. This result confirms that hope can have varied internal and external sources

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[25] Existing studies in the rainforest stress that *individual* or *household* migration can pressure social relations through separation, abandonment of older adults, erosion of local traditional knowledge, and the lack of possibilities for migrants and stayers to provide for each other, see List (2016); Sherman et al. (2015); Sherman et al. (2016).

(Pleeging et al. 2021b). Imagining an eventual relocation evoked hope for a safer and better future in most respondents; this extends previous results (e.g. Boccagni 2016) by proving that hope can help both migrants *and* aspiring migrants to cope with hardship. Nevertheless, the constant delays and repeated governance failures also contributed to resignation, uncertainty, distrust, and doubts, which corroborates that a lack of progress and control can drain hope (Edey & Jevne 2003).

The implemented relocation of V3 specifically had time-dependent effects on SWB. At the start, enduring trauma, the straining, lengthy transition to the new site, and continued governance failures severely worsened farmers' emotional balance and cognitive satisfaction. Conversely, lasting *scarring* (Jovanović 2019; Mousteri et al. 2018) did not occur absent major health shocks or financial losses after relocation. Various villagers have experienced gradual hedonic adaptation. Contradicting findings on internal, *individual* or *household* migration in other poor countries (e.g. Chen et al. 2019; Mulcahy & Kollamparambil 2016), various relocatees even improved their SWB. Gains seemed to arise from two effects that respondents had hoped for in the new site, namely better development prospects and reduced hazard exposure. This confirms that the possibility to fulfill aspirations affects migrants' SWB (e.g. Chen et al. 2019). By contrast, *relative deprivation*, often a salient mechanism in internal migration (e.g. Knight & Gunatilaka 2018), was not central for V3 since the entire village moved to an unpopulated area, which prevented social comparisons with stayers or locals. Sentiments to the future were mostly optimistic but mixed with strong concerns and anxieties, similar as for relocatees in other areas (Yates et al. 2021). Various mechanisms expected from the review in chapter 4 applied: most relocatees were hopeful for progress related to work, education, as well as the anticipated solution to their land titling issues and the linked access to social programs and better infrastructure. Such hope might motivate further action that could eventually increase well-being (Pleeging et al. 2021a). Even so, economic insecurity affected many farmers, some of whom were anxious regarding the future. Still others held more positive outlooks despite similar issues thanks to personal coping mechanisms, such as faith or humor (two aspects that remain understudied in migration studies, as the review in chapter 4 shows). Finally, in both villages, many thought only of the future for their children, a known externalization pattern for many migrants (Boccagni 2016).

6.4   **Summary and Induction of Propositions**

In this section, I summarize key well-being effects and mechanisms in the delayed, but completed *voluntary* relocation of V3 and the prolonged, *forced* immobility in V4. Building on the analysis of these cases, I then induce propositions on broader well-being dynamics in climate (im)mobilities.

Figure 6.10 portrays the identified well-being effects as well as relevant structural conditions and mechanisms of action. Severe floods in 1999 and 2015 raised aspirations to migrate voluntarily in V3 and V4, respectively. Yet, due to limited migration capabilities and lacking state support, farmers in V3 only relocated after 15 years, whereas those in V4 have remained in entrapment until today. These (im)mobilities occurred under *distress* because structural opportunities were only low to average, whereas high structural constraints emerged from severe climate risks and deficient DRR/DRM; poverty and inequality; dependency on ecosystem services with few diversification options; spatial insularity; weak governance; limited political participation; and the influence of non-state actors. The *Indígenas'* prolonged entrapment in V4 has had significant impacts on their well-being. Because the state designated their village as a high-risk flood zone but failed to purchase a promised new plot for the relocation, farmers did not only still suffer from continued flooding, but also lost planned infrastructure investments. Their vulnerabilities have increased on a trajectory of "chronic distress" (Seebauer & Winkler 2020a: 2227). With worsening need fulfillment, most respondents lost SWB *(deprivation).*[26] Many also expressed negative outlooks on the future *(enforced fear)* given economic insecurity and years of bad governance, which have raised doubt that the relocation will be completed. By contrast, V3 faced major hurdles in the protracted relocation but eventually moved. Although challenges persisted after relocation, most farmers perceived the eventual transfer as successful in material dimensions owing to the decreased exposure to hazards as well as the improved access to jobs and markets. Most villagers followed a trajectory of "delayed recovery" (Seebauer & Winkler 2020a: 2227) and reported positive feelings, cognitive satisfaction *(higher well-being, despite mixed need fulfillment),* and optimistic views of the future *(enfolded hope).* The light gray boxes in the figure below synthesize the well-being mechanisms identified in these cases that may be relevant in other contexts as well.

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[26] For terminology, see section 2.3. *Deprivation* refers to adverse objective conditions accompanied by low cognitive satisfaction and negative emotional balance.
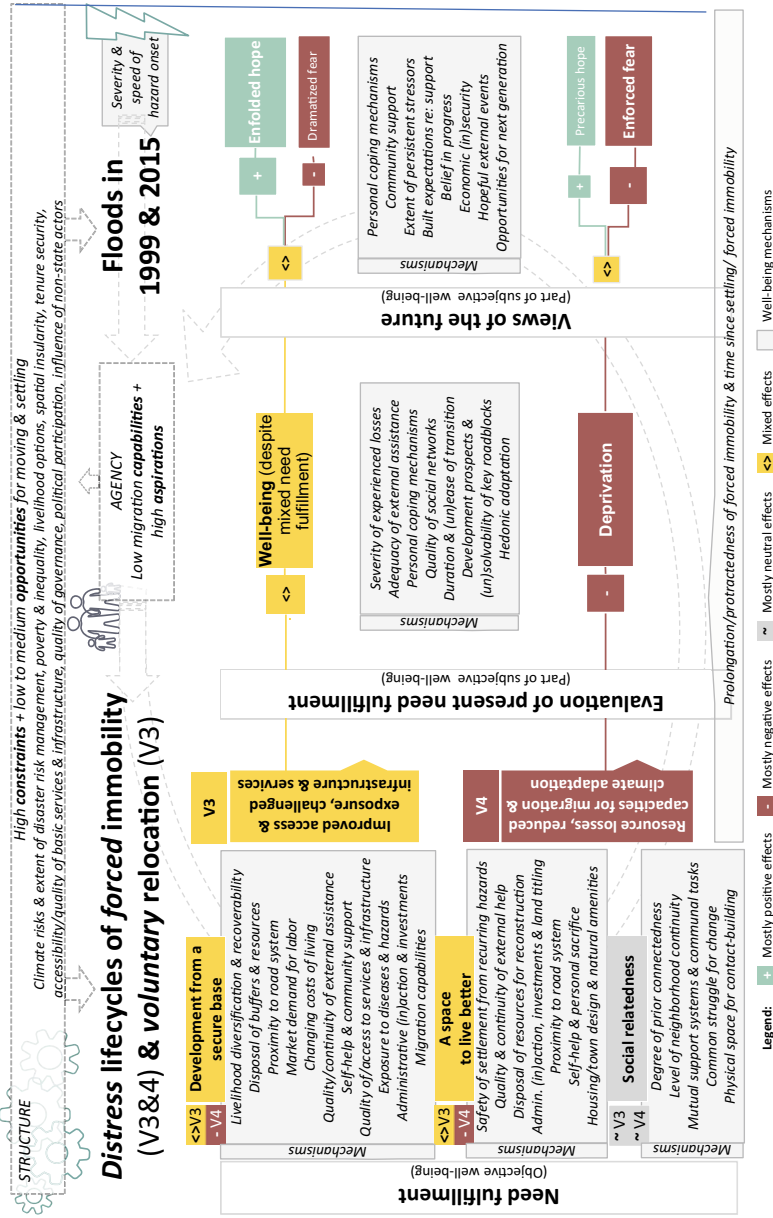
Figure 6.10 Main well-being effects for relocatees from V3 and trapped persons in V4, structural conditions, and identified mechanisms of action. (Note: Created by the author)

Based on these empirical findings, more general propositions on the well-being impacts of climate (im)mobilities can be induced along the four studied axes.

(1) First, the results suggest that when poor agricultural communities with limited migration capabilities aspire to move away from severe climate hazards—but also wish to preserve their socio-spatial unit and ties to land or livelihoods—weak governance and deficient institutions can protract requested planned relocation over several taxing years. Access to decision makers, bureaucratic processes, and sustained funding are key for effective implementation, yet difficult to achieve for the many remote, poor, and politically disenfranchised smallholders in centralized states with low interest in rural communities. Resultant entrapment in high-risk zones and relocation procedures detached from rural needs, such as service discontinuation, likely threaten people's *development from a secure base* and *a space to live better*, and eventually reduce their adaptive capacities and migration capabilities. In such *distress* conditions, non-state actors can become pivotal players either moderating or multiplying state failures and well-being threats.

(2) Second, in poorer countries with deficient institutions, weak governance is likely to interact with land tenure issues to compound relocation obstacles. Ensuing entrapment and adverse well-being effects can become prolonged; they may end only if aspiring relocatees find ways to resist or circumvent governance failures and resolve land acquisition. If eventual relocation is achieved, even under *distress* conditions, it may have narrow positive effects for adaptive capacities over the long term. Yet, such limited gains only materialize if the new site significantly reduces hazard exposure while benefitting livelihoods, provided that the relocation does not create deleterious harm in other key dimensions of *development from a secure base* and *a space to live better.*

(3) Third, the results demonstrate that despite severe disaster losses and government failures that trap aspiring relocatees, small, tight-knit communities with deeply rooted traditions, support mechanisms, and effective organizational structures may be able to maintain positive *social relatedness*. During entrapment, in-group unity and cohesion can even increase in reaction to seriously constraining structural conditions and may ultimately catalyze action or resistance needed to mitigate the effects of state neglect. If relocation is achieved, even if in fragmented trajectories and *distress* conditions of moving, communities with the characteristics described above may be able to conserve positive *social relatedness* provided that the new spatial design is sensitive

to social needs and the relocation does not create other existential threats to well-being.

(4) Finally, the cases suggest that for marginalized communities lacking on-site adaptation options or state support to leave at-risk areas, climate change can create persistent stressors and severe OWB losses, which, in turn, also harm *SWB*. Because even high-quality social networks cannot offset such severe harm, it is likely that people will experience a subjective present state of *deprivation*. In addition, *enforced fear* of the future is to be expected for many trapped people worldwide who have experienced climate-related loss and damage, governments failing to fulfill their protection obligations, and a resulting lack of control or progress. Rising despair in such situations can further strain other well-being elements over time. Simultaneously, trapped people may cultivate *precarious hope* in case they have personal coping mechanisms, expect external support, hope to move to a better life elsewhere, or believe in opportunities for next generations. Contrariwise, *voluntarily* relocating away from risk zones may raise *SWB* depending on the duration, strains, and outcomes of the transfer. If relocation produces large gains in key OWB elements that outweigh likely challenges in other elements over time, it can lead to subjectively *higher (but often still mixed) well-being* with *enfolded hope for the future.* Such SWB, in turn, can create beneficial ripple effects on people's OWB, and may thus contribute to a virtuous cycle.

Costa: Flood Displacement During the 2017 Coastal El Niño in Peru

7

"El agua pasaba sobre mi cabeza, era altísimo, era como para ahogarme, sí por eso ya salimos de allá. No teníamos a donde irnos, salimos a la pista por mientras pero el agua se pasaba también… No teníamos pensado, ni en sueños lo teníamos, lo que íbamos a sufrir tanto … Porque en la casa ya teníamos todo, no nos faltaba nada …"

"The water was running over my head, it was so high, it was enough to drown me, yes that's why we left from there. We had nowhere to go, we went out on the track for a while, but the water came there too … We had never imagined, not even in our dreams, that we would suffer that much… Since in the house we already had everything, we did not lack anything …" (own translation, as in all the chapter).

Statement by a *mestizo* mother of six children, who was displaced after the Coastal El Niño 2017 floods in Piura. She worked in housekeeping and was in her early 40s at the time of the interview (LP-11).

For two reasons, the research interest in Peru's western arid coast (*Costa*) was in the well-being of persons displaced short distances away from their homes by floods during the 2017 Coastal El Niño (CEN) event. First, Peru's coast is periodically affected by severe El Niño-driven rainfall (Sanabria et al. 2018), which climate change will increase significantly in this century (Cai et al. 2015; IPCC 2019a; Peng et al. 2019). Second, related floods are the main driver of displacement on Peru's coast (Bayer et al. 2014; Ferradas 2015; French & Mechler 2017; Venkateswaran et al. 2017). The 2017 CEN floods, specifically, were the largest push for such displacement (or *acute, forced* migration) over the past decade in Peru, with close to 300,000 cases (IDMC 2019). Thus, examining the well-being of displaced persons from villages in the Piura Region after the 2017 CEN provides a useful temporal analog for future challenges. In the first section, I provide information on the geographical context, measured and projected climate change,

exposure, vulnerabilities, local coping and adaptation, and hazard-related migration by Peru's coast. Then, I explain the new qualitative and quantitative results of this case study of displaced persons' well-being following the 2017 CEN.

7.1   Context

Although Peru's narrow coastal strip covers only about 11% of its landmass, it is home to 58% of the population, a share that has significantly increased over the past decades (INEI 2018c).[1] The study sites herein are situated in the lower (LP) and upper part (UP) of the northern Piura Region (Figure 7.1).[2] Piura is Peru's second largest Region and was home to 1.86 million people in 2017, 79% of whom lived in urban areas. The studied sites comprise small villages of origin in two districts in LP and one district in UP. The larger districts have between 19,000 and 83,000 inhabitants (INEI 2018c). All districts consist of one larger district town each and several scattered, smaller satellite villages. On average, the sites in LP are at elevations of below 50 m.a.s.l. and those in UP at 100 m.a.s.l.

All study sites are nested in the ecological floor coined *Chala* (Pulgar Vidal 1972), which is characterized by a subtropical desert climate, warm to hot temperatures, and minimal, highly seasonal rainfall. The Andes separate the subtropical desert climate in the western coastal area from the tropical, humid climate in eastern Amazonia (Mächtle 2016). As a result, less than 2% of Peru's renewable water resources accrue to the Pacific basin (ANA 2018), where 58% of Peru's inhabitants live (INEI 2018c). About a third of Peru are drylands and desertification is a major, ongoing threat (CEPES 2015; INRENA 2006, 2011; MINAM 2016a). Most of the coastal rivers are short and seasonal. Irrigated crop farming is only possible on a narrow band west to the mountains; further downhill, shrublands extend, and the coastal plain has almost no natural vegetation cover. In certain desert areas, an intensive groundwater-irrigated and export-oriented agroindustry exists, which often overexploits local water resources (Damonte 2019; Damonte & Boelens 2019). UP has greater average rainfalls and lower temperatures than LP (Figure 7.2) because it is at a higher altitude and farther away from the coast.[3]

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[1] This section partially draws on my previous work published in Bergmann et al. (2021a).

[2] For privacy protection, neither the names of the study sites nor of interviewees are specified.

[3] The station name is concealed for privacy protection. I would like to thank again my colleague Stephanie Gleixner who kindly produced graphs for the results chapters on the *Sierra* and *Costa* with PISCO data, and for the *Selva* chapter with station rainfall data and PISCO temperature data.
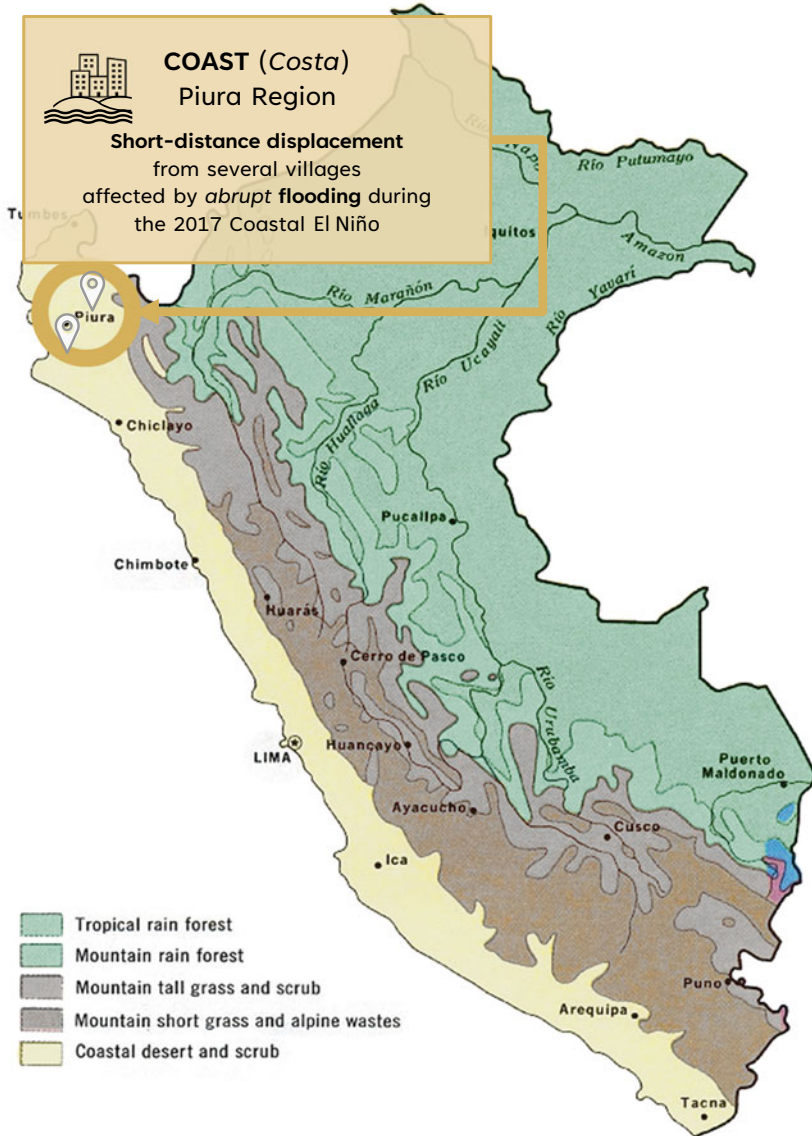
Figure 7.1 Sites for qualitative data collection on Peru's coast. (Note: To protect the respondents, the pins indicate approximate locations only. Created by the author, based on CIA (1970))
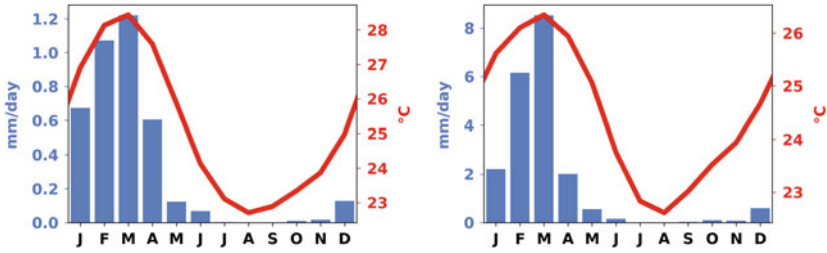
Figure 7.2 Temperatures and rainfall close to the sites in Piura. (Note: The figure depicts average temperatures and rainfall per month 1982–2016 close to the sites in LP (left) and UP (right). The station names here and in the following figures are concealed to protect the privacy of respondents. Produced by Stephanie Gleixner with PISCO data, edited by the author)

Farmers in Piura have to cope continually with "too wet and too dry conditions" (Sperling et al. 2008: 25). During recurrent El Niño events, they are threatened by *abrupt* events such as storms, heavy rainfall, pluvial or fluvial flooding, and *huaycos*[4] (flash floods). In addition, farmers suffer from *gradual* hazards such as warming, dry spells, and droughts.

Climate change has raised the frequency and intensity of these slow-onset and sudden-onset hazards. On the coast, temperatures have increased between 0.15 and 0.25 °C per decade between 1981 and 2016 (Aybar et al. 2020). An analysis of gridded data, based on satellite and station data from the PISCO dataset (Lavado-Casimiro et al. 2016), offers details for the study sites in LP. It shows higher average temperatures through most of the year in the period 1997–2016 compared to 1982–2001. Annual mean temperatures have not changed significantly, but the daily temperature range has increased. Extreme heat (95th percentile of maximum temperature) and the number of hot days are significantly greater than before. Other studies confirm that the number of cold nights has declined while the number of tropical nights and hot days have risen (Donat et al. 2013; Skansi, María de los Milagros et al. 2013). Extremely warm days have increased at least by two in northern South America over recent decades in austral summers (Ceccherini et al. 2016; Feron et al. 2019). The analysis of PISCO data illustrates the temperature trends in LP. It shows increases in average

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[4] *Huaycos* are flash floods formed in the highlands after extreme rainfall, which carry mud, rock, and debris flows through ravines and valleys.

temperatures, in maximum daily temperature range, and temperature extremes (Figure 7.3).
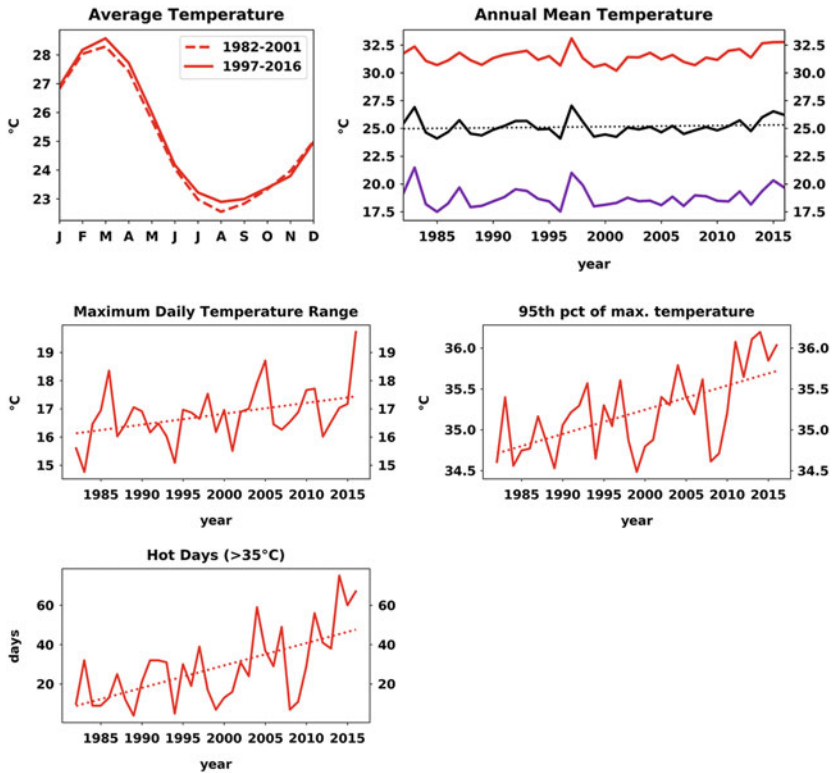
Figure 7.3 Temperature trends close to LP. (Note: Average monthly temperature 1982–2001 compared to 1997–2016 (top left) and annual mean, maximum, minimum temperature (top right); daily maximum temperature range (middle left), 95th percentile of maximum temperature (middle right); and number of hot days >35 °C (bottom left). Produced by Stephanie Gleixner with PISCO data, edited by the author)

Average rainfall trends on the coast have not changed significantly (Haylock et al. 2006; Lavado-Casimiro et al. 2012a), but intensities may have risen in its south (Heidinger et al. 2018). Minimum annual runoff has increased (Lavado-Casimiro et al. 2012a), likely due to first stages of glacier loss in the highlands that increase meltwater until the peak flow is reached (Rau et al. 2019). The analysis of PISCO data in LP reveals that the yearly average rainfall and rainfall extremes (95th percentile) have remained similarly low, apart from El Niño years (Figure 7.4). Figure 6.1 in chapter 6 illustrates that many of Peru's flood-exposed zones are on the coast, including in Piura (MINAGRI 2012: 38).
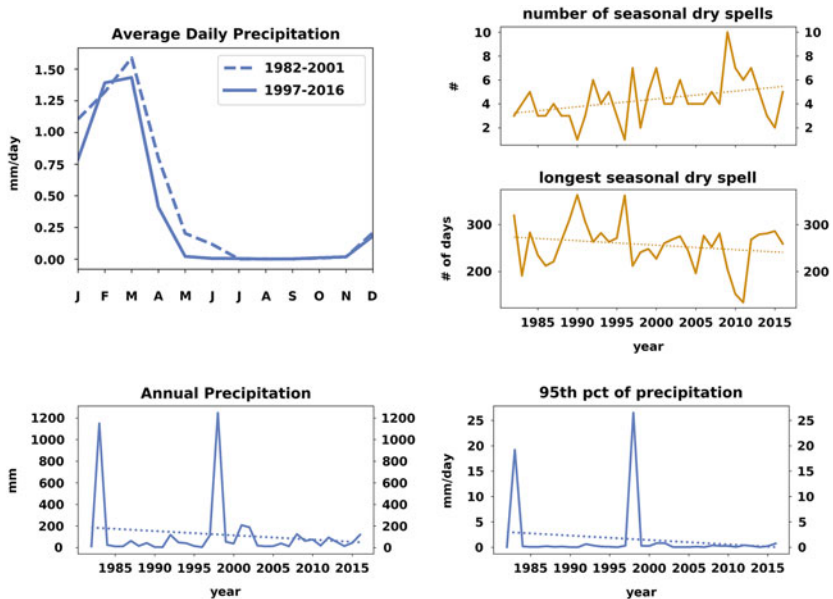
Figure 7.4 Rainfall trends close to LP. (Note: Average daily precipitation (top left) and annual precipitation (bottom left); dry spell (top right) and 95th percentile trends (bottom right). Produced by Stephanie Gleixner with PISCO data, edited by the author)

The El Niño Southern Oscillation (ENSO) is key for climate variability in Peru and worldwide (McPhaden et al. 2006). Every one to five years, the sea surface temperature (SST) in the Eastern (EP) or Central Pacific (CP) warms (El Niño) before it cools eventually (La Niña) (Sanabria et al. 2018). Strong EP El Niños increase rainfall by Peru's northern coast but reduce it in other

parts, whereas strong La Niña episodes have largely opposite effects (Lavado-Casimiro & Espinoza 2014). Conversely, strong CP El Niños decrease rainfall in upstream regions along Peru's western coast (Rau et al. 2017). The latest Pacific El Niño events that severely affected Peru occurred in 1982–1983 and 1997–1998, while the strong events in 1972–1973 and 2015–16 had weaker impacts (Sanabria et al. 2018). ENSO has significantly fluctuated in the past (Cobb et al. 2013), but its variance has increased over past decades (McGregor et al. 2013). Coastal El Niño (CEN) events are rarer than CP or EP El Niños, and previous episodes occurred in Peru in 1891, 1925, and 2017 (Hu et al. 2019; Peng et al. 2019; Takahashi & Martínez 2019). The unexpected 2017 CEN—the focus here—was probably driven by anomalously warm SSTs along South America's west coast (Hu et al. 2019; Rodríguez-Morata et al. 2019). Like strong EP El Niños, CENs can cause torrential rainfalls off Peru's northern coast. In March 2017, the CEN generated rainfall amounts similar to the Pacific El Niño events in 1982–1983 and 1997–1998 (Rodríguez-Morata et al. 2019). Climate change made the 2017 CEN at least 1.5 times more likely to occur compared to preindustrial times (Christidis et al. 2019).

In the coming decades, climate change could affect Peru's coast in various ways.[5] In a low emission scenario, average temperatures may increase between 0.75 to 1.5 °C by 2050 and between 1 to 1.75 °C by 2100 compared to 1985–2005; in a high emissions scenario, they could rise by 1 to 2 °C and 3.5 to 6 °C (Bergmann et al. 2021a).[6] In another high emission projection,[7] the 50th percentile of mean temperature would rise from 24 °C in the 2010s to 27 °C in the 2080s (Figure 7.5).

By 2050, in a medium emissions scenario, extremely warm days and heat waves would increase 5–10 times per season. In a high emissions scenario, what is an extremely hot summer day in Lima today would become 11 times more frequent compared to 1961–1990 (Feron et al. 2019). By 2100, extremely hot summer months will be much more common, especially on the coast (Adams

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[5] Climate models in the IPCC's Fifth Assessment Report used four representative concentration pathways (RCPs) to cover possible future emissions, see van Vuuren et al. (2011). RCP8.5 (high) assumes the highest CO_2 concentration, leading to a global surface temperature increase of 2.6 to 4.8 °C for the end of the 21st relative to the end of the 20th century. RCP2.6 (low), the most optimistic scenario that requires strong mitigation suggests an increase of 0.3 to 1.7 °C. RCP6.0 and RCP4.5 (medium) fall in between with 1.1 to 2.6 °C and 1.4 to 3.1 °C warming. See IPCC (2014).

[6] The results are averages of four ISIMIP models.

[7] SSP 3.70, leading to above 4 °C mean global temperature increase by 2100.
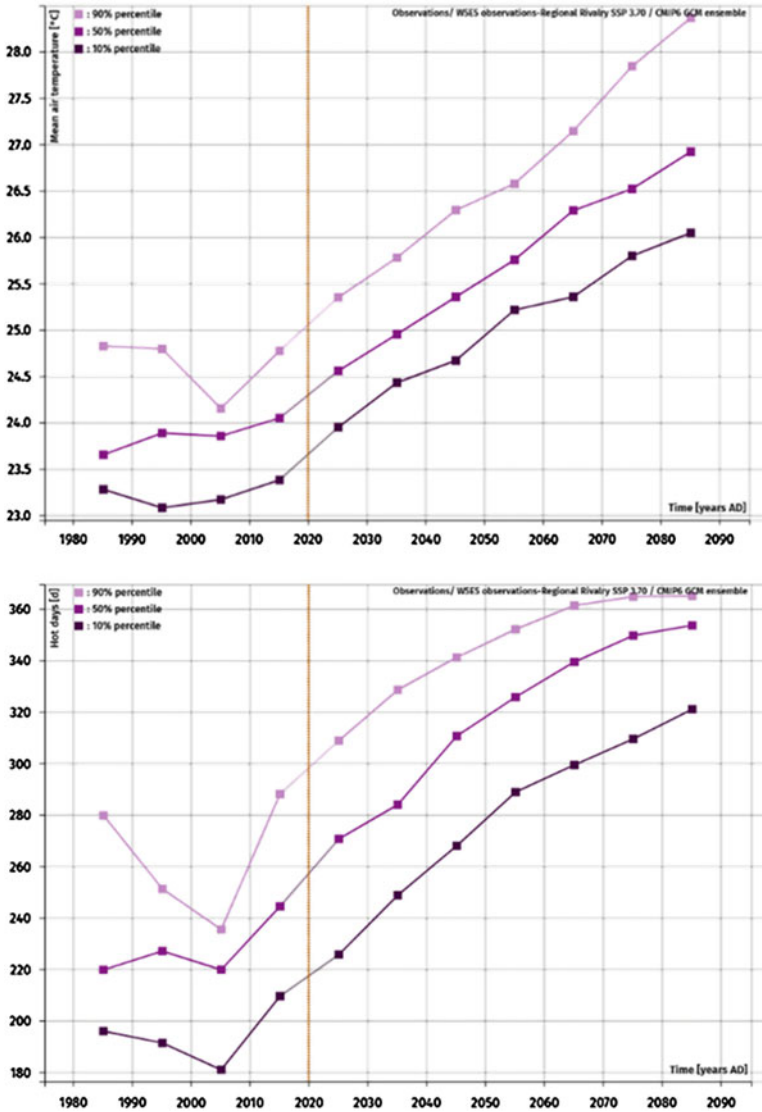
Figure 7.5 Observed and projected temperature in the Province where LP is sited. (Note: Mean air temperature (top) and number of hot days (bottom), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3 7.0 W/m^2 / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsdam.de)

et al. 2014). 3-sigma heat events,[8] still rare today, will be the norm in Peru roughly half of the summer months in a 2 °C warmer world by 2100 and for most summer months in case of 4 °C warming. 5-sigma events, which currently do not exist in Peru, will occur in 20% (70%) of summer months for 2 °C (4 °C) global warming. In the LP area, high emissions would lead to over 350 hot days per year (Figure 7.5). Globally, the risk of heat exceeding body thresholds of temperature and humidity will increase by between 48% in a low and 74% in a high emission scenario by 2100 (Mora et al. 2017a).

This study focuses on floods, but rainfall projections come with uncertainties. Peru may see fewer rainy days but more intense rainfalls (Christensen et al. 2013; Giorgi et al. 2014). On its arid northern coast, average rainfall may increase (Sörensson et al. 2010; Vera et al. 2006). Recent rainfall models confirm this trend (Figure 7.6). A study of a central coastal basin finds that discharge is seasonal and decreases in the dry-season but rises in the wet-season for the 2050s and 2080s (Olsson et al. 2017).

Climate change will also make El Niño events, the focus of this study, more frequent, even if temperatures should stabilize over the long term (Wang et al. 2017). The IPCC (2019a) has medium confidence that extreme events will occur twice as often under both low and high emission pathways in the 21st as compared to the 20th century. Other projections show that strong EP El Niños could rise from six events in the 20th to nine in the 21st century while CP El Niños and extreme La Niñas will also occur more frequently (Cai et al. 2015; Cai et al. 2018). More El Niño events can but do not inevitably create more extreme rainfall over Peru (Sanabria et al. 2018). Extreme CEN events may also become more frequent, but the range across models is large (Peng et al. 2019).

More frequent, extreme El Niño events will also interact with permanent sea-level rise (SLR) and thus present new threats to Peru's coastline population (Reguero et al. 2015). Globally, for 2100 compared to 1986–2005, a low (high) emission scenario could result in mean SLR between 0.29–0.59 m (0.61–1.10 m) (IPCC 2019a). For Peru specifically, the highest-emissions scenario could result in SLR of at least 0.7 m by 2100 (Church et al. 2013). After 2100, locked-in SLR will continue for long (Strauss et al. 2015) and in the highest emissions scenario, global mean SLR would reach 15 cm per decade (IPCC 2019a).[9] At this

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[8] 3-sigma or 5-sigma events are monthly and seasonal temperatures >3 or >5 standard deviations (SD) warmer than mean temperature.

[9] The collapse of the West Antarctic Ice Sheet could add several meters over the long term and a loss of the Greenland ice sheet would add about seven meters on a timescale of centuries to millennia. See IPCC (2019a).
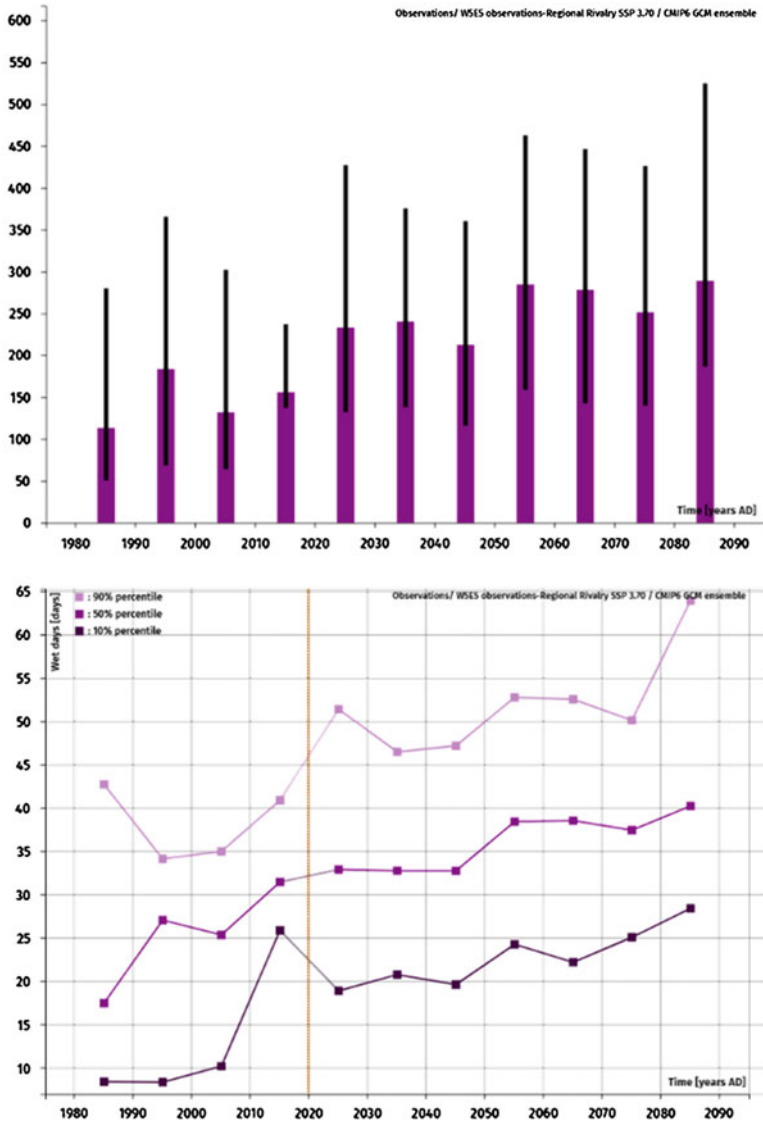
Figure 7.6 Observed and projected rainfall in the Province where LP is sited. (Note: Precipitation (top) and number of wet days (middle), 1975–2085. Observations/ W5E5 observations-Regional Rivalry SSP3 7.0 W/m^2 / CMIP6 GCM ensemble. Created with data from Climate Impacts Online by PIK, http://kfo.pik-potsdam.de)

pace, Peru would experience 1 m SLR over the next 100 years.[10] Adaptation may mitigate some damages in Peru (Anthoff et al. 2006; Nicholls 2011). Permanent, local SLR impacts are less severe than in the most affected Latin American areas but large relative to the coastal area of Peru (Dasgupta et al. 2009; Gosling et al. 2011; MINAM 2010; Pearson 2009; Teves et al. 1996; USAID 2011). Moreover, coastal flooding events will add to permanent SLR inundations and may threaten tens of thousands of inhabitants in Lima alone (Reguero et al. 2015). Synergetic effects of (permanent) SLR and more frequent (episodic) strong El Niño events could also worsen periodic coastal flooding in Peru, as ENSO can create extra SLR for several months off Peru's coast (Reguero et al. 2015). Finally, error-corrected data reveals that exposure to SLR and coastal floods may be much greater than assumed earlier (Kulp & Strauss 2019).

These hazards affect people in Peru in multiple ways. Exposure to El Niño events is high, with over 7 million people across the country (Figure 7.7, not counting droughts) (SINAGERD et al. 2014). They live mostly in the north, led by the Piura Region with 1.7 million people, where exposure is high due to hydro-geographical features, such as steep river gradients (French & Mechler 2017). During the 2017 CEN, rainfall deviated most strongly from the average of the previous decades in Peru's central and northern coast (where Piura is sited) and in the central rainforest (Figure 7.8). These rainfall anomalies led to extensive floods (Dartmouth Flood Observatory 2017; Son et al. 2020). In addition, settlements in flood-zones are also growing in Peru, often involving corruption or the state's acquiescence (Bayer et al. 2014; French & Mechler 2017). Poor dwellers in slums are most exposed, among them internal migrants who often settle on affordable but high-risk lands (Venkateswaran et al. 2017), and who tend to be less prepared for or experienced with ENSO impacts (Bayer et al. 2014).

Not only exposure but also vulnerabilities are high. People in Piura's rural areas are mostly traditional, smallholder crop and livestock farmers, who have to irrigate their crops year-round, or day laborers (Aragón et al. 2018; Bayer et al. 2014; Oft 2009). In a large-scale survey, about 27% of the farmers on Peru's desert strip were poor, and only 58% of the household heads had completed primary education (Aragón et al. 2018). Such exclusion from basic services is often gendered (Oft 2009, 2010). The lack of non-farming income sources and high poverty makes farmers highly vulnerable to production shocks (Aragón et al. 2021). In typical households, few members gain incomes, and their livelihoods

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[10] In 2010, Peru's Ministry of Environment expected SLR of 0.60 to 0.81 m along the northern coast of Peru over the next 100 years (MINAM (2010)), but recent studies suggest more severe impacts, see Pörtner et al. (2019).
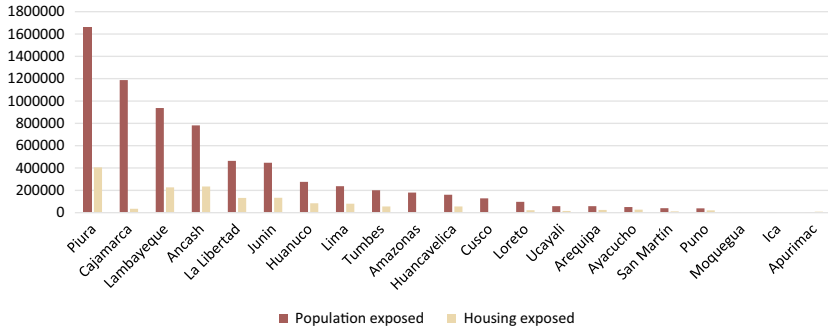
Figure 7.7 Exposure to probability of ENSO events by Regions. (Note: Not including droughts. Created by the author with data from CENEPRED, as published in SINAGERD et al. (2014: 26))

are centered on only one ecosystem-based activity, which raises climate vulnerability (Oft 2009, 2010). Most rural farmers in Piura have almost no savings or convertible assets and can hardly cover their monthly expenses. In some exposed areas, vulnerabilities are due to the lack of land titles (Bayer et al. 2014). A lack of oversight and frail materials leads to inadequate housing especially for poor people in Piura, which increases vulnerability to hazards (French & Mechler 2017).

As a result, El Niño events can have devastating effects. Table 7.1 indicates that estimated damages for the 2017 CEN, the focus of this research, amount to USD 3.1 billion or roughly 1.6% of Peru's GDP (French et al. 2020; Macroconsult 2017). The previous 1982–1983 and 1997–1998 events caused losses of USD 3.28 and 3.5 billion, equivalent to 12% and 6% of the annual GDPs, respectively (Sanabria et al. 2018; Vargas 2009). All these events severely damaged infrastructure, basic services, agriculture, fisheries, and livestock in Peru (Badjeck 2008; Sperling et al. 2008).

Previous studies find that the adaptive capacity of subsistence farmers in Peru's desert plains[11] for floods is low and depends on access to assets such as seeds, fertilizer, land and livestock (Sperling et al. 2008). For example, households that succeed in preserving livestock during El Niño events are better able to adapt

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[11] This section does not cover strategies of fishers and scallop farmers living directly by the sea, who employ different coping and adaptation techniques to deal with ENSO hazards. Their strategies include prey- or gear-switching, changing harvesting areas, or exiting fisheries or scallop farming. See Badjeck (2008); Badjeck et al. (2009); Kluger et al. (2019).
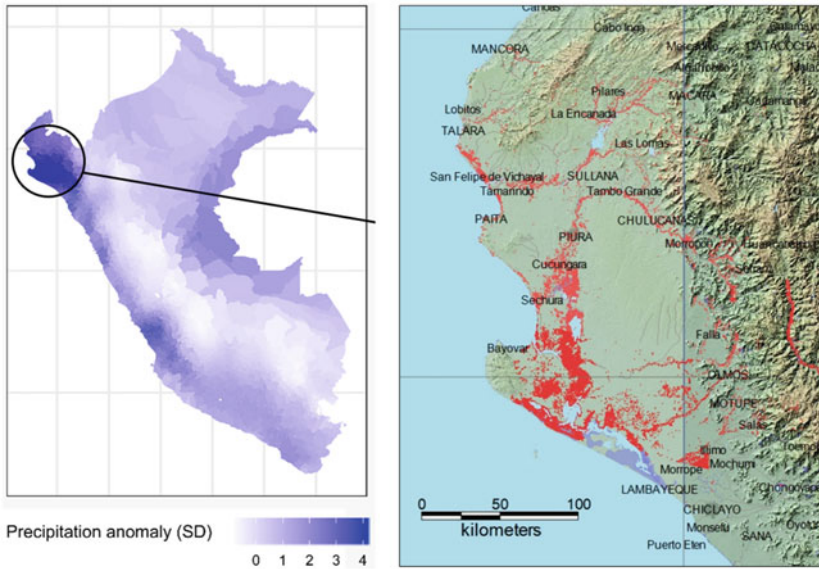
Figure 7.8 Rainfall anomalies during the 2017 CEN in Peru and flood extent in its northwest. (Note: On the left, the intensity of the rainfall anomalies during the 2017 CEN is calculated comparing the rainfall levels between January to March 2017 to those in the same months in the reference period 2000–2020. Created by Roman Hoffmann.[12] On the right, red is flood water mapped from ESA Sentinel 1 SAR data, dark blue is all previously mapped flooding, and light blue is the normal annual water extent mapped via NASA (90 m spatial resolution) SWBD. Cropped from Dartmouth Flood Observatory (2017))

and profit from their positive side effects, such as new vegetation cover. For coping with floods, the largest share of respondents in surveys across Piura asks for help from family and friends; many others either can do nothing, reduce expenses, or pursue extra work (Oft 2009, 2010). These coping strategies cover about three quarters of the incurred losses. When asked what respondents would do differently in a hypothetical future flood event, 23% would not change their farming strategies, 20% would diversify crops, and 15% would not grow anything at all. Similarly, a study in Tumbes indicates that residents find ways to live with

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[12] I would like to thank my colleague Roman Hoffmann, with whom I collaborated for the quantitative analysis in this chapter, for producing this figure. It uses MERRA-2 rainfall data by NASA, which is based on GPM satellite data. Riccardo Biella helped with the data extraction and resampling to a 1 km resolution applying bilinear interpolation.

Table 7.1 Loss and damage in Peru during recent El Niño events

Sector	1982–1983	1997–1998	2017
Population	• 512 deaths • 1,304 injuries • 1.27 million affected	• 366 deaths • 1,040 injuries • 0.53 million affected	• 138 deaths • 459 injuries • 1.45 million affected
Transport network	• 2,600 km of highway damaged • 47 bridges destroyed	• 3,136 km of highway damaged • 370 bridges destroyed	• 13,311 km of highway damaged • 449 bridges destroyed
Housing	• 98,000 homes destroyed • 111,000 homes damaged	• 42,342 homes destroyed • 108,000 homes damaged	• 63,802 homes destroyed • 350,181 homes damaged
Education	• 875 schools damaged	• 956 schools damaged	• 2,870 schools damaged
Health	• 260 health posts damaged	• 580 health posts damaged	• 934 health posts damaged
Σ value losses	USD 3.28 billion (1998)	USD 3.5 billion (1998)	USD 3.1 billion (2017)

Note: Reproduced by the author from (French et al. 2020: 5), based on INDECI data.

water shortages and loss of assets and homes after El Niño events, but recovery requires extensive time (Bayer et al. 2014). For water scarcity, studies indicate a similar range of reaction strategies as for floods.[13] For all hazards, migration also figures among people's coping and adaptation strategies, as is discussed next.

First, this study focuses on *abrupt* El Niño events, floods, and intense rainfalls, which are the largest drivers of internal displacement in Peru (IDMC 2021b). Such hazards usually force more temporary than permanent movements (Bayer et al. 2014; Espinoza-Neyra et al. 2017; French et al. 2020; Venkateswaran et al. 2017). For example, following the 1997–1998 event, 5% to 10% of people in one study left for good while a higher percentage looked for temporary work (Bayer et al. 2014). Oft's (2009, 2010) survey finds that 7% of households in Piura's lowlands migrate during floods, most often temporarily for day labor. When asked how they would adapt to floods over the longer term, only 1% pointed to temporary migration. For many, even temporary migration due to floods tends to

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[13] To deal with water scarcity, most coastal farmers ask for help from peers or reduce expenses; others cannot do anything, work additional time, ask for credit, use different crops, extend the used land, migrate temporarily, sell livestock, attempt to produce charcoal, and resort to child labor, see Aragón et al. (2018); Oft (2009, 2010); Sperling et al. (2008).

be an "option of last resort" to smooth income losses through jobs in coastal cities or the Amazonian lowlands (Sperling et al. 2008: 40). Flows can be gendered: while men migrate to work on rural farms, women move to cities for domestic work (Sperling et al. 2008). Multiple hazards related to El Niño events, compounded by development challenges, have also resulted in several attempted and completed community relocations in the coastal zone (Ferradas 2015; French et al. 2020; Oft 2009, 2010; Sperling et al. 2008; Venkateswaran et al. 2017). The focus of this analysis—the 2017 CEN event—forced both temporary and permanent migration. It was the single heaviest push for displacement in the past decade in Peru, with close to 300,000 displacements (IDMC 2019). Floods, mudslides, and flash floods destroyed 63,800 houses and damaged more than 350,000 dwellings; dented thousands of schools and health posts; caused close to 140 deaths; and affected a total of roughly 1.5 million people (French et al. 2020).[14] In May 2017, a survey registered 13,155 displaced persons in camps in Cura Moria and in Catacaos in LP (IOM 2017b). 87% of the sites emerged spontaneously, and most were close to the villages of origin, along streets to the city of Piura (Venkateswaran et al. 2017). In September 2017, a survey in 25 camps in LP found that the displaced persons were on average at the end of their 20s, and there was almost gender parity (IOM 2017c). In a non-representative survey in April 2018, 17% male and 18% female children lived among the remaining displaced persons in 16 sites in LP. 56% of all the respondents reported prior disaster displacement experiences (IOM 2018).

Second, while not the focus of this study, *slow-onset* processes also contribute to migration on Peru's coast. For example, water scarcity in Piura can damage health, livelihoods, and educational opportunities and drive migration as a result (Sperling et al. 2008). In one survey in Piura's lowlands, 8% of households affected by water scarcity used migration as a coping strategy, and 2% would consider it for longer-term adaptation (Oft 2009, 2010). Migration after droughts can be more permanent than after floods (Sperling et al. 2008). Temperature changes can also damage agricultural livelihoods (Aragón et al. 2021; Oft 2009, 2010), but few studies examine possible links to migration.

For future movements by Peru's coast, the climate projections debated above could have several implications. Many hazards that influence the drivers of (im)mobilities will intensify. To begin with, projected high temperatures during

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[14] While not the focus of this study, El Niño events also shape the availability of marine resources, which, in turn, affects fisher's reliance on seasonal or long-term migration, see Badjeck (2008); Kluger et al. (2019); Kluger et al. (2020).

much of the year and periodic heat waves—combined with rising water scarcity—will likely have strong, rising impacts on farmers' livelihoods and health, and thus affect migration and entrapment. Simultaneously, more intense rainfalls could destroy productive assets and homes and thereby compel displacement in the absence of effective disaster risk reduction and management (DRR/DRM). Especially the impacts of more frequent El Niño events could coerce more flight. More frequent, *episodic* strong El Niño events will also have synergetic effects with *permanent* SLR and could result in displacement and relocation if adaptation inaction, population growth in exposed areas, and weak governance combine (Reguero et al. 2015; Wrathall et al. 2019).

Against this background, the next section empirically evaluates how the 2017 CEN floods displaced people from the study sites and how this displacement has affected their well-being.

7.2   Qualitative Empirical Results

In November 2018, I interviewed 24 persons (9 m / 15f) displaced by the 2017 CEN in camp sites in LP (Figure 7.9) and in flood-affected villages in UP. Respondents' average (median) age was 44 years (43 years), with a range of 22 to 62 years (Table 7.2). Most respondents were subsistence farmers. Few of them had supplementary but limited livestock, and various did not possess own fields but rented them or worked as day laborers for agribusinesses and other landowners. A small number of interviewees worked as civil servants, in construction, or transportation. Interviewed women usually oversaw complementary activities such as free-range animals and some vending of farmed products. All interviewees spoke Spanish and auto-identified as *mestizo*.

To gather background evidence, I also interviewed staff at the Regional government's units for Social Development, Urban Planning, and Natural Resources, and the Authority for Reconstruction with Changes (RCC) for the 2017 CEN. Furthermore, an advisor to the mayor of Piura, two local mayors, one village alderman, and three community leaders in camps for displaced persons shared insights.

Figure 7.9 Impressions of the field work in Piura. (Note: The photos show homes of displaced persons interviewed in lower (LP, left) and upper Piura (UP, right). Photos by the author)

7.2.1 Climate Change Dimensions

Most respondents who were forced to flee after the 2017 CEN stressed that flooding and flash floods had affected them. In addition, many perceived climate-related diseases and pests that affected human beings and animals, heat, as well as strong winds and declining crop productivity (Figure 7.10). Less than one fifth of the respondents also mentioned droughts, water scarcity, and rainfall changes.

Villagers in LP and UP remembered several major El Niño events. Moreover, families living close to a drain by the Piura River in LP stated that they were flooded mildly every winter. While the 1983 and the 1998 El Niños had also displaced persons, the 2017 CEN floods were the most severe in people's memory. In UP, respondents suffered pluvial and fluvial floods in mid-March 2017. The floods developed rapidly, blocked or destroyed access streets, isolated households, and forced many to seek shelter on hills and in communal buildings, as discussed below. Impacts were most severe for those in low-lying areas. Unmaintained drains and the nightly flood-onset exacerbated damages:

> When we were sleeping, no, like at two in the morning, no, it started to rain hard … The water started to rise, and we only saved what is necessary, clothes, it caught us off guard. When my son tells me 'Mom, the house is already full, we can no longer do anything,'… the only thing [I could do] was to watch how I lost mattresses, clothes, shoes, everything was ruined. (UP-6)

Table 7.2 Basic data on interviewees in areas affected by the 2017 CEN in LP and UP

Alias	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
LP-1	F	59	Free range animals keeping	Selling produce	*Mestizo*
LP-2	F	56	Free range animals keeping	–	*Mestizo*
LP-3	M	48	Day labor	Crop farming	*Mestizo*
LP-4	F	54	Providing services (civil servant)	Providing services (sewing)	*Mestizo*
LP-5	M	45	Providing services (construction)	Crop farming	*Mestizo*
LP-6	M	42	Day labor	–	*Mestizo*
LP-7	F	43	Housekeeping	Free range animals keeping	*Mestizo*
LP-8	M	57	Day labor	Free range animals keeping	*Mestizo*
LP-9	F	36	Free range animals keeping	Day labor	*Mestizo*
LP-10	F	22	Housekeeping	Free range animals keeping	*Mestizo*
LP-11	F	42	Housekeeping	Free range animals keeping	*Mestizo*
LP-12	F	39	Housekeeping	Free range animals keeping	*Mestizo*
LP-13	F	31	Free range animals keeping	–	*Mestizo*
LP-14	F	23	Free range animals keeping	Day labor	*Mestizo*
UP-1	M	51	Providing services (civil servant)	–	*Mestizo*
UP-2	F	26	Crop farming	–	*Mestizo*
UP-3	F	31	Crop farming	–	*Mestizo*
UP-4	M	34	Day labor	Crop farming	*Mestizo*
UP-5	M	60	Crop farming	Free range animals keeping	*Mestizo*

Table 7.2   (continued)

Alias	Sex	Age	Main occupation	Secondary occupation	Ethnicity or "race"
UP-6	F	42	Crop farming	Day labor	*Mestizo*
UP-7	F	47	Crop farming	–	*Mestizo*
UP-8	F	62	Crop farming	–	*Mestizo*
UP-9	M	58	Crop farming	Day labor	*Mestizo*
UP-10	M	43	Crop farming	–	*Mestizo*
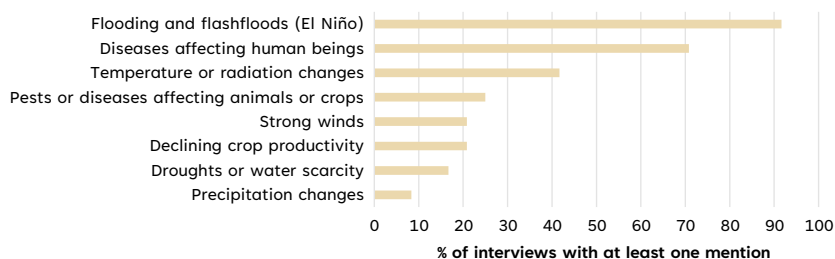
Figure 7.10   Hazards affecting interviewees in the coastal region. (Note: The graph depicts the percentage of interviewed affected people from the coastal villages who mentioned different types of hazards affecting them at least once during the interviews. Created by the author)

In LP, the Piura River broke levees, overflew rapidly, and severely damaged villages twice in late March. People perceived the magnitude of the floods as unprecedented and felt overwhelmed:

> *The water came twice, it came on a Monday and the other came on Wednesday, and it came back even more… Thank God it was daytime, if it had been nighttime, how many would have died, creatures, old people. Quickly, the water rose and came from all sides. (LP-14)*

Several respondents did not believe in an early warning they had received and refused to leave, because previous El Niño floods, although severe, had never reached the same intensity. Most villagers close to the broken levees lost their houses, fields, and other assets, and were displaced:

One could not save anything because the water rose very quickly, our concern was to get ourselves out, so we left with our clothes on, nothing else, all things stayed there, everything was lost …. (LP-5)

Beyond floods, combined gradual climatic and non-climatic stressors have affected the farmers, decreased their coping capacities, and rendered them more susceptible to periodical abrupt El Niño-hazards. Interviewees in LP and UP witnessed more heat and more or new plagues, which threatened agriculture and human health and forced some migration. For example, one farmer observed:

Ah yes, it no longer produces as before, the production is decreasing now ... Because of the climate, the sun that burns a lot ... It was not like this before then, in previous times, those that the elderly tell you about; well, they say that the plants produced like this, you just sowed and harvested. (LP-3)

Immediate coping with the 2017 CEN event was difficult for the interviewees owing to the sheer magnitude of the losses. Because they had few assets convertible to money or savings, many had to depend on the uneven humanitarian assistance. For longer-term adaptation, numerous people in LP indicated they wanted to stay in the areas they had fled to, which were protected from floods (see section 7.2.2). In UP, farmers observed a lack of knowledge, skills, and finances for DRR/DRM, and attested that, *"People worry … They don't know what to do, what they can do"* (UP-10). Some attempted to build basic physical protection but lacked the required means:

Yes, a wall was made, but it does not provide guarantees, ... it is made of sand. If it [the rainfall] is slow, it does nothing, but if it comes with force, it tears the wall down as if there was nothing. (UP-5)

Soil deterioration is an additional stressor. Farmers needed to borrow money to buy fertilizers and pesticides, and to sow again after harvest losses, which might result in vicious debt circles if later harvests are also unsatisfactory. Water scarcity is also a perennial issue, especially after El Niños, and migrants said that population growth and more water-intensive crops had intensified the issue over the past decade. While some interviewees stated that they struggled to cope with water scarcity, the focus of this analysis is on the 2017 CEN, which were the main driver of displacement.

7.2.2 Migration Dimensions

Next, applying the framework of section 2.2, I assess migration drivers, *aspirations*, *capabilities*, and common paths. Interviewees had to flee fast as the CEN floods threatened homes and lives:

> The water was running over my head, it was so high it was enough to drown me, yes that's why we left from there … Yes, the first time [it flooded] we stayed in the church, in the schools, but because of the downpour, the roofs were destroyed and the water was entering. The second time we already had to leave, in that humidity, in that mud that was left, it was very ugly, we were crying, the thunder was scary, we were asking God to have pity with us. (LP-11)

> … [I]t started to rain hard… Then over there [by my brother's house] they started to scream, to cry, we all went there ... the house was coming down on them… 'No, right now there is no way we can stay here, we better get out ourselves', … it caught us off guard. (UP-6)

Before the floods, most interviewees had had low or no aspirations to leave. One indication of these aspirations to stay is that many ignored early warnings and preferred to remain on site despite the imminent flood threat. Yet, once the water flooded their houses, they had little choice but to flee for survival and protection. Migration aspirations were thus instrumental (de Haas 2021) and the movements were *forced*, *acute* displacement. For example, a displaced woman in her early 40s said:

> We had never thought about leaving before the flood. We had never imagined, not even in our dreams, that we would suffer that much… since in the house we already had everything, we did not lack anything, we had a chair to sit on, a table where the children could write, we had light, we had water. (LP-11)

Most displacement started in a similar way because the abrupt floods created a largely homogeneous, acute need to flee, which affected people simultaneously. Migration capabilities influenced people's options in LP tangentially. Their movements did not require specific social capital, such as relatives offering shelter, since migrants fled to a nearby, uninhabited land (although conflicted land, see 5.2.2: Basic services).[15] Those with access to boats could escape marginally

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[15] Interviewees had allegedly received this land after the 1998 El Niño; it was, however, eventually sold to two agribusinesses, resulting in land conflicts after the CEN caused displacement in 2017.

easier and faster and were able to save some belongings; others without trans-portation means were trapped briefly before the army evacuated them. Timing differed only slightly. Many farmers fled early on during the first flood, as the water rose rapidly to the top of their houses; others persevered for hours in the flooded area, some out of choice, others against their will. Finally, a small num-ber waited out until the second flood hit. For most, displacement occurred over several spatial steps: they escaped first to their rooftops, nearby hills, or higher buildings; then to the close-by highway; and eventually to the nearby land where they built camps or settled in designated evacuation areas. Displaced persons were forced to stay away for long as their villages of origin remained flooded and the houses seriously damaged. When I conducted the interviews in November 2018, they had lived in prolonged displacement for close to 20 months.

In UP, in mid-March 2017, intense rainfalls damaged or destroyed several low-lying houses and forced the owners to flee over short distances. However, because the impacts were less severe in UP than in LP, the interviewees returned earlier. Displacement was also more disperse in UP than in LP, where most people ended in camps. For example, two farmers in UP had been displaced to the high school for one month but returned to their land after they had received temporary housing modules. Another female farmer and her family were displaced to relatives first and then to the high school for one month. She initially had to leave her father behind because he was unable to walk and *"everything was water over there"*, so they *"raised his bed with bricks"* until they could *"get him out later"* to the high school (UP-6). This case stresses the role of health status and physical ability for migration capabilities. Others stayed with relatives or in tents for several months. For example, one female farmer in her mid–20s lived with her man and their two years old child in a tent for more than a year.

Beyond short-distance and short-duration displacement, a few young farmers from UP migrated to the sea or to cities for some months to smooth income losses. For example, a man in his mid–30s worked in coastal fisheries for several months to support his family after he had lost his house. Some interviewees observed scant permanent movement, but others stated that, *"Many people who lost their houses got displaced to Lima, especially if they did not receive assistance initially"* (UP-10). The longer and farther away people wanted to move, the more vital were capabilities. For example, a displaced crop farmer in his early 60s recalled he could not move as far as he would have liked since *"there are no resources to evacuate to another place"* (UP-5). He remained in *forced* immobility.

Many of the respondents had been displaced multiple times in earlier El Niño events. For example, a woman in her late 30s had fled to a relative's house in

1998 for one month, then was displaced from her house again in 2002 for one night, and finally had to leave again in 2017 (LP-12).

Among those displaced in the 2017 CEN, a few had come to UP from the highlands years ago, partially due to climate impacts in their villages of origin. These farmers can be considered "double climate migrants", and their plight stresses the salience of accumulating shocks. For example, a crop farmer in his early 60s, originally from the rural highlands, indicated that he like many others had migrated with his whole family to UP ten years ago due to worsening agricultural production. They had built a decent life, but then lost close to everything in the 2017 CEN floods (UP7).

The camps in LP were built relatively close to the flooded home villages, which enabled varied translocal ties, such as going back to rescue belongings early on and clean premises later; sending children to unaffected schools back home (see section 7.2.3: Educational opportunities); or visiting the ruined homes for nostalgic reasons. Only few displaced persons returned completely because they wanted to be closer to their previous schools or had succeeded in restoring parts of their fields. Several farmers had dual residencies or moved between the locations for their work but lived in the camps.

During the interviews in November 2018, most displaced persons from LP had already spent 20 months in the barren desert camps and still wanted to stay. They acquiescently abandoned their old homes and accepted longer distances to fields. A central reason to stay was fear of new floods, especially among children and older adults. This fear of more inundations was built up through cumulative flood experience and boosted by radio forecasts or word of mouth:

> *Most have stayed here ... out of fear ... due to the danger of the river, it was not the first time… I have experienced this since I was a child. (LP-7)*

These fears often combined with the experienced losses, which made a return less viable:

> *When [the kids] see that rain falls, they are already scared, they run inside the house, due to the rain they get really scared. They don't want to go back anymore… why return, so that the children get scared? The houses are already destroyed, they collapsed, how are we going to stand up again? (LP-11)*

Finally, besides El Niño events, the interviews confirm that droughts can drive seasonal migration. For example, the male head of one household in UP would

migrate close to every year to the coast for fishing in dry seasons, when the family suffered economically.

7.2.3   Well-Being Dimensions

In the following, I describe the results of the qualitative text analysis of the primary data collected from interviews with displaced persons. I examine how the displacement from areas in LP and UP harmed by CEN floods have affected people's well-being and apply the four well-being axes explained in section 2.3: *development from a secure base, a space to live better,* and *social relatedness* (objective well-being, OWB), as well as *subjective well-being* (SWB).

7.2.3.1   Development from a Secure Base
7.2.3.1.1 Decent Livelihoods
When I interviewed the displaced persons in LP in November 2018, 20 months after the floods, they were still struggling to make a decent living in the nearby camps.[16] The floods had destroyed harvests and assets, fields were not yet fully recovered, and owners of parcels *"can no longer give work"* (LP-11). Many men and some women switched to work as day laborers for a nearby agribusiness that had remained unaffected. The agribusiness owned the conflicted land where their camps were erected, and reportedly, the displaced could work for it as the result of negotiations on the land (see 5.2.2: Basic services). This day labor provided a key income buffer after the flood shock. Yet adults older than 50 years remained excluded, stressing how age can influence disaster recovery. The offered work was also precarious and unstable, as one of the community leaders detailed. Another leader criticized:

> Let's say that the need for work is such that you endure the work, ... the company takes advantage … [Y]our daily salary is 33 soles [Peruvian currency] and with a break of 15 minutes, not more, they exploit people. This is one of the realities that people [live], the difference of your own farm and of providing a service… Staff who do not perform, they remove after four days ... Although our people suffer at work, at least there is a source to make their family livelihood ... Imagine if these companies did not exist ... But I still say there is a mistreatment of the workers. (LP-6)

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[16] Similarly, the displaced persons perceived that the few longer-distance migrants who had gone to work temporarily in Lima or Piura city often ended in precarious work, without social security, unstable income, and irregular housing.

Despite these limited options for day labor, various farmers remained un- or underemployed and had entered economic hardship. Even those who could continue their pre-flood jobs (such as some *moto* drivers) suffered losses, albeit to a smaller extent. Regardless of the specific income source, many respondents were only earning *"just enough for food, more than anything to survive"* (LP-10). When asked on his income, a middle-aged farmer who was forced to switch to day labor replied:

> *Enough for the sustenance of the house, but not more [nervous laughter], it depends on the children you have, I have four… [Before] there was something to sell, now as the situation is, one cannot work on the farm as the water has left sands in the fields ... Yes, one works only for the sustenance of the house, for the daily expenses, it is not enough to save and buy other things [lowered voice]. (LP-3)*

Before the floods, women usually contributed to household incomes by raising free-range animals. However, most could not rescue their animals. One woman in her mid–50s explained how her income had decreased significantly since they had lost all their animals and lacked jobs or savings to reinvest:

> *Oh yes, sometimes it is not enough and now everything is expensive. ... Sometimes it is sad because there is no work ... I am already [mid 50s], they don't give me work anymore, that is painful to me… [I]t's the first thing we want, that there be something to work, to buy some small things, more than anything food. (LP-4)*

Some women were starting to invest in animals again with the help of NGOs and local farmers, aiming to start producing and selling food. If households combined their income activities, they could subsist but not thrive. For example, one woman in her mid–30s with six children, and highly pregnant when interviewed, had lost all animals, and was only slowly reinvesting with support from a charity. She could not produce *chicha* [alcoholic drink] anymore as she lacked wood and water, and her man was precariously employed in day labor, rendering their income just enough *"to survive"* (LP-9).

Displaced persons in UP suffered similar losses of assets, animals, and crops, due to rainfalls, floods, and subsequent pests. Those lucky enough to rescue some animals usually had to sell them after the floods to smooth the income losses. Farmers had to wait long until they could sow crop seeds and grow pastures for livestock again. Water scarcity added as an obstacle to their recovery. Most people had been poor before the floods, but afterwards, under- or unemployment aggravated their situation. The labor market provided even less possibilities to buffer losses than in LP, because UP had less agribusiness demand for day labor.

Those farmers who were able to switch to day labor worked precariously and had worse income than before. A female farmer in her early 40s deplored:

> *What you earn is only to survive, you cannot progress, because they pay you little, that is why when the phenomenon [El Niño] came, it hit us too strong, and left us poorer. One works to survive, to support the children, they cry, they ask for food, milk. That's the experience we have here. (UP-6)*

She and her family could only take the most necessary things and lost most assets. They had nothing to eat initially, as their crops were destroyed, pastures for livestock could not grow, and new crops required time until harvesting. They received limited help from the government, pointed to corruption, and felt abandoned by the state. Many interviewees confirmed this lack of state presence and noted that NGOs and villagers' mutual support mechanisms mitigated these gaps to some extent.

In summary, the 2017 CEN eroded livelihoods. It also increased the climate vulnerability of displaced farmers because they lacked seeds, food, and income from harvests, or savings, and no DRR/DRM were taken to protect livelihoods. A mayor rued:

> *Eh, well if it [a future flood] comes it would be worse, but we must prepare to prevent… Well, right now with this government there is no support, there is nothing, the municipality is worse, we are close to the end of the year and there is no support. (UP-1)*

7.2.3.1.2 Health and Food Security

Shortly after the CEN floods, the displaced persons had large needs regarding health and nutrition. In November 2018, the interviewees confirmed that diseases remained widespread. The vulnerabilities of older adults, children, people with physical disabilities, pregnant women, and people with preexisting diseases were particularly exacerbated by poverty and the unhealthy living conditions during the displacement. In UP, insufficient water quantity and quality was a widespread issue because the displaced persons lived close to the flooded areas, sanitation had collapsed, and people lacked funds to buy water. As a result, infectious diseases spread fast, especially among children.

With their livelihoods destroyed and no savings, most respondents also suffered from hunger and depended on humanitarian assistance or mutual support. In UP, the floods had blocked access streets and exacerbated food insecurity. A farmer remarked: *"There was no passing, we were isolated then. For [nearby cities]*

there was no access, for example in terms of food, we suffered a lot here because of food" (UP-9). Dependency on external assistance was high and when I interviewed the displaced persons 20 months after the floods, many still could not produce or purchase enough food for adequate nourishment. A highly pregnant woman stressed the difficulties for her and her six children:

> *Sometimes, here we suffer because there is none [food]; we endure hunger, but children do not. Sometimes, there are days when you eat, there are days when you don't, and sometimes we help each other with a plate of food because the spouses don't have a job. (LP-9)*

People who lacked housing or land titles struggled to access social programs, and the National School Feeding Program (*Qali Warma*) seemed not easily portable. A community leader described widespread food insecurity, which affected children in particular:

> *Yes, it affects the alimentation of the children, the reason is that there is no work ... Yes, because we do not know how to get [food] ... We asked for a* comedor *[popular dining room] that is suitable for children, but we were not lucky. (LP-5)*

Camp sector leaders also stressed the psychosocial impacts of the floods and displacement (see 5.2.2: Emotional balance and cognitive satisfaction). Several women suffered trauma due to the experienced threats to live, losses, and flight. In few areas, NGOs provided basic care, but most respondents rued that they received no emotional or psychological support. Others had to make substantial efforts to receive help. As one mother explained, *"I had to take my 7-year-old daughter there to [town] to be seen by a psychologist because she was scared and did not want to stay …"* (LP-11).

Further health challenges related to decreased protection possibilities from adverse weather conditions, for example, because the displaced persons remained in inadequate shelter:

> *We have been in a tent for eight to nine months, there we already burned, we were very burned ... When there was sun, we could not enter the tents, it burned too much.... (LP-4)*

> *And now children with this climate—the children get sick with the flu, the cough. At night [it's] quite cold and here, we sleep on the floor, and it is cold. (LP-9)*

Health service provision has stayed fragmented after the CEN floods. In November 2018, the interviewees felt that the health situation had slightly improved

compared to the start of their displacement and the serious infrastructure losses then, but was still worse than before. Several camp sectors had only a health post in a container with intermittent service. Other areas stated that services were gradually withdrawn and that *"there is no health center here, the nurses are leaving because they are hired, and we are left with nothing"* (LP-11). Several respondents had to travel to unaffected health posts in surrounding villages. Health emergencies constituted severe challenges because they required costly travel to the district city for help and transportation options were low at night:

> *In the afternoon, in the evening, there is no one attending you. There have already been abortions here, there have been people who have come out of an emergency, children with respiratory infections late at night,… the routes are not adequate, and we do not have the mobility to be able to help people. (LP-6)*

Finally, the lack of income or insurance to pay for health services exacerbated health problems:

> *Yes, they [the agribusinesses] don't pay you as it should be…. You work your working day, you don't have insurance, you don't have anything, you fall ill, and you die since you don't have money. (UP-6)*

7.2.3.1.3 Educational Opportunities

When interviewed in November 2018, respondents rued the substantial losses of school infrastructure and the lack of services for the large number of displaced children. They observed that schools in the camps had been built fast and for temporary use (linked to the land conflicts, see 5.2.2: Basic services), but remained the only available option for a long time. According to one community leader, infrastructure was only slowly improving and promised support such as school feeding programs did not arrive. All respondents confirmed that educational opportunities for their children had severely deteriorated after the CEN. Various children had to walk strenuous, long distances to the few unaffected high schools in their villages of origin: *"they have to go up hills and go down"*, remaining *"in the sun, the children burn, they get blisters, they get tired"* (LP-9). The exhaustion, adding to mental health issues, made it difficult for children to concentrate in class. Parents felt that, *"Sending children to schools is scary"* (LP-11) as it involved a passage over the nearby highway and the risk of (at times deadly) accidents (LP-6). Yet, sending them by *moto* (autorickshaw) on a regular

basis was too expensive for most parents. Finally, the lack of light in homes also hindered homework.

7.2.3.2 A Space to Live Better
7.2.3.2.1 Adequate Housing
The quality of housing heavily deteriorated for most displaced persons. The interviewees confirmed that many arrived with nothing but their clothes to the desolate, empty desert area. They received tents that provided basic shelter initially, in which they spent one to twelve months. 20 months after the floods, several of the interviewees still had only basic additional structures built around their tents. Only few respondents received temporary housing modules later. While they perceived these modules as an improvement over tents, the modules were of poorer quality than the houses they had had before the CEN. Inadequate housing conditions exacerbated other vulnerabilities, especially of pregnant women, older adults, children, and people with physical limitations:

> *Another of the great needs here is, the type of life as we have, no, the houses for example as you see are of rustic material, we have the elderly, we have children, we have the disabled [sic], and housing is not so adequate because of the cold here, the wind that makes people fall with respiratory infections. There have also been diarrheas, well the situation is critical, no ... The conditions are, let's say, precarious, no, rustic material, kitchens of this type and well…. (LP-6)*

For example, a highly pregnant woman in her mid–30s explained how the shelter failed to protect her family from the cold and how she was afraid of the health impacts on her baby. Cooking occurred mostly with collected wood, which created health risks through indoor pollution and fire risks.

All interviewees described the shelter reconstruction as arduous and *"expensive"* (LP-3). *"Little by little"* (LP-4), they made small improvements, although the materials remained *"rustic"* (LP-3):

> *The material is expensive ... we bought it suffering hunger ... [It is] expensive to make such a house, here we have invested to make this room, not more, over there I still need to do one, but I do not have money to buy the materials. Well, that is the situation [sighs]. (LP-2)*

Compared to LP, displacement was more dispersed in UP and resulted in different shelter situations. The displaced persons lived in tents, public buildings, and unaffected houses of relatives. For example, two crop farmers were forced to move to the high school and stayed there for one month before returning to

their land, where an NGO provided temporary housing modules. Overall, the farmers described that housing had significantly deteriorated compared to before the floods, and that damages were long lasting. Although many respondents had already suffered damages in previous El Niño events, they ignored or could not adhere to warnings by authorities not to rebuild in low-lying land and to avoid poor materials, as they lacked financial means and safe plots for protected homes.

7.2.3.2.2 Basic Services

Most of the interviewees had had almost complete access to basic services in their villages of origin before the 2017 CEN. They struggled with managing the ensuing lack of provision in the barren desert camps. Land conflicts posed a major obstacle to receiving investments in basic services. Interviewees had allegedly received the land to which they escaped after the 1998 El Niño; yet *"because of bad leaders"* (LP-6), it had been sold to two agribusinesses, which created land conflicts after the displacements in 2017. After the CEN, this land conflict stalled government investments:

> … [T]he state itself did not even want to set foot here due to the very situation of the private [land]… … The minister came also, he told us that he could not invest because they were not in the capacity to invest in a property that did not belong to the state. (LP-6)

Conflicts (see 5.2.2: Security) and talks led to partial solutions for persons in some sectors, who could stay and work for the company. For these sectors, municipalities agreed to a land-use change from rural to urban to legalize settlements. Notwithstanding, people doubted that the agreement was final:

> First his [the landowner's] family came to throw them away, the fences we had; they fought, they set their dogs on us [laughs]. Then the young lady from the municipality came to resolve, they came here and had an agreement, but now the gentleman says no, and does not want to give the terrain. So, we only have certificates. (LP-12)

In other camp sectors, the company did not compromise and ended the discussions. For these displaced persons, the land issues resulted in high uncertainty. They were worried because *"many told us that they were going to take the land from us"* (LP-8) and longed for a solution:

> What we most want is that they give us a proof of possession, we want it to be a true one, that they do not take away from us. Because here there are problems sometimes,

if the businessman throws us out, where are we going to go back to? We want that they give us a document that protects us…, for the well-being of the children… The other time, they also said that they were going to evict us, and the children are scared when they hear that, they start crying. We sleep alert, too. (LP-11)

These obstacles and the fragmented humanitarian assistance resulted in an uneven availability of basic services in the camps. Various respondents voiced their frustrations with the government and often alleged corruption. Crowded living conditions added further pressure on the insufficient services.

Although water provision was a crucial need for survival and recovery, many camps remained without sufficient, safe, and reliant water for long. In November 2018, the interviewees remarked that water quantity, quality, and costs diverged across sectors. In some zones, the agribusiness owning the land provided water in tanks, in limited amounts but of sufficient quality. Other areas regularly received free water to group tanks from the state. For still others, private trucks provided water to group tanks in sufficient quantity but at high costs. In addition, water deliveries were becoming less frequent, so that some sectors now experienced scarcity. Finally, various sectors had to rely on water of insufficient quantity and quality from wells in nearby villages.

Regarding sanitation, the difficult situation with few latrines shared by many households had improved at first but then declined again. By November 2018, the interviewees rued a widespread lack of sanitation and drainage. In several areas, the temporary constructions built by the state or NGOs were decaying, after more than one and a half years of use by numerous displaced persons, or had already collapsed and were dysfunctional:

… [I]n the very school, for example their toilets, the toilets were also built thanks to the NGOs…. but these services were not, in other words, this is temporary, and because we have been around for a while, we will have spent two years here, and these hygienic services have already collapsed. (LP-6)

In contrast to their villages of origin, in November 2018, most interviewees described a persistent lack of light and electricity in the camps. Only few had access to solar lanterns or panels outside of their modules for limited hours of light. Several interviewees recalled that they had been promised access to electricity and light but expressed doubt that the promises would be fulfilled. The darkness complicated children's schoolwork, resulted in security risks, and lead to fire risks due to the use of candles. For example, a father of four children in his late 50s pleaded that,

> *Hopefully the new Regional authorities ... we hope they help us and remember us, because here we are without water, without light, which is the most essential thing for children who have to do their homework. (LP-8)*

Poor roads created additional obstacles for the displaced persons. Transportation providers (*motos*) could not enter the sandy camps as most *"roads are pure sand, are not even planned"*, which increased respondents' perceived isolation and made them *"suffer"* (LP-6). They got *"blisters"* and were exhausted from walking on the sands (LP-4), especially children and older adults:

> *Here the only thing we want is access roads, the ladies from [nearby town] have to carry their bundle from here to there, no motorcycle enters, it is what one suffers the most without access roads. (LP-3)*

7.2.3.2.3 Pleasant Surroundings

By the time of the interviews, the displaced persons in UP had returned to their homes, and many of them rued the destruction of their fields and missed the work there. Yet overall, they described limited changes regarding the satisfaction with their locality, natural surroundings, and related activities.

By contrast, the displaced persons in LP arrived in barren desert lands that most perceived as hostile compared to their prior home villages: *"In these small terrains we have all been; pure thorns, herbs were these lands; all together, we had to help clean, men and women"* (LP-1). According to a community leader, the living conditions were crowded, with more than 2000 families living in an area apt for 500, which raised stress on the already stretched infrastructure (see 5.2.2: Basic services). Additionally, the significantly smaller sizes of the new lots complicated the traditional raising of free-range animals and the storing of produce. Positive feelings about the surroundings were rare.

7.2.3.2.4 Safety from Hazards

In UP, a large number of displaced persons moved back to their old lots and thus into the same flood exposure as before. Consequently, many feared new floods and felt less prepared for possible impacts than before (see also 7.2.1; 5.2.2: Safety from hazards, Outlook on the future). In November 2018, the respondents in LP stated they felt safer from floods as the camps were located on sandy ground that could absorb downpours. They were slightly more elevated and farther away from the canal and drain. Especially traumatized persons reported relief to be on

safer grounds. For example, a displaced woman in her mid–30s, when asked if she felt safer or not in the new destination, replied:

> *Yes. Although it was difficult for us to tarry here, we were crying, it was sad to be here… Remembering is sad, we didn't eat, we only took care of the children, but little by little we got used to here, and to return there, no? Not anymore. (LP-9)*

While safer from floods, the displaced persons in LP faced exposure to new hazards in the barren desert, which was exacerbated by poor housing (see 5.2.3: Adequate housing). The exposure to adverse weather conditions harmed especially the health of at-risk groups, such as children and older adults (see 5.2.2: Health and food security). By day, the desert sun caused sun burns and the heat in the tents was unbearable while overnight, they were exposed to winds and cold temperatures.

7.2.3.2.5 Security

In November 2018, interviewees reported insecurity, including violence due to the land conflict (see section 7.2.3: Basic services), thefts, and robberies. First, after fleeing, the land conflict with the private landowner created tensions. Violent clashes allegedly killed at least one displaced person. By the time of the interviews, some sectors had found a compromise on the land, but others continued in uncertainty (see 7.2.3: Basic services). The second insecurity issue concerned thefts and robberies, which were widespread in UP during the flood and at the start of displacement. In LP, robberies and thefts of water tanks or animals were still common. Farmers said, *"When we call them [the police], they come whenever they feel like it, and the thieves have already fled"* (LP-9). Finally, some sectors self-organized citizen patrols (*rondas*) that contributed to interviewees' perceived security:

> *We make the* ronda *[citizen patrols] at night ... since a month ago there were robberies in a row ... as the animals are stolen and that's because they see that there is no security, with this* ronda *things are improving ... Several things have been taken ... Right now, we are, as one says, relaxed, we feel that there is no theft anymore. (LP-8)*

However, other sectors without *rondas* or police forces perceived perennial insecurity. The lack of light (see 7.2.3: Basic services) exacerbated the security risks: *"More than anything, we want them to improve our town so that we too can live more peacefully, because the darkness of the night is dangerous"* (LP-7). Women in the interviews did not explicitly mention gender-based violence. However, when male

household members migrated to other areas for work, insecurity for women and children could rise. For example, the young mother of one child described how her husband's migration to the coast to smooth income losses raised insecurity:

> *Yes, here with the children I stay ... It is not easy, and it is also dangerous since it has happened to us once that they scared us, that hooded men came here, they scared us. So sometimes I'm also afraid of being alone. (UP-3)*

7.2.3.3   Social Relatedness

The interviewees asserted that they had formed functional, cohesive communities prior to the floods. In UP, most people fled within their villages and felt that *"we are united"* (UP-9). They maintained good relations and observed solidarity: *"[W]e all give a hand to each other. For those affected, we tried to help, to give them a way out so they could progress, and not leave [them] alone"* (UP-9).

In LP, the CEN displaced entire villages. The displaced explained that social cohesion and unity remained high because neighborhoods and social structures were replicated in the camps: *"Yes, we know each other here, we live in one community, and we support each other"* (LP-9). A community leader said, *"Here we treat each other as one family because we stand together and we are always there, in dialogue"* (LP-5). The displaced persons observed good social relations, with mutual support systems buffering the worst damages. Sharing tools or assets and mutual help in reconstruction and communal tasks was common. The displaced persons in LP also swiftly self-organized to elect community leaders who acted as local camp sector coordinators.[17] One of these leaders stated, *"Yes, we hold meetings almost weekly, biweekly, in order to organize ourselves, to coordinate"* (LP-5).

The interviewees did not mention changes in family relations due to the flood and displacements. They only described adverse social effects in cases when peers migrated to other areas for work. For example, a young mother and her children missed her husband who had migrated to the coast to smooth losses, and recalled how his absence raised security issues (see section 7.2.3: Security). Her husband, returned by the time of the interview, confirmed the difficulties during the family separation:

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[17] A non-representative survey in May 2017 showed that in 80% of camps, displaced persons had formed communal committees to help with the site management. 63% of respondents in camps in Piura received their information primarily from community leaders and 77% identified them as the most trustworthy sources. See IOM (2017b).

… [T]he situation is ugly because you leave your family in the situation that was here…
Yes, well, it would be nice if there was work in only one site, if we both worked together,
with the children. (UP-4)

7.2.3.4 SWB Dimensions
7.2.3.4.1 Emotional Balance and Cognitive Satisfaction
Disaster experiences and displacement can have a long-lasting impact on SWB.
20 months after the CEN disaster, the interviewees still experienced strong neg-
ative emotions due to the floods and the displacement. For several religious
displaced persons, who considered the flood a punishment by god for previous
misbehavior, the disaster evoked feelings of guilt and regret (see section 7.2.3:
Outlook on the future). Yet, most prevalent were feelings of helplessness, sad-
ness, and pain. Respondents linked these negative emotions to losses, increased
poverty, poor shelter, threats to health, and stress:

… [F]or the one who no longer has a place to live, until now it is something traumatic.
My sister-in-law always says, 'I would like just one room [to live in]', but nothing. I'm
begging to God, and I really do want some help to come because it hurts. (UP-6)

These negative feelings were salient especially at the start of displacement when
deprivations were greatest. However, for many, these emotions persisted despite
slow advances as they worried about the arduous recovery. For example, a woman
described how her family was sad about the losses, the new exposure to weather
extremes, the costly and troublesome reconstruction, and the hunger (LP-2).
Family separation due to longer-distance migration also created sadness (see
section 7.2.2).

Many displaced persons stressed perennial psychosocial issues, including anx-
iety, fear, shock, and trauma. For example, one woman described how she had
feared to drown in the floods, lost all her assets, arrived horrified in the camps,
and still suffered 20 months later: *"We were already scared, and the other year left*
us traumatized" (LP-11). Many intensely feared that more floods might occur:

We don't [want to go back] anymore, because the radio stations start saying that the
water is going to come again, we are already traumatized by that, we all cried when
it happened. (LP-4)

Children, in particular, were traumatized after the floods and afraid of new disas-
ters. Mothers suffered to witness the continued anxiety of their children. One of
them observed that,

… [The children] no longer want to return, they are afraid. When they left, they were
scared, traumatized by what happened because well, that was never seen in life before.
(LP-5)

The interviewees criticized that professional psychological care was insufficient
in most areas (see section 7.2.3: Health and food security). Still, a small number
of displaced persons slowly lightened up because they had started rebuilding lives
and felt safer from future floods. Various respondents showed notable resilience,
which was at times supported by humor. For example, a respondent in UP was
saddened by the loss of his house and assets. Although he worried about his
wife's health and was afraid of a new flood, he was also humorous, laughed
during the interview, and made jokes (UP-5). Yet, in other cases, laughing was a
mechanism of defense rather than an adaptive humorous take:

Interviewer: "We are investigating the social impacts of the phenomenon of El Niño.
How did you pass that experience?" LP-4: "We don't want to remember [laughs]".
LP-13 [adds]: "It was a sadness."

Various children processed their experiences by playing games. One mother
reported how she, saddened by her losses, felt pain when she watched her three
children playfully simulate the floods. However, the children seemed to enjoy
the game (LP-4). Another mother said her son had liked the time when they
were forced to live in the school building, although he had suffered from a seri-
ous stomach infection shortly before, and the family lacked money to receive
adequate health care.

My son used to tell me, 'Mom, how cool, living in a school'. I have never had a house
with a second floor, but my son would go up to the second floor in the school, and he
liked to live in the school, he was happy, he did not want to leave from there. (UP-7)

While various interviewees expressed gratefulness toward humanitarian assistance
by NGOs, they were angry, annoyed, disappointed, and frustrated about the gov-
ernment's handling of the CEN and the recovery. Many felt angry or deceived due
to the empty promises for improving their situation (see also e.g. section 7.2.3:
Decent livelihoods). Various observed corruption. For example, a woman who
had lost her house in 1998 for the first time, and then again in 2017, was angry
about the *"neglect of authorities"* to maintain drains, because otherwise the flood
"could have been avoided" (UP-6). She was also frustrated and disappointed by
the flawed government responses after the flood:

To [name of an NGO] we are grateful, they helped us a lot… The state is absent… The state is taking a long time, many obstacles; what happens is that the state has a lot of corruption… Yes, the governments that we have had have been bad, in a row, bad, bad. (UP-6)

This perceived corruption also evoked feelings of injustice and shame among the displaced persons.

7.2.3.4.2 Outlook on the Future

When prompted to assess their views of the future, various people stressed religious faith as their anchor for consolation, hope, and patience, even in their dire circumstances and with evident trauma:

There are families that are still in need, but they also have to wait, yes God makes that it continues, otherwise they will have to wait just with patience, and someday God will touch their hearts again…. I have consolation, hope and I have faith in God that someday we are going to recover some things, not everything, because the situation does not allow anymore to buy everything we had. (LP-5)

Even so, various religious persons perceived the CEN as a divine punishment, which instilled guilt, regret, and surrender in some of them. Others hoped that virtuous behavior could improve their plight:

But since one believes in God, these are tests that little by little they are making for us, sometimes we say, 'Why does it happen, why does it happen?', but it happens because sometimes we also no longer obey God and God gets tired of correcting us. We do bad things and then God, when he punishes, he sends for everyone, good and bad, and thank God we are surviving here. Yes, but when you are with God everything comes to your house ... [It is] the will of God and you have to have patience. (UP-6)

Beyond faith, the solidarity in communities, the decreased exposure to floods, and trust in individual capabilities also made respondents in LP hopeful that they would be able to progress and improve the future of their children (see section 7.2.3: Safety from hazards). People hoped that progress would be possible if the land conflict was solved (see 5.2.2: Basic services), if the state invested more, and if NGO support continued. Many followed the Peruvian narrative that progressing (*salir adelante*) was always possible. This idea seemed to be a sign of resilience in several cases; in others, where possibilities for growth were extremely low, this narrative of progress created extra pressure or led to self-deception. For example, when asked about his view of the future, a community leader contended:

> *Ah well, we aim to* salir adelante *[to progress], keep fighting, start living a new life. In other words, start again from the bottom since certainly all the things that we had, well, we no longer have. Now, to start a new life, start buying things, start building a new home—and sometimes one does not have the resources, and the materials are expensive and cannot be bought, but anyway, one is getting up little by little ... Also, hope, clearly, [we] value everything we have, and we will recover little by little. (LP-5)*

Conversely, several displaced persons expressed resignation, discouragement, and fatigue due to economic and land insecurity (see section 7.2.3: Basic services). Two respondents feared that, *"Maybe we will never replace what we have lost [sad]"* (LP-2) and, *"Well, I think everything will remain the same [nervous laughter]"* (UP-2). In UP particularly, farmers stressed that their precarious agricultural livelihoods limited their economic prospects, and to make things worse, El Niño floods, alternating dry spells, and warming have repeatedly disrupted their lives and decreased hopes for the future. The CEN losses made farmers feel *"clearly less, less prepared"* for future hazards, which could undo their slow recovery: *"God forbid too [laughs],* pucha *[slur], it would be worse [if a flood happened again] … Well, we no longer have somewhere to sow and how to survive"* (UP-9).

7.3   Quantitative Empirical Results

In this section, I complement the qualitative study of Piura with a quantitative analysis based on secondary data that cover all districts across Peru which were declared in a state of emergency due to the CEN. These data yield additional insights into people's differential displacement risk and the impacts of displacement on their well-being one month and seven months after the event (whereas the qualitative data was collected more than one and a half years after the disaster).

As detailed before in section 3.2.2, the analyses are based on two surveys. These two surveys are (a) the CEN Survey collected around one month after the disaster, between mid- and end of April 2017, and (b) the National Census enumerated six months later, at the end of October 2017. The CEN Survey contains data on 398,148 persons in 199,938 dwellings and 2,615 public buildings in the 892 districts declared in a state of emergency (see Table 3.1). Both analyses below focus on a subsample of 186,437 *affected* adults, namely those whose homes suffered at least minor damages in the disaster.[18] 88% of this group

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[18] The analysis excludes children below 18 years to avoid double-counting and because the survey did not contain relevant data for them on key well-being items, such as employment.

(164,084 adults) could be tracked in the National Census for the well-being analysis, which compares well-being effects between the *affected, disaster displaced adults* and those respondents who were *affected but could remain at home* as the most suitable comparison group.

7.3.1   Magnitude of Displacement and Differential Displacement Risk

To begin with, the CEN Survey provides insights into the magnitude of the overall displacement and households' differential displacement risk. However, the data does not explicitly identify displaced households.[19] In this dissertation, I focus on the habitability of respondents' homes to infer if they were displaced due to the disaster.[20] In the CEN Survey, enumerators observed and indicated whether the visited houses were (a) unaffected; (b) habitable but in need of renovations; (c) uninhabitable; or (d) collapsed.[21] Because the comparison here focuses on the *affected* population, category (a) was excluded. The analysis operates with a new binary variable which uses category (b) for the status of *affected but non-displaced* and merges categories (c) and (d) as the proxy for *disaster displaced*. Applying these proxies, 24.1% of all affected households (or 42,410 adults) surveyed after the CEN were displaced: the homes of 15.53% of the households (or 27,583 adults) were uninhabitable while those of 8.57% (or 14,827 adults) were entirely collapsed. In some districts where rainfall was intense, more than 20% of the households were displaced; Figure 7.11 illustrates the extreme rainfall anomalies during the CEN in the 20 districts with the highest share of displaced households.

In a next step, three logistic regression models were applied to assess who among the affected 86,734 households had been most at risk of displacement (Table 7.3). The first model uses exogenous environmental factors as proxies for

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[19] The CEN survey identifies "damaged" persons, but this designation is only an indication of possible displacement. One cannot take for granted that all "damaged" persons were displaced because INEI applies the label "damaged" to persons who *either* had uninhabitable houses, *or* suffered severe economic losses, including unemployment or losses of agricultural assets, *or* whose health was affected due to the CEN. See INEI (2017c: 8).

[20] As explained in section 3.2.2, this assumption that the habitability of homes is a proxy for displacement is a plausible basis for the analysis but comes with certain limitations.

[21] For 1,550 datapoints, enumerators noted that there was no infrastructure or land in the designated lot; they were excluded from the analysis. Likewise, households that consisted only of children were excluded from the analysis.
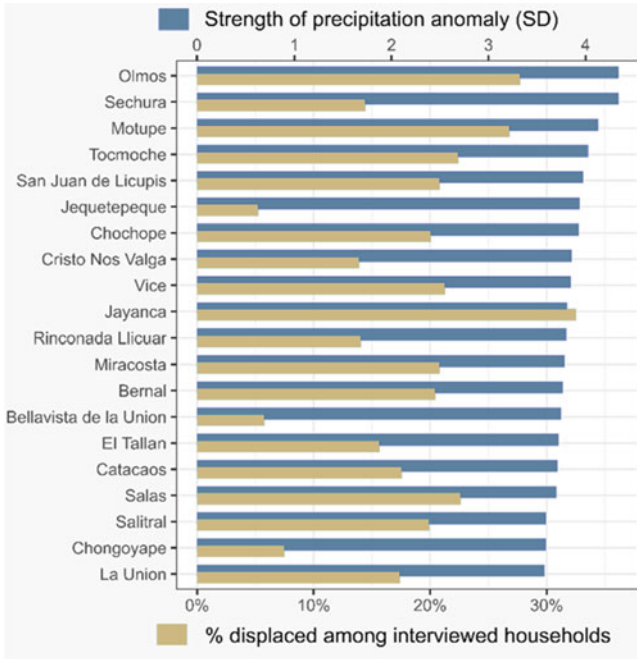
Figure 7.11 Rainfall anomalies and household displacement in severely affected districts. (Note: The figure compares the standard deviations (SD) of rainfall between January and March 2017 with the same months in the period 2000–2020. It shows the intensities of the anomalies in the 20 most severely affected districts in the country (blue bars) and the percentage of households in the CEN Survey reporting to have lost their home (turquoise bars). Created by Roman Hoffmann)

people's exposure to the disaster, namely data on rainfall anomalies between January and March 2017 as well on the average distances to inland water bodies, maximum elevations, and elevation ranges in the analyzed districts.[22] The second model adds household composition and demographic characteristics to these environmental factors, including household size, the share of children, older adults, or people with disabilities in the households, if the household was headed by a single parent, and the level of education. The third model expands these prior parameters further with variables on livelihood characteristics and the wealth

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[22] The data sources for these regression parameters included GTOPO30 and MERRA-2, as explained in footnote 28 in Chapter 3.

of the households, such as occupation, tenure security, as well as housing and infrastructure quality.

Regarding performance, model 3 has the highest Pseudo-R^2 and therefore the highest explanatory power. In this best-fit model, most parameters had a statistically significant influence on displacement risk. All results in the models are marginal effects calculated at the mean of all covariates. The risk increased greatly due to environmental factors, such as the intensity of the CEN rainfall anomaly (0.2507***) and the elevation range in the districts (0.2344**). If households were farmers (0.3178***), lived in small rural villages (0.2036**),[23] had young or older children (0.1965*** or 0.0769***), were headed by single parents (0.1691***), or had members with disabilities (0.1589***) also critically raised displacement risk. By contrast, dwelling in decent types of housing, such as houses or flats (–0.3122***),[24] and owning property with a title (–0.2373***) strongly reduced the risk. Smaller decreases in displacement risk followed for households with larger sizes (–0.1303***), who rented or lived with family (–0.1281**), and at greater distance to inland water bodies (–0.0721***). For every 10-percentage point increase of adults with at least secondary education or female members in the household, the risk of being displaced also decreased by 1.6% (**) and 1.3% (***), respectively.[25] Parameters without statistical significance were limited access to public infrastructure prior to the CEN, living in non-standard housing (such as hotels or asylums), the maximum elevation in the district, the number of older adults in the household, and if all adult household members were unemployed prior to the disaster.

7.3.2   Short- and Mid-Term Impacts of Displacement on Well-Being

The next analysis focuses on the impacts of displacement on respondents' well-being directly after the CEN and seven months later. The two surveys provide

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[23] INEI considers settlements with less than 2,000 inhabitants as rural. See INEI (2018c: 15).

[24] The variable is coded as follows. *Decent types of housing* refers to houses and apartments or rooms in tenements. *Non-standard types* include collective housing (hotel, hostel, lodging, asylum) and other types. The reference for both is *deficient types of housing*, such as huts, cabins, improvised housing, or premises not intended for human habitation.

[25] All variables referring to a *percentage share* of household members are scaled from 0 to 1. For example, 0.1 represents 10% of female household members. Thus, the effect on the dependent variable gauges an increase from 0% to 100% of women. A 10-percentage point increase of women in the household would lead to an effect of $-0.1283/10 = 0.0128$.

Table 7.3 Logistic regression models analyzing marginal effects of drivers of household displacement risk

Independent variables	Dependent variable: Household displacement (binary)		
	(1)	(2)	(3)
Environmental factors			
Maximum elevation in district (in 1000 m)	0.0162	–0.0257	–0.049
	[0.067]	[0.066]	[0.065]
Elevation range in district (in 1000 m)	0.2034*	0.2376**	0.2344**
	[0.104]	[0.102]	[0.105]
Precipitation anomaly in Jan-Mar (in SD)	0.2416***	0.2314***	0.2507***
	[0.052]	[0.051]	[0.054]
Average distance to inland water bodies in district (km)	–0.0739***	–0.0691***	–0.0721***
	[0.023]	[0.024]	[0.025]
Household characteristics			
Household size		–0.1282***	–0.1303***
		[0.016]	[0.018]
Single parent household		0.1422***	0.1691***
		[0.040]	[0.042]
Any household members with disabilities		0.1725***	0.1589***
		[0.039]	[0.041]
Number of children < 5 years in household		0.2228***	0.1965***
		[0.029]	[0.028]
Number of children 5–17 years in household		0.0934***	0.0769***
		[0.020]	[0.020]
Number older adults > 65 years in household		–0.0386	–0.007
		[0.035]	[0.030]
% of adults with at least secondary education[26]		–0.2962***	–0.1610**
		[0.069]	[0.064]
% female household members		–0.1601***	–0.1283***
		[0.034]	[0.034]
			(continued)

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[26] Footnote 25 applies to all parameters that gauge percentage shares of household members.

Table 7.3 (continued)

Independent variables	Dependent variable: Household displacement (binary)		
	(1)	**(2)**	**(3)**
Livelihood characteristics and wealth			
All adult household members unemployed prior to disaster			−0.0001
			[0.036]
Housing type: decent (reference: deficient)			−0.3122***
			[0.093]
Housing type: non-standard (reference: deficient)			−0.1137
			[0.470]
Household owns property with title (reference: property without title)			−0.2373***
			[0.065]
			−0.1281**
Household rents or lives with family (reference: property without title)			[0.057]
Household has only limited access to public infrastructure prior to disaster (water, sewerage, electricity)			0.116
			[0.079]
Agricultural household			0.3178***
			[0.045]
Household lives in rural area			0.2036**
			[0.094]
Observations (households)	86,734	86,734	86,734
Pseudo R²	0.016	0.023	0.034
AIC	94,263	93,574	92,624

*Note: Regression coefficients in cells with clustered standard errors in parentheses. The coefficients are shown as marginal effects calculated at the mean of all covariates. Standard errors were clustered at the district level. P-values: * ≤ 0.1 ** ≤ 0.05 *** ≤ 0.01.*

insights into a selection of the central well-being dimensions applied in this dissertation (section 2.3 explains the full framework), mainly into *a space to live better* and *development from a secure base*. Yet, the data are limited on various key subitems of these dimensions, such as education, safety from hazards, and physical security. Additionally, the surveys lack data on *social relatedness* or *SWB*. The well-being analyses below are thus not as comprehensive as the qualitative study in section 7.2.3 but they illuminate key changes in the well-being of a much larger number of people. For context, note that the quantitative data cover people's situation directly after the event in April and half a year later in October 2017, whereas the qualitative data sheds light on the situation in November 2018, more than a year later.

To begin with, shortly after the disaster, people displaced by the CEN reported substantially higher damage on livelihoods, health, shelter, and basic services than those residents who were affected by the disaster but able to remain in their houses within the districts declared in a state of emergency (Table 7.4). Because the sample covers close to the full affected population, summary statistics render robust results on people's well-being outcomes. Regarding *development from a secure base*, the survey registered severe damages to livelihoods: the agricultural production of 92% of the displaced compared to 85% of the non-displaced, but affected households was damaged; 25% of the displaced and 17% of the non-displaced households lost work due to the disaster; while 90% of the businesses in homes of displaced households and 72% of those in the non-displaced group were damaged. Additionally, the disaster strongly affected people's health. In Piura—the focus of the qualitative study—109 persons died, out of a total of 280 fatalities countrywide. In all of Peru, 6% of the displaced and 3% of the affected non-displaced persons were injured in the event. As many as 43% of the displaced and 41% of the non-displaced households suffered from health problems one month after the CEN, such as respiratory infections, diarrhea, dengue, and tuberculosis. Finally, food insecurity was rampant in the districts declared in a state of emergency. Approximately 80% of the displaced households compared to 69% of the non-displaced respondents suffered from moderate or severe food insecurity in the month after the event. In addition, the CEN Survey registered 81 damaged health centers. As the only indication of changes in educational opportunities in the data, the survey also recorded damages to 518 educational facilities. Other sources document an even higher damage to 934 health posts and 2,870 schools (French et al. 2020: 5). The effects on *a space to live better* were similarly severe: around 85% of the displaced persons noted that the disaster had severely damaged the walls or roofs of their houses, compared to less than 10% for the non-displaced group. Among the displaced households, 78% had no

access to sanitation, 71% lacked access to water, and more than half of them lived without electricity, which represent substantially higher shares than for the affected, non-displaced group. The data is visualized in Figure 7.12 below.

In a next step, linear regression analyses were used to discern the impacts of displacement on the *individual* (not household) well-being of respondents seven months after the disaster. The analysis draws on a dataset with the affected adults of the CEN survey tracked in the National Census. A well-being index was constructed based on 35 items available in the Census. Most items existed for *a space to live better,* including the type of housing;[27] construction materials; access to water, sanitation, and electrical light; property title; number of persons per rooms; fuel used for cooking; and the availability of household assets (16 assets, such as computer, cell phone, refrigerator, and car). For *development from a secure base*, the Census provides three items of interest, namely indictors on people's employment status, their health insurance, and disabilities, whereas no relevant data existed for education. All individual indicators were combined in a well-being index using principal component analysis (PCA). In PCA, items are assigned weights based on their relative importance in the sample. Well-being items that allow to differentiate more effectively between different groups are given a higher weight. The resulting index was normalized to a scale from 0 to 100 to simplify the interpretation (Table 7.5, Table 7.6).

Figure 7.13 illustrates the distribution of the respondents along this normalized well-being scale. It indicates that the respondents' well-being is skewed toward the lower end of the scale.

In a next step, five models linearly regressed peoples' well-being score on displacement. As a baseline, the first model uses displacement as the only variable, while the subsequent models gradually add more controls. The second model includes the exogenous environmental factors from the prior analysis as controls, such as the intensity of the CEN rainfall anomaly. The third model controls for these environmental parameters as well as for household composition and demographics. In addition, the fourth model also encompasses livelihoods and wealth variables. Lastly, the fifth model adds individual characteristics to the parameters already included in the previous models. By adding further environmental, household, and individual variables to the models, the analysis attempts to control for self-selection effects that might confound the estimation of displacement impacts on well-being. Displacement is not a random process, but factors, such as the

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[27] Decent types of housing include houses and apartments or rooms in tenements, as opposed to huts or cabins, improvised housing, and others. Hotels, hostels, lodging, boarding houses, health facilities, penitentiary, residential care centers, army bases, and houselessness are excluded.

Table 7.4 Summary statistics on loss and damage experienced by households due to the CEN event in 2017

	Not displaced			Displaced		
	Share of respondents	SD	N	Share of respondents	SD	N
Development from a secure base						
Agricultural production damaged	.85	.358	32,245	.921	.27	12,160
Lost work due to disaster	.168	.374	56,803	.251	.434	17,699
Business got damaged	.723	.448	5,839	.898	.303	1,352
Got injured in disaster	.033	.178	65,830	.055	.228	20,904
Experienced health impacts	.412	.492	65,830	.43	.495	20,904
Experienced food insecurity	.693	.461	65,830	.796	.403	20,904
A space to live better						
Walls of house severely damaged	.096	.295	65,830	.842	.365	20,904
Walls of house moderately damaged	.879	.326	65,830	.158	.365	20,904
Roof of house severely damaged	.069	.254	65,830	.85	.357	20,904
Roof of house moderately damaged	.773	.419	65,830	.15	.357	20,904
Household has no access to water	.511	.5	60,704	.71	.454	19,071

Table 7.4   (continued)

	Not displaced			Displaced		
	Share of respondents	SD	N	Share of respondents	SD	N
Household has no access to sanitation	.583	.493	59,760	.777	.416	18,669
Household has no access to electricity	.284	.451	62,588	.555	.497	19,451

Note: Based on responses from 86,734 households in the CEN Survey. Some indicators are calculated for a sub-sample of the relevant respondents. For example, the share of households experiencing damages in their business or agricultural production refers to all households who had a business or an agricultural production prior to the disaster.
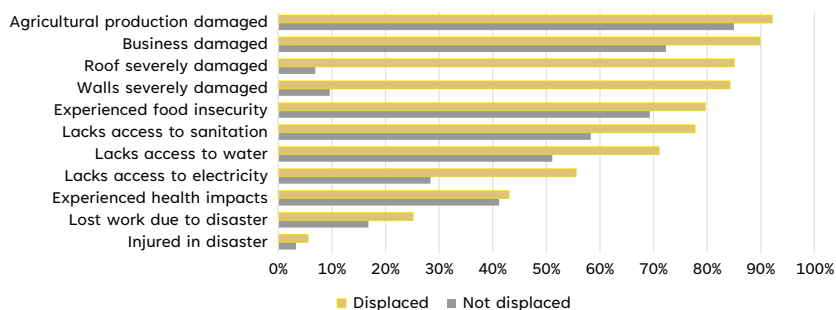
Figure 7.12   Loss and damage among the affected, displaced or non-displaced population. (Note: Visualizes the data specified in Table 7.4 above)

age, sex, or socioeconomic status of respondents can change the probability of displacement in systematic ways (Aksoy & Poutvaara 2021; Borjas et al. 1992; Kaestner & Malamud 2014). Because displacement is driven by a range of such factors that might simultaneously influence the well-being outcome, the observed changes in well-being in the dataset might not be due to the displacement itself, but rather due to pre-movement factors that made displacement more likely in the first place. Controlling for these factors in the models renders a more accurate representation of displacement effects, which is reflected in changes in the regression coefficients as the numbers of controls increase from model 1 to 5.

The results in Table 7.7 demonstrate that displacement led to statistically strongly significant well-being decreases in every model. The negative effect of

Table 7.5 Summary statistics of variables used for constructing the well-being index

Variable	Mean	SD	min	max	N	PCA weights
Decent type of housing[28]	.97	.171	0.000	1	165,724	.0414296
Wall materials: high quality	.683	.465	0.000	1	162,920	.1497772
Roof materials: high quality	.221	.415	0.000	1	162,920	.1587134
Rooms: low quality	.552	.497	0.000	1	162,920	−.2254049
Rooms: intermediate quality	.383	.486	0.000	1	162,920	.1491993
Rooms: high quality	.065	.246	0.000	1	162,920	.1606593
Water: low quality	.217	.412	0.000	1	162,920	−.1533882
Water: intermediate quality	.14	.347	0.000	1	162,920	−.0548475
Water: high quality	.643	.479	0.000	1	162,920	.171703
Sanitation: low quality	.361	.48	0.000	1	162,920	−.1939327
Sanitation: intermediate quality	.106	.308	0.000	1	162,920	−.0679328
Sanitation: high quality	.518	.5	0.000	1	162,920	.2348671
Access to electricity	.849	.358	0.000	1	162,920	.1529223
House with property title	.357	.479	0.000	1	162,920	.113005
Not more than 2 people per room	.966	.181	0.000	1	162,920	.0243775
Access to modern cooking fuel	.618	.486	0.000	1	165,724	.2369635

<div align="right">(continued)</div>

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[28] The reference here are all other types of housing, including non-standard and deficient housing.

Table 7.5 (continued)

Variable	Mean	SD	min	max	N	PCA weights
Assets: audio system	.269	.444	0.000	1	162,920	.18807
Assets: television	.658	.474	0.000	1	162,920	.2222769
Assets: gas stove	.667	.471	0.000	1	162,920	.23341
Assets: refrigerator	.37	.483	0.000	1	162,920	.2432326
Assets: washing machine	.108	.31	0.000	1	162,920	.2067373
Assets: microwaves	.074	.261	0.000	1	162,920	.1793246
Assets: electric blender	.435	.496	0.000	1	162,920	.2432661
Assets: electric iron	.393	.488	0.000	1	162,920	.2401447
Assets: computer	.156	.363	0.000	1	162,920	.2248524
Assets: cell phone	.765	.424	0.000	1	162,920	.1491313
Assets: telephone	.085	.279	0.000	1	162,920	.1830393
Assets: TV connection	.263	.44	0.000	1	162,920	.2076736
Assets: internet connection	.126	.332	0.000	1	162,920	.2010318
Assets: car	.048	.213	0.000	1	162,920	.1182356
Assets: motorcycle	.131	.338	0.000	1	162,920	.0856661
Assets: boat	.017	.13	0.000	1	162,920	–.0230222
Unemployed	.544	.498	0.000	1	165,724	–.0515379
Disability	.148	.355	0.000	1	165,724	–.0044143
Health insurance	.771	.42	0.000	1	165,724	–.0306757

displacement on well-being remains consistent and statistically significant across all models, while the strength of the effect decreases from model 1 to 5 as these models successively account for more confounding variables. Concerning model performance, model 5 has the lowest AIC score, which indicates the highest explanatory power. Based on the estimated Adjusted R^2, this best-fit model explains about 36% of the variance in the well-being outcome (whereas displacement alone in model 1 explains 1.5% of the variance). In the best-fit model 5,

Table 7.6 Summary statistics of the principal component analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	7.5032	5.17752	0.2144	0.2144
Comp2	2.32568	0.397699	0.0664	0.2808
Comp3	1.92798	0.323601	0.0551	0.3359
Comp4	1.60438	0.278449	0.0458	0.3817
Comp5	1.32593	0.136607	0.0379	0.4196
Comp6	1.18932	0.054026	0.034	0.4536
Comp7	1.1353	0.043758	0.0324	0.4861
Comp8	1.09154	0.033382	0.0312	0.5172
Comp9	1.05816	0.054001	0.0302	0.5475
Comp10	1.00415	0.051416	0.0287	0.5762
Comp11	0.952739	0.022173	0.0272	0.6034
Comp12	0.930565	0.01811	0.0266	0.63
Comp13	0.912455	0.037086	0.0261	0.656
Comp14	0.875369	0.026125	0.025	0.6811
Comp15	0.849244	0.004975	0.0243	0.7053
Comp16	0.844269	0.015962	0.0241	0.7294
Comp17	0.828307	0.013588	0.0237	0.7531
Comp18	0.814719	0.04309	0.0233	0.7764
Comp19	0.771629	0.029271	0.022	0.7984
Comp20	0.742358	0.037959	0.0212	0.8196
Comp21	0.704399	0.015796	0.0201	0.8398
Comp22	0.688603	0.01267	0.0197	0.8594
Comp23	0.675933	0.028652	0.0193	0.8787
Comp24	0.64728	0.064251	0.0185	0.8972
Comp25	0.583029	0.025423	0.0167	0.9139
Comp26	0.557607	0.027468	0.0159	0.9298
Comp27	0.530139	0.022066	0.0151	0.945
Comp28	0.508073	0.025027	0.0145	0.9595
Comp29	0.483046	0.047434	0.0138	0.9733
Comp30	0.435613	0.052929	0.0124	0.9857

(continued)

Table 7.6 (continued)

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp31	0.382684	0.292096	0.0109	0.9967
Comp32	0.090588	0.064955	0.0026	0.9993
Comp33	0.025633	0.025543	0.0007	1
Comp34	9.02E-05	9.02E-05	0	1
Comp35	0	.	0	1
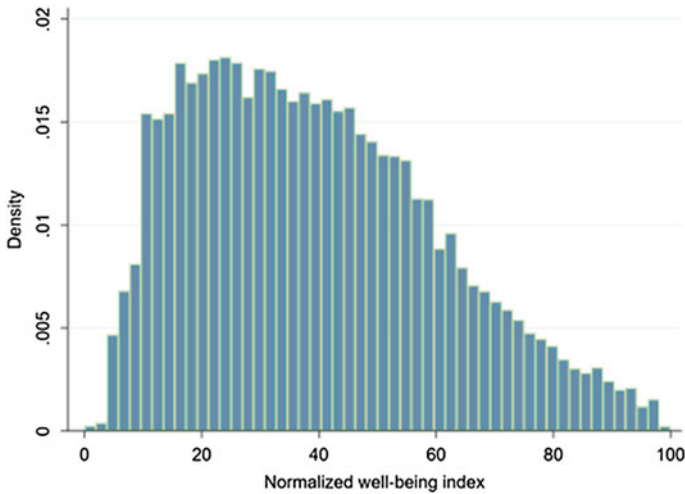
Figure 7.13 Histogram of the normalized well-being index based on 35 indicators. (Note: Created by Roman Hoffmann)

displacement caused statistically significant losses of 3.14 points on the well-being scale that ranges from 0 to 100 (–3.1389***, compared to –6.2189*** in model 1).

In addition, most control parameters have statistically significant effects on well-being. Strong influences in the best-fit model 5 are secondary education (14,9207***), housing type (11,9633*** and 4,9532***), living in small rural villages (–10,4514***), and owning property with a title (5,9972***). Migration between districts in the five years prior to the Census also substantially

Table 7.7 Linear regression models analyzing drivers of individual well-being impacts seven months after the CEN

Independent variables	Dependent variable: Well-being (continuous)				
	(1)	(2)	(3)	(4)	(5)
Displacement	-6.2189***	-6.2163***	-4.6671***	-3.1353***	-3.1389***
	[1.013]	[0.946]	[0.630]	[0.510]	[0.491]
Environmental factors					
Maximum elevation in district (in 1000 m)		-0.0067***	-0.0050***	-0.0039***	-0.0039***
		[0.001]	[0.001]	[0.001]	[0.000]
Elevation range in district (in 1000 m)		0.0063***	0.0047***	0.0045***	0.0045***
		[0.002]	[0.001]	[0.001]	[0.001]
Precipitation anomaly in Jan-Mar in district		-0.942	-0.8416	-1.5547***	-1.5122***
		[1.045]	[0.704]	[0.565]	[0.553]
Average distance to inland water bodies in district (km)		-0.557	-0.7608*	-0.8263**	-0.8248**
		[0.554]	[0.398]	[0.370]	[0.361]
Household characteristics					
Household size			1.9252***	1.7427***	2.0147***
			[0.177]	[0.162]	[0.166]
Single parent household			-0.9090**	-1.6123***	-2.1539***
			[0.407]	[0.335]	[0.317]
Any household members with disabilities			-0.3457	-0.1222	0.2187
			[0.332]	[0.255]	[0.211]

(continued)

Table 7.7 (continued)

Independent variables	Dependent variable: Well-being (continuous)				
	(1)	(2)	(3)	(4)	(5)
Number of children < 5 years in household			−3.1101***	−2.5400***	−2.1056***
			[0.235]	[0.201]	[0.175]
Number of children 5–17 years in household			−1.0414***	−0.7287***	−0.5589***
			[0.122]	[0.110]	[0.109]
Number older adults > 65 years in household			3.0808***	2.3352***	1.2695***
			[0.478]	[0.361]	[0.276]
% of adults with at least secondary education[29]			22.1204***	17.0473***	14.9207***
			[1.423]	[1.148]	[1.071]
% female household members			4.4697***	3.8720***	2.3341***
			[0.398]	[0.350]	[0.303]
Livelihood characteristics and wealth					
All adult household members unemployed prior to disaster				−3.5964***	−4.2015***
				[0.213]	[0.235]
Housing type: decent (reference: deficient)				5.0598***	4.9532***
				[0.680]	[0.667]

(continued)

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[29] Footnote 6 applies to all parameters that gauge percentage shares of household members.

Table 7.7 (continued)

Independent variables	Dependent variable: Well-being (continuous)				
	(1)	(2)	(3)	(4)	(5)
Housing type: non-standard (reference: deficient)				12.1200*** [2.150]	11.9633*** [2.177]
Household owns property with title (reference: property without title)				6.0970*** [0.587]	5.9972*** [0.565]
Household rents or lives with family (reference property: without title)				3.7503*** [0.787]	3.7391*** [0.780]
Household has only limited access to public infrastructure prior to disaster (water, sewerage, electricity)				−4.3532*** [0.568]	−4.2752*** [0.553]
Agricultural household				−4.5387*** [0.666]	−4.4098*** [0.645]
Household lives in rural area				−10.6750*** [0.663]	−10.4514*** [0.652]
Individual characteristics					
Female respondent					1.7038*** [0.168]

(continued)

Table 7.7 (continued)

Independent variables	Dependent variable: Well-being (continuous)				
	(1)	(2)	(3)	(4)	(5)
Marital status: divorced, separated, widowed					−1.1245***
					[0.202]
Secondary education or higher					2.3800***
					[0.185]
Respondent was unemployed prior to disaster					0.2926
					[0.201]
Disability					−1.3301***
					[0.217]
Age					0.0921***
					[0.011]
Recently migrated (past 5 years)					5.3214***
					[1.221]
Observations (individual respondents)	162,427	162,427	162,427	162,427	162,427
R²	0.01525	0.05936	0.24923	0.3536	0.36194
Adjusted R²	0.01525	0.05933	0.24917	0.35352	0.36183
AIC	1,447,954	1,440,519	1,403,914	1,379,618	1,377,522

*Note: Linear regression coefficients in cells with clustered standard errors in parentheses. Standard errors were clustered at the district level. The outcome is the normalized well-being index ranging from 0 (lowest well-being) to 100 (highest well-being). P-values: * ≤0.1 ** ≤0.05 *** ≤0.01.*

raises well-being (5,3214***). Examples of the various other control parameters with strong influence include being an agricultural household (–4,4098***) or having limited access to infrastructure (–4,2752***) and unemployment (–4,2015***) prior to the CEN. Two controls without statistically significance are unemployment prior to the disaster and having household members with disabilities.

7.4   Discussion

In this chapter, I interpret the empirical results of the *Costa* case study and situate them in the broader literature. The focus is on the key mechanisms of action and structural conditions that have influenced the observed hazard-(im)mobility dynamics and resultant well-being effects.

7.4.1   Hazard-(Im)mobility Links and Pathways

The abrupt floods during the 2017 CEN *acutely forced* farmers from LP and UP who lacked previous migration *aspirations* to flee. The qualitative data from Piura suggest that because the floods constituted a largely uniform, rapid, and critical push to move, migration *capabilities* were tangential at first. Yet, the quantitative data offer a more nuanced view of differential displacement risk across Peru. Clearly, higher exposure to the disaster strongly increased displacement risk. Both pluvial and fluvial flooding raised the displacement risk, since rainfall intensities and the proximity to inland water bodies (thus the possible excess of water) as well as the elevation range in the districts (thus slopes for possible floods and mudslides) had significant effects. Other studies confirm that hydro-geographical features have contributed to people's exposure to the CEN in Peru (French & Mechler 2017). Therefore, spatial disaster risk analysis is imperative to understand and address related displacement risk. Peru has done first steps in the direction of such spatial analyses (SINAGERD et al. 2014), but the data requires updates and should also account for the associated displacement risk. However, the regressions also reveal that not all the exposed people faced the same risk of being displaced; rather, this risk was greatly influenced by their social vulnerability to flood impacts.

First, the threat of being displaced due to CEN impacts was high for people living in poorly protected shelter. The Peruvian state recognizes that deficient housing is a major cause of disaster vulnerability in the country (SINAGERD

et al. 2014). Four out of five houses in Peru are self-constructed, with limited oversight or control of building codes (Calderón et al. 2015).[30] As a result, precarious housing with poor materials is widespread. In cities, over one third of dwellers lived in slums in 2014 (World Bank 2019), and informal settlements have grown threefold between 1993 and 2012 (Calderón et al. 2015). The expansion of informal settlements continues and is accompanied by plot trading and challenges such as clientelist state behavior and unequal access to opportunities. Although the vulnerability of informal settlements in Peru is known, it remains unattended (French & Mechler 2017). This analysis stresses the need to improve housing quality in disaster-exposed areas to reduce displacement risk. Conversely, the regression results emphasize that owning property with a title strongly reduced displacement risk, as did renting or living with family, albeit to a lesser extent. A possible interpretation is that homeowners with a title have more income which allows them to protect their houses better from hazards. Furthermore, they might be more likely to live in legal settlements in more affluent neighborhoods with better infrastructure, DRR/DRM, governance, and access to social programs.[31] In the same way, people who rent or live with family may dwell in more resilient conditions than those without a title. Consequently, addressing the widespread tenure insecurity in Peru (Calderón et al. 2015; Prindex 2022) may help reduce disaster displacement risk.

Moreover, farmers were at higher risk of displacement than those in other economic sectors. One explanation could be that many smallholders and subsistence farmers have undiversified income sources and depend on ecosystem services and livelihood assets close to their homes that disasters tend to disrupt for long. Numerous poor farmers also lack buffering capacities to cope with shocks. In Peru, this lack of access to financial mechanisms for self-protection is a major cause of disaster vulnerability (SINAGERD et al. 2014) and, by extension, of displacement risk. Farmers also tend to depend on water for irrigation and might therefore have lived close to water sources that are prone to spill over during heavy rainfalls and damage people's homes as a result. The substantial displacement risk of farmers should concern policymakers because around 30% of the Peruvian labor force works in agriculture (World Bank 2019), a share that is considerably higher in rural areas. 97% of these agricultural jobs were informal in

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[30] The insights from other studies referenced in this and the following paragraphs draw in part on my previous work published in Bergmann et al. (2021a).

[31] Another hypothesis which cannot be assessed with the applied data is that homeowners might also have decided to stay longer due to higher place attachment, for example, to protect their assets.

2014 and lacked proper social security (CEPLAN 2016), which can raise susceptibility to disasters and displacement. Related, the regressions indicate that living in small rural villages increased displacement risk. Most farmers in Peru live in the countryside. Peru's rural areas are generally poorer and more deeply deprived, and they have worse infrastructure and DRR/DRM systems in place than its cities. An estimated 46% of rural residents were below the national poverty line in 2014 compared to 15% of the urban population, and the poverty gap for the rural poor was on average 14% below this line, but only 3% for the urban poor (World Bank 2019). As a result, the risk of displacement is considerably higher in rural than in urban areas. Even so, urban displacement risk can also be high, especially in marginalized neighborhoods (IDMC 2021c).

Finally, various intersectional social factors—such as being a household headed by a single parent, having limited education, having household members with disabilities, or having young children—made displacement more likely. Other studies have also demonstrated that intersectional factors strongly influence the climate adaptation options available to people in Peru (Erwin et al. 2021). These findings can be interpreted in two ways. First, due to systematic marginalization and resulting disadvantages in Peru (Sanborn 2012), these social factors may deprive people of basic resources required for protection against disasters, such as resilient shelter. Second, all the variables above, and particularly lower education levels, probably also correlate with having less income, buffering capacities, and resources for fleeing. Displacement is generally more associated with fast- than with slow-onset hazards (Koubi et al. 2016; Zickgraf 2021), but when hazards hit fast and hard, vulnerable households may be unable to evacuate out of harm's way (Boas et al. 2020).[32] Finally, the analysis indicates that households with more male members were more likely to be displaced. Data corroborates that the probability of flight is usually higher for men than for women in other contexts as well (Aksoy & Poutvaara 2019). Some studies suggest that households with more women may be better prepared for disasters, but the literature is inconclusive on this question (Alam & Rahman 2017; Ashraf & Azad 2015; Bronfman et al. 2019; Castañeda et al. 2020; Sharma et al. 2015). An alternative explanation, but outside of this framework, is that attitudes toward risk-taking behavior, such as flight, might have differed during the disaster depending on people's sex. Another possible explanation could be that social

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[32] A third hypothesis, which cannot be examined through the data, is that households with at-risk members might have had to move fast to seek assistance and protection and, as a result, were less likely to remain in their damaged homes.

norms or sex-specific discrimination in learning, for example concerning swimming, could have trapped more women than men in damaged buildings (Rigaud et al. 2018). A different possibility is that caregiving norms may have forced women to stay with and assist at-risk family members (Ariyabandu 2009; Valdés 2009). Taken together, these findings on displacement risk related to intersectional social factors underscore the need to address systematic disadvantages in highly unequal societies such as Peru to lower disaster displacement risk. In addition, the findings call on humanitarian actors to prepare for the fact that people displaced by disasters can include a high share of persons in vulnerable situations due to certain social factors that do not only make displacement more likely but also increase post-disaster vulnerability. These results contradict another seminal study which finds that selectivity of migration may be limited in sudden-onset disasters; the displacement observed in that study was not predicted by age, education, sex, or socioeconomic status (Gray et al. 2014), although these factors are usually seen as influencing vulnerability to hazards (Cutter et al. 2003; Cutter et al. 2010; Cutter et al. 2014). By contrast, the statistical analysis herein indicates that certain social factors do raise displacement risk. This finding is in line with other papers which observe that (im)mobility in disasters is differentiated by various population characteristics (Black et al. 2013; Boas et al. 2020). Consequently, these factors may provide entry points for policy and planning to reduce displacement risk in future El Niño events in Peru. For example, improving education would support development and simultaneously decrease vulnerabilities to disasters and displacement. Education reduces disaster vulnerability regarding preparedness and response because it improves skills, knowledge, information, and resources to handle disasters, shapes risk perceptions, and supports wealth and health (Muttarak & Lutz 2014).

In summary, the statistical analyses underline that displacement risk was substantially driven by poor shelter and tenure insecurity; undiversified and vulnerable agricultural livelihoods located in deprived rural zones; physical disaster exposure; and intersectional social factors that reduced coping capacities and increased humanitarian needs. These detected factors could also inform recent efforts by international organizations to develop indicators for monitoring disaster displacement and ensuing risks (Guadagno & Yonetani 2022; IOM & IDMC 2022). The indicators are intended to feed into disaster-related assessment and monitoring processes. Beyond, these efforts to develop risk indicators should also consider other commonly applied disaster vulnerability metrics, such as social (e.g. social networks), institutional (e.g. local disaster training), or community capitals (e.g. community cohesion) (Berkes & Ross 2013; Cutter et al. 2014;

Cutter & Finch 2008; Kim et al. 2018; Norris et al. 2008; Sherrieb et al. 2010), which this study could not explore due to a lack of available data.

The qualitative data from Piura reveals more details about the displacement trajectories. Most interviewees fled fast, over short distances, and for *survival* under strong constraining structural conditions. Subsequent settling was dispersed in UP, where people lived in public buildings, in tents, or with relatives, which stresses the need to address urban and non-camp displacement in Peru and world-wide (IDMC 2021c; UNHCR 2014). These migrants fled for a short duration and had mostly returned to their original land by the time of the interviews, which underlines the need to investigate micro-mobilities, an issue for which data is still limited and that remains unattended by policy and donors (Safra de Campos et al. 2017; Safra de Campos et al. 2020). Conversely, in LP, most people were displaced to nearby camps in the barren desert for a long period because their villages of origin remained devastated, which echoes global findings that displacement often implies prolonged challenges (Crawford et al. 2015; Devictor 2019). Most displaced persons in the camps intended to stay permanently out of fear of future floods. Nonetheless, they have kept translocal connections and occasionally dual residencies for educational and livelihood needs, which provides evidence that translocality approaches are needed in this field of study (Peth & Sakdapolrak 2020). Furthermore, the findings reinforce global calls to assess secondary displacement risk, cumulative shocks, and how more frequent climate impacts may influence patterns of recurrent displacement (Blocher et al. 2021b): in both LP and UP, many displaced persons had been previously displaced by earlier El Niño events, while several others had originally migrated to Piura due to climate impacts in the highlands, but then been forced to leave again by the CEN impacts. In addition to the large-scale, short-distance displacement analyzed in the qualitative data, other studies and anecdotal interview evidence point to limited, larger-distance moves driven by the CEN floods, which validates the global finding that vulnerability and mobility are often inversely related (Adger et al. 2014). Beyond *abrupt* El Niños, *gradual* processes such as warming and droughts have also shaped migration in Piura through complex effects, which points to the understudied intricacies of compounding effects of slow- and sudden onset hazards (IOM 2020).

7.4.2 Well-Being Effects, Structural Conditions, and Mechanisms

The statistical analyses demonstrate consistently that displacement negatively affected people's well-being one and seven months after the disaster. Displacement greatly reduced well-being in statistically significant ways in all models, including in those controlling for environmental and socioeconomic parameters at the household and individual level. In the best-fit model with a sample of 162,331 affected adults, displacement led to an average 3.14-point loss on the well-being index that ranges from 0 to 100. The data reveals that displacement strongly deteriorated people's *space to live* (including housing quality, tenure security, and basic services) and *development from a secure base* (based on the applied employment and health indicators) around half a year after the disaster.

While the quantitative analysis thus substantiates the short- and medium-term losses that the displaced persons experienced,[33] longer-term effects cannot be deduced from the data. The broader literature is also limited on this question but suggests that intersectional social factors influence the outcomes. In one of the few available studies, education was not predictive of post-traumatic stress one year after a disaster, but higher educated individuals had better housing, smaller declines in spending and consumption, and better psycho-social health four years later (Frankenberg et al. 2013). Similarly, several empirical studies in a special issue (Muttarak & Lutz 2014) confirm that people with higher education suffered lower loss and damage and could recover more swiftly after disasters than others. Future work could expand the analysis here and discern the determinants of recovery for displaced persons after the CEN in Peru to verify if intersectional factors also influenced their results over the longer term. For the development of the well-being effects up to one and a half years after the disaster (around one year later than the survey data), the primary qualitative data collected for this dissertation provided additional insights. These insights, including into a range of well-being metrics and mechanisms that were unavailable in the used datasets, are contextualized in the literature below.

7.4.2.1 Development from a Secure Base

The qualitative data demonstrates that the respondents often remained impoverished after they had lost their agricultural livelihoods, as seen in other studies of

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[33] As discussed in the limitations in section 3.2.2, the data does not allow to distinguish if the displaced people remained in displacement or were able to return with the analyzed period. Thus, it is unclear if displacement itself has an impact regardless of the time spent away from home or if short periods of displacement affect well-being even after months.

the 2017 CEN (IOM 2017c, 2018) and previous El Niños (Oft 2010; Sperling et al. 2008). Several mechanisms contributed to the severe economic losses of the displaced persons First, previous levels of livelihood diversification had been low, and as most farmers had depended entirely on farming or day labor, flood damage to their small farms was difficult to buffer. Second, displaced persons had often engaged in livelihood activities that were difficult to recover. It took long before they could plant and harvest crops or raise animals again for consumable or marketable outputs. Third, many respondents lacked savings or lost livestock in the floods, which hindered reinvestments. Fourth, few of the subsistence farmers disposed of skills transferable to job markets less affected by the floods, such as those in cities. Fifth, the effects of livelihood erosion were significantly moderated by the demand for day labor by agribusinesses in areas surrounding LP that were spared flood damage. However, this buffer was inaccessible for older adults in LP and not available to the same extent in UP. Sixth, household composition shaped the economic effects; the more healthy members at working age a household was composed of, the better it could pool income options for recovery. Finally, economic consequences were aggravated by alleged corruption and lack of humanitarian assistance by the state, and basic service gaps have impeded livelihood recovery. Conversely, help by NGOs or private actors, and mutual community support, slightly mediated economic damages.

Other studies also confirm the result that the 2017 CEN severely harmed people's health. It damaged infrastructure (French et al. 2020); on-site health services in camps remained limited; mental health issues were widespread; infectious diseases abounded; and many of the displaced depended on gradually more irregular food distributions (Espinoza-Neyra et al. 2017, 2018; IOM 2017a, 2017b, 2017c, 2018). This study provides detailed insights into the mechanisms underlying these impacts. First, the floods destroyed health facilities and created lasting risks from new diseases. Second, in the camps, displaced persons suffered from more hazard exposure while living in substandard shelter with poorer protection. Third, flood damages and livelihood erosion, combined with a lack of savings or credit, hindered access to medicine or health services and raised food insecurity. The displaced also lacked psychosocial care options. The health risks were most salient for those with vulnerabilities relating to age, sex, and physical ability. Fourth, the lack of land titles in the camps further impeded access to social programs that could have enhanced health. Fifth, NGO support could only partially buffer the gaps of state presence, and their services dwindled over time with rising donor fatigue.

Similarly, prior work corroborates the finding that El Niño-induced damages and hardship tend to worsen educational opportunities (French et al. 2020; Sperling et al. 2008). In the 2017 CEN specifically, a large number of children were displaced and faced educational challenges (IOM 2018). The analysis here demonstrated that several mechanisms worsened their educational opportunities. First, flood damages damaged educational infrastructure and external assistance was insufficient for people's needs during the prolonged displacement. Second, flood-impoverished families struggled to pay school fees or had to withdrew children for work. Third, physically accessing educational facilities resulted difficult due to the larger distances, strenuous trajectories, and costly passages. Finally, pupils struggled to study and learn due to the exhausting physical access, trauma, stress, anxiety, food insecurity, and the lack of light for homework.

Altogether, the findings therefore re-emphasize the concerns from the review in chapter 4 that pre-movement vulnerabilities set the limits for people's *development from a secure base*, and that those most affected by severe hazards, and moving under *survival* conditions, have the highest risk to suffer losses (e.g. Afifi et al. 2016). This study also reinforces the result of the review that livelihood, health, and educational risks can persist for long after displacement, especially if external assistance is insufficient (e.g. Bruijn 2009; Cazabat 2020; Crawford et al. 2015; UNESCO 2020).

7.4.2.2   A Space to Live Better

Many of the displaced had consciously lived in flood-exposed areas because of livelihood and land needs or choices. In a vicious circle, they have struggled to repair or rebuild flooded homes at high costs close to every 15 years, which has often left them less prepared for future floods, as witnessed in the CEN. After the CEN, their prospects for recovery were poor for various reasons. First, few displaced persons had resources to reconstruct in a safe and adequate way. In LP, they settled in barren desert spaces too small for their needs and felt dissatisfied with their new setting. In UP, they returned to their familiar but damaged homes, and rued the destruction of their fields and missed the work there. Second, external assistance for shelter was deficiently funded, unevenly provided, and centered on temporary help instead of long-term development needs of prolonged displacement. Third, similar reasons (including the lack of state presence, corruption, uneven or short-term, unsustainable humanitarian assistance, and donor fatigue or withdrawal) also led to greatly worsening basic services for most of the displaced. In LP, land conflicts were an additional key hindrance for service investments by the state. The deprived displaced persons also lacked money to buy or repair decaying services, and crowded living conditions raised pressure on

the weak infrastructure. This work thus echoes prior studies on the 2017 CEN in Peru which identified extensive challenges in housing, infrastructure, and basic services that persisted long after displacement (French et al. 2020; IOM 2017a, 2017b, 2017c, 2018). This analysis also reinforces the finding from the broader literature that the definitive losses suffered by displaced persons, their disenfranchised societal positions, and the lack of external help often impede recovery (e.g. World Bank 2017b).

Changes in the exposure to hazards depended on the availability of unaffected land after the displacement: in LP, people fled to an area safer from floods but exposed to other minor hazards, whereas in UP, they mostly stayed close to or returned to the same exposure. Few displaced persons received support for or could afford to build adequate shelter to protect themselves from future risk. Nonetheless, the cases in LP highlight that even displacement may yield limited gains when it helps people to move out of harm's way, as seen in other areas of Peru (Jarman 2020). Conversely, returning may be desired for many reasons but can also mean a return to the same hazard exposure, as seen in UP. These findings echo global concerns that climate migration can bring safety from initial hazards, but also create new exposure (e.g. Adger et al. 2014), especially because migrants often settle in high-risk zones and are unaware of hazards (for Peru, see e.g. Rubiños & Anderies 2020).

Finally, two factors substantially contributed to physical insecurity. First, the absence of security personnel created conditions conducive to violence and crime during the floods and throughout the prolonged displacement. Patrols self-organized by the displaced buffered this insecurity moderately. Second, land conflicts with the private landowner in LP also raised violent tensions, which negotiations could partly offset with time. The review in chapter 4 confirms that insecurity is common in climate migration (Melde et al. 2017), especially for women (Fleury 2016), after disasters, and during displacement (e.g. McMichael et al. 2012). Prior studies specifically on the CEN 2017 also echo the insecurity reported here, and indicate that the lack of security provisions, secure lighting, or safe spaces for children and women in camps amplified risks (IOM 2017a, 2017b, 2017c, 2018). Contrary to the women interviewed in this study, IOM (2017b) also observed gender-based violence in the camps, especially where infrastructure such as public light and shelter was deficient. However, the answers in the study here may represent sample bias or relate to the interview situation, social taboos, fear of over-disclosure (Reczek 2014), or a normalization of violence.

7.4.2.3 Social Relatedness

Social relatedness remained good due to several mechanisms. First, communities had had strong social ties before displacement and because they preserved a similar spatial dispersion after settling in camps (in LP), or stayed in their villages (UP), they were able to maintain these bonds. Second, pre-existing mutual support systems as part of local traditions, such as communal tasks and food sharing, contributed to good relations. Third, people's capacity to self-organize and the availability of capable community leaders were essential to channel social life and structure support. After displacement due to the CEN, this social capital was a key asset for coping and recovery, as witnessed by other studies in Peru, especially where people felt abandoned by authorities (Moncada et al. 2018; Venkateswaran et al. 2017). Although prolonged absences of family members did put pressure on social structures in some cases, this study thus contradicts the global finding that displacement often threatens *social relatedness* (e.g. Schwerdtle et al. 2020; World Bank 2017b).

7.4.2.4 SWB

How displaced persons appraised their new lives emotionally and cognitively depended on various factors. A first key variable was the severity of experienced flood losses and perceived recovery options. Many suffered greatly; sadness, pain, helplessness, anxiety, fear, and trauma were salient especially at the beginning of displacement but persisted or were (re-)produced over the arduous recovery. Second, respondents also reported subjective ill-being because they felt inadequately cared for or supported by external actors, which evoked feelings of anger, disappointment, frustration, injustice, and disgrace. Third, the lack of professional support for coping with negative experiences also worsened SWB. Fourth, personal coping mechanisms, including humor and religious faith, provided limited buffer. Fifth, social networks offered support and care that helped many households, but such networks were heavily missed when migration separated household members. The study thus adds to and echoes the limited evidence of present SWB after *forced* migration. Prior studies also find that SWB losses in displacement result from the lack of preparedness and the forced conditions of moving; *scarring* effects before and after moving; and intersectional vulnerabilities to emotional, social, and health risks of moving (e.g. Bartram 2015; Luhmann et al. 2012). The analysis here focuses on the internal standards of the displaced respondents (pre- vs. post-movement). *Relative deprivation* related to stayers or locals—another key strain on SWB identified in the literature (e.g. Chen et al. 2019)—is unlikely in Piura, since most respondents were similarly affected, almost no one stayed in the source areas, and destination zones lacked

pre-defined host communities. Finally, the cross-sectional design makes it difficult to assess if hedonic adaptation has occurred. However, the data collected 20 months after the floods emphasized that people still suffered from a large SWB decline. The wider literature also suggests that *scarring* can lastingly reduce SWB (e.g. Kettlewell et al. 2020; Luhmann et al. 2012; Mousteri et al. 2018), which seems likely here due to the unemployment, financial losses, and health shocks caused by the CEN. Other qualitative studies on the CEN also report persistent suffering and despair after the disaster (Moncada et al. 2018).

Almost no displaced persons held neutral views of the future, and many expressed hopelessness as they suffered from combined, large well-being stressors. Such despair may further deepen perceptions of vulnerability and block action or engagement (e.g. Schueller & Seligman 2011). Most but not all of the mechanisms identified in the reviewed literature reduced hope (Edey & Jevne 2003; Snyder 2002). Especially experiences of trauma and loss as well as lack of control and progress (such as related to weak governance, economic hardship, and tenure insecurities) raised despair in Piura. Conversely, alienation or a lack of social connections were not observable. Religious faith was one key contributor to hope and consolation, as known from other contexts (e.g. Lim et al. 2019), but faith also evoked feelings of guilt, regret, and surrender in some cases, an effect still understudied. Other people nourished hope thanks to trust in their individual capabilities, solidarity in their communities, and a belief that external actors would support them. The social narrative that progressing was possible (*salir adelante*) created optimism for many migrants, and such optimism can be a key motivator of further productive action (Forgeard & Seligman 2012). However, given the factual hurdles, such optimism seemed unrealistic and self-deceiving in some cases, and such forms of illusionary hope can be detrimental (Turner 2017). Finally, many of the displaced persons held mixed sentiments toward the future, confirming the need to consider outlooks on the future as layered, as the review in chapter 4 suggested. For example, faith in god and patience regarding recovery would mix with pessimism and anxiety regarding future floods in some cases, similar as in a study of climate migration in the Pacific (Yates et al. 2021). Overall, because SWB is key for effective functioning, displaced persons' decline of present SWB and their challenged views of the future can pose cascading threats for other OWB dimensions (e.g. Carver & Scheier 2014; Diener et al. 2018b).

7.5   Summary and Induction of Propositions

In this section, I first briefly recap the observed well-being dynamics, mechanisms of action, and structural conditions in this case of displacement (*forced, acute* migration) under *survival* conditions. After that, I induce broader propositions on the potential well-being implications of climate migration.

Figure 7.14 provides a visual summary of the identified well-being effects, relevant structural conditions, and mechanisms of action. It illustrates that displacement occurred under high structural constraints, including severe climate risks and deficient DRR/DRM; poverty and inequality; limited livelihood options; tenure insecurity; poor and hardly accessible basic services; weak governance; and limited political participation. Various of the adverse structural conditions identified through the qualitative analysis as influential drivers of well-being were confirmed by the complementary statistical analyses. Conversely, structural opportunities were low, such as the influence of non-state actors. As a result, the severe and abrupt CEN floods caused *forced*, *survival* migration with detrimental conditions for moving and settling. Throughout the lifecycle of displacement, people suffered extreme losses, which continued to worsen their prospects for *development from a secure base* and *a space to live better*. Conversely, *social relatedness* remained similar after moving. Because displacement has become prolonged without substantial improvements, people's need fulfillment, long-term asset base, and capacities for climate adaptation have worsened. Consequently, most displaced persons evaluated their need fulfillment as negative (*deprivation*), and only few experienced partial positive feelings or cognitive satisfaction despite their plight (*adjustment*).[34] Expectations for the future were mostly negative and resulted in prevalent *enforced fear* as well as some *fragile adjustment*. The light gray boxes in the figure summarize key conditions and well-being mechanisms which may also be influential in other contexts.

Based on the findings in this case of *survival* displacement (*forced*, *acute* migration) by Peru's coast, one can derive more general propositions on the well-being impacts of climate migration.

(1) First, the results stress that in the constraining structures of societies with weak governance, ineffective DRR/DRM, insecure tenure, and undiversified subsistence farming with minimal margins, sudden-onset hazard displacement

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[34] For terminology, see section 2.3. *Deprivation* refers to adverse objective conditions accompanied by low cognitive satisfaction and negative emotional balance. *Adjustment* is subjective well-being despite adverse objective conditions.
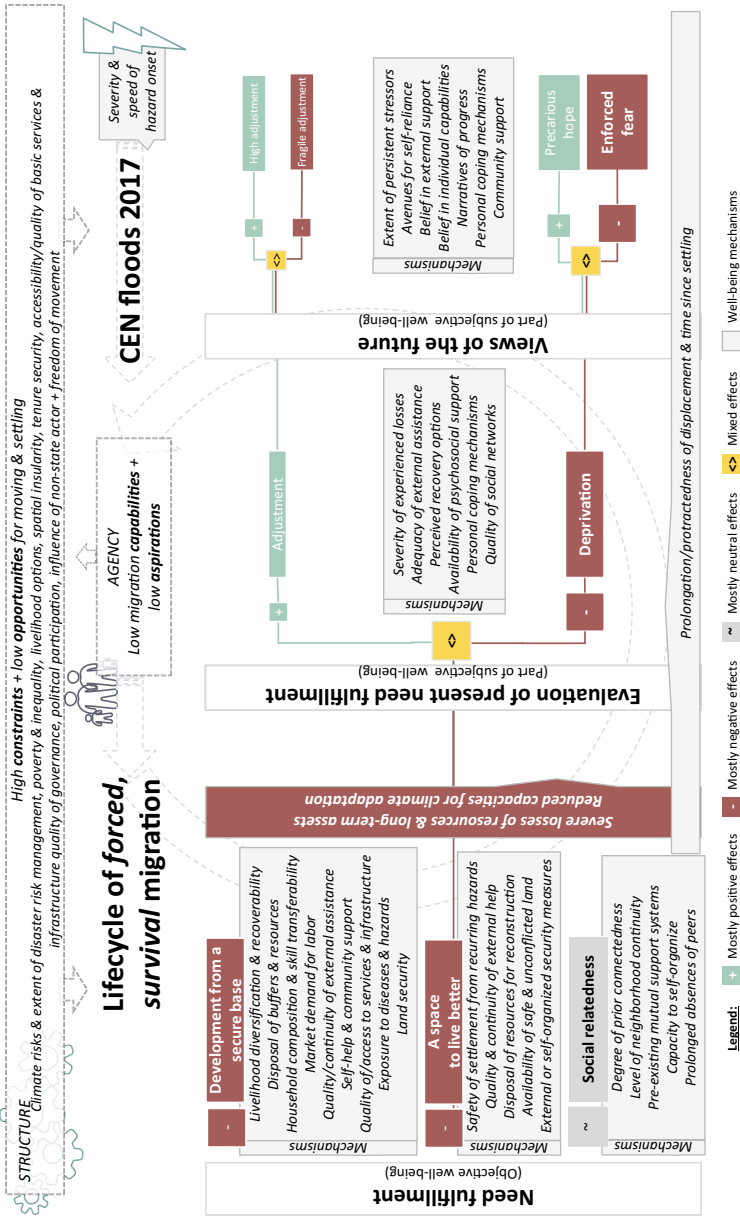
Figure 7.14 Main well-being effects for displaced persons from LP and UP, structural conditions, and identified mechanisms of action. (Note: Created by the author)

can greatly reduce people's agency and prospects for *development from a secure base*. When effective DRR/DRM is unavailable, repeated displacement may be the only way to safe one's life. When such forced*, acute* migration becomes prolonged or protracted without an avenue for self-reliance, it is likely to worsen people's long-term asset base and capacities for climate adaptation in dangerous areas. Women, minors, older adults, and those with health limitations are at especially high risk of losing resources.

(2) Second, climate change also increases the risk that poor farmers who need to carve out a precarious living in areas exposed to recurring, abrupt hazards can suffer from cumulative shocks, whose destructions diminish their chances to obtain *a space to live better*. After displacement, farmers' losses, insecure asset base, the lack of land and housing titles, along with neglect by authorities, can force them into vicious circles of inadequate housing, deficient access to basic infrastructure, and perennial insecurity.

(3) Third, strong community bonds and traditions, self-organization capacities, and neighborhood continuity can create conditions that shield displaced groups from some of the possible harm. Where these factors exist, *social relatedness* may be preserved.

(4) Finally, the results suggest that the *SWB* of forced*, survival* climate migrants is at risk. Profound losses, arduous recovery, and negative governance experiences make it likely that OWB and SWB losses converge into a present subjective state of *deprivation*. Extreme stress results as the displaced lose resources, or resources (such as farming skills) become devalued or obsolete, and as their goals are obliterated or obstructed after displacement. Subjective *adjustment* may occur exceptionally when strong social networks combine with personal coping mechanisms such as faith or humor. Whether *deprivation* and *adjustment* are accompanied by optimism (*precarious hope* or *high adjustment*) or by pessimism regarding the future (*enforced fear* or *fragile adjustment*) depends on the balance between persistent, large stressors and setting-, community-, or person-related resilience factors. The greater the stressors, the more likely more fear than hope for the future. Because despair is likely to be salient in displacement under *survival* conditions, negative ripple effects on other well-being dimensions are to be expected.

Comparative Analysis and Overarching Propositions

8

In the following comparative analysis, I induce overarching propositions regarding the well-being impacts of climate (im)mobilities. To increase the validity of the propositions, I use the full empirical evidence base generated from the three case studies. The case studies on the highlands, rainforest, and coastal zone of Peru had similar starting points in terms of the inhabitants' livelihoods, climate vulnerabilities, and exposure. However, they involved varied hazards and (im)mobilities with dissimilar numbers of people and spatiotemporal pathways. Moreover, different structural settings created a wide array of *improvement*, *distress,* and *survival* conditions for (im)mobilities. Finally, migratory agency differed across the cases and led to dynamics ranging from more *voluntary* to clearly *forced* instances of migration or immobility. Table 8.1 contrasts the configurations of the key variables of the conceptual framework devised in chapter 2 in the case studies. By comparing the three different cases, I identify resemblances and divergences regarding the well-being impacts of climate (im)mobilities and mechanisms of action. I then distill these differences and similarities into propositions that can be applied beyond the contexts studied here and tested in future research.

Table 8.1 Key migration and immobility variables in the case studies

	Sierra	*Selva*	*Costa*
Source area	Lima Region	San Martín Region	Piura Region (for QUAL analysis); all of Peru (for quant analysis)
Severity and speed of hazards precipitating migration	*Gradual* hazards, developing over decades: rainfall changes as well as ongoing (V1) and complete (V2) glacier retreat	*Abrupt* hazards: major, severe fluvial floods over several days in 1963/99 in V3 and in 1977/2015 in V4; additionally damaging but manageable annual floods in V4	*Abrupt* hazards: severe fluvial and pluvial floods over various days during the 2017 Coastal El Niño event
Migration drivers	Water scarcity emerging as driver in V1 and a cause of exodus in V2, in interaction with socioeconomic, educational, and lifestyle factors	Flooding as abrupt and critical push for initial short-term displacement, as well as subsequent relocation requests and immobility	Flooding as abrupt and critical push for prolonged displacement
Acuteness of migration	Anticipatory/proactive (V1), increasingly acute/reactive (V2)	*Acute/reactive*	*Acute/reactive*
Agency (aspirations, capabilities)	Limited but sufficient migration capabilities + mixed aspirations → more *voluntary* to increasingly *forced* migration; stayers partially *voluntarily* (V1), acquiescently or forcibly immobile (V2)	Low to average migration capabilities + high aspirations → V3 eventually completed *voluntary* relocation after years of *forced* immobility, V4 in protracted *forced* immobility	Low migration capabilities + low aspirations → *forced* migration

Table 8.1 (continued)

	Sierra	Selva	Costa
Structural conditions for staying or moving and settling	Average constraints + average to low opportunities → migration and immobility on a continuum between *improvement* and *distress* conditions	High constraints + low to average opportunities → immobility and relocation under *distress* conditions	High constraints + low opportunities → migration under *survival* conditions
Entities moving or staying	Individuals and households moving (younger, wealthier, male groups first); mostly older adults (primarily women) staying	Two entire communities aspiring to relocate but forced to stay; one still in protracted *forced* immobility (V4), one eventually relocated (V3)	Many families (UP) and entire communities (LP) migrating
Trajectories and destinations	Over long distances, from rural to urban areas (to Lima >300 km and Huancayo >100 km), mostly direct but some stepped migration; mainly to city peripheries; generally permanent	Initially short-distance, short-interval forced migration followed by return; protracted, stalled (V4) and completed permanent relocation (V3) over a short distance to direct vicinity (<1 km); uninhabited, agricultural land	Over short distances (mostly <20 km); to camps on uninhabited agricultural lands (LP) or to public buildings and relatives (UP); mostly permanent, dual residencies common, few complete returns (LP) or return common (UP)
Translocal ties	Stronger ties for V1 than for V2 (less remote, more mobile reception, more stayers); mostly sociocultural links, limited financial remittances; fewer returns than previously; active urban hometown associations	None, since entire village relocated (V3) or whole community trapped (V4)	In LP, several dual residencies to work in fields close to old sites; sending children to unaffected schools back home; visiting the ruined homes for nostalgic reasons

8.1   Well-being Impacts

In the subsequent descriptive analysis, I contrast the net well-being impacts in the three case studies, compare the results within and across the four well-being axes, and explain how the effects evolved.

First, the studied (im)mobilities led to a range of total well-being outcomes, with more net-negative than net-positive results on average. Building on the case studies and other work (Bonanno et al. 2011; Seebauer & Winkler 2020a), I classified and located all the results on a spectrum of five well-being Ideal types (Figure 8.1). Most severely harmed were the *survival* migrants after the Coastal El Niño and the trapped farmers in the *Sierra*, who had completely lost their glacial meltwater; these villagers suffered *a tailspin into severe ill-being*. Achieving mainly negative but marginally better results than these two groups were most migrants from the *Sierra* and the trapped farmers in the *Selva* (V4), who were *deadlocked in a worsening state of life*. Many stayers in the *Sierra* village affected by mid-stage glacier retreat displayed well-being levels between *deterioration* and *stagnancy*. Similar to this group, but on the more positive side of the spectrum, were the *Selva* farmers who were eventually relocated and fared between *stagnancy or return to baseline* and *fragile advances*. Finally, a few migrants from the *Sierra* who had moved under comparatively better conditions experienced *incremental* but *fragile advances* in well-being. No group reached *eventual, genuine well-being*.
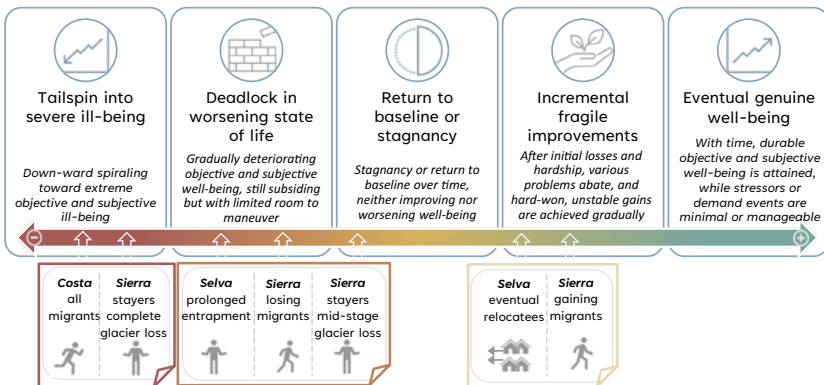
Figure 8.1 Spectrum of well-being Ideal types and outcomes of studied groups. (Note: Created by the author)

Second, these net totals should not conceal the multilayered nature of people's well-being outcomes. The heatmap in Figure 8.2 tabulates the qualitative results of chapters 5–7 and portrays the well-being impacts observed across the analyzed groups. In chapter 7, the statistical analyses corroborated the qualitative results for those well-being dimensions for which data was available.
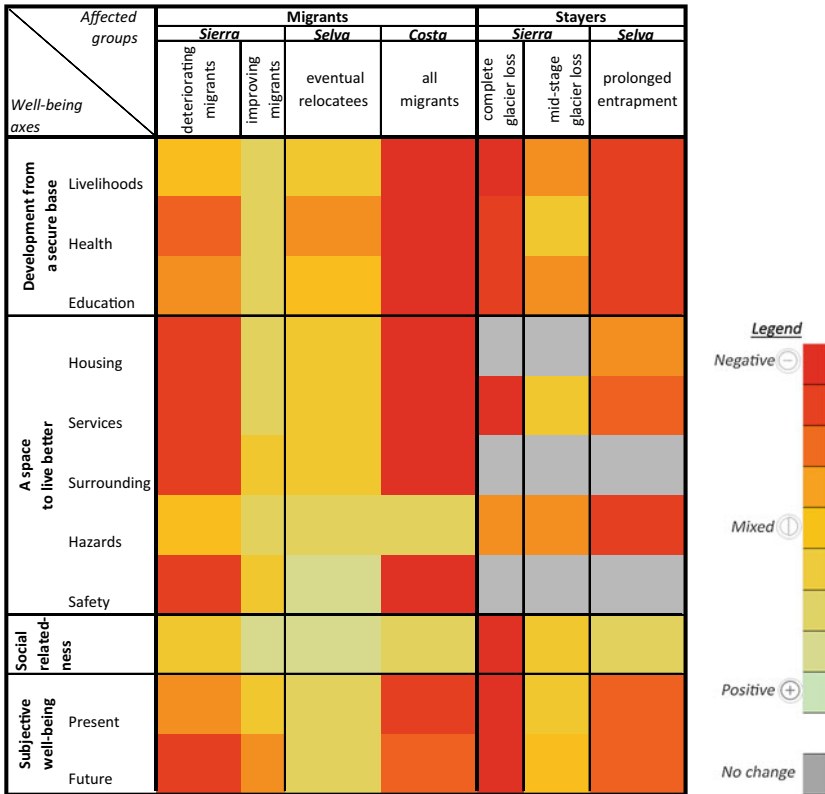
Figure 8.2   Heatmap of well-being outcomes. (Note: Qualitative results were ranked on a scale from 1 (negative) to 9 (positive) and then color coded. Created by the author)

The heatmap illustrates that obtaining *development from a secure base* and *a space to live better* were challenging for most groups. Since these first two objective well-being (OWB) components mostly changed in similar directions (despite

important exceptions in one or two sub-variables, such as safety from hazards), it seems that bidirectional effects existed between them. For example, migrants who lacked income were also less likely to be able to fulfill other needs such as housing; simultaneously, a lack of basic services such as water or sanitation hindered livelihood, health, and educational advances. Overall, the best outcomes were achieved in *social relatedness*, which proved neutral to positive for most groups and did not worsen even in severely adverse settings. While social ties contributed to OWB and subjective well-being (SWB), for example by buffering losses, they remained remarkably unaffected by changes in the other two OWB axes, which points to partially separate mechanisms of action. Finally, *SWB* mainly changed in a direction similar to OWB, and, accordingly, most groups' SWB tended to decline. It seems that *development from a secure base* and *a space to live better* had a joint strong impact on SWB, while *social relatedness* had moderating effects. However, because some migrants had worse SWB results than key OWB variables would predict and vice versa, it is critical to measure *both* OWB and SWB. To conclude, most well-being impacts converged within and across the studied axes for the various groups, but a small number of significant divergences were observed. Figure 8.3 summarizes these possible directions of interactions between the well-being axes.

Figure 8.3 Approximate directions of interactions between well-being components. (Note: Created by the author)

Third, the varied (im)mobilities had different well-being impacts over time. To begin with, the time required to initiate migration after the onset of the hazard

heavily affected well-being. If people desired but were unable to move, they were forced to remain in unsafe zones where they suffered further OWB losses, while the realization that desired movement was unattainable also reduced their SWB. For most farmers who succeeded in moving, the early phase of settlement was challenging due to prior loss and damage, the costly transitions to new sites, and the need to build a new life. The start was most difficult when structural conditions such as governance or tenure systems were unfavorable. Although most migrants underwent an initial OWB decline after moving, their paths diverged over time. Nearly all migrants' OWB improved relative to their levels at the taxing start of the process, but the extent of improvement varied. Short-term gains were related to finding ad-hoc solutions to the numerous new demands faced after moving and reaping the initial rewards of hard work and sacrifice. Longer-term improvements, however, required either resources with transformative potential, such as investments in education and the fruits of improving social networks, or beneficial events, such as the receipt of external assistance or the granting of land titles. Conversely, a longer duration of stay threatened to reproduce or exacerbate vulnerabilities, especially for the many people who were subjected to adverse structural conditions and had limited baseline resources. Finally, while (im)mobilities caused a persistent shift in some people's SWB, several others achieved partial hedonic adaptation to their new situations over time. Such cognitive and emotional adaptation was even observed for several forced migrants who had an expectedly high resistance to moving.

In summary, the well-being impacts in the three cases analyzed can be grouped together in three characteristic temporal trajectories across seven phases of (im)mobilities (Figure 8.4).[1] The first path led survival migrants on the *Costa* and trapped people in the *Sierra* into a *tailspin into severe ill-being* with almost no possibility of improvement. The second path created a *deadlock in a worsening state of life* for most migrants from the *Sierra* and the trapped people in the *Selva*, while the voluntary stayers in the *Sierra* risked ending up on this path as well. Finally, a few of the *Sierra* migrants and *Selva* relocatees reached *incremental fragile advances* in well-being. Because of these improvements, the direction of future change was less predetermined for this third pathway than for the other two.

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[1] Note that the seven phases identified here should not suggest that (im)mobilities and related well-being changes occurred linearly. Rather, structural and individual challenges or opportunities frequently lead to fragmented journeys as well as strong well-being vacillations over time.

Well-being   ←

Phase/time   →

Eventual genuine well-being

Incremental fragile advances

Return to baseline or stagnancy

Deadlock in worsening state of life

Tailspin into severe ill-being

(1) Pre-hazard	(2) Trigger	(3) Initiation	(4) Arrival	(5) Changeover	(6) Establishment	(7) Future paths
Life before the decision (or need) to move or stay	Making the decision to move or stay (or being forced to)	Executing decisions to move or stay (or trying to)	For migrants: reaching new site, reconfiguring most key life variables	For migrants: settling into the new site and striving to rebuild a life	Becoming more deeply embedded in the current situation	Deepening roots in current site, potential onward movement, return, etc.

Figure 8.4 Three characteristic well-being trajectories of climate (im)mobilities over time. (Note: Created by the author)

8.2   Conditions and Mechanisms Shaping Well-being

This study aimed not only to identify the well-being effects of climate (im)mobilities but also to explain what contributed to, enabled, or produced them. Viewed comparatively, the Peruvian case studies highlight the importance of three major aspects that shape well-being across the lifecycles of (im)mobilities, as visualized in Figure 8.5. The most dominant influence was (a) the (un)favorability of structural conditions, followed by (b) the nature and impacts of hazards. Finally, there were (c) moderating effects of people's level of agency, namely their migratory aspirations and capabilities as well as the additional resources required to settle or stay. Below, I discuss how these three elements were configured in the case studies and the ways in which they influenced the results. (As noted above, there were also feedback effects between the different axes of well-being, with a stronger effect of objective on subjective dimensions than vice versa; these effects are not discussed again).
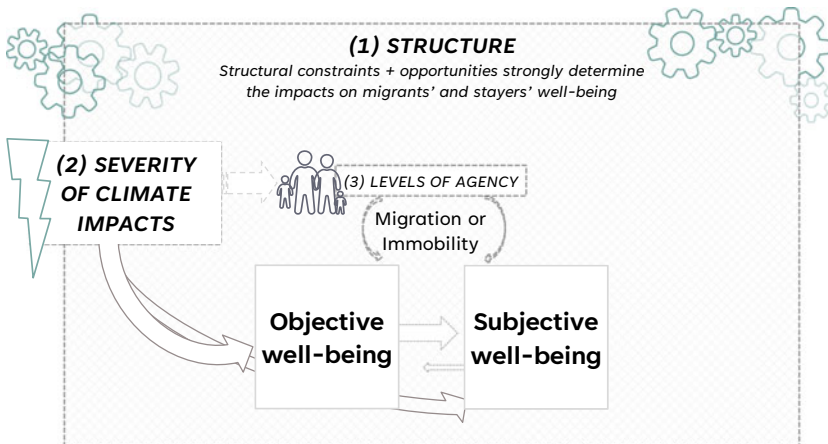
Figure 8.5 Major influences on well-being changes. (Note: Created by the author)

8.2.1   Structural Conditions

First and foremost, the boundaries of migrants' and stayers' actions and well-being paths were strongly determined by manifest structural conditions at varying levels, such as institutions, policies, customs, norms, networks, and social stratification, as well as people's socialization into these structures. The analysis below highlights that structural constraints considerably outweighed structural opportunities in most cases, which frequently promoted ill-being (Figure 8.6).
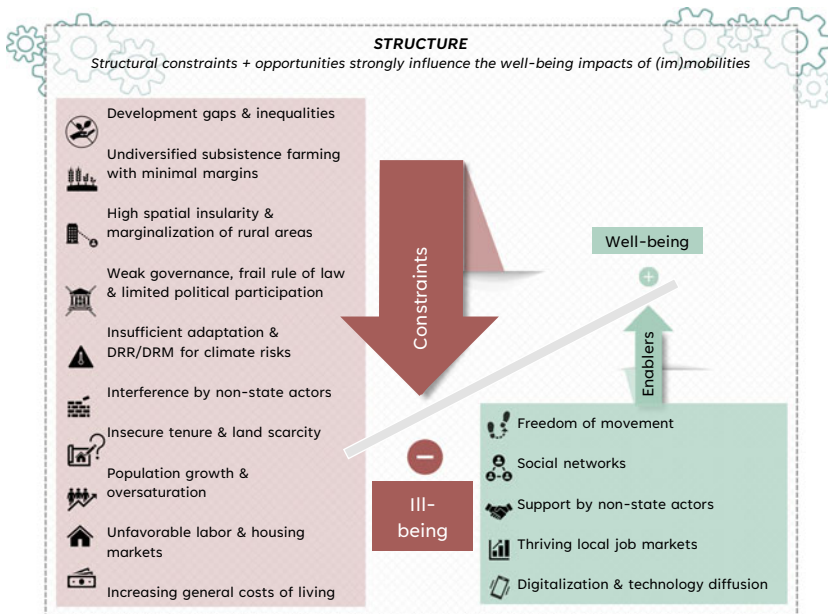
Figure 8.6   Structural constraints and limited opportunities strongly influence well-being paths. (Note: Created by the author)

In all cases, various structural constraints significantly reduced people's opportunities to be well. The studied agricultural communities were structurally disadvantaged in three ways: they were heavily exposed to climate hazards due to global emissions, while local rural-urban development divides and weak governance reduced their ability to manage these climate threats in ways that would

preserve well-being. To begin with, the affected people were systematically disadvantaged because they had to cope with climate hazards emerging from global emissions to which they had made a negligible contribution. Furthermore, as undiversified subsistence farmers, they operated with minimal margins and had seriously limited capacity to cope with the increasing climate impacts. In Peru, 80% of farmers depend on informal subsistence livelihoods, and many of these farmers are vulnerable to food insecurity and income shocks (CEPLAN 2016; WFP & CENEPRED 2015; World Bank 2019). In 2014, people in rural areas in Peru were three times more likely to live below the national poverty line than urban residents, and their poverty was more profound (World Bank 2019, 2021c). In addition, since most farmers lived in remote areas in a centralized state that did not prioritize rural areas, they tended to be disenfranchised and subjected to weak governance. As a result, a lack of administrative resources, the absence of rule of law, and insufficient quality and continuity of state assistance further hindered effective local climate adaptation and disaster risk reduction and management (DRR/DRM). Spatial insularity also constrained people's prospects for well-being in other ways; for example, poor mobile reception and transportation options reduced the ability of the trapped people in the *Sierra* to maintain contact with migrated peers. These structural deficits in development, climate adaptation and DRR/DRM, and governance heightened the risk of entrapment or movement under *distress* or *survival* conditions, which typically reduced well-being. For example, inhabitants of the poor rainforest villages had few options but to request relocation as they lacked the resources needed to adapt in place and the government did not invest in local DRR/DRM. Later, weak governance and bureaucratic failures left them trapped in risk zones for years, which further worsened their well-being. Already marginalized people had few chances to escape such disenfranchisement; when they migrated, state neglect was mostly reproduced and occasionally reinforced across space, regardless of whether farmers moved to nearby uninhabited zones or faraway settlements. For example, weak governance and a lack of administrative resources constrained the development opportunities and climate adaptation options for the farmers in the *Sierra* village who were deprived of glacial meltwater, and similar structural factors continued to limit their room to maneuver after they were forced to migrate to Lima and Huancayo. In the cities, weak urban governance and state neglect curbed these migrants' ability to access adequate public services and other requisites for well-being.[2] Furthermore, structural ripple effects of rapid, irregular urban expansion

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[2] Thus, as predicted by segmented assimilation theory (see section 2.2.3), the *hostile* urban *mode of incorporation* strongly reduced migrants' opportunities to raise OWB and SWB.

and population growth worsened migrants' opportunities for well-being as they struggled with oversaturated housing markets alongside largely unregulated and informal but highly competitive job markets.[3] In addition, rising costs of living threatened to nullify the possible income gains migrants stood to make following their move. Moreover, increasing land scarcity and tenure insecurity challenged the well-being of the urban migrants, who were increasingly forced to settle in irregular, peripheral city zones marked by limited state presence and adverse living conditions. Similar land and tenure issues also reduced people's well-being in the *Selva* and *Costa* cases, where non-state actors further aggravated these factors, for example by increasing land prices or contributing to land conflicts.

Finally, certain individuals and groups faced disproportionately high structural constraints due to systematic marginalization related to *intersecting social factors.* Across all cases, women, minors, older adults, people with health limitations, and *Indígenas* tended to be at higher risk than others of a well-being decline when migrating or staying. For example, while most migrants suffered from government neglect, pregnant women, young children, and older adults were affected particularly hard by state failure to facilitate access to social programs and basic services.[4] Such systematic marginalization due to social factors was widespread: displaced children on the *Costa* and trapped children in the *Selva* were disproportionately harmed by restricted health and educational services; older, often-sick, and primarily female adults with limited migration capabilities who ended up trapped in the *Sierra* village with complete glacier loss struggled to make a living without appropriate state support in the increasingly uninhabitable area; pregnant women in both the prolonged displacement on the *Costa* and the fragmented, drawn-out relocations in the *Selva* suffered disproportionately from health challenges due to the degraded health infrastructure and state failure to restore it; migrants from the *Sierra* with prior health burdens or disabilities faced difficult starting conditions and limited livelihood options in the cities due to inequitable labor market structures and insufficient public services; and, finally, a number of women on the *Costa* suffered from insecurity after their male partners had migrated, given the lack of security provision by the state. These findings support calls to use intersectional and gender lenses in climate migration studies in ways that also account for structural inequalities (Edwards & Wiseman 2011; Lama et al. 2021). At a minimum, sensitivity to the role of gender is needed:

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[3] Not all changes were negative. For example, educational offers improved, but for many migrants, they were too costly.

[4] Remarkably, *Sierra* migrants did not explicitly mention structural discrimination after moving, which is common in Peru' cities, see Barrantes & Busse (2014); Moreno & Oropesa (2012); Sanborn (2012).

half of Peru's population is female and disproportionately affected by structural disadvantages, such as illiteracy and tenure insecurity (Oliver-Smith 2014; UN 2021), and these factors also influence their migratory agency and opportunities for well-being.

In contrast to these significant structural *constraints* on well-being, structural *opportunities* had low to average importance. To start with, in all cases, freedom of movement was a fundamental source of support for people's transitions across space; all aspiring migrants with sufficient resources could execute their decisions to move within Peru without facing legal or political limitations. In addition, social networks constituted both key structural opportunities and resources that benefitted well-being in all case studies. For example, strong social support systems helped affected people who were neglected by the state to mitigate their experienced loss and damage to some extent and enabled migrants to decrease the transition costs of their moves. Moreover, non-state actors such as NGOs and private businesses mitigated hardship in several cases but seldom did so entirely. For example, support from NGOs and international organizations after the 2017 Coastal El Niño partially mitigated losses and the negative impacts of the state's insufficient humanitarian assistance. In addition, thriving sectoral job markets contributed structurally to well-being in a few cases. For example, the *Selva* relocatees gained better road access after moving and could thereby also profit from the general growth in labor demand at the time. While businesses' self-interested demand for labor occasionally coincided with migrants' need to make a living, working conditions were often exploitative, as seen in the *Costa* case.Finally, there were more marginal or case-specific effects of other structural opportunities, such as digitalization and technology diffusion, which helped the voluntary stayers in the *Sierra* to maintain contact with the migrants and thus contributed to their well-being.

In summary, a major reason that most migrants' and stayers' well-being outcomes tended to be net-negative was that structural constraints significantly limited their room to maneuver. *Survival* migration or immobility, occurring under high structural constraints and low opportunities, entailed the highest risk of ill-being, while most *distress* (im)mobilities under high constraints and low to average opportunities also reduced well-being. By contrast, some of the rarer cases of *improvement* migration under more favorable structural conditions resulted in fragile well-being advances.[5]

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[5] *Free* migration, the fourth Ideal type mentioned by de Haas (2021), did not occur in this study.

8.2.2   Nature and Impacts of Hazards

While structural constraints were a dominant influence on people's well-being trajectories, the nature and impacts of hazards also shaped the types and conditions of (im)mobilities that occurred, as well as the resultant well-being paths. Key factors were the speed of hazard onset as well as the severity, irrevocability, and possible accumulations of impacts, and, closely related, the extent to which people could anticipate the climate threats and deal with them. All the case studies validated that subsistence farmers who operated with minimal margins and depended on difficult-to-diversify, ecosystem-based livelihoods were highly vulnerable to cumulative impacts from severe *gradual* and *abrupt* hazards and had limited options for local coping or adaptation, which resulted in well-being threats.

First, *abrupt* hazards left little time for preparation and caused displacements which challenged well-being, but the extent of the resulting hardships depended on the severity of the hazards. To begin with, moderate annual floods caused temporary displacements in one *Selva* village and cumulative damage that inhabitants could mostly manage on-site with moderate well-being losses. Conversely, *severe* abrupt hazards, such as exceptional floods, forced acute survival migration of large groups in the *Selva* and *Costa*, and while the initial, short-distance movements saved lives, they had to be implemented rapidly and under unsafe and traumatizing conditions that considerably reduced well-being. On the *Costa,* people remained displaced for prolonged periods and fell into ill-being due to the experienced losses and the lack of recovery options. While safer from hazards, they heavily depended on self-help and dwindling humanitarian assistance. By contrast, most of the displaced persons in the *Selva* at first returned to their flood-exposed home areas due to place attachment or a shortage of better options; when they decided to leave but lacked the resources necessary to do so, they ended up trapped for years, waiting for relocation. Such entrapment in areas with recurrent *abrupt* hazards—which often interacted with *gradual* processes such as warming and rainfall changes—significantly harmed well-being in both the *Sierra* and *Selva*. Only those who eventually relocated to a safer area in the *Selva* years later slightly improved their well-being. This finding highlights the need for durable solutions to prolonged or protracted entrapment.

Second, early- or mid-stage *gradual* hazards, such as extensive glacier loss in water-scarce *Sierra* areas, slowly expanded *anticipatory improvement* migration at first, which had mixed to positive well-being effects. However, as climate impacts accumulated in later stages, there was a change in the resources and conditions required for moving as well as the resultant well-being effects, and

the farmers who moved after the meltwater had been completely lost in V2 had on average worse well-being outcomes. The cases suggest that when gradual climate impacts threaten habitability, they can force *acute* migration under *distress* or *survival* conditions similar to that described above for grave *abrupt* hazards. In such cases, migratory feedback mechanisms can lead to gradual settlement abandonment, which also threatens the shrinking population's well-being. While some farmers in the *Sierra* chose to stay and experienced mixed well-being effects (at least before climate impacts and emigration intensified), others whose migration resources eroded became trapped in deprivation.

To summarize, the hazards contributed to varied well-being paths. Nonetheless, parallels emerged between the well-being tracks taken after (a) low-intensity, abrupt impacts and early-stage, gradual impacts as well as between those taken after (b) severe, abrupt impacts and irrevocable, late-stage gradual impacts. The latter type of hazard made ill-being most likely because it caused greater and less repairable loss and damage, while the affected people had the weakest abilities to anticipate and deal with these hazards.

8.2.3 Agency

Finally, although well-being trajectories were primarily defined by structural constraints and the severity of climate impacts, the affected people's limited *agency* also shaped these paths. Building on the framework presented in section 2.3, the analysis confirmed that people's agency depended on (a) their migratory *aspirations* and *capabilities* to move and (b) the additional *resources* required to settle or stay, which were partially influenced by intersecting social factors such as age and sex.

To begin with, migratory *aspirations* shaped well-being paths. Being *forced*[6] to move tended to reduce well-being most severely, because migrants' unrealizable desire to stay in their homes lowered their readiness to invest in their new lives after moving (*Sierra* V2 and *Costa*). Conversely, *voluntary* (and, in the best case, anticipatory) migrants usually nurtured aspirations that supported their new starts (*Sierra* V1, *Selva* V3). They were eager to profit from the longed-for

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[6] As discussed in section 2.2.2, migration or staying is seldom unambiguously *voluntary* or *forced*. Even seemingly voluntary cases can be connected to financial or social necessities, and even apparently forced instances can have elements of choice. Furthermore, capabilities and aspirations can interact, and such interactions may shape well-being effects, for example, when people who aspire to stay start to direct their resources to improve the local situation and thus are better.

change and dealt with the initial struggles in the hope that future gains would reimburse them. Yet, such high migratory aspirations also made disappointment more likely, since not all expectations could be met, as seen for some *Sierra* migrants. Finally, people who stayed *voluntarily* typically fared better than those who aspired to leave but were unable to do so and ended up *trapped*, as noted below.

The second element influencing well-being outcomes was migratory *capabilities*. Most migrants lacked sufficient resources to be able to move in safety and dignity. For example, several displaced persons in the coastal zone lost close to all their resources in floods; they had to flee rapidly for survival under highly adverse conditions and ended up in a barren desert strip. The additional trauma, insecurity, and losses experienced during these journeys reinforced their later pathways toward ill-being. Conversely, the few people in the case studies with more capabilities were usually able to move earlier and more safely. For example, in the *Selva*, people with savings were the first to relocate to sheltered land and thereby reduced their hazard exposure and improved their well-being. Finally, if people's capabilities were too low to enact an existing desire to leave, their well-being usually declined severely because they were forcibly trapped in situations they wanted or needed to escape.

People required not only migratory capabilities but also further *resources* to fulfill their needs, pursue their goals, and address demands where they settled or stayed (Ryan et al. 2008). Within the structural constraints that severely limited people's actions, the amount of resources that they possessed created further path dependencies for well-being impacts. For changes in the well-being dimension *development from a secure base*, key resources included the availability of buffers and resources to cope with shocks, the state of livelihood diversification and recoverability, the transferability of prior skills and access to new skills, as well as health and education baselines. Next, whether people obtained *a space to live better* depended strongly on the socioeconomic resources they had available to pursue reconstruction after disaster displacement or to settle in secure, legal city zones after migration. Further, people's *social relatedness* paths were contingent on their baseline embeddedness in their home communities as well as on the number and quality of social entry points or networks in their destination. Finally, personal coping mechanisms and people's tendency toward optimism or pessimism shaped *SWB* trajectories significantly. Overall, people who had low baseline resources that could not easily be transformed to match their new situations and who struggled to acquire new resources often faced roadblocks, predetermined breaking points, and downward spirals of ill-being. For example, after their villages had been destroyed by floods, migrants on the *Costa* were

forced to settle in makeshift camps with extremely low baseline resources. Many spiraled into ill-being because prior losses of livelihoods, assets, infrastructure, and health constituted large burdens for their attempts to rebuild their lives. As another example, most *Sierra* migrants remained *deadlocked in a worsening state of life* in the cities because they lacked the educational profiles required to obtain decent jobs and lived in slums. Simultaneously, their baseline poverty hindered their ability to make investments that could have compensated for these disadvantages, such as moving to more secure zones with adequate basic services. In Ryan and colleagues' (2008) terms, migrants who lacked sufficient baseline resources struggled to cope with *aversive demands* (adverse external events and experiences) while facing frequent *demand overload* or *demand strains* (insufficient resources to satisfy needs or goals or the availability of finite resources to address competing priorities). Conversely, more baseline resources—especially those with transformational potential, such as transferable skills—usually resulted in more room to maneuver and greater well-being. These resources enabled people to deal better with aversive demands, to experience less demand overload or strains (Ryan et al. 2008), and to create or take advantage of opportunities.[7] For example, a small number of *Sierra* migrants possessed or acquired the resources needed to start studying, which allowed them to gain the skills required to obtain better jobs (although in often arduous processes); these skills, in turn, increased other aspects of their well-being. At the individual level, resources conducive to well-being in all cases included good health, the ability to study and work, sacrifice, self-help, innovation, entrepreneurship, social skills, and personal coping mechanisms. Resources at the community level accrued from the capacity to self-organize, act, and resist marginalization. For example, dense social networks, mutual support mechanisms, communal task systems, self-organized reconstruction measures compensating for state deficits, as well as joint struggles for change contributed to positive impacts on every well-being component studied here. The case of the *Selva* village demonstrates that persistent community action can, in certain cases, mitigate some of the worst well-being risks associated with climate (im)mobilities. Ultimately, people's resources were partially determined by *intersecting social factors*. Some of these intersecting factors, such as health burdens, reduced people's resources and thereby increased their susceptibility to aversive demands such as worsening health infrastructure, whereas migrants or stayers with better health were either not affected by or better equipped to

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[7] Ryan and colleagues (2008) point out that high *resources* can also create well-being risks when they result in *demand insufficiency*, namely un- or underchallenging situations. Such demand insufficiency was not witnessed in the cases here.

deal with such demands. Simultaneously, certain socially ascribed factors created well-being challenges or opportunities because they resulted in systemic marginalization or privileges. This is where the individual level connects with structure, as discussed in the section above on structure. For example, because the systematically disadvantaged Indigenous people in the rainforest had limited access to education and social services, their resources to cope with the floods were limited.

8.3   Summary and Overarching Propositions

In summary, the comparison of the case studies reveals that significant structural constraints set hard limits on people's well-being pathways. Foremost, weak governance as well as development and climate inequalities, together with other structures of neglect and marginalization, created an uneven distribution of opportunities to migrate in the first place, to move or stay under tolerable conditions, and to subsequently preserve or enhance well-being. For migrants moving to formerly uninhabited spaces and stayers, structural factors and the respective social systems did not change fundamentally, which is why inequalities tended to be reproduced or reinforced. Although migrants from the *Sierra* settled in different urban settings, moving also typically reproduced or exacerbated and only partly modified strong structural constraints; in some cases, old constraints (such as spatial insularity) were replaced with new ones (such as tenure insecurity). Therefore, structural constraints constituted a dominant determinant of people's well-being and the reason that most stayers and migrants experienced deprivations. Simultaneously, people's well-being trajectories also depended on the varying nature and impacts of hazards, which shaped their baseline resources to different extents. Severe *abrupt* or late-stage *gradual* climate impacts created particularly heavy well-being burdens for subsequent (im)mobilities. Moreover, the analysis demonstrated that most farmers had very limited agency to address climate impacts or circumvent state failures and other structural hurdles, which further lowered their chances of maintaining or enhancing their well-being. Few affected people managed to use their limited agency to achieve small advances within their constrained room to maneuver. Figure 8.7 synthesizes these findings of the comparative analysis. By plotting the three key influences on well-being identified here, it displays that strong structural constraints, severe hazards, and limited agency led to net well-being declines or stagnation for most analyzed groups.
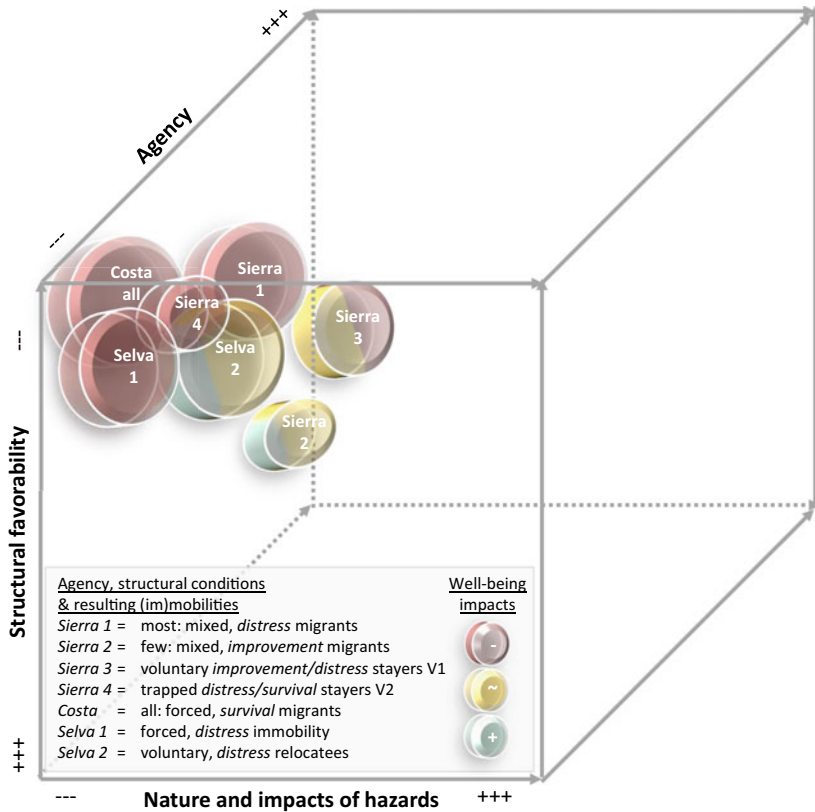
Figure 8.7 Well-being impacts in function of structure, hazards, and agency. (Note: Created by the author)

Lastly, the comparative analysis of varied forms of climate (im)mobilities in Peru makes it possible to induce propositions that are transferable to certain settings beyond these specific cases. In particular, the propositions may be applicable to subsistence farmers and other people with marginal access to socioeconomic, spatial, and political resources, who live in climate impact hotspots that are characterized by both weak governance and adverse social structures, as is discussed in more detail in the conclusions in chapter 9. The nine propositions below respond to the main questions that guided this research, namely, in what ways

and why migrating from or staying in areas harmed by climate hazards affects people's well-being.

(1) People's well-being trajectories during climate (im)mobilities are highly contingent on the favorability of structural conditions as well as on the nature and impacts of hazards, while people's levels of agency can moderate well-being effects to a limited extent.

(2) The more damaging or less repairable the climate impacts, the higher the risk of harmful conditions during related climate migration or immobility and of ensuing well-being losses. Well-being risks are particularly high after severe abrupt hazards, late-stage gradual hazards, and cumulative shocks.

(3) The more unfavorable the structural conditions under which staying or climate migration and settling occur, the more damaging the impacts on people's well-being. Well-being is especially threatened where development gaps, constrained livelihood options, weak governance, marginalization, and land issues combine.

(4) Because most marginalized climate migrants and stayers lack the opportunity to influence larger societal structures, prior marginalization and inequalities are likely to be reproduced or exacerbated in most cases if third actors do not intervene substantially.

(5) For most poor, undiversified subsistence farmers living in societies with weak governance and deep inequalities, climate migration likely entails well-being losses early on, which hinders the farmers' subsequent well-being trajectories. The majority may experience net-negative outcomes.

(6) The more people are forced to move or stay against their aspirations, and the fewer their capabilities for migration, the higher the risk of adverse well-being effects. Poverty, a lack of social networks, and the often unplanned, precarious circumstances of forced (im)mobility constitute key risks for well-being losses.

(7) The fewer people's further resources are for either settling after migration or staying at their original sites, the more likely are deepening vulnerabilities during (im)mobilities. In particular, the lack of financial, social, and human capital that can be flexibly applied in changing surroundings increases vulnerabilities.

(8) The more intersecting social factors, such as age, ethnicity, health status, and sex, make affected people susceptible to aversive demands or lead to structural marginalization, the more likely well-being losses during climate (im)mobilities.

(9) Regardless of whether subsistence farmers migrate or stay after climate impacts, the impacts on *development from a secure base* and *a space to live better*—which include livelihoods, health, education, and decent living conditions—tend to influence one another strongly. By contrast, the impacts on *social relatedness* can partially differ. Jointly, these OWB elements have a stronger feedback effect on *SWB* than vice versa.

These propositions are based on a systematic comparison of observations made in the case study chapters 5–7 and the identified patterns of similarities and differences. While the propositions are specified in the theoretical domain, future research could transform them into falsifiable hypotheses in order to test them in the empirical domain (Bhattacherjee 2022); doing so is beyond the scope of this dissertation. To this end, the concepts from the mostly qualitative findings would need to be operationalized and translated into corresponding quantitative variables. Subsequently, the hypotheses built on these variables could be tested with observed data and either supported or rejected (Morgan 2015). Such future research would be welcome to expand the still limited knowledge on the well-being impacts of climate (im)mobilities and enable the construction of better theories regarding the impacts of migration and staying in general.

Part III
Seeing Behind the Curtain

Conclusions

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In this dissertation, I examined the multidimensional well-being of internal climate migrants and stayers in affected areas across Peru's three large topographical zones, namely its highlands, rainforest, and coastline. I focused on the extent to which people could meet their needs *and* how they self-assessed well-being. The applied objective well-being (OWB) axes concerned people's chances for *development from a secure base* (including livelihoods, health, and education)*, a space to live better* (factors such as shelter), and *social relatedness*. The subjective well-being (SWB) axis included present *emotional balance* and *cognitive satisfaction*, and *views of the future* (see chapter 2). The findings indicate how moving or staying affected well-being, how different components of OWB and SWB varied and related to each other, and how they changed over time. In addition, the results show which mechanisms of action and social conditions influenced the observed well-being impacts.

Taking a comparative approach, I analyzed qualitative and quantitative data on well-being impacts from three case studies that shared similarities and differences. The cases focused on climate migration from, or immobility in, rural villages with similar subsistence livelihoods that were struck by water-related hazards typical for Peru's three large topographical zones. Resulting (im)mobility dynamics were characteristic of the respective hazards but dissimilar across cases, which created varying conditions for well-being impacts. In the first case study, I examined long-distance, rural-to-urban individual or household migration from two villages in Peru's highlands (*Sierra*) in the Lima Region to large cities. Gradual water scarcity due to glacier recession and rainfall changes influenced their migration. Movement ranged from more *voluntary* to clearly *forced* instances and mostly occurred under *distress* because of unfavorable structural conditions, as

opposed to a few migrants moving under more favorable *improvement* conditions. Stayers were mostly *voluntarily immobile* in one and *trapped* in the other highland village. In the second analysis, I focused on attempted planned relocation of two villages in the rainforest (*Selva*) Region of San Martín after severe, *abrupt* floods. Both cases resulted in *forced immobility* for years under structural constraints that created *distress* conditions. Only one of the two villages eventually completed *voluntary* relocation to another location in its close vicinity, equally under structural *distress* conditions. In the third case, I examined short-distance, internal displacement driven by abrupt floods during the 2017 Coastal El Niño, with a focus in the coastal (*Costa*) Region of Piura in the qualitative strand and regression analyses for all of Peru. This *forced* migration occurred under structural barriers that led to *survival* conditions for moving.

Through qualitative text analysis and regression models, I demonstrated that well-being impacts were on average more net-negative than net-positive across cases. The wide range of the examined cases could be clustered in three characteristic well-being pathways with similar dynamics across the different phases of migration or immobility. First, displaced persons in the coastal zone and trapped people in the highlands experienced a *tailspin into severe ill-being*. Both groups suffered extensive losses because of severe climate impacts, which jeopardized their later well-being. Because staying or migrating proceeded under highly adverse structural conditions and with very limited agency, these affected people ended in downward spirals of objective and subjective destitution with little room for recovery. Second, most migrants from the highlands and the trapped people in the rainforest winded up *deadlocked in a worsening state of life*, while the voluntary stayers in the Andes risked following this path as well. Increasing climate-induced harm, combined with structural marginalization and constrained individual resources, blocked their opportunities for well-being in the urban areas characterized by increasingly unreceptive modes of incorporation. Finally, a small number of migrants from the highlands and the relocatees in the rainforest were able to recover slowly after climate impacts, albeit with taxing and laborious processes. Less adverse structural conditions or more moderate levels of agency enabled them to obtain *incremental, fragile advances* in well-being. Despite these absolute well-being differences *between* groups, *within* the examined groups, the OWB and SWB components mostly changed in similar directions. Especially *development from a secure base* and *a space to live better* had palpable bidirectional links, and jointly, they influenced *SWB* strongly. Conversely, *social relatedness* assumed a partially separate dynamic: due to strong community or diaspora ties and self-organization capacities, most migrants and stayers preserved or regained social capital, even in cases when other well-being components deteriorated.

Using the full body of the evidence generated from the individual case studies, I induced several propositions on the underlying mechanisms behind the observed well-being effects. The results suggest that well-being impacts of different climate (im)mobilities are primarily contingent on the favorability of structural conditions as well as on the nature and impacts of hazards. Critical structural constraints which amplify risks to well-being include gaps in development and climate adaptation; limited rural livelihood options; land scarcity; tenure insecurity; marginalization; weak governance; and the effects of population growth. Conversely, subsistence farmers' frequently low levels of agency can moderate the effects only to a limited extent. In most cases, well-being losses early on after the onset of hazards create strong, persistent burdens for people's subsequent prospects to be well, regardless of whether they stay or migrate. The risk of additional deprivation is particularly high when structural constraints outweigh structural opportunities in defining the course of (im)mobilities; when people's migratory agency and further resources are minimal; and when intersectional social factors result in high vulnerabilities or systemic disenfranchisement. Consequently, for most poor, undiversified subsistence farmers harmed by severe climate impacts and subjected to serious structural constraints, climate migration and immobility are bound to threaten well-being in the short to medium term. Prior structural adversities are likely reproduced or exacerbated during such climate (im)mobilities, if concerned actors do not intervene thoroughly. In rarer cases when structural conditions, hazard impacts, and levels of agency are relatively favorable, well-being may return to the baseline, stagnate, or rise marginally, however, such recovery or gains tend to be frail.

9.1   Implications

There are substantial reasons for concern that the risks to well-being identified here exist not only for the studied groups but also for other structurally disadvantaged subsistence farmers engaged in climate (im)mobilities across Peru and worldwide.[1] In Peru, about one in four laborers work in agriculture, and around 80% as subsistence farmers (CEPLAN 2016; World Bank 2019). Their vulnerabilities are frequently as high as in the case studies conducted for this dissertation: 46% of Peru's rural residents are poor and many more threatened

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[1] While the focus here was on rural areas, numerous urban residents also face displacement risk, see IDMC (2021c).

by poverty (World Bank 2017a); four in five farmers have insecure land owner-ship or tenure (FAO 2022); most farmers work informally (CEPLAN 2016); and 70% of all towns in Peru, mainly in the rural areas, are in a state of high or very high food insecurity (WFP & CENEPRED 2015). These numbers provide an indication of the scale of people threatened by well-being losses related to climate (im)mobilities in Peru today.

At the global level, around two in three people in low and lower-middle-income countries live in rural areas and work in climate-sensitive agricultural activities (UNDESA 2021; World Bank 2021c). They are often subjected to structural conditions similar to those that increased the risks to well-being most strongly in this study. Compounding the well-being threats, these structural drivers of risk are particularly salient in countries where climate hazards are also most severe. First, development gaps are large in many of the world's rural areas, and the COVID-19 pandemic has reversed much of the progress of past decades (UN 2021). Globally, close to one fifth of the rural residents live in extreme poverty (UNDESA 2021); 65% of all poor, working adults are farmers (World Bank 2021c); about half of all food-insecure people depend on small-scale agriculture (Sanchez & Swaminathan 2005); and 91% of those working in agri-culture lack social protection (UN 2021). Second, while smallholders are greatly exposed and vulnerable to climate hazards (Donatti et al. 2019; Niles & Salerno 2018), adaptation remains fragmented and insufficient worldwide (Berrang-Ford et al. 2015; Berrang-Ford et al. 2021), and adaptive capacities are weakest in low and lower middle-income countries (ND-GAIN 2022). The adaptive capacities of smallholders are especially low, and they have already reached soft limits of adaptation in various world regions today (IPCC 2022a). Third, most subsistence farmers have limited options to improve or adjust their livelihoods, leaving them vulnerable to shocks. Key barriers for developing or diversifying on- or off-farm activities include small farm sizes, limited access to modern markets, and gaps in rural education (Fan & Rue 2020; Lakin & Gasperini 2003). Fourth, land scarcity and tenure insecurity remain pervasive structural constraints that increase well-being risks related to climate (im)mobilities in many countries. Around four in five farms worldwide are smallholdings with less than two hectares in size, which require substantial human labor and inputs, have a low productivity, and are vul-nerable to shocks because they operate with minimal margins (Gómez y Paloma et al. 2020; Hannah Ritchie & Max Roser 2021; Herrero et al. 2017; Lowder et al. 2014). Simultaneously, in most poorer countries, more than half of the farmers lack land ownership or secure tenure, especially smallholders and female farmers (FAO 2022; UN 2021). Globally, close to one billion people fear to be likely or very likely evicted in the next five years (Prindex 2022). Fifth, many social

groups worldwide continue to be systematically marginalized. As two examples, 3 billion girls and women live in countries with poor or very poor gender equality (EM 2022; World Bank 2021c), and the world's one billion people with disabilities also continue to suffer from socioeconomic exclusion and poverty rates above average (WHO & World Bank 2011; World Bank 2020b). Sixth, weak governance poses a persistent constraint in many world regions (World Bank 2017d), which can exacerbate well-being risks linked to climate (im)mobilities. For example, corruption remains a serious problem in two thirds of all countries, with almost no progress achieved (Transparency International 2022). Further challenges concerning state legitimacy, fragility, rule of law, and human rights are extensive around the globe (FFP 2021). Close to half of the world's population distrusts state institutions, around one third perceives civil servants as untrustworthy, and politicians are seen as the least trustworthy among various professions (Edelman 2022; Ipsos 2021). Seventh, population growth can add to the structural factors that raise well-being risks related to climate (im)mobilities. Critically, most growth might be concentrated in poorer countries which also face most climate risks (Guzmán et al. 2009; Nugent 2019; UNDESA 2019), although access to modern energy and education could still significantly attenuate such growth trajectories (Belmin et al. 2022; KC & Lutz 2017; Lutz & KC 2011). Altogether, the number of people in Peru and globally subjected to structural constraints similar to those identified in this study is large, which stresses the scale of possible well-being threats related to climate (im)mobilities. A great share of future climate (im)mobilities may occur in the regions with the highest structural constraints: while projections for immobility, relocation, and displacement are unavailable, close to 3% of the total population in six developing regions, or 216 million people, may become internal climate migrants by 2050, if high emissions combine with unequal development (Clement et al. 2021).[2]

The findings identified here also yield insights with relevance beyond Peru for another reason: Peru is home to examples of most of the Earth's climate zones, highly varying landscapes, and megadiverse ecosystems and can therefore be considered a microcosm of the global challenges caused by climate change (MINAM 2015). In this dissertation, I purposefully gathered data in three significantly different zones of this megadiverse country to raise the external validity of findings and provide insights for adjacent areas which share similar livelihood systems, ecosystems, and climate zones. Examples of such areas include Chile's northern

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[2] The regions included in the models are East Asia & the Pacific; Eastern Europe & Central Asia; Latin America; North Africa; South Asia; Sub-Saharan Africa. The estimates are to be considered conservative, see Clement et al. (2021: 4).

desert, other mountainous zones in the Andean countries, and rainforest regions in neighboring states. To date, few studies collect comparative data on climate (im)mobilities in neighboring countries, although especially border regions often share fundamental similarities. This thinking within national boundaries limits the research community's ability to understand the nexus within similar socioecological systems more comprehensively. Such comparisons would be useful to examine the effects of different policy setups.

In a following step, the findings on how and why different climate (im)mobilities affect well-being can also inform future research and planning to protect affected people. Such insights are needed as the numbers of climate migrants and trapped people are set to rise but studies on the related well-being impacts remain scarce (Clement et al. 2021; Foresight 2011; Hoffmann et al. under review). Chiefly, this dissertation has implications for two arenas. First, it sheds light on adequate methodological and conceptual approaches for studying this issue. Second, it provides evidence for the ongoing debates on the adaptive potential of migration or staying as well as for those on Loss and Damage due to climate change, which, jointly, underpin policymaking and planning in this field.

To begin with, the study adds to the methodological development in the field by using mixed methods. Such designs have been called for to improve the understanding of mechanisms of action, the validity of findings, and researchers' reflectivity, but remain rare[3] (Bergman 2018; Boas et al. 2020; Durand-Delacre et al. 2021; Schwerdtle et al. 2020). The central qualitative component in this study was key to both identify the well-being effects of climate (im)mobilities and *understand* their underlying mechanisms of action. This work thus corroborates that qualitative research has unique "powers" and is "inimitable" to assess climate impacts and related experiences people make in the social world (Nature Climate Change 2021: 717). Applying the same qualitative methods to varying forms of climate (im)mobilities across Peru also rendered a robust evidence base that, through comparative analysis, allowed inducing propositions with greater validity. Three lessons were learned for future mixed methods studies in this field. First, they could expand their qualitative components with more focus groups for groups deserving specific attention (Ruppenthal et al. 2005; Skop 2006; Wilkinson 1999). Second, an intergenerational and life course perspective for time-dependent effects could be valuable (Kley 2011; Singh et al. 2019; Wingens et al. 2011). Lastly, fine structure and system analyses of the primary data, two resource-intensive methods, may provide additional depth (Froschauer & Lueger

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[3] For examples in this topic area, see Fernández et al. (2019); Guodaar et al. (2017); Rademacher-Schulz et al. (2014).

2003). Simultaneously, the applied quantitative methods were valuable to corroborate the well-being losses and measure the strength of effects in the case study of the 2017 Coastal El Niño. The dataset with close to 190,000 respondents covered all of Peru and rendered results with statistical and substantive significance that validated the results derived from the small-scale, qualitative sample from select sites in northern Peru (Mahoney 2008). Peru's statistical agency supported this research by matching respondents in two previously separate datasets, which rendered longitudinal data that allowed analyzing well-being changes over time. This type of collaboration could provide a model for how to obtain data to improve knowledge on various other aspects of climate (im)mobilities (Vinke & Hoffmann 2020). In addition, the regression analyses of the extensive survey data identified new patterns only visible in samples much larger than the qualitative one, such as the increased displacement risk related to being a single parent. However, a statistical analysis alone would have been unable to provide the same depth of analysis of the processes, context, and social conditions that led to the well-being impacts, and thus, the qualitative strand proved key "to understand the meaning of what we see" in the survey data (Boas et al. 2020: 195). Because the regression analyses were also limited to the available items in the secondary survey, which did not reflect all pertinent well-being elements, the primary qualitative data remained critical to identify the wide range of relevant changes. Therefore, to summarize, the mixed methods approach centered on a strong qualitative strand and enhanced by statistical analyses proved fitting to identify the well-being impacts of climate (im)mobilities and understand underlying mechanisms of action.

Beyond these methodological lessons, the study also provides insights into conceptual frameworks suited to study climate (im)mobilities. Conceptualization is vital because only what is defined can be measured, assessed, and consequently inform policy and planning. Well-being proved an appropriate lens for this study, which is in line with the approach favored recently by the IPCC (Cissé et al. 2022). The findings confirmed the importance of all components in the applied well-being framework, namely needs derived from universal and local views (Copestake 2008b; McGregor et al. 2015) combined with people's subjective life evaluations (Costanza et al. 2007; OECD 2013). This multidimensional well-being framework covered most key metrics on vulnerability in displacement suggested by international organizations (EGRIS 2020; JIPS 2018) as well as the reconstruction needs for displacement and resettlement described in Cernea's (2004) influential model (see Section 2.3). In the analysis, the framework proved valuable for two reasons. First, the applied *objective* measures were sufficiently comprehensive for the complexity of the research questions at hand. The analysis highlighted that all objective measures deserved separate attention

because they often changed in the same direction, but not always. For example, past studies often only used income or the three human development metrics income, education, and health as proxies for overall well-being; yet such a narrow lens would have overlooked diverging changes in other well-being realms in the case studies, such as the diverging effects on *social relatedness*. The international metrics on displacement vulnerabilities mentioned above also insufficiently account for social relatedness. Conversely, those metrics recommend measuring political and legal items as well, such as access to documentation, which I did not examine in this study, but which could usefully inform future data collection on climate migration. Second, applying a lens on people's *subjective* state of life resulted in new—and occasionally contradictory—insights into people's well-being.[4] It demonstrated that people's SWB was challenged for the most part and in some cases, even seemingly reasonable conditions failed to translate into positive lives in people's own evaluations. Such SWB declines require dedicated policy attention not only as they demonstrate how people's self-appraised life quality can come under pressure, but also because SWB can impinge on other well-being variables (Diener et al. 2018b; Forgeard et al. 2011). For example, the widespread hopelessness among climate migrants and trapped people could intensify perceptions of vulnerability, uncontrollability, and unpredictability; it may also block action to protect oneself against harm, to protest injustices, and ultimately to subsist in adverse settings (Carver & Scheier 2014; Forgeard & Seligman 2012). An analysis merely centered on OWB, or standard economic measures of success, would have failed to expose these nuanced effects. The findings of this study thus support calls for more complete measures of well-being in migration research and policies (Hendriks & Bartram 2019). Particularly, they emphasize that a multidimensional well-being lens built on objective and subjective measures of well-being is indispensable for examining the complex effects of climate (im)mobilities. However, to my knowledge, such human-centered lenses have not been applied previously in this field, despite their increasing significance in studies on migration (Haindorfer 2019a) and sustainable development (Adams et al. 2020; Lutz et al. 2021). While I focused on *hedonic* approaches to SWB in this study given time and resource constraints, future work could apply lenses that also integrate *eudaimonic* ideas. Eudaimonia (from ancient Greek "flourishing") was the highest goal of human action for Aristotle. It centers on positive functioning, personal development, self-realization, meaning and purpose (Robinson 1999), using and developing the best in people (Huta & Ryan 2010), or

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[4] Similarly, both subjective evaluations of the present and views of the future should be measured because they diverged occasionally, which resulted in different well-being states.

living virtuous lives that realize the human potential (Delle Fave et al. 2011b; Huta & Waterman 2014). Psychological well-being (PWB) research builds on this notion (Ryff 1989; Ryff & Keyes 1995; Ryff & Singer 2008). While hedonic and eudaimonic measures are associated, they refer to distinct subjective states and underlying phenomena (Henderson & Knight 2012; OECD 2013). A primary reason why eudaimonic ideas deserve integration in studies on migration impacts is that gains and losses in both hedonic *and* eudaimonic dimensions affect overall well-being (Huta & Ryan 2010). For this reason, several scholars argue that these paths jointly form SWB (Delle Fave et al. 2011a; McGillivray 2007; Stiglitz et al. 2009). Available integrated approaches[5] would offer potential to understand well-being impacts of climate (im)mobilities even more comprehensively. Such future work could also mitigate agreed limitations of exclusively hedonic SWB frameworks.[6]

Beyond informing methodological and conceptual debates, this study also has key implications for discussing the adaptive potential of climate migration and related policymaking or planning. At least since scholarly work in the 2000s (McLeman & Smit 2006) and the inception of the Cancún Adaptation Framework (UNFCCC 2010), migration, displacement, and relocation have been considered from a climate adaptation viewpoint (Warner 2012). Whereas prior studies on Peru have echoed related framing debates without critically engaging with them (see Bergmann et al. 2021a), the results of this study cast doubt on the notion of *migration as adaptation*. They suggest that under prevailing policy and structures, migration does not work as a positive adaptation strategy for many people. However, it could be more successful with the reforms recommended in Section 9.2.

First, the findings emphasize that *gradual* climate impacts (such as glacier retreat and rainfall changes) can render migration conditions increasingly *distressful*, especially for people with tangible prior vulnerabilities and those subjected to state neglect. Most affected people suffered from substantial OWB hardship and

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[5] Examples include the *flourishing* work by Keyes (2007); (2010); (2014) or Huppert and So (2013), as well as the *orientations to happiness framework* by Peterson et al. (2005); Park et al. (2009); Seligman (2011, 2018).

[6] For example, satisfaction and a good mood are not always the product of a good life or can arise from morally ambiguous actions, and actions causing momentary pleasure may be self-destructive overall, see Kashdan et al. (2008); Annas (2004). Climate change is a stark example that the 'pleasant' lives of a small share of the world population, built on unsustainable consumption, can threaten the well-being of generations to come. By contrast, eudaimonic views stress that satisfaction and good feelings are no ends in themselves for intellectual, social, and moral beings, but authentic well-being also requires virtuousness, a greater cause, and engagement, see Henderson & Knight (2012); Ryan & Deci (2001).

evaluated their needs as unfulfilled while these SWB losses, in turn, threatened to further reduce OWB. In destinations, adverse structural conditions continued to diminish migrants' prospects for adaptive gains. For example, land scarcity and unequal tenure systems left rural *distress* migrants with few choices but to live in irregular settlements where they lacked decent housing, basic services, and tenure security. The results also support concerns that even those who manage to adapt to primary climate impacts in their homelands by migrating often encounter secondary hazards in the cities (Adger et al. 2018). Taken together, these findings suggest that in societies with strong structural inequalities, few poor people may have sufficient agency to confront escalating hazards effectively, either by moving or staying. Accordingly, the results reinforce existing challenges to presentations of migration as adaptation (Blocher et al. 2021a; Sakdapolrak et al. 2016; Vinke 2019; Vinke et al. 2020; Wrathall et al. 2014). Moreover, the study reveals that for poor migrants from isolated areas moving under *distress* structural conditions, moving is prone to fail as a translocal group risk management strategy, as suggested by advocates for migration as adaptation and NELM theory (Ober & Sakdapolrak 2017; Stark & Bloom 1985). For example, remittances had palliative effects for stayers in the highlands but could not effectively support climate adaptation or nullify the negative effects of emigration, such as losses of labor force and social capital. The more advanced the stage and volume of emigration, the more negative became the impacts for areas of origin, especially once thresholds toward settlement abandonment were crossed. Consequently, the adaptive potential of migration seems limited in the many areas worldwide where *gradual* climate impacts threaten to be most severe but where, at once, structural inequalities and constrained household resources make it unlikely that migrants benefit in the short to medium term. If such migration can yield better adaptive results over the longer term, particularly over generations, remains an important open question that requires more longitudinal studies.

Second, this study cautions that displacement forced rapidly by *abrupt* hazards such as floods, and occurring as displacement under structurally challenging *survival* conditions, unequivocally threatens to degrade adaptive capacities. For example, migration saved lives after the 2017 Coastal El Niño floods in Peru, but overall, outcomes for OWB and adaptive capacities were devastating as people lost their livelihoods, assets, and homes. These unfulfilled needs caution about the absence of progress toward durable solutions for people displaced by climate impacts (EGRIS 2020; JIPS 2018) and the Sustainable Development Goals (UNGA 2015). Most migrants also ended in subjective states of *deprivation*, which can further deteriorate OWB. These observed well-being losses provide a call to increase investments in disaster risk reduction and management (DRR/

DRM), which is all the more needed as the hazards which have caused most disaster displacement in Peru to date are projected to increase (see chapter VII). Without concerted efforts, displacement risk will also rise since more people will be living in exposed areas in Peru (SINAGERD et al. 2014) and globally (de Sherbinin et al. 2012). While some people are forced to settle in such exposed zones, others choose to live in them because of interim benefits, such as having access to affordable land (Hallegatte 2017; Mishra 2001). Nevertheless, this study suggests that such cost–benefit calculations could change rapidly as recurrent *abrupt* hazards become more frequent and severe, and their impacts accumulate with *gradual* processes such as warming. As a result, permanent displacement risk can arise for those who chose to 'live with the floods' before (Gaillard et al. 2008; Sultana 2010) and those who are forced to do so. Because such *acute*, forced *survival* movements are bound to threaten well-being, displacement should not be discussed under the umbrella of adaptation.

Third, it should not be forgotten that many people stay in place even when severely threatened by climate impacts, which can also strongly affect adaptive capacities and well-being. Nonetheless, stayers remain "a neglected challenge" in policy, data, and research in Peru (Bergmann et al. 2021a) and worldwide (Foresight 2011; Geddes et al. 2012: 953). Policymakers and planners must recognize that immobilities have multiple drivers and varied impacts (Black et al. 2013; Upadhyay et al. under review). Many people in Peru *voluntarily* opt to stay in the beginning of *gradual* climate changes and attempt to adapt locally because they are bound to their homes through place satisfaction, social obligations, or fear of leaving (Adams 2016; Koubi et al. 2016). Conversely, climate impacts that wear down migration capabilities can *trap* at-risk groups in dangerous zones (Black & Collyer 2014).[7] The analyses in Peru's rainforest and highlands caution that especially such forced immobility can worsen adaptive capacities and well-being, including through continued hazard exposure and resultant downward spirals of loss and damage, SWB declines, and further reductions of migration capabilities. People trapped in areas with frequent, severe hazards may risk ending up threatened by periodic, life-threatening displacements. Entrapment must thus be a humanitarian and development concern in the many poor areas globally where climate impacts are worsening but governance is weak and local adaptation options limited. Adequate resources and policies are needed to address operational issues (Geddes et al. 2012), yet required efforts are difficult because they involve domestic politics of states that are often ill-equipped or unwilling

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[7] While the focus here is on immobility in hometowns, it can also occur *during* or *after* climate migration journeys.

to deal with the issue (Black et al. 2013). Finally, the case in Peru's *Sierra* shows that *voluntary* immobility in risk zones can initially yield better results than entrapment (Ahsan et al. 2022); but as climate impacts and migration intensify, conditions can gradually worsen and threaten stayers' adaptive capacities and well-being, another reason why more longitudinal research is needed.

Fourth, the analysis demonstrates that planned relocation in states with weak governance carries significant risks for people's adaptive capacities and well-being. When on-site reaction strategies reach their limits, moving can become the only viable—although challenging—option. Facilitated climate migration can be one way to meet the protection responsibilities of home governments, emitting states, and the international community (Aleinikoff 2020), and corrective and prospective relocations are one concrete tool that concerned actors use to facilitate escape from risk zones. Yet, past relocations in Peru have been burdened with a lack of oversight, financial limitations, and institutional frictions.[8] Implementing authorities often disregarded land and social issues, livelihood necessities, and people's place attachment. Therefore, several related initiatives have threatened well-being. Many affected people have either declined to move, returned, or maintained dual residencies (see review in Bergmann et al. 2021a). The new *Selva* case study herein verifies that attempted relocation can have ambivalent effects for adaptation and well-being. It cautions that relocations are often fragmented journeys and threaten to entail long phases of harmful entrapment. Even the more positive trajectory of the one completed relocation created mixed OWB and SWB impacts at best. This result suggests that relocations can help groups lacking proper migration capabilities adapt to climate risks only under specific conditions (Ferris & Weerasinghe 2020): the adaptive potential is limited without suitable institutional capacities, committed state support and funding for the often-prolonged transitions, genuine consultation and participation, and safeguards for people's rights. Relocation can only be a last resort for a small share of the growing number of people who live in high-risk zones, and the evidence presented in this study cautions that severe well-being problems can ensue. When relocation is required, Peru's relocation legislation constitutes progress,[9] but this analysis demonstrates that its implementation remains fragmented. Other studies confirm this gap between policy and practice in Peru's DRR/DRM (French et al. 2020; French & Mechler 2017; GFDRR 2010), which echoes its general governance problems (McNulty & Guerra Garcia 2019; Morón & Sanborn 2006;

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[8] This paragraph is partially based on my previous work published in Bergmann (2021).

[9] *Ley N°29,869* (Law, 2012); *Ley N°30,645* (2017, Modification); and *Decreto Supremo N°115–2013-PCM* (Regulation).

Thiery 2016). Similar concerns exist worldwide: relocation legislation often does not exist and if it does, execution is weak and can imperil people's well-being (Wilmsen & Webber 2015). An additional threat is that relocations can serve political and economic motives, including control over populations (Farbotko et al. 2020). Thus, relocations remain a risky option for people's adaptive capacities and well-being. Worryingly, global "momentum is shifting toward planned relocation" despite this conflicted past use (Farbotko et al. 2020: 703), and Peru has also embraced it as a strategic solution in various frameworks (French et al. 2020; Lavell et al. 2016).

Altogether, these findings question how much adaptive potential diverse forms of climate (im)mobilities offer, especially when they occur under structurally adverse *survival* or *distress* conditions, after severe hazards, involuntarily, and with limited agency. The latest IPCC report agrees that while people attempt to respond to climate-induced uncertainty and well-being threats through migration, the "migrant success [sic]" is highly variable and delimited by structure and agency (Cissé et al. 2022: 48–49). As a result, especially displacement and forced migration have "generated and perpetuated vulnerability" (IPCC 2022a: 12). In many countries with high structural constraints, adaptive gains may be limited to few cases where climate impacts are less severe and where people possess resources above average or systematic advantages. It is worrying that even migration under structurally more favorable *improvement* conditions seems to create short- to medium-term advances that are fragile at best, while initially voluntary stayers in risk zones may also increasingly lose adaptive capacities as climate impacts intensify. Although the long-term balance between the costs and benefits of staying or moving still requires more research, the findings above do have implications for the approaches championed in policy processes such as the Cancún Adaptation Framework (UNFCCC 2010), the Global Compact for Migration (UNGA 2018), and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Guadagno 2016; UNISDR 2015). Because climate migration and immobility threaten to exacerbate many people's vulnerabilities for years, human rights protection and human security approaches should supplement and, in many cases, supplant migration as adaptation lenses. Such a shift in tone would also stress that states must assume their protection responsibilities instead of transferring responsibility for adaptation to individuals by calling on them to migrate (Bettini & Gioli 2016). The findings of this study reveal the blind spots of migration as adaptation perspectives: if applied in simplistic ways, they risk ignoring that climate (im)mobilities of subsistence farmers in highly unequal societies tend to (re)produce vulnerabilities; that numerous people are threatened with entrapment which reduces their well-being; and that sending areas

may not profit strongly from emigration. Finally, migration can entail a substantial impoverishment risk as well as loss and damage for those who move (Cernea 2004; Thomas & Benjamin 2020), as discussed below. Unfortunately, staying in place under the status quo is not an alternative for many households that face the increasingly damaging effects of climate change. As discussed in the recommendations, actions to improve well-being for both movers and stayers are needed.

Against this background, migration rightfully features in policy discussion on Loss and Damage (L&D), which have been riddled by controversies, however (James et al. 2014; Tschakert et al. 2019). The debate has been catalyzed by improved scientific knowledge on severe or irrevocable climate impacts that have not been avoided—or cannot be avoided anymore.[10] In 2013, L&D became institutionalized in the Warsaw International Mechanism (WIM) in the UNFCCC. Because displacement is a climate change effect that can imply significant L&D, WIM commissioned a task force to provide options "to avert, minimize and address displacement" (Task Force on Displacement 2018: 1). Multidimensional well-being studies like the present one can inform this debate by providing a fuller picture of both OWB and SWB gains and losses due to climate (im)mobilities. Foremost, the *Costa* case study highlights the severe economic and non-economic L&D experienced by persons displaced by *abrupt* hazards in Peru, both prior to and throughout movement and settling. Moreover, recurrent state failures have contributed to continued L&D in the rainforest, at first when the two studied villages were forced into immobility in risk zones, and later when one of them eventually relocated but lacked promised protection and support for reconstruction. Finally, findings in the *Sierra* indicate that *gradual* climate impacts in remote, ecologically vulnerable areas with limited state presence can lead to mixed movements; however, both initially more *voluntary*, *improvement* migrants as well as increasingly *forced distress* migrants are threatened by provisional and non-provisional losses throughout their journeys (although to different extents). Additionally, the analysis underlines that climate change and related (im)mobilities can bring about losses for both migrants and sending communities, such as the erosion of traditional knowledge and community cohesion. From a climate justice perspective, all these losses require remedies and compensation by the international community (Page & Heyward 2017). This study reinforces calls that "financial, technical, and legal support would be appropriate for instances where hard [adaptation] limits are transgressed" (Mechler et al.

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[10] Still, the evidence base remains unfortunately skewed towards richer countries, see van der Geest & Warner (2020).

2020: 1245), especially for losses regarding *development from a secure base* and *a space to live better*. Other losses are more difficult to recover or compensate for, however. Examples include emigration-induced losses of cultural practices, traditions, identity, and social organization in hometowns or migrants' losses of aesthetic and cultural ecosystem services. As these losses can also strongly reduce well-being, they urgently require responses by the international community. However, while UNFCCC members agreed to improve action and support for people affected by L&D—including through finance, technology, and capacity building—words are not followed by necessary action, and WIM has had an overall limited effect to date (Mechler et al. 2020). A particular concern is that *gradual* events and non-economic L&D —two factors that were salient in this study—remain insufficiently addressed. Because richer and poorer countries hold diverging views on questions of liability and event attribution, the compensation offered by the former is far from the L&D incurred by the latter (Calliari et al. 2020; Gewirtzman et al. 2018). Given estimated L&D of several hundred billion USD per year, assistance would need to equal at least 300 billion in 2030 (Hirsch 2021), but richer states removed the Glasgow L&D Facility envisaged by poorer states in the Conference of the Parties 26 in 2021 (Basu 2021; Broom 2021). This study demonstrates how urgent it is to solve this difficult question and address rising volumes of climate migration and immobility that result from, and can entail, substantial loss and damage.

9.2   Recommendations

While the three case studies corroborate the pervasive well-being risks associated with several forms of climate (im)mobilities, the comparative analysis also establishes that concerned actors have scope to uphold or enhance well-being. The major entry points following from the analysis are thoroughly improving challenging structural conditions, profoundly lowering climate risks, as well as supporting the agency of climate migrants and stayers. Figure 9.1 shows that action is recommended across four clusters: (a) reducing climate risks; (b) protecting and informing stayers; (c) facilitating movement in dignity where needed; as well as (d) safeguarding and improving the well-being of migrants.

Reduce climate risks
- Reduce global greenhouse gas emissions
- Invest in local adaptation
- Improve DRR/DRM
- Take stringent development action

Protect and inform stayers
- Support local adaptation in dignity & vulnerability reduction
- Enhance livelihood diversification
- Strengthen financial resources
- Provide skills trainings, awareness-raising & education
- Install monitoring systems
- Enable early informed decisions on staying or leaving
- Support social systems, self-help & community support
- Compensate loss & damage
- Improve rural-urban linkages and remittances
- Ensure delivery of public services
- Provide Mental Health and Psychosocial Support & Positive Psychology interventions
- Conserve local knowledge & traditions

Facilitate movement in dignity where needed
- Identify & map risk areas
- Ensure freedom of movement & legal status
- Provide alternative legal pathways for migration
- Support translocal diversification (e.g. pre-departure skills trainings, microcredits, loans & social safety nets)
- Improve labor market access in destinations
- Support translocal communication & organizations
- Enhance access to social network
- Provide incentives for polycentric settling
- Facilitate planned relocation

Safeguard and improve migrants' well-being
- Strengthen agency
- Mitigate structural constraints, especially weak governance

See details in Figure 2 on:
- Facilitate development from a secure base
- Provide a space to live better
- Enhance social relatedness
- Support subjective well-being

Figure 9.1 Recommendations to enhance the well-being of affected populations. (Note: Created by the author)

First, climate risk reduction is imperative since people's well-being trajectories strongly depend on the nature and impacts of hazards.[11] Global emissions reductions are pivotal to curb climate impacts yet reaching the Paris Goal of limiting warming to a less critical level of 1.5 °C global mean surface temperatures higher above pre-industrial times by 2100 seems impossible with current commitments. Current real-world action suggests a path that would more likely result in 2.7 °C (Climate Action Tracker 2021; WMO 2021). Ensuing climate hazards in such a scenario would pose high well-being threats to migrants and stayers alike in affected areas (Masson-Delmotte et al. 2021). Next, because pressures on people's well-being will grow even in lower emissions scenarios, reducing exposure and vulnerability is as important as mitigating greenhouse gases (Masson-Delmotte et al. 2018). Foremost, the findings in all three case studies stress that the international community and states must invest more to address livelihood erosion, uninhabitability, and settlement abandonment in affected areas. Chiefly, they must reduce displacement risk where staying in dignity is viable and desired, by addressing structural, intersectional inequalities. To this end, regional and international cooperation, increased funding, and dedicated development efforts are

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[11] This and the next paragraph are based on my previous work published in Bergmann et al. (2021a, 2021b).

needed fast, because climate change threatens to exacerbate the existing inequalities that already raise displacement risk for people in rural areas (Hallegatte et al. 2016; Hallegatte et al. 2018) and cities (IDMC 2021c). Modelling indicates that stringent development action can sharply reduce forced internal migration related to *gradual* climate impacts (Clement et al. 2021; Rigaud et al. 2018). Accompanied by investments in DRR/DRM (Hallegatte et al. 2017) and in local climate adaptation (GCA 2019; IPCC 2022a), such efforts can also shield people from well-being losses. Critically, Peru should accelerate the shift toward building long-term resilience and prospective DRR/DRM instead of after-the-fact responses. Mobilizing DRR/DRM resources, for example, by targeting global climate funds, is key especially for zones with high displacement risk. At the same time, all DRR/DRM efforts must work hand in hand with climate adaptation to expand subsistence farmers' room to maneuver. More transformational, effective adaptation is needed (Berrang-Ford et al. 2021) and tested options for such adaptation include investments in livelihood diversification; fertilizer and compost practices; water supply and irrigation systems; agroecology and agroforestry; extension services; community-based programs; sharing traditional and local knowledge; and reliance on social networks (Owen 2020).

Second, protection for stayers must be a priority for areas with worsening climate impacts. As seen in the *Sierra* study, increasing emigration can lead to losses of labor force, social networks, traditions, and critical infrastructure in rural areas, which, in turn, create a risk of severe, progressive OWB and SWB declines. In the *Selva,* entire communities wishing to relocate were forced into immobility that threatened their well-being for years. Concerned actors need to expand operational efforts to address such immobilities. First of all, forced immobility implies challenges for domestic and international protection and efforts are needed to support in-place DRR/DRM, local adaptation in dignity, and vulnerability reductions (Geddes et al. 2012; Nawrotzki & DeWaard 2018). For example, support should diversify livelihoods, train skills, strengthen financial resources (Afifi et al. 2016), improve monitoring systems for diseases, food, and water security (Brubaker et al. 2011), and compensate for loss and damage (Page & Heyward 2017). However, care is needed so that support efforts do not *contribute* to forced immobility by "implicitly oblig[ing] … citizens to hold fast and dig in, shore up defences and hope for the best" (Baldacchino 2018: 223). Next, the state must recognize that some people—especially older adults and those with special ties to land—do not want to leave despite high risks, and that they may have a right to stay (Black et al. 2013). *Voluntary* immobility implies challenges at the domestic level, with international assistance, to build resilience and sustain livelihoods (Geddes et al. 2012). Humanitarian and development actors must

address common problems such as economic hardship, education and health service problems, food insecurity, and psychosocial issues. Action is also needed to conserve local knowledge, traditions, and customs to avoid losses of identity, culture, and history. Furthermore, for both *forced* and *voluntary* immobility, translocal approaches integrating communities in source and destination areas are required, as the *Sierra* case study emphasizes. Projects should expand the adaptation potential of financial and social remittances sent by individuals and through hometown associations. Supporting translocal communication possibilities could also contribute to the well-being of migrants and stayers. However, care must be taken to ensure that responsibilities for protection and adaptation are not outsourced to affected individuals (Bettini & Gioli 2016); where climate impacts threaten people, the international community must guarantee adequate climate financing for adaptation and compensate for loss and damage. Finally, while staying can be a choice, the international community and states must enable all people in affected areas to access evidence about the local interplay of *gradual* and *abrupt* hazards and their cumulative effects, so they can make informed decisions about whether to invest in place or prepare moving to suitable destinations. Information campaigns, financial literacy programs, access to financial resources, and pre-departure orientation workshops could help (Clement et al. 2021). Such information may be provided through trusted local gatekeepers such as farmers' organizations, migrant actors, or NGOs. The *Sierra* case illustrates that this type of data must account for adaptation limits and possible social tipping points, such as closure of critical infrastructure.

Third, all case studies highlight that when severe climate impacts cannot be avoided anymore, moving may remain the only path to safety among various perilous options and should be supported carefully (Guadagno & Yonetani 2022). Many people who desire to stay for socio-cultural reasons simultaneously perceive that climate impacts can overwhelm their capacities and express the need to move (Zickgraf 2019). Concerned actors should not attempt to force such people into ill-fated local adaptation efforts (Baldacchino 2018); rather, they should support the 'right' to move to reduce well-being risks related to forced immobility (Black et al. 2013; Bronen & Chapin 2013; Geddes et al. 2012; Nawrotzki & DeWaard 2018). Such efforts can be considered a duty from a moral and climate justice perspective (Bettini et al. 2017; Bettini & Gioli 2016; Gemenne 2015); many of those most affected by climate impacts are poor farmers who have often managed to live with, not at the expense of, nature for centuries and caused limited emissions, but may still lose their home and well-being. They have a right to protection, compensation, and remedies. Facilitated migration can

be one way to meet the protection responsibilities of home governments, emitting states, and the international community (Aleinikoff 2020). Yet, care must be taken that state obligations for protection and climate adaptation are not outsourced to at-risk groups themselves, such as when narratives of retreat from risk areas intend to obscure "state withdrawal and the individualisation of responsibility" (Baldwin 2016; Felli & Castree 2012; Tubridy & Lennon 2021: 517). Rather, planners should identify and map areas that may degrade severely and will not be habitable in the future, register inhabitants, and ensure their rights are respected, protected, and fulfilled (Brookings et al. 2015). In Peru, numerous remote rural areas may be at risk of settlement abandonment; such abandonment can be a standard process due to demographic changes, but in some cases, it is the combined result of climate impacts and an absent state, which means that entry points for action exist. Options must be provided to those who make informed decisions to leave these areas but do not have sufficient migration *capabilities*, such as the studied villages in the *Selva* and certain households in the *Sierra.* Foremost, Peru and other states should ensure legal status and freedom of movement, if needed beyond national borders. A multilateral initiative for a climate passport could contribute support for safe and early enough migration in dignity (WBGU 2018). In addition, South America is already a pioneer when it comes to regional freedom of movement, as I have discussed elsewhere (Bergmann et al. 2021a).[12] Nonetheless, alternative legal pathways may also be needed in some cases here, such as options to apply for protection prior to reaching desired destinations (Humble 2014), or bilateral and regional agreements for labor migration (Geddes et al. 2012; McLeman 2019). Beyond these policy needs, investments in people prior to moving are key, especially for those with preexisting vulnerabilities, who are at elevated risk of a well-being decline. Aspiring migrants must be able to acquire skills that are transferable to destinations, so that they can move early enough and are able to secure jobs elsewhere. Additional support options for livelihoods include microcredits, loans, and safety nets (Afifi et al. 2016) or job creation in destinations (Foresight 2011). Equally important, social networks are key resources for people aspiring to migrate and can help smooth newcomers' transitions to new areas; states could consider ways to extend their benefits, such as by facilitating communication options between migrants and hometowns or backing activities by diaspora organization (Nawrotzki & DeWaard 2018). Moreover, efforts are needed to devise incentives for migrants to settle across

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[12] South America converges towards a discourse of freedom of movement, see Acosta (2018); Cernadas (2013); Llamas (2017). Various solid protection mechanisms exist in the region and have been applied for disaster displacement in the past, see Nansen Initiative (2015) For a detailed discussion, see the policy chapter in Bergmann et al. (2021a).

various municipalities suitable for their needs, beyond the habitual major destinations. To avoid overwhelming single hubs and preserve people's well-being prospects, ways of making secondary cities and other destinations more attractive should be investigated, planned, and developed. Such polycentric incentives could include income opportunities, microcredits, provision of public services, and housing programs in alternative destinations. Lessons can be learnt from Bangladesh, whose Perspective Plan 2021–2041 embraces a growth pole strategy to incentivize migrants toward secondary urban cities while developing rural growth centers (GED 2020; Khan et al. 2021).[13]

Among the options to facilitate movement for aspiring migrants, planned relocation may be a last resort measure if applied carefully, giving special attention to people's rights and well-being, in line with best standards and existing laws (Ferris & Weerasinghe 2020).[14] Nevertheless, the *Selva* case study suggests that several improvements are needed in Peru. To start with, the state should enforce zoning properly to avoid new settlements in high-risk zones. It ought to clarify legal ambiguities of what makes risks "unmitigable" for existing settlements (Venkateswaran et al. 2017) and ensure the exhaustion of softer options for DRR/DRM and climate adaptation for them, as instructed by law (French et al. 2020). To this end, authorities should strengthen the participative process that leads to the decision to move. If relocation is agreed on, its implementation requires better governance, more institutional resources, and national frameworks translated into local practice. The central government should invest in technical and absorption capacities of subnational authorities in strongly affected areas, alongside technical support by experts. In addition, access to information, consultation, and effective participation must be strengthened throughout relocation and in legislation, which enshrines these rights only ambiguously.[15] To bridge funding gaps, the state could better exploit the legally permitted option of using charges from natural resource exploitation and mining. Likewise, the *Selva* cases demonstrate that efforts are needed to alleviate public investment gaps between declarations of uninhabitability and settlements' eventual relocation. Next, to address land scarcity issues and to avoid land price hikes, the state should explore the legally permissible tool of compensated expropriation. Furthermore, legislation entitles relocatees to benefits and rights, but the Ministry of "Vulnerable Populations and

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[13] However, lessons must also be learnt from problems in past growth pole strategies, including on possible spillover and leakage effects, spatial polarization, and enclave dynamics, see Lo (2013); Parr (1999b, 1999a); Polenske (2017).

[14] This paragraph is based on my previous work published in Bergmann (2021).

[15] Peru's relocation law makes citizen participation a right but only "when circumstances allow" and "with the necessary availability" (art. 5, 6, 17, translated by the author).

Women" [sic][16] lacks adequate funding to fulfil its legal task to protect and assist them, with special attention to at-risk groups. The state should also invest more in long-term livelihood restoration and decent living conditions in line with people's customs and culture, as legally granted. To this end, ensuring proximity to accessible livelihood options, transportation, and markets is key. Swifter granting of individual titles is also needed so people can receive the access to social programs that legislation encourages, including social housing and reconstruction support. Another imperative is to improve oversight and accountability in relocations. Despite grievances, complaints, and conflicts, the Peruvian state did not fulfil its obligation to inform relocatees about legally required resolution mechanisms (including mediation and arbitration by designated government entities), and thus rendered these mechanisms inaccessible. It is also key to catalyze third-party engagement in relocations. First, engagement by actors such as the Peruvian Ombudsman, non-governmental organizations, and the media could improve state accountability. For example, advocacy organizations with campaigning experience in development-induced resettlement could integrate disaster relocation in their portfolios, and international protective accompaniment could help defend people's rights. Lastly, the study highlighted that private sector engagement is key for success. The state could encourage landowners to consider cooperation with communities wishing to relocate, such as swapping territories or trading land for labor. Moreover, it could support companies to bring forward planned investments in destinations and offer preferential access to relocatees to create income for recovery. Likewise, the state could promote private sector contributions to relocation costs, for example, through solidarity funds, materials, or microcredits.

Fourth, this study located entry points to counter the risk that migrants, displaced persons, and relocatees suffer severe well-being losses after moving. To begin with, Peru should protect rural-to-urban migrants and their families as well prepare key urban destination areas for addressing the local effects of immigration. To this end, states and municipal actors must work toward receptive *modes of incorporation* and policies that enable migrants to flourish together with host communities, whose receptivity is another key determinant of migrants' well-being (Helliwell et al. 2018a). They must actively manage urban growth and attend related challenges for infrastructure, services, and markets. Interventions for *development from a secure base* could include labor rights protection in informal job segments; access to education so that migrants can transform their skills

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[16] Original Spanish name: *Ministerio de la Mujer y Poblaciones Vulnerables* (MIMP).

to match urban markets, according to their wishes and possibilities; voucher systems for flexible training programs; and micro credits to support entrepreneurship. Migrants' health must also be protected, including through universal health care, portable social protection, and adjustable social welfare systems, which could be supported by mobile money and digital identification systems (Clement et al. 2021; Rigaud et al. 2018; Schwan & Yu 2018). To improve migrants' *space to live,* it is key to address tenure insecurity in irregular settlements and facilitate access to public services. To this end, the state should guarantee titling and investments in viable zones without incentivizing new settlement in high-risk areas; improve land use management and land administration systems; and recognize customary land practices. In addition, cities must protect migrants against physical insecurity and pollution, as well as urban climate hazards and related displacement risk. As one example, the magnitude of challenges for Peru's cities related to glacier loss will depend on how they invest in buffering capacity while managing rising water demand (Veettil & Kamp 2019). Next, to support *social relatedness,* it is recommendable to strengthen diaspora organizations and community structures, social cohesion between host and migrant groups, and mechanisms against discrimination. Finally, *SWB* challenges are probable, and states should address them by backing personal coping mechanisms and community support. Mental health and psychosocial support for mental disorders is needed (Mukdarut et al. 2017; Tol et al. 2011) alongside positive psychology programs for mentally healthy, but SWB-deprived migrants (Hernandez & Overholser 2021; Koydemir et al. 2021). Social relationships and community resources are equally key for building psychological resilience that supports transformational responses to climate change (Adams et al. 2021). It is encouraging that Peru's National *Action Plan to Avert and Address Forced Migration and Displacement due to the Effects of Climate Change,*[17] which is currently being developed, calls on the state to avoid the deterioration of migrants' well-being in the cities, to address rising demand on urban infrastructure and services, and to reduce the possibility of social conflicts. In addition, the Municipality of Lima, the city with the highest concentration of migrants in Peru and likely a primary destination for future climate migrants, has started work on the topic. Lima has actively collaborated in the Task Force of the Global Working Group of Mayors on Climate and Migration and helped to develop their Action Agenda (C40-MMC 2021). The Agenda is based on three priorities, namely (a) urban resilience, (b) urban inclusion, and (c) urban transformation, ten principles, six recommendations, and 27 proposed actions. When the Municipality of Lima consulted the author of this dissertation,

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[17] Original Spanish names: *Ley Nº30754 Ley marco sobre cambio climático.* (2018, Law).

it announced that it would work on the implementation of the Action Agenda and focus on generating evidence and information (Garreta 2022). Moreover, Lima's Local Plan for Climate Change 2021–2030[18] points to migrants as populations in potentially vulnerable situations and aims at reducing exposure and vulnerability in the city (MML 2021). If words are followed by action, these frameworks could help advance the protection of climate migrants. To end with, from a climate justice view, the international community must support cities in affected countries in these numerous tasks. Funding for adequate resources and personnel in public service provision is needed in cities with increasing immigration and natural growth, alongside remedies for loss and damage. Municipalities and city networks such as C40 can be stewards that create inclusionary cities (Lacroix 2021; Oomen 2020), especially in states with weak central governance or state disinterest, as discussed further below. Next, many of these recommendations for rural-to-urban migration due to *gradual* hazards also apply to large-scale forced, *acute* climate migration due to *abrupt* hazards. For such cases, it is additionally key to build bridges between DRR/DRM (such as better early warning) and sustained, people-centered displacement care (such as providing durable shelter and infrastructure as well as addressing physical insecurity). Concerned actors may also learn from the buffer effects of *social relatedness* observed in this study and devise strategies to strengthen social capital (Stojanov et al. 2021). Humanitarian assistance should be closely connected with development efforts, such as by involving the private sector in job recovery or through adaptive social protection (Béné et al. 2018; Bowen et al. 2020). The *Costa* case study also emphasizes that strategies against aid withdrawal and donor fatigue are needed, especially when future disasters will multiply and overstretch attention and resources that are already scarce today. Finally, states must work with, consult, and have displaced persons participate in finding durable solutions that fit their intersectional needs; as return is occasionally inconceivable or the best option, local integration and resettlement need to be duly considered (Bradley 2018; Harild & Christensen 2010). Figure 9.2 summarizes these recommended actions on migrants' well-being.

All things considered, to safeguard and improve people's well-being, concerned actors must address climate risks; improve structural constraints; and strengthen climate migrants' and stayers' agency. In particular, stakeholders must address the fact that structural constraints often create insurmountable obstacles for affected people. Especially weak governance emerges as a major barrier for

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[18] Original Spanish name: *Plan Local de Cambio Climático de la Provincia de Lima (PLCC) 2021–2030.*
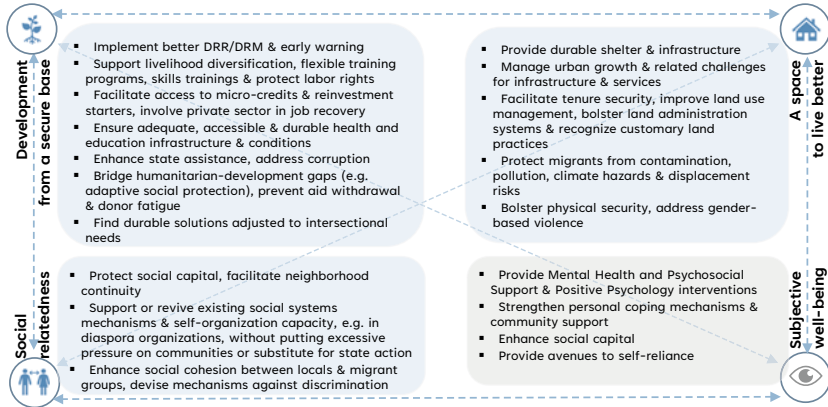
Figure 9.2 Intervention options to safeguard and improve migrants' well-being. (Note: Created by the author)

raising well-being in climate (im)mobilities effectively, since it increases disaster risk (Ahrens & Rudolph 2006; Sen 2010; Tierney 2012) and impedes durable recovery (Shaw 2014). As the UN Secretary-General's Special Representative for DRR stated, "the biggest risk driver of all is bad risk governance" (UNDRR 2020: para. 22). For example, the weak DRR/DRM and climate adaptation governance witnessed in the case studies echo Peru's general governance problems, including corruption that has debilitated its democracy and economy for decades (Bigio & Ramírez 2017; Quiroz 2019). Therefore, on the one hand, it is necessary to provide comprehensive support for affected people that is, where necessary, decoupled from unwilling or incapable authorities. Alternative pathways include working through subnational actors, such as city networks (Lacroix 2021; Oomen 2020), or building resilience through NGOs. However, such action should not provide an easy way out for the state and avoid duplications or parallel systems (Fraser & Kirbyshire 2017; Medina 2021). On the other hand, the international community must invest in efforts to improve governance in countries with worsening climate risks (Patterson 2020). I have analyzed policies in Peru in detail before and demonstrated that existing legislation in various arenas provides a valid starting point to address climate migration (Bergmann et al. 2021a). Still, policy gaps persist; norms remain insufficiently interconnected; and financing and implementation gaps continue, especially at subnational levels (French et al. 2020; GFDRR 2010; Venkateswaran et al. 2017). The main recommendations

detailed in that prior study are briefly restated here. Policy improvements are needed for immobility and especially entrapment, which are still absent in most frameworks in Peru. For climate migration, the landmark project for strengthening government efforts should remain Peru's *Action Plan to Avert and Address Forced Migration and Displacement due to the Effects of Climate Change* (which is currently being drafted as envisaged in Peru's *Climate Change Framework Law* and the linked *Regulation*).[19] In addition, updates of Peru's National Adaptation Plan (NAP), Nationally Determined Contributions (NDCs), as well as other climate and agricultural strategies should integrate measures to enable people to stay if they can do so in safety and dignity[20] and support migrants under the five existing adaptation priority areas agriculture, fishery, forestry, health, and water.[21] Besides policy improvements, Peru should strengthen intersectoral and multilevel coordination for integrated DRR/DRM, climate adaptation, and human rights protection, as well as streamline related institutional responsibilities. Increased international funding will be key to support effective governance Peru, but the country also requires better subnational capacities to absorb this funding in a manner consistent with the subsidiarity principle. Lastly, dedicated action to strengthen institutions and organizational capacities is required now in Peru and elsewhere (Cissé et al. 2022), as increasing climate impacts will challenge state institutions and might further impair the needed responses in the future (Mahadevia Ghimire 2021).

Nevertheless, this study also cautions that persistent structural constraints may be difficult to address and therefore highlights the simultaneous need for strengthening affected people's agency thoroughly. Bolstering agency is key because concerned states frequently lack political will and have limited capacities to meet their obligations to respect, protect, and fulfill the rights of people harmed by climate change (Aleinikoff & Martin under review). To this end, climate adaptation funding could sponsor community organization building and negotiation training for local leaders.[22] Supporting citizens' campaigning skills could be another avenue, for instance, through access to watchdog networks or social

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[19] Original Spanish names: *Ley Nº 30,754 Ley marco sobre cambio climático* (2018, Law); *Decreto Supremo Nº013-2019-MINAM que aprueba el Reglamento de la Ley Nº 30,754* (2019, Regulation).

[20] *Forced* climate migration should be avoided where possible but must not be prevented at all costs, since it can be necessary to save lives in adverse situations.

[21] Original Spanish names: *Plan Nacional de Adaptación al Cambio Climático del Perú*, Resolución Ministerial Nº096 -2021-MINAM; *Contribuciones Nacionalmente Determinadas del Perú 2015*; and *Reporte de Actualización de las NDC del Perú al 2030*.

[22] This paragraph partially draws on my previous work published in Bergmann (2021).

media and media training. Moreover, projects could sponsor exchange between affected communities to promote peer-to-peer sharing of experiences and alliance-building. Enabling meaningful conversations within frontline communities and learning from them will be equally key (Climigration Network 2021). In addition, action to foster more horizontal relationships between communities and the state is advisable, for example, by integrating traditional knowledge in collaborative risk monitoring and assessment, by nurturing community-based self-reliance strategies, or by raising self-governance capacities through community-based DRM and climate adaptation (Bronen et al. 2020; Chapin et al. 2016; Forsyth 2013; Grube & Storr 2014; Norris et al. 2008; Shaw 2012). Finally, another promising avenue could consist in increasing support for migrants' own networks, such as hometown associations, which could help buffer hardship for newcomers, assist them during settling, and facilitate translocal ties to hometowns.

9.3   Research Avenues

Beyond providing new empirical insights for an emergent field of investigation, this study also indicates various directions where more knowledge is desirable.[23] The two key research needs I stress in the following are (a) holistic well-being assessments for heterogenous climate (im)mobility dynamics and (b) further evidence on effective solutions to enhance affected people's well-being.

First, scientists could improve the understanding of how climate change influences (im)mobilities and how affected people fare.[24] To begin with, climate immobility remains a major knowledge gap (Hoffmann et al. 2020); new studies could clarify concepts and apply comparative approaches to explore how people react to and anticipate hazards, what makes them unwilling or unable to move, how much agency they retain, and how their well-being develops over time (Mallick & Schanze 2020; Schewel 2020). Likewise, scholars should explore the interactions of multiple migration drivers more in detail, including the economic, political, and demographic drivers that currently remain understudied in Peru (such as consumer prices or conflict). Critically, few existing studies conduct climate impact analyses with adequate depth to date, even though these impacts can affect all migration drivers (Adger et al. 2015; Black et al. 2013). Interdisciplinary

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[23] While I focus on *research* avenues here, the dissertation also bolsters calls for better *data* on climate (im)mobilities. A prior study of mine provides detailed recommendations for such data issues in Peru, see Bergmann et al. (2021a).

[24] This paragraph is partially based on my previous work published in Bergmann et al. (2021a).

research teams could provide one way forward to close this gap. One example of a topic that requires views from both natural and social science are climate threats to habitability and linked dynamics of settlement abandonment (McLeman 2011), including the possible social tipping points and feedback mechanisms witnessed in the *Sierra* case study. Simultaneously, studies could examine not only what makes people susceptible to primary or secondary displacement, but also where and why entrapment is a risk. Furthermore, for a fuller picture of how risk landscapes in Peru are shifting due to climate change, future studies are needed that expand their focus beyond smallholders as possibly affected groups. For example, research is also needed on how climate change harms marine livelihoods, the agroindustry, agricultural processing and distribution activities, off-farm livelihoods, as well as the secondary and tertiary sectors in general, and how such impacts affect climate (im)mobilities. In addition, while most existing work focuses on rural-to-urban climate migration, this study demonstrated that movements over small distances or limited periods of time within rural areas can also strongly affect well-being. Such micro-mobilities remain under the radar of research, policy, and donor attention in Peru and worldwide (Cundill et al. 2021; Safra de Campos et al. 2020).

Improving knowledge on why and how people move or stay in the context of climate hazards is a steppingstone to enhance the understanding of linked well-being impacts. To identify entry points for planning and policies that can support well-being, methodological innovation is needed. For example, mixed methods studies that combine qualitative data with longitudinal data and employ intersectional, intergenerational, and life course views might offer potential. Big data could also help study well-being but must be used carefully to protect respondents (Martin & Singh 2022). Moreover, it is indispensable that more studies use conceptual frameworks that facilitate holistic assessments of multidimensional well-being effects. The framework devised in this dissertation could be adjusted and applied to contexts outside of Peru; for example, emic research could help amend the applied objective measures of well-being according to local conceptualizations in regions of interest. Future research could also deepen the understanding of the indicators suggested in this analysis. On the one hand, studies on the social effects of (im)mobilities remain rare, although *social relatedness* affected all other well-being dimensions in this study and changed itself in mixed and unexpected way during (im)mobilities. Future migration studies must not overlook this key dimension of well-being. On the other hand, more analyses are needed on the *long-term* SWB effects of climate change (Fischer & van de Vliert 2011; Maddison & Rehdanz 2020), linked immobility (Farbotko & McMichael

2019; Mallick & Schanze 2020), and migration (Luhmann et al. 2012). Scholars could also clarify the exact interplays of all SWB elements (Pleeging et al. 2021a), for example, how views of the future affect SWB and motivation for action in the present. Further, as argued above, studies could use integrated, hedonic *and* eudaimonic approaches to analyze SWB holistically. More theoretical advancements on the impacts of migration and immobility would also be welcome. Finally, in order to improve the knowledge base and build better theories on the consequences of climate (im)mobilities, the propositions developed in chapter 8 could be operationalized into hypotheses that quantitative research could test in additional contexts (Morgan 2015). Long-term longitudinal studies could yield benefits for understanding both the causes and effects of climate (im)mobilities (KNOMAD 2016).

Second, besides integrated well-being assessments of climate (im)mobilities, this study also calls for research on effective solutions that help preserve or enhance well-being. To begin with, researchers should examine options for people wishing to stay, including in-place climate adaptation and DRR/DRM. For example, mapping, studying, and integrating traditional and Indigenous knowledge in livelihood adaptation to extreme climatic conditions should become a key research area (Makondo & Thomas 2018; Petzold et al. 2020). Further, although internal remittances have a significant volume in Peru (Sánchez Aguilar 2012a), their potential contribution to climate adaptation and the well-being of stayers remains understudied (as do threats to equality that may be linked to remittances) (Bergmann et al. 2021a). Concurrently, a better evidence base is needed on possible effective interventions to support people who wish to leave unsafe areas, since uninhabitability and the numbers of climate migrants are set to increase in many regions worldwide (Clement et al. 2021). Donors should fund high-quality program evaluations, such as through randomized controlled trials (RCTs) (Gazeaud et al. 2021; Meghir et al. 2022), on pre-migration assistance efforts, support for migrants to settle across polycentric destinations, and improved relocations. States must enhance the monitoring and evaluation of implemented relocations, not only in Peru (Bergmann 2021). Next, more research is needed on effective options to support migrants' well-being. Studies could examine the effectiveness of interventions to enhance migrants' resources to settle in decent conditions, according to their intersectional needs (Cundill et al. 2021; Erwin et al. 2021). Resources that might offer transformational potential could include skills training programs (Panth 2013; Ratha et al. 2015), Mental Health and Psychosocial Support (MHPSS) (Augustinavicius et al. 2018; Bangpan et al. 2019; Tol et al. 2012), and Positive Psychology interventions (Bolier et al. 2013; Carr et al. 2021). Programming could also benefit from more insights into how hopelessness can be

addressed in ethical ways without creating false hope (Cheavens & Guter 2017; Hernandez & Overholser 2021; Polivy & Herman 2002). Critically, beyond better evidence on options to support *individuals*, more studies are also needed on how to mitigate the varied *structural* factors that obstruct climate migrants' and stayers' chances to be well. Two key areas for research here are ways to improve land issues and weak governance, two of the major obstacles to achieving well-being. For example, studies should evaluate how more receptive *modes of incorporation* for migrants can be supported in destinations in durable ways so that receptivity persists even during crises. Generally speaking, an urban study perspective on climate migration is needed to advance research since cities will be key destinations for migrants. For example, scholars could examine which factors make certain cities likely destinations or source areas for climate migrants and which differentiated preparations for urban governance are needed depending on the characteristics of climate impacts, migration, and cities themselves (Adger et al. 2020; de Sherbinin et al. 2007; de Sherbinin et al. 2012; DePaul 2012; Stojanov et al. 2021). Action to support destinations remains another major research gap. For example, by what means can institutional and absorption capacities be bolstered while municipal resource constraints are addressed (UNDESA 2018)? In which ways can arrangements for multilevel coordination and accountability be augmented (Mukhopadhyay & Revi 2012; Srivastava 2020)? Simultaneously, how can regulatory environments be improved and planners' or policymakers' negative attitudes toward migration be changed (McLeman 2020; Tacoli 2009)? Moreover, this study emphasizes that more research is needed on how non-state actors influence affected people's well-being, and how they can be integrated in solutions. To date, collective actors such as hometown associations, faith-based organizations, social institutions, or local NGOs have received limited attention in climate migration studies (Pairama & Le Dé 2018). Similarly, options to integrate the private sector and local businesses (besides migrants themselves) into climate adaptation and DRR/DRM remain understudied (Adamo 2010; Gemenne et al. 2020; Tacoli 2007).

Finally, more knowledge is needed on how to support people's agency in the many zones worldwide where state protection is unlikely (Bergmann 2021; McMichael et al. 2019). For example, scholars could examine ways to connect affected individuals in peer learning networks and support groups (Block et al. 2018) or via peer-provided counseling in areas that lack specialist services (Graaff et al. 2020; WHO 2016). Studies may also explore how to increase affected people's financial resources for action through peer-to-peer lending, crowdfunding, and private sponsorship (Emanuel-Correia et al. 2021; Lenard 2016). Moreover, collaborative risk monitoring and assessment as well as citizen science could

contribute to climate adaptation (Bremer et al. 2019; Bronen et al. 2020; Groulx et al. 2017; Walker et al. 2021; Wehn et al. 2021). Lastly, researchers could assess how to enhance collective agency, for example by efforts to increase communities' capacity for "do-it-yourself" adaptation and resilience (Cloutier et al. 2018: 284; Koliou et al. 2018). As climate injustices and state failures are multiplying, more knowledge is also needed on programs that support collective resistance by bolstering community organization, support systems, grass root movements, civil disobedience, and protest (Chenoweth & Stephan 2008; Lemons & Brown 2011; Reeves et al. 2014).

9.4   Outlook

Extensive human activity affecting the Earth's geology and environment has ended the stable conditions of the Holocene and moved the planet into a new, human-dominated epoch, the Anthropocene (Steffen et al. 2018; Zalasiewicz et al. 2017; Zalasiewicz et al. 2020). As one feature of this transition, climate change is magnifying threats to live on Earth in an unparalleled fashion (IPCC 2022a), and ever more affected people are forced to decide whether to stay or leave their homes (Clement et al. 2021). It is difficult to foresee how the nexus between such climate (im)mobilities and well-being will evolve in the near and far future in Peru and worldwide. However, the well-being outcomes observed here provide an indication that worsening climate impacts could sharply reduce subsistence farmers' chances to fulfill their needs and perceive their lives as satisfactory, regardless of whether they stay or migrate after being affected by climate impacts.

In the near future, many climate impacts are strongly predetermined by committed warming due to past emissions (Huntingford et al. 2020; Zhou et al. 2021).[25] When current *gradual* hazards intensify as a result, one can expect that they will also amplify existing internal migration patterns in Peru, namely from rural to urban areas in all of the country, especially from the highlands to coastal cities and to some extent to the rainforest. Likewise, as *abrupt* hazards will become more severe and frequent in the next years, present displacement and relocation dynamics in Peru's coastal flood zones and its rainforest could expand. Simultaneously, entrapment could threaten gradually more poor farmers in marginalized rural zones. As structural conditions are unlikely to improve fast,

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[25] Near-term climate change also depends on current rates of near-term climate forcers (NTCFs), but the exact extent (and therefore the scope for possible mitigation if NCTFs are reduced) remains an issue of research, see Allen et al. (2020); Collins et al. (2013); IPCC (2021); Nakajima et al. (2020); Smith & Mizrahi (2013).

current climate (im)mobilities provide valid temporal analog for understanding possible well-being effects in such near-future processes, and the findings of this study caution that the outcomes could be more negative than positive. People subjected to high structural constraints, affected by severe hazards, and possessing limited agency will be most at risk of misery.

By contrast, over the long run, many interactions between climate impacts, migration, and immobility are possible, and the well-being outcomes are less certain.[26] These interactions depend on global emissions and climate sensitivity, action taken to reduce exposure and vulnerability, demographic, societal, and political change, and other factors. My findings as well as the synopsis of both the climate and migration literature in Peru suggest that while the exact magnitude of challenges may differ depending on the pathway chosen, severe well-being threats are to be expected in most cases. Even in an optimistic scenario—in which emissions would be drastically reduced to limit global warming to 2 °C by 2100 compared to pre-industrial levels—strong climate impacts would threaten well-being in Peru in the long term. As one example, extensive *gradual* glacier retreat would cause severe water stress and raise questions of habitability in the *Sierra* (Pörtner et al. 2019; Vuille et al. 2018). As a result, internal *improvement* migration for livelihood diversification could continue to rise steadily and turn into *distress* movements over time, in parallel with entrapment risk in poor, disenfranchised zones. Simultaneously, the *abrupt* hazards causing disaster displacement in Peru would rise even in this more optimistic scenario. For example, even in lower emissions paths, extreme El Niño events will become more frequent in this century (Cai et al. 2018; IPCC 2019a; Peng et al. 2019) while settlements in exposed areas still grow (SINAGERD et al. 2014). Thus, the number of *acute*, forced *survival* migrants could rise and put gradually more people at risk of severe ill-being. Nonetheless, this lower-emissions future would grant Peruvian policymakers and society more leeway to prepare for and address impacts. First, certain development gains could still materialize and be invested in development and local climate adaptation to reduce vulnerabilities (Hallegatte et al. 2016) while the moderate and gradual nature of migration overall would grant more options to prepare. The state could incentivize polycentric settlement, while cities would have more time to devise protection mechanisms for migrants as well as to prepare public services, housing, infrastructure, and labor markets. In addition,

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[26] The next paragraphs partially draw on my previous work published in Bergmann et al. (2021a).

concerned actors would retain better chances to reduce the risk of rapid displacement through DRR/DRM (Hallegatte et al. 2017), including by using softer, more well-being-preserving options than planned relocation.

However, if states continued their current path of climate action, the Earth could warm around 2.7 °C by 2100 (Climate Action Tracker 2021; WMO 2021) and the resultant climate hazards would become increasingly difficult to manage (Masson-Delmotte et al. 2021). In such a scenario, climate impacts could undo much of Peru's development progress and sharply increase vulnerabilities (Hallegatte et al. 2018; World Bank 2017c). In parallel, populations would continue to grow in highly exposed areas, resulting in salient climate risks across rural and urban zones. The adaptation option space would shrink extremely while loss and damage would multiply strongly (Mechler et al. 2020). Questions of habitability would become increasingly pressing due to three unparalleled "no-analog" climate threats in Peru, namely near-complete deglaciation and related water stress in the *Sierra*; extreme heat stress and a risk of rainforest dieback in the *Selva*; and more frequent extreme El Niño events on top of rising sea levels on the *Costa* (Bergmann et al. 2021a: 1). This study suggests that if such parallel and cumulative threats to habitability materialized, they could lead to both entrapment for large populations and unparalleled migration flows that would threaten people's well-being. Migration could become predominantly forced when climate impacts reduce resources to move in a safe manner, and as a result, migrants' vulnerabilities would increase. Key destinations such as Lima and regional capitals would be at risk of getting overwhelmed, both due to immigration and their own climate impacts, such as water scarcity (Buytaert et al. 2017; Schütze et al. 2019). One can imagine that at a future point in this scenario, a partial migration flow reversal could occur: if coastal cities would become overwhelmed and poor people living in their margins suffered from extreme water and food insecurity, they might start settling in the few remaining rural areas that still allow for subsistence agriculture. These zones would, in turn, experience rapidly growing populations that exert pressure on available resources and well-being. Shocks can induce such reversals of migration corridors, as seen most recently during the COVID-19 pandemic (Dupraz-Dobias 2020; Martin & Bergmann 2021). Also in pre-Hispanic Peru, monsoon-driven changes in water availability recurrently overwhelmed local adaptive capacities and induced migration from the coast to the highlands, and vice versa (Fehren-Schmitz et al. 2010; Fehren-Schmitz et al. 2014; Reindel 2009). Because the climate impacts in the future scenario discussed here could be more severe than in pre-Hispanic times and affect a more densely populated country, cities' capacities to ensure food security and provide basic services could be overstretched even when considering technological and

institutional advancements. Taken together, in this future climate scenario, adaptation in ways that preserve well-being ways would become impossible for large numbers of Peruvians.

To conclude, while this study cannot offer a definite answer to the question of future climate (im)mobilities in Peru, it cautions that the well-being threats related to migrating or staying could be extensive. As discussed earlier in this chapter, similar arguments apply for the large number of smallholders who live in similar conditions in many of the world's rural regions. Therefore, stringent efforts are required to reduce climate risks, protect stayers and migrants, and facilitate movement in dignity where needed. The recommendations presented here are all the more critical because well-being risks due to climate change can compound the effects of other shocks, such as conflicts and economic or health crises. For example, the COVID-19 pandemic strongly exacerbated vulnerabilities and inequalities and created new ones in Peru and worldwide. Similar as for the climate (im)mobilities studied here, those people subjected to most structural constraints and with least agency were hit hardest, and their well-being has continued to suffer from the ensuing health and economic crises (Abizaid et al. 2020; Carreras et al. 2021; Gamero & Pérez 2020; World Bank 2021b, 2021a). Globally, migrants have been among the most affected by the pandemic (Guadagno 2020; Martin & Bergmann 2021; Orcutt et al. 2020). Thus, as humankind is breaking more planetary boundaries in the Anthropocene (Lade et al. 2020; O'Neill et al. 2018), complex emergencies that threaten the well-being of large populations may become the new normal in numerous regions of the Earth.

Actions taken in this decade will be critical in determining the magnitude of future climate impacts, other shocks, resultant migration and immobility, and their well-being impacts. The prospect for mitigating climate impacts to a more manageable extent depends on the level of global ambition and the pace of change in emissions reduction. Simultaneously, policies and action to achieve the Sustainable Development Goals could contribute to reduce vulnerabilities and build resilience to shocks (IPCC 2022a). Improved climate adaptation targeted at vulnerable populations would bring multiple co-benefits, not least to increased resilience against other emergencies, such as the COVID-19 pandemic. Nevertheless, committed warming and locked-in climate impacts could make migration the only option in various zones of Peru and at-risk regions worldwide, while entrapment risk could rise simultaneously. Merely striving to deter migration is neither

likely to succeed, nor will it lead to positive well-being outcomes (Webber & Barnett 2010). Rather, building systems, capacities, and institutions for dealing with a changing landscape of (im)mobilities in a future world with increasing climate risks must be a priority. Not only local policymakers and civil society will need to join forces to enable adaptation in dignity and to safeguard people's well-being, but also the international community must finally meet its protection obligations in Peru and other at-risk regions globally.

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