

A SOCIAL-ECOLOGICAL PERSPECTIVE ON CONFLICTS AND SOCIAL COHESION IN SOUTHWESTERN AMAZONIA

How does governance shape pathways towards
co-operative or conflictive social-ecological tipping points?

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I hereby declare that this dissertation entitled "A Social-Ecological Perspective on Conflicts and Social Cohesion in Southwestern Amazonia" is my own work. All aids and sources have been specified and the contribution of other authors has been documented and referenced. I further confirm that this thesis has never been submitted for the award of any other degree at any university or other tertiary institution. I am aware that a violation of any of the aforementioned points may result in the withdrawal of the doctoral degree and may also have further legal consequences.

Rebecca Froese
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THESIS COMPONENTS AND AUTHOR CONTRIBUTIONS

This cumulative dissertation includes six chapters (Chapter 2-7) which have been published or submitted to peer-reviewed scientific journals. For the inclusion into this manuscript, the formatting required by the journal has been removed, spelling mistakes were corrected and all sections, figures and tables were re-numbered to fit in a common layout. References of each chapter were combined in a single list of references at the end of this dissertation.

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ABSTRACT

Human interferences within the Earth System are accelerating, leading to major impacts and feedback that we are just beginning to understand. Summarized under the term ‘global change’ these impacts put human and natural systems under ever-increasing stress and impose a threat to human well-being, particularly in the Global South. Global governance bodies have acknowledged that decisive measures have to be taken to mitigate the causes and to adapt to these new conditions. Nevertheless, neither current international nor national pledges and measures reach the effectiveness needed to sustain global human well-being under accelerating global change. On the contrary, competing interests are not only paralyzing the international debate but also playing an increasingly important role in debates over social fragmentation and societal polarization on national and local scales. This interconnectedness of the natural and the social system and its impact on social phenomena such as cooperation and conflicts need to be understood better, to strengthen social resilience to future disturbances, drive societal transformation towards socially desirable futures while at the same time avoiding path dependencies along continuing colonial continuities. As a case example, this thesis provides insights into southwestern Amazonia, where the intertwined challenges of human contribution to global change in all its dimensions, as well as human adaptation and mitigation attempts to the imposed changes become exaggeratedly visible. As such, southwestern Amazonia with its high social, economic, and biological diversity is a good example to study the deep interrelations of humans with nature and the consequences these relations have on social cohesion amid an ecological crisis.

Therefore, this thesis takes a social-ecological perspective on conflicts and social cohesion. Social cohesion is in a wider sense understood as the way "how members of a society, group, or organization relate to each other and work together" (Dany and Dijkzeul 2022, p. 12). In particular in contexts of violence, conflicts, and fragility, little has been investigated on the role of social cohesion to govern public goods and build resilience for (future) environmental crises. At the same time, governments and international decision-makers more and more acknowledge the role of social cohesion – comprising both relations between social groups and between groups and the state – to build upon resilience against crises. Facing uncertainty in how natural and social systems react to certain disturbances and shocks, the governance of potential tipping points, is an additional challenge for the governance of social-ecological systems (SES). Therefore, this thesis asks: "How does governance shape pathways towards cooperative or conflictive social-ecological tipping points?"

The results of this thesis can be distinguished into theoretical/conceptual results and empirical results. Initial systematic literature research on the nexus of climate change, land use, and conflict revealed, an extensive body of literature on direct effects, for example, drought-related land use conflicts, with diverging opinions on whether global warming increases the risk for conflicts or not. Adding the perspective of indirect implications, we further identified research gaps, and also a lack of policy recognition, concerning the negative externalities on land use and conflict through climate mitigation and adaptation measures. On a conceptual note, taking a social cohesion perspective into the analysis is beneficial to shift the focus from the problem-oriented perspective of vulnerabilities and conflicts to global change and poten-

tial resulting conflicts to a solution-oriented perspective of enhancing agency and resilience to strengthen collaboration. The developed Social Cohesion Conceptual Model and the related analytical framework facilitate the incorporation of societal dynamics into the analysis of SES dynamics. In addition, the elaborated Tipping Multiverse Framework took up this idea and enhanced it with a more detailed perspective on the soil ecosystem and the household livelihood system to identify entry points to potential social-ecological tipping cascades. As such, the Tipping Multiverse Framework offered two matrices that can advance the understanding of regional SES by identifying core processes, functioning, and links in each TE and thus provide entry points to identify potential tipping cascades across SES sub-systems. The exemplified application of these two frameworks on southwestern Amazonia shows the analytical potential of both proposed frameworks in advancing the understanding of social-ecological tipping points and potential tipping cascades in a regional SES.

On an empirical note, zooming in on questions of governance by applying a political ecology lens to human security, we find that 'glocal' resource governance often reproduces, amplifies, or creates power imbalances and divisions on and between different scales. Our results show that the winners of resource extraction are mostly found at the national and international scale while local communities receive little benefit and are left vulnerable to externalities. Hence, our study contributes to the existing research by stressing the importance of one underlying question: "governance by whom and for whom?" This question raised the demand to understand the underlying dynamics of resource governance and resulting conflicts. Therefore, we aimed at analyzing how (environmental) institutions influence the major drivers of social-ecological conflicts over land in and around three protected areas, Tambopata (Peru), the Extractive Reserve Chico Mendes (Brazil), and Manuripi (Bolivia). We found that state institutions, in particular, have the following effects on key conflict drivers: Overlapping responsibilities of governance institutions and limited enforcement of regulations protecting and empowering rural and disadvantaged populations, enabling external actors to (illegally) access and control resources in the protected areas. Consequently, the already fragile social contract between the residents of the protected area and its surrounding areas and the central state is further weakened by the expanding influence of criminal organizations that oppose the state's authority. For state institutions to avoid aggravating these conflict drivers but instead better manage them or even contribute to conflict prevention and mitigation, a transformation from reactive to reflexive institutions and the development of new reflexive governance competencies is needed.

This need for reflexive governance becomes particularly visible when sudden disturbances or shocks impact the SES. Our analysis of the impacts of the COVID-19 pandemic on the interconnections of land use change, ecosystem services, human agency, conflict, and cooperation that the pandemic has had a severe influence on the human security of marginalized social groups in southwestern Amazonia. Civil society actions have been an essential strategy in the fight against COVID-19, not just in the health sector but also in the economic, political, social, and cultural realms. However, our research also showed that the pandemic has consolidated and partly renewed criminal structures, while the already weak state has fallen further behind due to additional tasks managing the pandemic and other disasters such as floods.

In conclusion, it can be said that the reflexivity of governance is crucial to foster cooperation and preventing conflicts in the realm of social-ecological systems. By not only reacting to already occurring changes but also reflecting upon potential future changes, governance can shape transformation pathways away from the detrimental and towards life-sustaining pathways. It can do so, by exercising agency across scales to avoid the crossing of detrimental social-ecological tipping points but rather to trigger life-sustaining tipping points that contribute to global social-ecological well-being.

ZUSAMMENFASSUNG

Die Eingriffe des Menschen in das Erdsystem nehmen zu und führen zu erheblichen Auswirkungen und Rückkopplungen, die wir gerade erst zu verstehen beginnen. Zusammengefasst unter dem Begriff ‚globaler Wandel‘ setzen diese Auswirkungen menschliche und natürliche Systeme unter immer größeren Druck und stellen eine Bedrohung für das menschliche Wohlergehen dar, insbesondere im globalen Süden. Die globalen Entscheidungsgremien haben anerkannt, dass einschneidende Maßnahmen ergriffen werden müssen, um die Ursachen zu mildern und sich an diese neuen Bedingungen anzupassen. Dennoch erreichen weder die derzeitigen internationalen noch die nationalen Zusagen und Maßnahmen die Wirksamkeit, die erforderlich ist, um das Wohlergehen der Menschen angesichts des sich beschleunigenden globalen Wandels zu sichern. Im Gegenteil, konkurrierende Interessen lähmen nicht nur die internationale Debatte, sondern spielen auch eine immer wichtigere Rolle in Debatten über soziale Fragmentierung und gesellschaftliche Polarisierung auf nationaler und lokaler Ebene. Diese Verflechtung von natürlichem und sozialem System und ihre Auswirkungen auf soziale Phänomene wie Kooperation und Konflikte müssen besser verstanden werden, um die gesellschaftliche Resilienz gegenüber zukünftigen Krisen zu stärken, den gesellschaftlichen Wandel hin zu sozial wünschenswerten Zukünften zu entfesseln und gleichzeitig Pfadabhängigkeiten entlang fortbestehender kolonialer Kontinuitäten zu vermeiden. Als Fallbeispiel bietet diese Arbeit Einblicke in das südwestliche Amazonien, wo die miteinander verflochtenen Herausforderungen des menschlichen Beitrags zum globalen Wandel in all seinen Dimensionen sowie die menschlichen Anpassungs- und Klimaschutzversuche an die ausweichlosen Veränderungen überdeutlich sichtbar werden. Der Südwesten Amazoniens mit seiner großen sozialen, wirtschaftlichen und biologischen Vielfalt ist ein gutes Beispiel, um die tiefgreifenden Wechselbeziehungen zwischen Mensch und Natur und die Auswirkungen dieser Beziehungen auf den sozialen Zusammenhalt inmitten einer ökologischen Krise zu untersuchen.

Daher wird in dieser Arbeit eine sozial-ökologische Perspektive auf Konflikte und sozialen Zusammenhalt eingenommen. Sozialer Zusammenhalt wird in einem weiteren Sinne verstanden als die Art und Weise, „wie die Mitglieder einer Gesellschaft, Gruppe oder Organisation miteinander in Beziehung stehen und zusammenarbeiten“ (Dany and Dijkzeul 2022). Insbesondere in Kontexten, die von Gewalt, Konflikten und Fragilität geprägt sind, wurde die Rolle des sozialen Zusammenhalts bei der Verwaltung öffentlicher Güter und der Stärkung der Widerstandsfähigkeit gegenüber (künftigen) Umweltkrisen bisher kaum untersucht. Gleichzeitig erkennen Regierungen und internationale Entscheidungsträger mehr und mehr die Rolle des sozialen Zusammenhalts an (der sowohl die Beziehungen zwischen sozialen Gruppen als auch zwischen Gruppen und dem Staat umfasst), um die Widerstandsfähigkeit gegen Krisen zu stärken. Die Ungewissheit darüber, wie natürliche und soziale Systeme auf bestimmte Störungen und Schocks reagieren, stellt eine zusätzliche Herausforderung für die Steuerung sozial-ökologischer Systeme dar. Daher lautet die Frage dieser Arbeit: "Wie kann Governance die Wege zu kooperativen oder konfliktiven sozial-ökologischen Kipppunkten beeinflussen?"

Die Ergebnisse dieser Arbeit lassen sich in theoretisch-konzeptionelle Ergebnisse und empirische Ergebnisse unterteilen. Eine erste systematische Literaturrecherche zum Zusammen-

hang von Klimawandel, Landnutzung und Konflikten ergab eine umfangreiche Literatur zu direkten Auswirkungen, z.B. zu dürrebedingten Landnutzungskonflikten, wobei die Meinungen darüber, ob die globale Erwärmung das Risiko für Konflikte erhöht oder nicht, auseinandergehen. Wenn man die Perspektive der indirekten Auswirkungen hinzufügt, stellt man außerdem fest, dass es Forschungslücken und einen Mangel an politischer Anerkennung gibt, was die negativen externen Effekte auf Landnutzung und Konflikte durch Klimaschutz- und Anpassungsmaßnahmen angeht. Aus konzeptioneller Sicht ist es von Vorteil, die Perspektive des sozialen Zusammenhalts in die Analyse einzubeziehen, um den Fokus von der problemorientierten Perspektive der Anfälligkeiten und Konflikte im Zusammenhang mit dem globalen Wandel und den potenziell daraus resultierenden Konflikten auf eine lösungsorientierte Perspektive der Stärkung von Handlungsfähigkeit und Widerstandsfähigkeit zu verlagern und damit die Zusammenarbeit zu stärken. Das entwickelte konzeptionelle Modell des sozialen Zusammenhalts und der damit verbundene Analyserahmen erleichtern die Einbeziehung gesellschaftlicher Dynamiken in die Analyse sozial-ökologischer Dynamiken. Darüber hinaus hat das ausgearbeitete Tipping Multiverse Framework diese Idee aufgegriffen und um eine detailliertere Perspektive auf das Bodenökosystem und das System der Lebensunterhaltstrategien erweitert, um Ansatzpunkte für potenzielle sozial-ökologische Kippkaskaden zu identifizieren. Folglich bietet das Tipping Multiverse Framework zwei Matrizen, die das Verständnis regionaler sozial-ökologischer Systeme durch die Identifizierung von Kernprozessen, Funktionsweisen und Verbindungen in jedem Kippelement verbessern können und somit Ansatzpunkte für die Identifizierung potenzieller Kippkaskaden über sozial-ökologische Teilsysteme hinweg bieten. Die beispielhafte Anwendung dieser beiden Rahmenwerke im Südwesten Amazoniens zeigt das analytische Potenzial der beiden vorgeschlagenen Rahmenwerke, um das Verständnis von sozial-ökologischen Kippunkten und potenziellen Kippkaskaden in einem regionalen sozial-ökologischen System zu verbessern.

Empirisch betrachtet und durch die Perspektive der politischen Ökologie auf die menschliche Sicherheit auf Fragen der Governance eingehend, stellen wir fest, dass die "glokale" Ressourcen-Governance häufig Machtungleichgewichte und Spaltungen auf und zwischen verschiedenen Ebenen reproduziert, verstärkt oder schafft. Die Ergebnisse zeigen, dass die Gewinner der Ressourcenextraktion vor allem auf nationaler und internationaler Ebene zu finden sind, während die lokalen Gemeinschaften nur wenig Nutzen daraus ziehen und durch externe Effekte verwundbar bleiben. Die Studie trägt damit zur bestehenden Forschung bei, indem sie die Bedeutung einer grundlegenden Frage hervorhebt: "Governance durch wen und für wen?" Diese Frage führte zu der Forderung, die zugrunde liegende Dynamik der Ressourcenbewirtschaftung und die daraus resultierenden Konflikte zu verstehen. Daher haben wir untersucht, wie (Umwelt-)Institutionen die Hauptfaktoren für sozial-ökologische Konflikte um Land in und um drei Schutzgebiete – Tambopata (Peru), das Rohstoffreservat Chico Mendes (Brasilien) und Manuripi (Bolivien) – beeinflussen. Wir fanden heraus, dass insbesondere staatliche Institutionen die folgenden Auswirkungen auf die wichtigsten Konfliktfaktoren haben: Sich überschneidende Zuständigkeiten der Regierungsinstitutionen und die begrenzte Durchsetzung von Vorschriften zum Schutz und zur Stärkung der ländlichen und benachteiligten Bevölkerung ermöglichen externen Akteuren den (illegalen) Zugang zu und die Kontrolle über die Ressourcen in den Schutzgebieten. Infolgedessen wird der ohnehin schon brüchige Gesellschaftsvertrag zwischen den Bewohnern der Schutzgebiete und ihrer Umgebung und dem Zentralstaat durch den wachsenden Einfluss krimineller Organisationen, die sich der Autorität des Staates widersetzen, weiter geschwächt. Damit staatliche Institutionen diese Konflikttreiber nicht verschärfen, sondern sie stattdessen besser bewältigen oder sogar zur Konfliktvermeidung und -minderung beitragen können, ist ein Wandel von reaktiven zu reflexiven Institutionen und die Entwicklung neuer reflexiver Governance-Kompetenzen erforderlich.

Dieser Bedarf an reflexiver Governance wird besonders deutlich, wenn plötzliche Störungen

oder Schocks auf ein sozial-ökologisches System einwirken. Unsere Analyse der Auswirkungen der COVID-19-Pandemie auf die Zusammenhänge von Landnutzungsänderungen, Ökosystemleistungen, menschlichem Handeln (*agency*), Konflikten und Zusammenarbeit zeigt, dass die Pandemie die menschliche Sicherheit marginalisierter sozialer Gruppen im Südwesten Amazoniens stark beeinträchtigt hat. Maßnahmen der Zivilgesellschaft waren eine wesentliche Strategie im Kampf gegen COVID-19, nicht nur im Gesundheitsbereich, sondern auch im wirtschaftlichen, politischen, sozialen und kulturellen Bereich. Unsere Untersuchungen haben jedoch auch gezeigt, dass die Pandemie kriminelle Strukturen gefestigt und teilweise erneuert hat, während der ohnehin schwache Staat aufgrund zusätzlicher Aufgaben bei der Bewältigung der Pandemie und anderer Katastrophen wie Überschwemmungen weiter ins Hintertreffen geraten ist.

Zusammenfassend lässt sich sagen, dass die Reflexivität der Governance von entscheidender Bedeutung für die Förderung der Zusammenarbeit und die Vermeidung von Konflikten im Bereich der sozial-ökologischen Systeme ist. Indem sie nicht nur auf bereits eingetretene Veränderungen reagiert, sondern vielmehr auch über potenzielle künftige Veränderungen nachdenkt, kann Governance Transformationspfade weg von zerstörerischen und hin zu lebenserhaltenden Pfaden gestalten. Sie kann dies tun, indem sie skalenübergreifend agiert, um das Überschreiten schädlicher sozial-ökologischer Kippunkte zu vermeiden und stattdessen lebenserhaltende Kippunkte auszulösen, die zum globalen sozial-ökologischen Wohlergehen beitragen.

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List of Acronyms

ABT	Forest and Land Agency, Bolivia <i>Autoridad de Fiscalización y Control Social de Bosques y Tierra, Bolivia</i>
AC	Acre, State in Brazil
ACLED	Armed Conflict Location & Event Data Project
ANF	Agencia de Noticias Fides, Bolivian private news agency
APG	Assembly of the Guaraní People, Bolivia <i>Asamblea del Pueblo Guaraní, Bolivia</i>
ARM	Alliance for Responsible Mining
ASM / ASGM	Artisanal and Small-scale Gold Mining
BioTip	Interdisciplinary BMBF Research Program: "Tipping Points, Dynamics and Interactions of Social and Ecological Systems"
BMBF	Federal Ministry for Education and Research, Germany <i>Bundesministerium für Bildung und Forschung</i>
CASM	Community and Small-scale Mining
CBD	Convention on Biological Diversity
CEDIB	Documentation and Information Center, Bolivia <i>Centro de Documentación e Información, Bolivia</i>
CIVICUS	Global Alliance of Civil Society Organizations and Activists
CNS	National Council for Extractivist Populations, Brazil <i>Conselho Nacional das Populações Extrativistas, Brasil</i>
CO2	Carbon dioxide
COP	Conference of the Parties
COSUDE	Swiss Agency for Development and Cooperation
COVID-19	Contagious disease caused by a virus (SARS-CoV-2)
CPT	Pastoral Land Commission, Brazil <i>Comissão Pastoral da Terra, Brasil</i>
CSO	Civil Society Organizations
CSR	Corporate Social Responsibility
CV	Comando Vermelho, Brazilian criminal group
DFID	Department for International Development, UK
DICAPI	Armed Forces, Peru <i>Dirección General de Capitanías y Guardacostas, Perú</i>
DIVIAC	High Complexity Crime Investigation Division, Peru <i>División de Investigaciones de Delitos de Alta Complejidad, Perú</i>

DREM	Regional Directorate of Energy and Mines, MDD <i>Dirección Regional de Energía y Minas, MDD</i>
DRR	Disaster Risk Reduction
DS	Supreme Decree <i>Decreto Supremo</i>
EIA	Environmental Impact Assessment
EITI	Extractive Industries Transparency Initiative
ENSO	El-Niño-Southern-Oscillation
EPA	United States Environmental Protection Agency
ESS	Ecosystem Services
FAEAC	Federation of Agriculture and Livestock of the State of Acre <i>Federação da Agricultura e Pecuária do Estado do Acre</i>
FAO	Food and Agricultural Organization
FBSP	Brazilian Forum for Public Security <i>Fórum Brasileiro de Segurança Pública</i>
FEDEMIN	Federation of Artisanal Miners in MDD, Peru <i>Federación Minera de Madre de Dios, Perú</i>
FELCN	Special Force against Drug Trafficking, Bolivia <i>Fuerza Especial de Lucha Contra el Narcotráfico, Bolivia</i>
FENAMAD	Native Federation of the Madre de Dios River and its Tributaries, Peru <i>Federación Nativa del Rio Madre de Dios y Afluentes, Perú</i>
FGD	Focus Group Discussion
FPIC	Free Prior and Informed Consent
FSC	Forest Stewardship Council
GHGs	Greenhouse Gas Emissions
GOREMAD	Regional Government of Madre de Dios, Peru <i>Gobierno Regional Madre de Dios, Perú</i>
GW	Gigawatt
GWEC	Global Wind Energy Council
ICMBio	Chico Mendes Institute for Biodiversity Conservation, Brazil <i>Instituto Chico Mendes de Conservação da Biodiversidade, Brasil</i>
ICMM	International Council on Mining and Metals
ID	Identification (identity document)
IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
IIPFCC	International Indigenous Peoples Forum on Climate Change
ILO	International Labour Organization
IMAZON	Institute of Humans and the Environment of the Amazon, Brazil <i>Instituto do Homem e Meio Ambiente da Amazônia, Brasil</i>
INE	Bolivian National Statistics Institute Bolivia <i>Instituto Nacional de Estadística, Bolivia</i>
INPE	National Institute for Space Research, Brazil <i>Instituto Nacional de Pesquisas Espaciais, Brasil</i>

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INRA	National Agrarian Reform Institute, Bolivia <i>Instituto Nacional De Reforma Agraria, Bolivia</i>
INRENA	National Institute of Natural Resources, Peru <i>Instituto Nacional de Recursos Naturales, Perú</i>
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRIN	Integrated Regional Information Networks News, independent, non-profit news agency (since 2019 The New Humanitarian)
ISTOÉ	ISTOÉ Independente, weekly news magazine in Brazil
KNBS	Kenya National Bureau of Statistics
KPR	Kenya Police Reserves
LSM	Large-scale Mining
LTWP	Lake Turkana Wind Power Consortium
LUCC	Land Use and Land Cover Change
MAP	M adre de Dios (Peru), A cre (Brazil), P ando (Bolivia)
MAXQDA	Software program for qualitative data, text and multimedia analysis
MDD	Madre de Dios, Department in Peru
MDRyS	Ministry of Rural Development and Land, Bolivia <i>Ministerio de Desarrollo Rural y Tierras, Bolivia</i>
MEM/MINEM	Ministry for Energy and Mines, Peru <i>Ministerio de Energía y Minas, Perú</i>
MHE	Ministry of Hydrocarbons and Energy, Bolivia <i>Ministerio de Hidrocarburos y Energías, Bolivia</i>
MINAM	Ministry for the Environment, Peru <i>Ministerio del Ambiente, Perú</i>
MMA	Ministry of Environment, Brazil <i>Ministério do Meio Ambiente, Brazil</i>
MMAyA	National Ministry of Environment and Water, Bolivia <i>Ministerio de Medio Ambiente y Agua, Bolivia</i>
MPAC	Acre State Public Ministry, Brazil <i>Ministério Público do Estado do Acre, Brasil</i>
NDCs	Nationally Determined Contributions
NGO	Non-governmental Organization
NIMBY	'Not-in-my-backyard'
NTFP	Non-timber forest product
OAS	Organization of American States
OC	Organized crime
OECD	Organisation for Economic Co-operation and Development
PA	Protected area
PAHO	Pan American Health Organization
PCC	Primeiro Comando da Capital, Brazilian criminal group
Ph.D.	Philosophiae Doctor
PRISMA-ScR	PRISMA Extension for Scoping Reviews

PRODIGY	"Process-based & Resilience-Oriented management of DIversity Generates sustainabilitY", research project in the BMBF funding line BioTip
PSFM	Soil-plant feedback mechanism
PT	Worker's Party Brazil <i>Partido dos Trabalhadores, Brasil</i>
QGIS	A Free and Open Source Geographic Information System
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REN21	International policy network dedicated to building a sustainable energy future with renewables
ResEx	Chico Mendes Extractive Reserve, Brazil <i>Reserva Extractivista Chico Mendes, Brasil</i>
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SC	Social Cohesion
SCCM	Social Cohesion Conceptual Model
SERNANP	National Service of Natural Areas Protected by the State, Peru <i>Servicio Nacional de Áreas Naturales Protegidas por el Estado, Perú</i>
SERNAP	National Service of Protected Areas, Bolivia <i>Servicio Nacional de Áreas Protegidas, Bolivia</i>
SES	Social-Ecological System
SESAI	Special Secretariat for Indigenous Health, Brazil <i>Secretaria Especial de Saúde Indígena, Brasil</i>
SID	Society for International Development
SNMPE	National Society of Mining, Petroleum and Energy, Peru <i>Sociedad Nacional de Minería, Petróleo y Energía, Perú</i>
SPA	Science Panel for the Amazon
SPDA	Peruvian Society of Environmental Law <i>Sociedad Peruana de Derecho Ambiental</i>
SUNAT	National Superintendency of Tax Administration, Peru <i>Superintendencia Nacional de Aduanas y de Administración Tributaria, Perú</i>
TE	Tipping Element
TCO	Transnational criminal organizations
TP	Tipping Point
UCSP	San Pablo Catholic University, Peru <i>Universidad Católica San Pablo, Perú</i>
UK	United Kingdom
UMOPAR	Mobile Police Unit for Rural Areas, Bolivia <i>Unidad Móvil Policial para Áreas Rurales, Bolivia</i>
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNFCCC	United Nations Convention on Climate Change
USA	United States of America

CONTENTS

WBGU	German Advisory Council on Global Change <i>Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen</i>
WHO	World Health Organization
YPFB	Re-nationalized hydrocarbon corporation, Bolivia <i>Yacimientos Petrolíferos Fiscales Bolivianos</i>
WWF	World Wildlife Fund

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1 | INTRODUCTION

"I want you to panic. [...] And then I want you to act." – with these words, Greta Thunberg urged the world leaders at the UN General Assembly in September 2019 to act on the causes and consequences of climate change (The Guardian 2019). One should be critical about whether actions in a mood of panic will be the best ones that societies and decision-makers can think of. However, these words capture well the severity of the problem that global society is facing and the decisive measures that have to be taken to mitigate the causes and adapt to the new conditions under climate change (IPCC 2022b). Additionally, human interference with the climate system is just one of several major impacts that humans have within the Earth System (Crutzen 2006; Folke et al. 2021). Over the past decade, the scientific literature increasingly speaks of the Anthropocene as the geological epoch in which humans became the major force in the Earth System (Crutzen 2006; Rocha et al. 2015; Steffen et al. 2018; Waters et al. 2016). The consequences, which are often summarized under the term 'global change' comprise, besides climate change, the loss of terrestrial and aquatic biodiversity, the increase in soil erosion as well as the increasing connectivity through global trade flows, digital technologies, and growing inequality within and across countries (Folke et al. 2021). The international community has reacted to each of these processes with multilateral agreements that set out the general objectives that the states could agree on: The United Nations Convention on Climate Change (UNFCCC) for the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UN 1992b, p. 9); The Convention on Biological Diversity (CBD), for the "conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (UN 1992a, p. 3); The Convention to Combat Desertification (UNCCD) to "combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification" (UN 1994, p. 5); and the Agenda 2030 for Sustainable Development to "[...] end poverty and hunger [...], protect the planet from degradation [...], ensure that all human beings can enjoy prosperous and fulfilling lives [...], foster peaceful, just and inclusive societies which are free from fear and violence [...], based on a spirit of strengthened global solidarity [...]" (UN 2015, pp. 5–6).

These goals indicate the general global awareness of the challenges of the 21st century. However, the specific measures to reach these goals are highly contentious. Scientific bodies, such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) regularly draw scenarios of potential futures under policies with different degrees of ambition (IPBES 2019; IPCC 2014b; IPCC 2022b). Nevertheless, the current international measures do not reach the effectiveness needed to sustain global human well-being throughout the Anthropocene. On the contrary, competing interests over the pathways how "no one will be left behind" (UN 2015, p. 6) are not only paralyzing the international debate but also play an increasingly important role in debates over social fragmentation and societal polarization on national and local scales (Dressler and Plagemann 2022; Kenkel and Hoffmann 2022). Hence, social cohesion is increasingly taken up in the international discourse, as an umbrella concept describing "how

members of a society, group, or organization relate to each other and work together" (Dany and Dijkzeul 2022, p. 12). In particular in contexts of violence, conflicts, and fragility, little has been investigated on the role of social cohesion to govern public goods and to build resilience for (future) environmental crises in the Anthropocene. At the same time, governments and international decision-makers more and more acknowledge the role of social cohesion to build upon resilience against crises (Aall and Crocker 2019; Club de Madrid 2009; Jeannotte 2000; OECD 2011).

In southwestern Amazonia, the intertwined challenges of human contributions to global change in all its dimensions and human mitigation and adaptation measures are distinctly visible. As such, southwestern Amazonia with its high social, economic, and biological diversity offers a strong example in which to observe the deep interrelation of humans and nature and the consequences this relationship has on social cohesion amid an ecological crisis (for details on the southwestern Amazon, see section 1.2). Recognizing these dynamics, this dissertation takes a social-ecological perspective on conflicts and social cohesion in southwestern Amazonia.

1.1 Main Research Question and Objectives

A social-ecological perspective on conflict and social cohesion is helpful to address the need for collaboration concerning public goods in SES, as accelerating global change raises awareness about potential future crises. Such collaboration among different actors in governments and societies requires social cohesion and is seen as a potential strategy to build resilience against future disturbances and shocks. Against this background, it becomes increasingly important to understand the role of governance (both state and non-state, see section) and its scopes for action on local to global scales. Facing uncertainty in how natural and social systems react to certain disturbances and shocks, the governance of non-linear processes, and potentially resulting tipping points, are additional challenges for the governance of social-ecological systems (SES) in the Anthropocene. SES assume that environmental, economic, and social (including cultural and political) sub-systems are interconnected (e.g., Folke (2006) and IPCC (2022b), see also section 1.3.1). Interactions may lead to tipping points, which are "abrupt changes that take place over a few decades or less, persist (or is anticipated to persist) for at least a few decades and cause substantial impacts in human and/or natural systems (IPCC 2022a, p. 2898, see also Lenton 2008, and section 1.3.3). Therefore, the overarching research question of this dissertation is: **"How does governance shape pathways towards co-operative or conflictive social-ecological tipping points?"**

This research question combines discourses from different scientific disciplines and therefore requires a thorough theoretical basis to deliver results that contribute not only to the scientific discourse but also serve as recommendations for decision-makers in a later stage (for the theoretical and conceptual approach, see section 1.3). Therefore, several steps are taken in the theoretical realm (Chapters 2-4) before embarking on empirically investigating the research question (Chapters 5-7). Specifically, the above-described research question is contextualized in the following research aims:

- to explore the current research of climate change and conflict in the context of the altered resource of land, taking into account both the direct effects of climate change on land and land use as well as the indirect effects that may be introduced through climate mitigation and adaptation measures (Chapter 2);
- to systematically approach and better understand social cohesion by (1) developing a conceptual model of social cohesion that approaches social cohesion from a system's perspective, and (2) developing a conceptual framework to show how such an integration

1.2. THE RESEARCH REGION

can be applied, using land system change as one example of a major SES dynamic (Chapter 3);

- to propose an analytical framework to (1) apply a global tipping point (TP) concept to a regional SES, and (2) systematically assess interactions and feedbacks within it (Chapter 4);
- to show the benefits of embedding the analysis of human security in a multi-scalar political ecology perspective (conceptual aim); and to contribute to the empirical understanding of how the governance of non-renewable extractive resources affects key dimensions of human security, namely environmental security, livelihood security, and safety and political security (empirical aim) (Chapter 5);
- to better understand the main drivers of social-ecological conflicts over land in and around three protected areas in the transboundary region of the southwestern Amazon, and to analyze how (environmental) institutions influence these drivers (Chapter 6);
- to better understand the impacts of the COVID-19 pandemic on the interplay of land use change, ecosystem services (ESS), human agency, conflict, and cooperation, with a focus on civil society organizations (CSOs) and criminal networks (Chapter 7).

As can be seen in these research aims, the following chapters first built up a theoretical framework that is rooted in well-known theoretical approaches and concepts from human geography, political sciences, sociology, and peace and conflict studies, before applying the framework or parts of it to empirical research in southwestern Amazonia. To embrace the complexity of the research topic and to react to upcoming limitations due to the COVID-19 pandemic, different research methods have been applied (see section 1.4). The results that are shown from the application of the framework in southwestern Amazonia, do not claim to be generalizable – a task, that proves difficult when considering diversity within and across the different sub-systems of the southwestern Amazonian social-ecological system. Nevertheless, the theoretical frameworks that are presented might be suitable to be adapted to different regions and hence contribute to the wider conceptualization and research on the governance of social-ecological tipping points.

1.2 The Research Region

The research region in focus of this thesis is located in southwestern Amazonia, a tropical forest region at the border of Brazil, Peru, and Bolivia. A map of the region can be found in the following chapters, e.g., in chapter 3 (Fig. 3.4) or chapter 4 (Fig. 4.1). More specifically, the region comprises the three sub-national entities Madre de Dios/Peru, Acre/Brazil, and Pando/Bolivia – also known as the MAP region. The region is contextualized throughout this thesis as the major SES, comprising similar constitutive ecological but different social sub-systems. Chapter 3, section 3.5.2 and 3.5.3 provide more details on the regional approach and the MAP SES and its embeddedness in the wider Amazon SES, which has been identified as a major tipping element of the Earth System (Nobre and Borma 2009; Steffen et al. 2018). In the following section, I will give a more general overview of Amazonia, first about the climatic and environmental conditions, before describing the major social dynamics and diversity in the region.

1.2.1 Environmental and Climatic Conditions in Southwestern Amazonia

The MAP region is part of the Southwestern Amazon Moist Forests ecoregion (Olson et al. 2001) comprising an extension of about 31 million ha (Selaya et al. 2017). The Amazon is

known for its regulation function for regional and global climate processes such as the 'aerial rivers' phenomenon (Arraut et al. 2012) and its sequestration function of anthropogenic CO₂ emissions (Brienen et al. 2015). In addition, its large areas of standing natural forests and its high biodiversity, are home to one-third of Earth's known species (Heckenberger et al. 2007). The three sub-national entities of the MAP share the presence of strongly weathered soils being poor in weatherable minerals and nutrients and rich in iron and aluminum hydroxides, a combination that makes agricultural production highly dependent on fertilizer (Wieder et al. 2014).

The climate of the southwestern Amazon features the typical characteristics of the moist tropics which are low thermal seasonality with an average annual temperature of 26 - 27°C and mean annual precipitation of 1500 - 3500mm. However, natural, temporal variations reinforce seasonal patterns resulting in both frequent droughts and extreme precipitation events (Aragão et al. 2018; Marengo et al. 2011; Souza et al. 2022; Sulca et al. 2018). Future climate scenarios indicate a prolonged dry-season length and increased drought frequency due to land use and land cover change (LUCC) and resulting regional climate change in the region (Boulton et al. 2022).

Such an increase in the dry season could be an indicator of the transition from rainforest to savannah, as Salati and Nobre (1991) stated in their Amazon savannization hypothesis already more than 30 years ago. The same authors conclude that, as "savanna vegetation is naturally more adapted to withstand fire and a long dry season" a "re-establishment of the rainforest" after destruction and under changing climatic conditions seems rather unlikely (Salati and Nobre 1991, p. 194). Recent research by Staal et al. (2020a) suggests, that the majority of the Amazon Rainforest ecosystem still appears resilient against current disturbances, but that this resilience might be undermined towards the end of the 21st century through changes on both ends of the scales: on the global scale through changes in rainfall patterns due to global climate change, and on the local scale with fire being "the most likely mechanism that can make a tropical forest tip" (Staal et al. 2020a, p. 2). Aragão et al. (2018) do not only show that the forest is much more susceptible to fire in times of drought, but that even under declining deforestation rates, the number of fires does not decline at the same rate, due to the degraded state of the forest, higher temperatures and increased frequency of extreme droughts. Leite-Filho et al. (2019) further show that forest cover loss delays the onset of the rainy season, while high deforestation correlates with longer dry periods during early and late rainy seasons. These data are supported by Butt et al. (2011) who find a delay of the rainy season of about 0.6 days/year, summing up to a delay of about 18 days within 30 years of deforestation. Leite-Filho et al. (2019) subsumes, that these effects may limit the feasibility of the double-cropping system as well as the cultivated variety in rainfed agricultural systems in the southern Amazon. Under these conditions, Gatti et al. (2021) indicate the risk of reversing the Amazonian capacity as a carbon sink into a potential carbon source in the future. Lovejoy and Nobre (2019) conclude that the above-mentioned changes may lead the Amazon forest to tip from rainforest into a savanna-like state if deforestation exceeds 20-25% of the total forest area.

These risks from climate change are magnified through increased numbers of forest fires, expansion of the agricultural frontier as well as expanding mining sites (Aragão et al. 2018; Cortés-McPherson 2019; Coy et al. 2017). These developments are accompanied by activities of the informal and illegal economy, unplanned and unstructured settlements, and a lack of basic sanitary infrastructure, putting people's health increasingly at risk. Latest, the COVID-19 pandemic showed the vulnerability of the health system in the Amazon which collapsed at the beginning of the pandemic due to a lack of health infrastructure, materials, and workforce. In addition, Alves de Oliveira et al. (2021) find that the combined effects of climate change and Amazon savannization could lead to an increase in heat stress by 2100. This would expose more than 11 million people living in the Amazon to severe health risks which are likely to

1.2. THE RESEARCH REGION

exceed human adaptation limits under a high emission scenario. Already today, observational data from 2003 to 2018 report extreme values of temperature in large deforested areas.

1.2.2 Social Dynamics and Diversity in Southwestern Amazonia

For over 12.000 years, indigenous people have been living in Amazonia. Archeological evidence, such as stone artifacts (e.g., Miller 1987), early crop cultivation (e.g., Lombardo et al. 2020), and landscape modification e.g., through 'geoglyph' building, (Watling et al. 2017) point towards the rich pre-Colombian social diversity in Amazonia. This is counteracting older theories postulated by Headland (1987, p. 463) and others, stating that hunter-gatherer groups were not able to expand to tropical forests before the development of agricultural practices, due to the "food-poor" conditions, in particular the lack of wild starch food. Yet, evidence shows that the early Amazonian populations increased food availability through the domestication of the Amazonian landscapes and "culturally constructing their niches [...] through practices including removing unwanted plants, protecting useful trees throughout their development, attracting animal dispersers, directly dispersing seeds, selecting specific phenotypes, managing fire, cultivating useful plants, and increasing soil fertility and structure such as creating anthropogenic soils and earthworks" (SPA 2021, p. 287, see also Levis 2018, p. 1).

European conquest and colonization, its colonial administration and exploitation starting in the 16th century, left its marks among the peoples of the Amazon through often violent political and social relations (SPA 2021). Multiple forms of domination and concomitant exploitation of the workforce, accompanied by subjugation and extermination proceeded with progressing extraction of natural resources (Herzog 2015). Population decline due to the spread of disease and colonial ruling led to the extinction of many indigenous peoples and contributed to the "myth of the great Amazonian emptiness" (SPA 2021, p. 349). This declining demography hindered the transmission of history and traditional practices between generations while at the same time being instrumentalized again to justify European occupation. "These memories are often anchored in specific landscape markers, highlighting how in the Amazon ecocide and epistemicide are two sides of the same coin" states the Science Panel for the Amazon (SPA 2021, p. 304). Nevertheless, this perception of 'civilizing' the 'barbarians' is still reflected in many ongoing amazonian 'development' plans.

The 19th and 20th centuries were shaped by boom and bust cycles of extractive forest products, starting with Chinchona, a medicinal plant, the rubber boom, and latest the extraction of Brazil nuts, which became a major source of income, in particular in the southwestern Amazon (Duchelle 2009). Schöenberg (2011, p. 70) describes this transition from subsistence or local market production to international market production as the transition from *traditional* extractivism to *colonial extractivism*. The latter used and reproduced colonial dependencies and created a monopolization of market access by relying on local merchant personalities (*patrão*). These *patrões* mediated between the producers in the hinterland and the trading houses in the city and created new dependencies by giving goods on a credit basis to producers in need. The resulting system is referred to as the 'aviamento system' which proved to be very stable as it continues in parts up to today (Schöenberg 2011). Due to the high influx of settlers in the 1970s, more and more conflicts around land use rights evolved between new settlers and traditional and indigenous people. Stimulated by an increase in global awareness about the role of Amazonia in the climate system, new socio-economic movements, supported by national and international political actions, emerged (Hecht 2011).

Since the 1960s, an improved road infrastructure made previously inaccessible areas in Amazonia accessible, leading to immigration from neighboring departments/states and the expansion of agricultural activities, local trade, and increased natural resource extraction (Southworth et al. 2011). This led to the southwestern Amazon undergoing various rapid social-ecological transformation processes driven by environmental and regional climate

change, with unpredictable rainfall leading to droughts and floods (Lovejoy and Nobre 2018); economic development patterns, such as anthropogenic land system change, agricultural intensification and ongoing infrastructure expansion (Perz et al. 2015); political agendas such as land reforms and formalization processes regarding access to land and natural resources (Damonte 2018); and societal phenomena such as lifestyle changes (Hoelle 2015), population growth, migration, and criminalization (drug trafficking, gang activities) (Coutinho 2019). Today, the economy in the region largely depends on the extraction of non-timber forest products (NTFP) such as Brazil nuts and açaí. Additionally, major drug routes from Bolivia and Peru cross the Brazilian Amazon to European and African markets. After the rubber boom at the beginning of the twentieth century, rubber lost its economic importance and many collectors of NTFP substituted their losses with other forest products or with cattle ranching (Acre and partly Pando) and gold mining (mostly Madre de Dios and partly Pando) (Damonte 2013; Duchelle 2009; Southworth et al. 2011).

The recent southern Amazonian social system is characterized by a high social diversity comprising indigenous peoples and traditional forest extractivists as well as recent migrants including settlers, ranchers, and miners, along with a growing urban population (Perz et al. 2015). In addition, the region faces political and economic marginalization from the political centers of the three states due to their remote location and a low political will, resulting in a lack of law enforcement and thriving organized crime (Froese et al. 2022a). At the same time, the transition between rural and urban involves complex mobility pathways, multi-sited households, and diverse economic and social relations. For example, it is common for a family to live in the city while some members work in the city and others frequently travel to their agricultural plots where they produce crops and fruits for subsistence or to sell on the market (Hoelle 2015). These result in much more permeable categories of the 'urban' and 'rural' compared to other regions in Latin America (Hecht 2011).

New emerging concepts such as 'biocultural diversity' (e.g., Maffi 2001) aim to bridge knowledge across human-environmental dimensions. Maffi (2001) emphasize the different elements of biocultural diversity – territory, governance, languages, knowledge, and livelihoods. As such, biocultural diversity aims at building relationships to re-connect biological, socio-cultural, and linguistic diversity that have co-evolved as social-ecological systems (see also SPA 2021). In addition, the SPA highlights, that indigenous peoples and local communities in their roles as stewards for "diverse worldviews, values, institutions, and governance systems are crucial not only to biodiversity conservation but also to democracy itself" (SPA2021, p. 357, see also Sieder 2002).

1.3 Theoretical and Conceptual Approach

The research pursued in this thesis navigates on the 'slack line' of interdisciplinarity, drawing from well-elaborated theories and concepts from human geography, political sciences, sociology and peace, and conflict studies while being contextualized in the SES literature. In the following section, the core concepts that build the foundation of this thesis will be briefly introduced. More detailed connections to the different research aims (see section 1.1) are given in the respective chapters. Here, I would like to focus on presenting the ensemble of the theories and concepts and their orchestration to help the reader navigate through the multitude of terms. The reader will notice that individual chapters draw on or emphasize specific concepts, and not all theories or concepts play a role in all chapters. Therefore, this section serves as an overview of the theoretical and conceptual approach of the thesis.

1.3.1 Systems Thinking and Social-Ecological Systems

A recent editorial in the scientific journal *Nature Food*, captioned «Systems Thinking, Systems Doing» (2020, p. 659) complains about the "lack of clarity on the operationalization of systems thinking in research". The authors state that high-level questions of applied research fall short of capturing the complexity needed to address their inherent multidimensionality. A 'system' in its most general sense is defined as 'an interconnected set of elements that is coherently organized in a way that achieves something' (Meadows 2008). The authors further elaborate on systems as having common properties, which are their elements, interconnections, and a function or purpose. The systematization of elements facilitates the identification of the system's structures (interconnections) and behaviors (functions). Systems can be described on very different scales, and their interaction and reaction to disturbances are covered in research on complex adaptive systems (e.g., Fraccascia et al. 2018; Gao et al. 2016). SES are specific complex adaptive systems of interconnected environmental, economic, and social (including cultural and political) sub-systems (Folke 2006). Therefore, a social-ecological systems approach is well suited to first understand complexity and multidimensionality at the interface of human and nature (system knowledge), before providing orientation and transformation knowledge through applied research that takes a solution-oriented approach (Meisch 2020).

1.3.2 Resilience, Human Security & Political Ecology

Research at the interface of humans and nature often uses the concept of 'resilience', with different connotations, as it is used in natural and social sciences. Here, I understand 'social resilience' in line with Schilling et al. (2017, p. 5) as "the ability of a group, community or institution [system] to withstand, recover, and learn from external disturbances". Using social resilience, I refer to 'situated' social resilience, which respects the "recursive relationship between knowledge, agency, and context mediated by power, culture and history" (Cote and Nightingale 2012, p. 484). Power in the context of power imbalances is understood here as an actor-specific resource that can be approached in its relation to societal change, following Avelino and Rotmans (2009). In this sense, power relations are crucial in long-term processes of structural change, as they influence the ability of people and institutions to act (agency). Thus, the analysis of power relations is highly relevant for governance analyses within and across institutional structures.

Besides power and agency, human security is a major variable in determining social resilience. Human security can be understood as "[...] more than living free of conditions of violent warfare, but also implying access to basic goods and services, and the absence of a continuous threat of violent crime, loss of livelihood or authoritarian governance" (Engwicht and Grabek 2019, p. 189). The United Nations (1994), as the key actor promoting the concept, distinguished seven dimensions of human security, namely economic security, food security, health security, environmental security, personal security, community security, and political security. Scholarship on human security has drawn on insights from environmental studies and development studies and the concept of human security has provided a useful analytical framework for interdisciplinary research across the natural and social sciences (Taylor 2013). At the same time, the concept of human security has been criticized for focusing too narrowly on the local level and basic human needs while neglecting how they are impacted by political decisions and power imbalances (Chandler 2012; Taylor 2013). Therefore, a perspective including the sensitivity for power structures, political dynamics, and the role of institutions beyond the local, as it is taken by political ecologists, appears meaningful (Perreault et al. 2015).

Political ecology assumes that ecological change cannot be understood without considering the political and economic structures and institutions in which it is embedded (e.g., Paulson et al. 2003; Peluso and Watts 2001). Its particular focus is on economic and power

dynamics in an increasingly interconnected world and the need to view these dynamics across scales (local-global). Originally, political ecology emerged from the study of the impact of large-scale resource extractivism projects in local communities in the global South. As such, political ecology is well suited to combine the strong suits of both approaches: a detailed, multidimensional assessment of impacts on the local scale with a critical transformative view of the interplay of power asymmetries mediating the distribution of costs and benefits across actors and scales and thus determining the resilience of societies to disturbances and shocks (see Schilling et al. (2021) and chapter 5).

1.3.3 Land System Change & Social-Ecological Tipping Points

Land system change, with its multitude of causes and consequences, is the major disturbance in Amazonia, posing risk to the resilience of the local population. Extending the distinction made by Turner et al. (2021a) between land-use science and land-system science, I understand the term 'land-use change' more as land system change to equally value land systems that are not of use from a neoliberal perspective – used for the extraction of resources – but of intrinsic value due to their existence and cultural embedment as, for example, a source of identity. In the case of southwestern Amazonia, the most prominent land system change is deforestation due to illegal mining activities in Madre de Dios (Damonte 2018), the extension of the agricultural frontier, particularly for cattle ranching in Acre (Klingler and Mack 2020), and road infrastructure development in Bolivia (Perz et al. 2015).

Land systems are governed by the interplay of local and regional with national and international governance dynamics. While they further include agricultural and extractive production as well as illegal activities and local or regional state regulation and control, the latter comprises global market dynamics and global governance instruments such as the United Nations Framework Convention on Climate Change (UNFCCC) or the Convention on Biological Diversity (CBD), certification schemes such as the Forest Stewardship Council (FSC) or transparency initiatives such as the Extractive Industries Transparency Initiative (EITI). These local to global governance dynamics impact land use decisions, which in turn impact the ecosystem services of the respective land system.

The impact of these processes and phenomena on the respective ecosystem services can also be distinguished by their contribution to life-sustaining and detrimental pathways (see section 3.4 and Fig. 3.3). The direct and indirect impacts of lost or preserved ecosystem services have an impact on human agency. Direct impacts comprise provisioning and cultural ecosystem services since these directly affect aspects of human agency, such as threatening people's identity through the loss of habitat or human security through the loss of income or the provision of food and water. Indirect impacts comprise regulating and supporting ecosystem services since their effects on human agency are more indirect and occur through interconnections and feedback on people's resilience.

The ecosystem services under impact have direct and indirect effects on social resilience and could lead to disturbance and the crossing of social-ecological tipping points, which are taken into account as extreme values of varying social resilience to environmental disturbance. In more general accounts, the IPCC (2022a, p. 2925) defines tipping points as "a critical threshold beyond which a system reorganizes, often abruptly and/or irreversibly" and "which takes place over a few decades or less, persists (or is anticipated to persist) for at least a few decades and causes substantial impacts in human and/or natural systems" (IPCC 2022a, p. 2898). Disturbances are here understood as drivers which are 'results of social, political, cultural, economic and environmental change' (Adger 2000). These drivers put stress on the system's functions on multidirectional spatial and temporal scales and thus impact the resilience of the social system at inter-group and group-state levels. This spatial and temporal variance requires a cross-scale resilience approach (Peterson et al. 1998). Following Peterson et al. (1998), a social system's resilience increases when the adaptive capacity builds on diverse

1.3. THEORETICAL AND CONCEPTUAL APPROACH

capabilities to govern change and transformation within a particular scale due to an overlap of potential options for adaptation. These effects can be reinforced across scales following the same underlying functions. Stabilizing effects strengthen the functions of the current state of the social system and are thus the most relevant characteristic of social resilience. Nevertheless, it is important to note that 'stability' is not necessarily understood positively, such as contributing to life-sustaining pathways. Rather, the stability of the current state can also be an indicator of deadlocked dynamics on a detrimental pathway. In contrast, self-enhancing feedback mechanisms weaken the functions of the system's current state and challenge its adaptive capacity. Like the ambivalence of stability mentioned above, the weakening of these functions does not necessarily denote a detrimental pathway but may indicate the overcoming of deadlock situations and the change of pathways. Such self-enhancing feedback effects are characteristic of run-away development and can ultimately lead the system – also referred to as tipping element – towards a tipping point.

1.3.4 Conflict, Social Cohesion and Governance

To understand social-ecological tipping points, the impacts of environmental disturbances on cooperative and conflictive societies as well as the reaction of governance systems to these impacts is crucial. I understand governance here as "the structures, processes, and actions through which private and public actors interact to address societal goals. This includes formal and informal institutions and the associated norms, rules, laws, and procedures for deciding, managing, implementing and monitoring policies and measures at any geographic or political scale, from global to local" (IPCC 2022a, p. 2910).

For governance in this sense to function, social cohesion – comprising both relations between social groups and between groups and the state – becomes increasingly relevant. The international discourses frame social cohesion as an umbrella concept describing "how members of a society, group, or organization relate to each other and work together" (Dany and Dijkzeul 2022, p. 12). However, in this thesis, I focus on conceptualizing social cohesion as a crucial system function of the social system. 'Function' here refers to the dynamic aspect of the social system, which is the social processes that ensure the stability of the system's structures (Parsons, 1991). Therefore, I follow Chan et al. (2006, p. 290) who define social cohesion as "a state of affairs concerning both the vertical and the horizontal interactions among members of society as characterized by a set of attitudes and norms that includes trust, a sense of belonging and the willingness to participate and help, as well as their behavioral manifestations". This definition points towards the important role that social cohesion or the lack of it plays in contexts of violence, conflicts, and fragility.

Following Scheffran et al. (2012a), we understand conflicts as social processes involving at least two parties (individuals, groups, state actors, etc.) acting according to diverging interests over a conflict item. Unequal actor constellations and imbalanced power structures among the conflict parties, as well as their capacities to use the social structures, impact the agency of conflict actors and thus increase the potential for asymmetry within the conflict (Bonacker 2005). Social-ecological conflicts are the causal phenomena resulting from the interplay of conflict drivers (independent variable), the intensity of the environmental disturbance (dependent variable), and the reflexivity of institutions (intervening variable). Reflexivity here is understood as the required institutional transformation within institutions (Whyte 2018) that can be created through adaptive management processes fostering proactive agency instead of mere reactive management of change, or as Dryzek (2016, p. 942) puts it 'being or becoming' a different institution rather than simply 'doing' something different. Taking these aspects into account, the understanding of governance can be specified alongside Arguedas (2019) and Saunier and Meganck (2009) as the process by which the state, non-state institutions, and civil society interact to make decisions, formulate and implement policies, exercise agency, and pursue other types of actions" to govern public goods and to build resilience for (future) environmental crises in the Anthropocene.

1.4 Methodology

1.4.1 Literature Review and Development of Theoretical Frameworks

Comprehensive literature research using the Web of Science, Google Scholar, and general internet research to include gray literature preceded all conceptual and empirical work conducted for this thesis. The literature research was tailored to the specific aims of the respective chapters and analyzed accordingly. The structured literature reviews were oriented along the PRISMA-ScR checklist for scoping and structural reviews (Tricco et al. 2018) to gain a general understanding of the field, identify main theories and concepts, and consequently derive existing knowledge gaps. Particular focus and guiding questions for the literature reviews are given in the respective chapters. The theoretical and conceptual approach of this thesis (section 1.3), as well as the frameworks presented in chapter 3 and chapter 4, are based on these literature reviews and inspired by the data collected during the fieldwork (see section 1.4.2). The initially obtained literature was regularly updated throughout the research process over the last 3,5 years, to follow the ongoing research discourse.

1.4.2 Data Collection

The empirical data presented in this thesis was collected through qualitative field research based on semi-structured interviews, focus group discussions (FGDs), and participatory observation. Due to travel restrictions during the COVID-19 pandemic, both in-presence and virtual field research, inspired by O'Connor and Madge (2003), were conducted. After a first scoping trip in June 2019, in-presence fieldwork took place in September/October 2019 for 1,5 months and in April/May 2022 for 3 weeks. In the chapters of this thesis, the focus is laid on different sub-fields, that correspond to the aim of the respective chapter, e.g., a focus on three protected areas within the MAP region. A detailed description of the methodology is given in each chapter.

Semi-structured interviews with representatives of the communities, local and regional government representatives as well as NGOs, and companies were conducted to compare and contrast the different views. An example guideline for semi-structured interviews is given in appendix B. FGDs were organized to discuss issues that turned out to be contradicting in previous individual interviews. In addition, the author co-organized and joined stakeholder conversations in the realm of the overall research project PRODIGY: (1) two living labs (Xapurí, Brazil; San Antonio, Bolivia, both September 2019), a world café (Rio Branco, Brazil, September 2019), a web-seminar (September 2020) and two scenario panels (Rio Branco, September 2019; and online, January 2021), and virtual peer-discussions during a post-graduate course with practitioners from the region (September 2020 to March 2021). All these events comprised several different knowledge holders from the research region, including representatives from the local and regional governments, NGOs, academia as well as local associations. The virtual character of some of these focus groups had the additional value of bringing participants from the three countries together, which would have been difficult during usual field research due to the remoteness and long distances that people would have had to travel.

The collected data were digitalized, transcribed (when audio recording was consented to by the interviewee), and analyzed using the software MAXQDA (Kuckartz and Rädiker 2019). After gaining a first overview of the available data and a review of the field notes and interview guidelines, major topics for code categorization were defined. In a second step, the interviews were coded along these categories, while leaving space for inductively redefining and adding new codes and sub-codes that appeared relevant during the in-depth analysis (e.g., on specific conflict lines, or interests of actors). The data collected in the field were triangulated with the analysis of primary documents like policies, legal sources, reports, and socioeconomic data provided by civil society actors, state institutions, and corporations.

1.5 Critical Reflections and Limitations

In this section, I will take a chance to critically reflect on my research and its limitations. The personal nature of these aspects is reflected in the first-person framing of this section.

1.5.1 Inter- and Transdisciplinary Research in the Global South

"The best research is done not when we pretend that we are perfectly objective, but when we acknowledge that we are not" (Saini 2020, p. 175). As a researcher in the social sciences, I acknowledge, that the process of my research, as well as its outcome, are directly influenced by me and the people I interact with in the field. As such, "fieldwork is always contextual, relational, embodied, and politicized" (Sultana 2015, p. 374). The knowledge I access as a white, female, European, young, and educated person will always be situated and hybrid knowledge. The methodologies used in this thesis, and generally in the social sciences, cannot be completely "objective nor value free" (McDowell 1992), not least due to the participants' reaction to my positionality (the way others construct my identity) (Sultana 2015), unequal power relations between me and the participant, or the inherent social desirability bias (Grimm 2010). McDowell (1992) and other feminist geographers, therefore, advocate the strategy of creating collaborative and non-exploitative relationships between the researcher and the participant. Methods of co-creation, as practiced in transdisciplinary research, acknowledge that "power and knowledge are inextricably connected" (Rose 1997, p. 318) and thus do not aim to separate knowledge creation from power dynamics but rather provide spaces in which different viewpoints and forms of knowledge are equally valued (see also Grosfoguel 2008).

Jahn et al. (2012) refers to these spaces as places in which transformation knowledge is co-created. In focusing on societal problems that are (often) interconnected with environmental problems and rooted in colonial continuities, such transformation knowledge has the potential to bridge the gap between knowledge and action, which is currently criticized not lastly by IPCC researchers who question what difference another report makes in ever again just confirming the call to action (Zhong 2022). As Piechocki (2007) and others have pointed out, concepts such as biodiversity and climate change emanated from global forums and since then are being negotiated across the political, scientific, and highly specialized civil society spheres. Rarely, however, do these concepts reach a wider population and engage people in actions. This is explained by the lack of connection to local knowledge, imagination, and logic. Therefore, policymakers and transdisciplinary scientists are increasingly aiming at overcoming these barriers, while again being confronted with the task of bridging the communicative gap between different knowledge systems (Pérez Ruiz and Argueta Villamar 2011). This process requires the 'experts' of reflecting their positionality and preconceptions as well as engage open-mindedly and without time constraints while being open to surprises (Verran 2002). I have to acknowledge, that time constraints and travel restrictions (see section 1.5.2) did not allow me to conduct thorough transdisciplinary research, but I led myself being guided by the fundamental question of creating transformational knowledge: "Research for what and for whom?" (Solano 2016, p. 40). Nevertheless, I was only able to grasp a glimpse of locally rooted knowledge during transdisciplinary stakeholder conversations and much more time would have been needed for in-depth communication, the creation of non-hierarchical spaces of dialogue and mutual learning, or what Verran (2002, p. 729) refers to as "postcolonial moments".¹

Working in this ambiguity of westernized research traditions, the respective requirements of pursuing a Ph.D., and the wish to take part in the paradigm shift, was not an easy

¹ This paragraph is based on the article "Ao Caminho de Criar Momentos Pós-Coloniais: Propondo uma Dinâmica de Intercâmbio de Conhecimento Rumo a uma Amazônia Sustentável" (Schönenberg et al. 2022), which I co-authored, as well as multiple preceding discussions about postcolonial knowledge production during the online symposium "Social Cohesion and Tipping Points: Perspectives, Approaches, and the Way Forward" which we organized on August 20-21, 2020.

task. Nevertheless, I am thankful for the horizontal dialogue spaces that came up during my research and that inspired me to continue this work on de-constructing (slow) violence, meaning the "epistemic and political dominance of particular narratives" (O'Lear 2016, p. 1), and contributing to building just solutions.

Further, learning and working in an inter- and transdisciplinary context has taught me how to communicate 'meaning' instead of 'results'. In collaboration with colleagues from different disciplines, I learned that this makes all the difference, as we approach the subject of study or the research question. Communicating the individual meaning that I make of my results, requires a translation effort by the 'sender' and a certain willingness in the 'receiver' in terms of the use of specific, disciplinary terminology and concepts. In this way, I echo Pasquini and Olaniyan (2004, p. 35) in their appraisal that "in order to develop its [interdisciplinary research] full potential we must at least try to understand, even if not share, the same epistemologies".

Having lived and worked in Brazil for 1,5 years before moving to the academic context and returning to the country, I could draw on experiences from previously committed errors and inappropriate behavior which facilitate settling in the new research context at least for the Brazilian parts of my research. Nevertheless, the positionality of the local research assistants is a crucial factor in 'gatekeeping' or 'opening doors' in local communities and institutions as it can somewhat buffer the alienation that local participants may feel towards me (for the role of research assistants in cross-cultural fieldwork see also Pasquini and Olaniyan 2004; Stevano and Deane 2019). Being able to communicate with the participants directly and not being dependent on translation, was an additional factor that did not only facilitate the preparation and organization of the research but also the research process itself. At the same time, my research was highly dependent on the willingness of the participants and research assistants to engage and interact with me and answer the multitude of questions, for which I am extremely thankful.

1.5.2 The Impact of the COVID-19 Pandemic on this Research

When the pandemic hit Europe in March 2022, I was just about to leave for a longer field research stay. Everything was prepared, the flights and hotels were booked, and I was looking forward to continuing the data collection, that I had started in 2019. Within days, it became clear, that I had to cancel my plans, and naively, one might say in retrospect, I was still hoping to just delay my field research by a month or two. In the end, it took me two years, until travel restrictions both in the research region and at the university allowed me to go into the field again. The traces of these limitations are visible in this work: Much of the initially planned data has not been collected in-presence in the field. At the same time, together with my colleagues, we explored the possibilities of virtual field research and embarked on thorough theoretical and conceptual discussions.

While other researchers had to put their research "on hold – indefinitely" (Fikrig 2020, p. 674), I was able to continue the empirical work to a certain (virtual) extent. Nevertheless, restrictions in access to the field due to limited internet availability in the research region and the bias of getting access to people in the field left some of the empirical data presented in this research open for validation during future field research. At the same time, the theoretical and conceptual elaborations benefited from deeper discussions and more time for elaboration with colleagues during the lockdown. Additional unplanned activities provided new insights as virtual communication efforts led to the de-hierarchization and intensification of communication with project partners and stakeholders. Lastly, the pandemic and the possibility to conduct virtual fieldwork served as grounds for the application of some theoretical and conceptual elaborations in an in-situ situation of crisis. The results can be read in chapter 7 of this thesis, where some insights on the transformative potentials of the COVID-19 pandemic in the MAP region are presented. In retrospect, I can say, that even though the pandemic crossed

1.6. STRUCTURE OF THIS THESIS

many of the plans I envisioned for my Ph.D. research, I was lucky in finding alternatives and getting an additional year of funding.

1.6 Structure of this Thesis

This thesis is structured along six journal articles, of which four have been published and two have been submitted to peer-reviewed journals. The author led five of the six publications and significantly contributed to the sixth publication.² The interdisciplinarity of the research which links theories and concepts from human geography, political sciences, sociology, and peace and conflict studies, is reflected in the variety of journals in which articles have been published. The chapter of this thesis build up on each other in terms of concepts and content but can also be read independently, as each chapter pursues an individual objective (see section 1.1).

Chapter two reviews the existing literature on the nexus of climate change, land use, and conflicts with a particular focus on its effects on human security. A distinction is made between primary interferences of climate change with human security, such as forest degradation for agricultural purposes, and secondary interferences for mitigation and adaptation, such as forest conservation measures. The chapter discusses the ambivalence of such measures which, while aiming to buffer the adverse effects of climate change, require land and hence indirectly increase the pressure on land as a resource.

Chapter three and four build up the theoretical and conceptual fundament for this dissertation. Chapter 3 zooms into social cohesion as a crucial system function of a society that exercises agency within the nexus of climate change, land use and conflict. First, the chapter presents a system's approach to social cohesion and a conceptual model of its constituents (shared identities, mutual trust, perceived equality). Second, the chapter integrates the model into a conceptual framework for SES research and in particular social-ecological tipping point analysis, using the example of land system change as a major social-ecological dynamic. The chapter closes with an illustration of the framework using the example of the MAP region.

Chapter four embeds the framework presented in chapter 3 into an interdisciplinary perspective by providing a framework, coined the 'tipping multiverse', to conceptualize potential tipping cascades in sub-systems of a regional social-ecological system. Specifically, these sub-systems comprise the soil ecosystem, the household livelihood system, the regional social system, and the regional climate system. The study first applies a global tipping points (TP) concept to a regional SES and second, systematically assesses the interactions and feedbacks within it. The framework is applied to the MAP region which is considered an example of other tropical regions.

Chapter five takes a first step in the analysis of resource governance and its impact on human security, highlighting the relevance of a 'glocal' perspective. Focusing on the most prominent four 'glocal' governance instruments in extractive industries, a political ecology lens is applied within this analysis of human security, to facilitate the investigation of power asymmetries across actors and scales. Examples from oil extraction in Kenya and Bolivia and artisanal and small-scale gold mining in Peru are presented to describe the role and actions of institutions in these realms and the local implication of 'glocal' resource governance.

Chapters six and seven present the results of the social-ecological conflict analysis. Chapter six starts with a transnational comparative analysis of social-ecological conflicts in and around three protected areas in the MAP region. First, the chapter describes the distinct characteristics of institutional governance structures in the three sub-national entities and their tensions with organized crime. Second, the chapter distills four main types of conflict drivers and analyses how these drivers are affected by formal, informal, and illegal institutions.

² Details are given in the section "Parts of this Thesis and Author Contributions" in the preamble of this thesis.

Chapter seven draws a comprehensive picture of the concepts and theoretical approaches used in the previous chapters, to analyze the impact of COVID-19 in the MAP region. The chapter depicts different impact pathways along the nexus of land use change, ecosystem services, human agency, conflict, and cooperation. COVID-19 is conceptualized as a major disturbance to the social-ecological system, revealing structural inequalities and accelerated trends of social fragmentation. The chapter analyses how different societies within similar environmental conditions cope with such sudden disturbance and particularly focuses on the role of civil society organizations and organized criminal networks.

Chapter eight closes with a summary of the key findings of the presented chapters and relates them to the major research question presented in chapter 1.1. Conclusions are drawn to inform further research and to provide policy recommendations to specific actors on local, regional and global scales.

2 | THE NEXUS OF CLIMATE CHANGE, LAND USE, AND CONFLICTS

2.1 Abstract

Purpose of Review: The aim of this paper is to explore the nexus of climate change, land use, and conflict. A particular focus is placed on the human security risks associated with the three elements.

Recent Findings: Climate change has been perceived as a threat multiplier, directly aggravating human security risks, such as food and water insecurity, as well as indirectly contributing to (violent) conflict in regions vulnerable to climate change. In addition to climate change-related environmental risks, such as droughts and floods, land and land use can be affected by climate mitigation and adaptation measures. These include, for instance, large-scale renewable energy plants and relocation efforts.

Summary: It is not only important for decision-makers to take climate change impacts into account but also to assess the indirect risks associated with climate change mitigation and adaptation measures. For further research, it is hence promising to explore how conflict-sensitive approaches to climate change adaptation and mitigation can be developed.

Keywords: climate change, conflict, land use, renewable energy, REDD+

2.2 Introduction

Climate change and resource scarcity are increasingly perceived as multipliers of risks and threats that exacerbate existing societal problems such as poverty, injustice, social insecurity, violence, terrorism, or civil war (Detges 2017; Ide et al. 2016; Scheffran et al. 2012b; Theisen 2017; WBGU 2008). As one of the most abundant, but also most contested resources, land and land use are subject to a variety of conflicts worldwide. In 2014, these security and conflict implications made it to the international policy agenda when the Intergovernmental Panel on Climate Change (IPCC), for the first time, included a chapter on human security in its fifth assessment report, and thus raising attention to the fact that climate change is undermining livelihoods of millions of people across the globe (Adger et al. 2014).

However, the pathways from climate change, resource access, and distribution to conflict are indirect, highly complex, and linked to other factors such as political, economic, and social conflicts, including ineffective institutions, social inequalities, or low economic development (Scheffran et al. 2012b). These pathways may have local or global origins in the form of changing temperature and rainfall patterns, causing extreme events such as floods and droughts, and more gradual change such as sea-level rise. However, land scarcity is not only induced through natural climate-driven phenomena, but also through anthropogenic interference which can be broadly distinguished in two categories: (1) primary interference, such as forest degradation for agricultural expansion, urbanization on formerly agricultural land, or

the competition for the use of urban space; and (2) secondary interference, such as large-scale renewable energy plants as mitigation of climate change or resettlement efforts as adaptation to climate change (Barnett and Chamberlain 2010). These measures aim at buffering the adverse effect of climate change in the region and making the local communities less vulnerable and more resilient to climate change (Boncour and Burson 2009). Many of the mitigation and adaptation measures, however, require land and thus indirectly increase the pressure on land as a resource.

The aim of this paper is to explore the current research of climate change and conflict in the context of the altered resource of land, taking into account both the direct effects of climate change on land and land use as well as the indirect effects that may be introduced through climate mitigation and adaptation measures. We first describe our understanding of the interlinkages between the direct and indirect risks through a conceptual framework before we go into more detail on the impacts of climate change, adaptation, and mitigation on land use and conflicts. Finally, we conclude with implications of the current research for conflict-sensitive approaches to climate change adaptation and mitigation measures.

2.3 Conceptual Framework

Key concepts that describe the pathways in research on climate change and conflict are vulnerability and resilience. While vulnerability encompasses a variety of concepts such as sensitivity and adaptive capacity, we apply the official IPCC definition of vulnerability – "the propensity or predisposition to be adversely affected" (IPCC 2014a, p. 128). Concomitantly, we define resilience as the "ability of a group or community to withstand, recover, and learn from external disturbances" (Schilling et al. 2017, p. 5). Another important concept that research on climate and conflict often draws on is environmental security (Homer-Dixon 1994). We define environmental security as the "absence of risk or threat to the environment a person or community depends on and lives in" (Vivekananda et al. 2014a, p. 490). While the securitization of climate change has been problematized (Selby and Hoffmann 2014), the benefits of a combination of the two concepts of resilience and environmental security have also been discussed recently (Schilling et al. 2017). In terms of anthropogenic responses to climate change, we draw on the commonly used distinction between adaptation, "the process of adjustment to actual or expected climate and its effects" (IPCC 2014a, p. 118), and mitigation, "human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs)" (IPCC 2014a, p. 125). In this paper, we cover both violent and non-violent conflicts. We understand conflict as a situation in which at least two actors (individuals, groups, states, etc.) perceive their goals, interests, beliefs, or actions as incompatible with each other. We speak of violent conflict when at least one of the conflict actors uses force to pursue its interest or to directly harm another conflict actor (Scheffran et al. 2012c). In this paper, we distinguish between two types of conflict. First, those that are directly related to the impacts of climate change (e.g., drought) and which mostly occur between or within communities, or between communities and the government. And second, conflicts that arise because of climate-related mitigation and adaptation measures, for instance, between project implementers, governments, and communities affected by the projects. 'Project' refers to the climate adaptation or mitigation measure such as a wind park or certification of a forest under Reducing Emissions from Deforestation and Forest Degradation (REDD+). While all conflicts discussed in this paper are connected to global/international and national levels, the focus of the conflict analysis is placed on the local level, where climate impacts are felt and projects are implemented (for the issue of scale see also Fig. 2.1 and Schilling et al. (2018b)).

Figure 2.1 shows the connections between climate change, including mitigation and adaptation measures and their impacts on land, human security, and response options. Human security is understood as the "condition where people and communities have the capacity to

2.3. CONCEPTUAL FRAMEWORK

manage stresses to their needs, rights, and values" (Barnett and Adger 2007, p. 640). We do not claim this figure to be complete. Nor do we want to suggest that the pathways from climate change to conflict or cooperation are apolitical. Indeed, history and institutions matter as political ecologists have rightly pointed out (see for instance Peluso and Watts (2001)). Global climate targets (currently 2°C) and mitigation and adaptation measures are discussed and defined by states under the lead of the United Nations Framework Convention on Climate Change secretariat (UNFCCC 2018). The land tenure system is usually set up by the national governments and implemented and enforced by government representatives at the local level. Land tenure includes land rights and rules to regulate the access to land, use of land, and protection of land against pollution and degradation, or as the FAO (2002, p. 47) summarizes it: "tenure systems determine who can use what resources for how long and under what conditions".

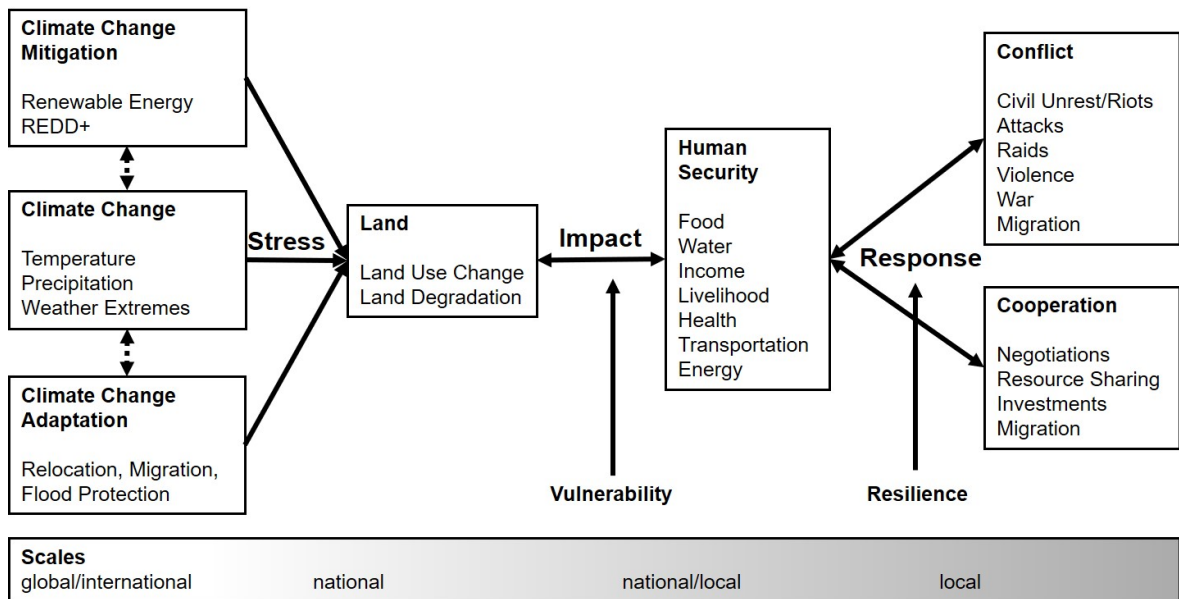


Figure 2.1: Conceptual framework of direct and indirect effects of climate change on resource availability and potential conflict and cooperation dynamics (modified from Scheffran et al. (2012c)).

The human security of people is both determined by how well a government provides for its people in terms of education, health, energy, and transport infrastructure, but it also depends on how well local communities sustain their livelihoods with limited support from the (central) government. Subsistence farming and nomadic pastoralism are just two examples. Particularly in the limited presence of government representation, informal institutions such as a council of elders or traditional chiefs matter in providing human security and determining whether a change in human security leads to cooperation or conflict (Scheffran et al. 2012a).

The purpose of Fig. 2.1 is not to deny the importance of institutions, but rather to illustrate the complexity of links within the nexus of climate change, land, and conflict. Pronounced changes in the climate system, such as alterations in temperature and precipitation, whether natural or anthropogenic, apply stress to land through a variety of complex interactions (e.g., through changes in availability of water, soil, or biodiversity) (for example Adger et al. (2014) and Scheffran et al. (2012b)). Subsequent drought, erosion, or other interactions may result in land degradation or forced changes in land use (for example, Ahmed et al. (2016) and Theisen et al. (2013)). Such changes influence the livelihoods of the population in various ways and may lead to conflict or cooperation processes. In this paper, we focus on illustrating potential conflict implications, as covering the links between climate change, land use, and cooperation would go beyond the scope of this paper. These links are particularly addressed

by the growing literature on environmental peacebuilding (see for instance Ide (2017) and Schilling et al. (2017)).

Recent research highlights that climate change affects the availability of land not only directly, but also indirectly through increased usage of land for mitigation and adaptation measures (Theisen 2017). Large-scale mitigation efforts, such as renewable energy power plants and REDD+ measures, play an increasing role for land use, particularly in developing countries (GWEC 2017; Sunderlin et al. 2018). When former communal land is acquired by the government or international investors to install large wind parks or concentrated solar power plants, the primary users of the land, may they be farmers, pastoralists, or indigenous people, are denied access to resources that sustain livelihoods and cultural identities (Barbier and Tesfaw 2012; Brannstrom et al. 2017). In a similar way, adaptation measures can affect land use and force land use change, for example, through relocation efforts or flood protection infrastructure. Relocation efforts include both voluntary and forced relocation as a consequence of mitigation or adaptation measures. For example, when people have to leave a forest in order to preserve it as a carbon sink under REDD+ or when people move away from coastal areas in anticipation of sea-level rise, floods, or storms (see section 2.4). Planned and organized relocation efforts are a key element of many disaster risk reduction (DRR) strategies (see, for example, Dikmen (2018) and King et al. (2014)).

Stress on land and the resulting land use change and land degradation can have adverse impacts on human security. Depending on the vulnerability of the community, land degradation, biodiversity loss, or land scarcity can undermine livelihoods and hence human security, e.g., when subsistence farmers lose land or pastoralists lose access to pasture and water points. These described impacts on human security and their interdependencies can, in turn, provoke human responses that affect the social system and aggravate existing social instabilities (Ide et al. 2016). These conflicts occur on subnational, national, or regional scales and may be non-violent or evolve into violent forms, such as riots, attacks, civil war, or forced migration, leading themselves to more social disruption and mistrust (Scheffran et al. 2012a).

2.4 Impacts of Climate Change on Land Use and Conflicts

Increasing temperatures, higher precipitation variability, weather extremes, or sea-level rise due to climate change are considered to affect human security through a variety of interconnections in the coming decades (Adger et al. 2014; Scheffran et al. 2012a). One of the interconnections is land use and land use change which are expected to be strongly influenced not only through the changing climatic conditions but also through human interference due to population growth, rapid urbanization, and consequent increasing pressure on ecosystem resources (Revi et al. 2014). Whether humans react cooperatively or with conflict to these dwindling resources is not easy to foresee and depends on different parameters, such as their vulnerability or resilience. In addition, links between climate and conflict are often indirect while human adaptive capacity to climate change is sensitive to conflict (Scheffran 2011).

Potential links between climate change and (violent) conflict have been discussed as early as 2003 by Barnett (2003), more concisely by Scheffran et al. (2012a) and most recently by Theisen (2017). While neo-Malthusian-simplified links between violent conflict and environmental deprivation, as drawn by Homer-Dixon (1994) or Bächler (1999), have been widely criticized, the community of researchers is divided on whether links between climate and conflict might be drawn or rejected (Ide et al. 2016). In Kenya, for example, several scholars have paid attention to violent livestock thefts (called 'raids') between different nomadic pastoral groups and their relation to changes in precipitation. While Witsenburg and Adano (2009) find a tripling of raids during the rainy season, which they explain with healthier stolen animals and less required attention for their own herds, Ember et al. (2012) find higher intensities of livestock raids during drier months and drought years as pastoralists have to migrate further

to find pasture and water and thus move closer to the territory of hostile groups, increasing the likelihood of violence. Schilling et al. (2014) and Raleigh and Kniveton (2012) argue that communal or rebel conflict events in several East African countries are influenced by a combination of resource scarcity and resource abundance, which are particularly sensitive to extreme rainfall variations. For Africa overall, the findings are ambivalent on whether climate change increases the risk of civil wars (Burke et al. 2009) or whether the climate "is not to blame" for such conflicts (Buhaug 2010, p. 1). While the former study argues that increasing temperatures aggravate the conflict risk for agricultural households and entire societies through negative effects on agricultural and economic productivity, the latter argues that the roots for conflict in Africa are not to be found in climate variability, but rather in the structural and contextual conditions, such as prevalent ethno-political exclusion, poor national economies, and the collapse of the Cold-War system. The latter findings are supported by Detges (2017), who warns against misinterpretation of ambiguous quantitative study links between climate and conflict. And while direct impacts of climate change on conflict remain unclear, it is recognized that pressure on land and water and subsequent food scarcity could escalate low-intensity conflicts (Benjaminsen and Bryceson 2012; Goulden and Few 2011; Uexkull 2014). Such conflicts over resources related to land, such as the degradation of forests or arable land (through, e.g., wind and water erosion), mining, or dam projects are predominantly local or regional and less likely to become international threats. The study by Detges (2017) finds that drought has little effect on short-term risks of violent conflict. However, he also highlights that the likelihood of sustained violence increases when drought is combined with unfavorable social and political conditions, such as political marginalization and poor citizen-government relations. These conditions favor the development of more radical attitudes or even violent interventions against the government.

2.5 Impacts of Climate Change Adaptation on Land Use and Conflicts

Adaptation to climate change is one of the responses to the increasing challenges that global environmental change imposes on human society. And while adaptation requires resources, not only in monetary terms but also in terms of knowledge, planning, and coordination, future vulnerability remains, among others, dependent on infrastructure investments, industrial strategic decisions, and rural and urban planning (Fankhauser 2017). Few attempts have been made from the socio-political perspective to understand the potentially problematic effects of climate change adaptation (Javeline 2014; Theisen 2017). This section gives some examples of adaptation measures that influence land use and describes their conflict implications in rural and urban areas.

2.5.1 Adaptation in Rural Areas

Among the few studies on adaptation impacts on land use is the paper by Fezzi et al. (2015) on Great Britain. The authors model how adaptation to climate change in agriculture is expected to affect aquatic ecosystems which could thus affect the availability of fresh water, wildlife, biodiversity, or carbon sequestration. A strong north-south divide is prevalent in the current agricultural system in Great Britain with more profitable areas in the drier southern lowlands than the wetter and colder highlands in the north. The results of the study point out that climate change will particularly benefit the northern and eastern midlands and uplands as higher temperatures will allow for higher livestock production and a larger share of arable land. However, the authors also highlight that the increased productivity of land comes along with a higher pressure on land, likely leading to emissions diffusing into rivers and thus increasing pressure on the environment as well as political pressure as it requires more effort

to fulfill national and international water-quality standards. On the other hand, the models also present a potential diminution of pressure on the environment in the southern lowlands as higher temperatures and precipitation rates may reduce the viability of agricultural land, reduce the nutrient input from agriculture, and thus facilitate the adherence of water-quality standards (Fezzi et al. 2015).

As described in the section on direct impact of climate change on land use and conflict, climate or environmental changes affect human security and human development. The related effects on land use and land rights have become drivers of migration in the Pacific (Bedford and Bedford 2010). Sea-level rise and concomitant loss of land are becoming a severe risk for low-lying small island states and hence entire nation states, reviving the often-called worst-case scenario of migration or resettlement as an adaptation option (Boncour and Burson 2009). Yet, although legal barriers for migration from many of the Pacific States to some other countries, mainly Australia and New Zealand, are small, it is rather expected that people would migrate internally to nearby islands that are located higher above sea level, due to cultural, spatial, and family proximity (Barnett and Chamberlain 2010). Nevertheless, increasing population density in the host communities may also implicate resource scarcity and a potential for conflicts between host communities and incoming migrants.

2.5.2 Adaptation in Urban Areas

The previously described examples were mainly focusing on rural environments. Yet, urban areas also require an integrated approach to climate change and land use. While access to urban land is a generally pressing concern in the Global South, Lombard and Rakodi (2016) highlight that conflicts over urban land are often mentioned but seldomly investigated in depth, until now. Such conflicts are often associated with urban growth, inequality, and regulatory failures of states (Lombard and Rakodi 2016) but increasingly also due to climate adaptation measures (Anguelovski et al. 2016). Anguelovski et al. (2016) address the lack of research in the nexus of climate adaptation and land use planning in cities by assessing whether such measures prioritize vulnerable and marginalized people in the cities or whether they recreate existing inequalities. The authors found that maladaptation under the umbrella of resilience and climate adaptation can even bear double disadvantages for marginalized and, often, poor people through (1) infrastructure investments, land use regulations, or new protected areas affecting the livelihoods or even displacing people; and (2) protection of economically valuable land over low-income neighborhoods.

Green spaces have been recognized as important and valuable adaptation measures, for example, to mitigate the impact of urban heat islands and steadily growing traffic, and improvement of air quality through the uptake of pollutants and reductions of energy costs for the cooling of buildings. Such measures also increase the demand for urban space (Gill et al. 2007; Govindarajulu 2014; Mathey et al. 2011). Additional pressure evolves through increasing property values in proximity to green spaces due to amenity and aesthetic reasons which may lead to gentrification of entire neighborhoods (Atkinson 2004; Haq 2011). Such developments, in the worst case, may even lead to forced relocation of disadvantaged people, who often informally inhabit land which becomes more valuable through urban growth and consequent land scarcity leading to community conflict (Atkinson 2004). In relation to green spaces, urban agriculture has been listed by the latest IPCC report as one climate change adaptation measure to increase food security and foster income generation and poverty alleviation (Revi et al. 2014), and thus foster the transformation into resilient cities (for example, Connelly and Bal (2016)). However, urban agriculture is highly dependent on the availability of land in urban environments. Badami and Ramankutty (2015) point out that urban agriculture is most feasible for the urban poor in high-income countries, where the availability of inexpensive and nutritious food tends to be high (see also Beaulac et al. (2009)). The authors see urban agriculture benefits in terms of the productive use of land that otherwise might have

been wasted, the greening of cities, and the social benefits of community building. On the other hand, Bryld (2003) highlights the importance of the legalization of urban agriculture for securing land for the urban poor in developing countries in order to enhance livelihoods and mitigate the risks for conflicts, due to theft of crops from other urban agricultural fields, for example Bryld (2003). While the author also discusses potential problems of urban agriculture, such as health hazards due to pesticides and wastewater irrigation and the risk of taking up of spaces for houses, he also refers to the potential benefits of food security, economic advantages, such as income generation, and ecological advantages, such as increased humidity, improvement of air quality, and nutrient recycling, which is again available for soils in the urban environment. Such co-benefits of secure land tenure for the urban poor mitigate the risk for conflicts arising from insecure land tenure. The above-mentioned studies and arguments show that policies focusing on land, water use, or public space require a high degree of integration across policy fields. However, current decision-making is still lacking approaches that take into account the wider implications of adaptation and seek to incorporate synergies and trade-offs.

2.6 Impacts of Climate Change Mitigation on Land Use and Conflicts

Many international mitigation strategies that aim to address the global challenge of climate change have very local effects. For example, when efforts to offset carbon through nature conservation force communities to leave their land, conflicts between them and the government can be the result (see Cavanagh and Benjaminsen (2014)). In this section, we focus exemplarily on two key mitigation strategies which feature strongly in the Paris Agreement and where land tenure is particularly important: (1) REDD+ to reduce emissions from conversion of forests and to increase carbon sinks through sustainable forest management, and (2) renewable energies, with a focus on large-scale wind power plants, to phase out fossil fuels.

2.6.1 Conflict Implications of REDD+ Initiatives

Reducing Emissions from Deforestation and Forest Degradation (REDD+) aims to create conditional, performance-based incentives for conservation and sustainable management of forests (REDD) and for enhancement of forest carbon stocks (the '+'). Since the climate negotiations in 2007 (COP 13) and the Bali Action Plan (UNFCCC 2007), REDD+ has been considered the leading option for climate change mitigation in the forest sector, which was planned to be initially publicly funded but was soon expedited through forest carbon offsets. Due to the failure of global carbon markets, the expected growth of REDD+ measures through private funding has failed to materialize (Brockhaus et al. 2014; Enrici and Hubacek 2016). However, through the Paris Agreement, the forest sector gained new attention as many developing countries have considered REDD+ as a substantial mitigation measure in their National Determined Contributions (NDCs) (Hein et al. 2018). While the recognition of the importance of the forest and its mitigation potential in the global climate system is certainly positive, critiques and fears of emerging conflicts have already been formulated early in the process. Land tenure is one of the most important topics in the REDD+ discourse. However, increased tenure security for local communities resulting from REDD+ initiatives has only been observed to a small extent, while the loss of forest access, for example, has often been reported (Caron and Fenner 2017; Sunderlin et al. 2018). This section gives an overview of the negative externalities and the conflict implication of REDD+ initiatives focusing on land tenure and the use of the forest.

Negative Externalities

Right after the adoption of the Bali Action Plan in 2007 (UNFCCC 2007), the International Indigenous Peoples Forum on Climate Change (IIPFCC) very clearly stated their critique on the program, saying that "REDD+ [...] will increase the violation of our human rights, our rights to our lands, territories and resources, steal our land, cause forced evictions, prevent access and threaten indigenous agricultural practices, destroy biodiversity and cultural diversity and cause social conflicts. Under REDD/REDD+, states and carbon traders will take more control over our forests". This statement stressed the environmental, institutional, socio-cultural, and livelihood dimension that Bayrak and Marafa (2016) identified 10 years later as the key dimensions through which REDD+ initiatives impact forest-dependent communities. All these dimensions are interrelated and bear a risk for conflicts between project implementers and local communities, for instance, when they are not allowed to use the forest to sustain their livelihoods and cultural identity. In the worst case, the commercialization of forest can displace entire communities (Khatri et al. 2018; Leach 2015). Forest governance schemes, such as REDD+, often try to address these interconnected dimensions in order to increase the sustainability of the forest management (Bayrak and Marafa 2016). However, REDD+ initiatives are mostly based on a technical approach that focuses on the distribution of benefits rather than choosing a political lens that uses justice, legitimacy, and community rights as key principals (Myers et al. 2018). As forests in many countries are state-owned, forest-dependent communities and their traditional rights to use the forest are often neglected in governmental land use and forest management (Bayrak and Marafa 2016; Khatri et al. 2018; Nepstad et al. 2013).

Conflict Implications of REDD+ in Low- and Middle-income Countries

Various studies have shown that REDD+ initiatives require secure forest and carbon tenure to successfully advance forest conservation and strengthen livelihoods (Asare et al. 2013; Duchelle et al. 2014b). However, REDD+ initiatives are often challenged by conflicting and unclear land tenure (see examples in Leach (2015)). Therefore, REDD+ initiatives often aim at improving tenure security. Sunderlin et al. (2018) investigated tenure efforts in five different countries (Brazil, Peru, Tanzania, Cameroon, and Indonesia) and their success in decreasing tenure insecurity. The authors found that REDD+ initiatives had limited impact on the improvement of tenure security, but where an impact was identified, it was positive. In contrast, Caron and Fenner (2017) have found decreased or even loss of communal access to forests as a consequence of REDD+ projects in eastern Zambia. In most cases, the reduced accessibility for communities was driven by reallocation of land and conservation-related restrictions. Caron and Fenner (2017) identify three main decision-makers for forest governance: customary authorities, the state, and the private sector. While the customary authorities play a significant role in deciding on forest rules and controlling access, communities reported that their access to forests were mainly limited by restrictions and the presence of state authorities. At the same time, village leaders named land purchase and leases and subsequently imposed restrictions through the private sector as the main reason for lost forest access. The loss of communal access to forests has caused two conflict dynamics. First, between the communities whose livelihoods are based on the forest and the central government who aims to implement the REDD+ project. The conflict has escalated into violence in the form of arrests, beatings, and imprisonment of community members. As a consequence, women in particular avoid the forests, as they fear punishment, imprisonment, and being separated from their families (Caron and Fenner 2017). The second conflict occurs between local chiefs and community members when the local chiefs are perceived by the communities as prioritizing interest of the private sector over those of the community. In the Zambian case, a chief reallocated a piece of customary land to lodge owners (Caron and Fenner 2017).

Myers et al. (2018) found that conflicts are more likely where unclear land tenure is prevalent. The authors identified contested boundaries and resources for agriculture and forests between two communities of which one claimed forest land for REDD+ which the other village previously used for agricultural purposes. In Vietnam, they also found communities who united against REDD+ initiatives from the state or against a company due to deforested rubber plantations (Myers et al. 2018). Many REDD+ initiatives have also experienced objection and protest, often because the local communities felt excluded from strategic planning and decision processes (Myers et al. 2018). Therefore, several studies have identified a need for participation of local communities, bottom-up approaches, and grassroots activities (Rodriguez-Ward et al. 2018; Wallbott and Florian-Rivero 2018). However, participatory approaches need a careful design in order to fulfill the expectations that are imposed upon them, as it has been described by Benjaminsen (2014). The author investigates the "village-project" relationship during a participatory pre-REDD process in Zanzibar, in which the villagers aim to have "lost land" and "disappearing benefits" taken into consideration by taking part in the negotiation process. However, the influence on the project fell short of expectations of the villagers due to the ahistorical and apolitical approach of the project developers, forcing them into resistance and marginalizing them in the negotiation process rather than letting them participate in shaping the local dynamics of external environmental interventions, such as REDD+, which are following a global agenda.

The above-described examples illustrate the four main conflict constellations that we identify in the REDD+ literature: (1) state-community conflicts, (2) private sector-community conflicts, (3) inter-community conflicts, and (4) intra-community conflicts.

2.6.2 Conflict Implications of Large-scale Wind Power Plants

Most scientists and decision-makers agree that a global transition from fossil fuel-based energy to renewable energy is necessary to mitigate climate change and keep the global mean temperature below the target of 2°C (for example, Karydis (2013) and Wiser et al. (2011)). Wind energy in particular plays an important role here. In 2017, renewable energies had an installed capacity of 1081 gigawatts (GW), of which wind energy accounted for more than 50% (REN21 2018). Projections suggest that the currently installed wind energy capacity of 487 GW will increase to 817 GW by 2021 (GWEC 2017). While this is certainly a positive development in terms of mitigating climate change, it is often neglected that wind parks require land and produce both benefits and negative externalities, which in turn can become a source of conflict. Using the example of wind parks and their implications on land use and conflicts, we show how developments at the global and international level, namely the target to limit global warming, affect the national level, such as expansion of renewable energy and dynamics at the local level. This section gives an overview of the conflict implications of wind parks with a particular focus on land and land use (see also Fig. 2.1). At the local level, the concept of 'not in my backyard' (NIMBY) has been widely used to explain resistance against and conflicts around wind parks in developed countries. It essentially means that people are not generally opposing a wind park or any other facility, but that they do not want to have it in their surroundings (Schively 2007; Schwenkenbecher 2017). More recently, the concept of NIMBY has been criticized for its limited explanatory power, for being "short-sighted" (Petrova 2013, p. 591) and for stereotyping local residents (e.g., Petrova (2016), Rand and Hoen (2017), and Wolsink (2007)). For this review, we first describe the negative externalities, and then briefly discuss their conflict implications.

Negative Externalities

A key negative externality that objectors stress in developed countries is the negative aesthetic effect on the "place attachment" or "place identity" (e.g., Devine-Wright (2011, p. 336)). Sev-

eral researchers have argued that the more strongly people feel attached to their landscape, "viewscape" (Burcher 2005, p. 1) or "seascape" (in the case of offshore wind parks, see Karydis (2013, p. 581)), the more likely they are to oppose wind parks because of aesthetic reasons Devine-Wright and Howes (2010). Similarly, communities may fear a loss of cultural landscape and national heritage (Becker et al. 2016; Reusswig et al. 2016; Wolsink 2007). A conflict between local residents and wind park developers over the landscape and land use can be the result (see, for example, Rand and Hoen (2017) and Zografos and Martinez-Alier (2009)). Hirsh and Sovacool (2013, p. 706) have further argued for the USA that "the siting of turbines on rural mountaintops intensifies the already existing conflict between rural landowners and urban customers. Psychologically and symbolically, the turbines sometimes suggest an industrialization of rural residents' environment and the values they perceive as different from those of city folk" (see also Zografos and Martinez-Alier (2009)). In addition to identifying the rural-urban conflict constellation, Hirsh and Sovacool (2013, p. 707) point out that wind parks create a general conflict potential as they make energy production visible and change the common image of energy as an "unseen and unthought-of commodity". Similarly, Ellis et al. (2007) have argued that some local residents oppose an offshore wind park proposal in Northern Ireland because of the anticipated negative visual impacts on the (tourism) economy and the aesthetic value of the landscape. The authors identify a conflict constellation between objectors and supporters of the wind park in which the objectors see the supporters as "being self-righteous" while the objectors are perceived by supporters as "self-interested, overly defensive and dogmatic" (Ellis et al. 2007, p. 537). Here, the different scales, noted in Fig. 2.1, play a role. While the objectors mostly argue on a local level ("our place/surrounding") and partly on a national level ("national heritage"), the supporters of wind parks mostly stress the importance of the national (achieving national climate targets and "doing our part") and particularly the global ("fighting global warming") level. Another externality and source of conflict associated with wind parks in developed countries is the environmental impact, specifically avian mortality. Estimates for the USA suggest that between 140,000 and 328,000 birds are killed annually by wind turbines (Rand and Hoen 2017). In Germany, about 250,000 bats are killed annually due to accidents with wind turbines (Voigt et al. 2015). Further, migratory routes of bats can be disrupted by wind power facilities (Voigt et al. 2015). These numbers motivate environmentally concerned people and environmental organizations to oppose and protest against the use of land for wind parks (Abbott 2010; Aitken et al. 2008). Similar developments can be found for offshore wind parks (e.g., Ellis et al. (2007)). Further direct negative externalities of wind parks for local residents may include health risks and a perceived reduction of quality of life because of noise emissions and shadow flicker caused by the rotor blades (e.g., Ellis et al. (2007), Schwenkenbecher (2017), and Weber et al. (2017)). Physical danger can arise during the winter when icicles fall down from turbines (Karydis 2013). Concerns for a devaluation of land and decreasing property prices tend to rank higher in public opinion polls in developed countries (Firestone and Kempton 2007; Jimenez 2011), see also (Hamilton et al. 2018; Hoen et al. 2015).

Studies show that wind parks in developed countries do not only have negative externalities but also socioeconomic benefits in terms of land rents or sales, and employment and business opportunities (Aitken et al. 2008; Ellis et al. 2007; Rand and Hoen 2017). However, the distribution of these benefits can become a source of conflict between neighboring communities or within one. For example, while parts of a community may benefit in terms of land rents or sales or because they are part of an energy cooperative, other parts may not benefit and hence only focus on the negative externalities of the wind park (Baxter et al. 2013; Reusswig et al. 2016).

Conflict Implications of Wind Energy in Low- to Middle-income Countries

All previously discussed studies have focused on developed countries where, so far, the majority of wind energy is produced (REN21 2018). However, in the future, it is expected that the installation of wind energy will grow faster in low- to middle-income countries (Sunderlin et al. 2018; Wisner et al. 2011). The body of literature on conflict implications of wind parks in developing countries is growing but still limited. Since the socioeconomic and political context in most developing countries is so significantly different than in developed countries, the causes, mechanisms, intensities, and overall complexities of conflict over wind energy in developing countries are likely to be very different as well. One should hence be careful when applying lessons learned in developed countries to wind energy conflicts in low- and middle-income countries.

Among the few studies on wind energy in middle-income countries is the paper by Brannstrom et al. (2017) on Brazil. The authors find that the wind park, which is partly located on dunes and mangroves at the north-eastern coast of Brazil, does not only reduce environmental security by producing negative environmental externalities but also erodes livelihoods of traditional communities, threatens human security, and leads to territorial and resource-access conflicts. For example, during the construction phase, a large inter-dune freshwater lake was destroyed. Before, the lake had been used by the local communities as a source of fish and for leisure purposes. In addition, community members reported to be highly disappointed with the promises made by the wind park developers in terms of local employment and local economic effects (Brannstrom et al. 2017).

Disappointed community expectations for employment are also drivers of (partly) violent conflicts between local community members and the wind energy company in northern Kenya, where the largest wind park on the African continent has been completed in mid-2017 (LTWP 2017). There, local community members, who were hoping for jobs with the wind park operator, protested against people from other communities being employed, and blocked the road to the wind park (Schilling et al. 2018a). These communities, who lived in proximity to the wind park, were already frustrated by the processes, as they were forced to move but not officially compensated, as they claimed (Danwatch 2016). Since the community did not hold any official land titles, the financial incentives in the form of land rents, as seen in wind park projects in developed countries, are not claimable by the communities. Here, one can see how land tenure systems at the national level differ between developed and developing countries and the systems have, hence, different implications for the local level, where people either benefit from land rights and compensations or not (see also Fig. 2.1).

These two examples from Brazil and Kenya further show that because the level of income is generally lower in medium-developed and medium-developing countries, the expectations for financial and employment benefits tend to be higher than in developed countries. Disappointing these expectations can then become a source of potentially violent resistance, depending on the previous level of conflict in the area. In Brazil and Kenya, a top-down approach was chosen with little to no opportunity for local communities to participate in the siting of the wind park nor in further distributional processes. In Canada, this "decide-announce-defend" (Hein et al. 2018, p. 103) approach has shown to be highly conflictive and similar developments can be expected in developing countries. Differences between developing and developed countries exist in terms of land rights and (absence of) environmental regulation that generally tends to be in favor of wind park developers rather than communities in developing countries. Protecting the rights of local communities and managing their expectations for benefits will hence be important for mitigating conflict associated with wind parks in developing countries. Further, several authors have argued that the siting process is critical. "A collaborative style in siting" is found to be "more effective than top-down planning" (Caron and Fenner 2017, p. 103), see also (Aitken et al. 2008; Karydis 2013). This is supported by several studies that suggest that opposition to wind parks in developed countries is strongest at the planning stage

and weaker once the wind park is complete and operational (e.g., Karydis (2013) and Wolsink (2007)). However, Petrova (2013, p. 589) suggests that "it is possible for initial opposition to turn into support, and vice versa". In general, the existence of trusted and neutral bodies providing unbiased information on the project, transparent communication, and the possibility for local communities to participate and influence the project tend to reduce local opposition and the risk of conflict (Devine-Wright and Howes 2010; Petrova 2016; Rand and Hoen 2017; Shaw et al. 2015). In developing countries, the social contract between the central government and communities in remote and marginalized rural communities (where wind parks tend to be constructed) is often already weak. If the communities feel that they are mostly exposed to the externalities of the wind park without benefitting in terms of employment and development, wind parks can further undermine the trust in the government that is perceived as unable or unwilling to protect the community's social and ecological values (Schilling et al. 2018a; Shaw et al. 2015).

2.7 Conclusion

With this paper, we review the nexus of climate change, land use, and conflict in both direct effects of climate change on land use and conflicts as well as indirect implications through mitigation and adaptation efforts. We find an extensive body of literature on direct effects, for example, drought-related land use conflicts, with diverging opinions on whether global warming increases the risk for conflicts or not. We further identify research gaps in detailed investigations on the indirect land use and conflict implications of climate mitigation and adaptation measures. Initiatives supporting these measures draw on leading policy developments such as the Paris Agreement and concomitant available financing to take action but often lack the recognition of the negative externalities and conflict implications of adaptation and mitigation measures. Therefore, we join other authors in warning against adaptation and mitigation measures like the expansion of wind energy and REDD+ to become "green grabbing" (Benjaminsen and Bryceson 2012, p. 335) or "conservation fad" (Lund et al. 2017, p. 124) that reproduce historically grown and existing inequalities (see also Myers et al. (2018)). Further research should hence focus on developing conflict-sensitive approaches to climate mitigation and adaptation measures (Caron and Fenner (2017) make a similar call for more community inclusion), and thus include these conflicts into the climate governance debate. Conflict sensitivity implies analyzing the local context and avoiding the creation of greed and grievances that may become a source of conflict. The concept further implies to be sensitive to existing conflict dynamics and to evaluate how the proposed project affects these. This goes beyond the do-no-harm principle in safeguarding against, for example, violation of human rights and land rights, but it means to conduct a comprehensive analysis of the potential impacts of the proposed project (for conflict sensitivity and assessments, see for instance International Alert (2010), International Alert and Engineers Against Poverty (2006), Schilling et al. (2018b), and Vivekananda et al. (2014b)). Failure to apply a conflict-sensitive approach increases the risk that climate change mitigation and adaptation measures aggravate or create local conflicts.

3 | A CONCEPTUAL MODEL FOR ANALYZING SOCIAL COHESION IN A REGIONAL SOCIAL-ECOLOGICAL SYSTEM

3.1 Abstract

Communities that invest in social cohesion are better able to cope with crisis situations, shows current research on the Covid-19 pandemic. However, research is still at the beginning in understanding the role that social cohesion plays in coping with multiple social-ecological crisis, such as climate change or biodiversity loss. Particularly, more clarity is needed with respect to the role of social cohesion in regional social-ecological systems (SES) and its relation to social tipping points. Therefore, this paper combines research on social cohesion with research on social-ecological systems and shows the benefits of a combination of these currently quite separated research strands. While a growing body of literature focuses on SES, we still lack a systematic analysis of specific functions within social sub-systems and their relations to overarching SES processes. To address this research gap, the article first develops a conceptual model of social cohesion (comprising shared identities, mutual trust and perceived equalities) that approaches social cohesion from a system's perspective. Second, the article develops a conceptual framework to show how the model can be integrated into analysis of SES using the example of land system change as a major social-ecological dynamic. Such a systemic approach strengthens the analysis of social functions within SES and could thus further guide future research on the interconnections of local social cohesion dynamics and land system change.

Keywords: Amazonia, conceptual model, land system change, social cohesion, social tipping points

3.2 Introduction

Social-ecological systems (SES) describe complex societal interactions with their environments (Reyers et al. 2018). Their components can be understood as interconnected environmental, economic and social (including cultural and political) sub-systems (Folke 2006). One major SES is the Earth SES, which has sustained global human wellbeing throughout the Holocene. However, its sustaining functions are being put under stress by human activities and their consequences, such as climate change and the loss of biodiversity and ecosystem services (Dearing et al. 2014; IPBES 2019; IPCC 2014b; Lenton 2013). These dynamics increase the risk of trespassing thresholds of life-sustaining functions, potentially leading towards the crossing of a tipping point. A tipping point in the Earth SES is defined as "the point [in the

state of a system (tipping element)], in which a small perturbation can cause a qualitative change in the future state of a system" (Lenton 2013, p. 2).

While the current scientific discourse about tipping points in the Earth System has mostly focused on climate and ecological tipping points, the focus only recently shifted towards social tipping points (e.g., Otto et al. 2020). Consequently, we still lack systematic analysis of specific functions within social sub-systems and their relation to overarching SES processes (Milkoreit et al. 2018) that potentially lead to social tipping points. Social cohesion has been identified by the literature as one particular characteristic of a social system (e.g., Parsons 1991; Taylor and Davis 2018) and is therefore considered in the following as a crucial system function. The aim of this paper is to approach and better understand social cohesion from a SES perspective in order to analyze its role in coping with multiple social-ecological crises. My definition of social cohesion is oriented along Schiefer and van der Noll (2017, p. 592), who define social cohesion as "a descriptive attribute of a collective, indicating the quality of collective togetherness". To make this rather broad definition operational for an SES perspective, I advance this definition by selecting three constituents – shared identities, mutual trust and perceived equalities – which have been widely discussed in the social cohesion literature (Bernard 1999; Chan et al. 2006; Dickes et al. 2014; Dragolov et al. 2016a; Green et al. 2009).

To approach social cohesion from an SES perspective, this paper follows a two-step approach: First, I develop a conceptual model of social cohesion (SCCM) that approaches social cohesion from a system's perspective. Such a systemic approach has not been developed yet, though it might facilitate the integration of social dynamics into SES analysis. Second, I develop a conceptual framework to show how such an integration can be applied, using regional land system change as one example of a key SES dynamic for crises, such as climate change, biodiversity loss or soil degradation. The framework aims at bridging the SCCM with current research on land system change in SES and could guide future research on interconnections between local social cohesion dynamics and land system change. I use the term land system change according to Turner et al. (2021a) to equally value land systems that are not of use from a neoliberal perspective – used for the extraction of resources – but of intrinsic value due to their existence and cultural embedment as, for example, a source of identity. In addition, Verburg et al. (2019) supports the terminology of land system change from a modelling perspective to combine the terms and meanings used under land use change and land cover change.

As an illustrative example, I have chosen the Southwestern Amazon, due to its similar constitutive ecological but different social systems. The empirical data that forms the basis for this illustration as been obtained during field research in the southwestern Amazon and continued as virtual field research during the COVID-19 pandemic. I am presenting this data as illustration and not as full empirical study, as the empirical data is somewhat biased, since field research in 2020 and 2021 was only possible with people who had internet access. While the empirical research, obtained in times of travel restrictions, needs further validation, I would like to point to the value of empirical illustration for the presented SCCM and the conceptual framework.

The paper is structured as follows: In Section 3.3, I describe the SCCM. Section 3.4 presents a conceptual framework in which the SCCM can be integrated to better understand the nexus of social cohesion and land system change. Section 3.5 illustrates the conceptual framework with examples from the Southwestern Amazon and indicates entry points for the application of the SCCM. Finally, Section 3.6 summarizes the most important contributions of the SCCM to scholarship on social tipping points within SES.

3.3 The Social Cohesion Conceptual Model (SCCM)

3.3.1 Methods

The SCCM is based on a literature review on social cohesion, particularly focusing on inter-group and group-state levels of social cohesion. I therefore focus on social cohesion between different actor groups and between actor groups and the state. Personal and intra-group levels of interaction are not considered since these dynamics are distinctly different from inter-group dynamics (Bottoni 2018). The literature review was guided by the following four questions:

- (a) Which definitions of social cohesion exist and which are most applicable within a SES framework?
- (b) Which phenomena and defining variables of social cohesion have been identified in the literature?
- (c) Which drivers and potential feedback mechanisms determine the state of social cohesion according to the literature?
- (d) Which indicators are suitable for analyzing social cohesion and its constituents?

The outcome to Question a) leads to a suitable definition of social cohesion for this paper. The answers to Question b) inform the specific structure of the SCCM. The outcomes from Questions c) and d) are presented in a table indicating the identified phenomena, the sub-systems in which they occur and their defining variables, drivers, feedback mechanisms and potential indicators. These results are then transferred to a scale diagram depicting drivers of social cohesion that operate on different scales (Bottoni 2018).

3.3.2 The Social Sub-System

I aggregate political, cultural and societal dynamics under the term 'social sub-system' since the agents of these diverse dynamics are always human. However, I distinguish the economic system from this social system because humans are actors but not necessarily agents (in the sense of exercising authority) of economic systems (for more detail on the distinction of actors and agents, see Betsill et al. (2020)). In addition, Schöenberg (2019) gives a useful example of actors as pinball of global governance. Following system's thinking by Meadows (2008), I approach the social sub-system through system properties. These comprise agents, interconnections and a function (see Tab. 3.1). The systematization as in Tab. 3.1

Table 3.1: Systematization of social system properties along agents, interconnections and functions (own elaboration based on Meadows (2008)).

Agents	Interconnections	Crucial function
humans, institutions	social networks	social cohesion

facilitates the identification and analysis of the system's structures (interconnections) and behaviors (functions) and can be applied to different sub-systems of the SES. Hence, this approach creates a useful frame for analyzing interconnections that span several sub-systems of a SES, such as land system change. An integrated conceptualization that considers other sub-systems of the SES is beyond the scope of this paper and is covered elsewhere. Here, I focus on conceptualizing the social system. 'Function' here refers to the dynamic aspect of the social system, which are the social processes that ensure the stability of the system's structures (Parsons 1991). 'Crucial system function' here means the main property of the system, which, when put under stress, significantly alters the state of the system (Lenton 2013). The crucial

social function (social cohesion) controls action processes in the system (human agency) and vice versa. Following Parsons (1991) structural-functional theory, when the structure of the system is known, functional analyses can indicate functional (life-sustaining) or dysfunctional (detrimental) actions. Thus, actions are not considered in isolation but within the structural context of their respective system (social system).

3.3.3 A System Perspective on Social Cohesion

Social cohesion, its constituents and involved processes have been widely discussed in the academic literature (Acket et al. 2011; Beauvais and Jenson 2002; Bernard 1999; Bottoni 2018; Chan et al. 2006; Dickes and Valentova 2013; Dragolov et al. 2016b; Fonseca et al. 2019; Friedkin 2004; Green et al. 2009; Schiefer and van der Noll 2017). It has also been popular in political discourse, particularly in the European Union, Canada and the OECD (Acket et al. 2011; Club de Madrid 2009; Dickes and Valentova 2013; Jeannotte 2000); more recently also in Africa (Langer et al. 2017) and Latin America (Andrade 2020; Arriagada 2010; Martínez-Martínez et al. 2021). Within these discourses, various theoretical approaches to social cohesion are prevalent, some focusing on social bonding, others focusing on cultural norm adherence (Friedkin 2004; Taylor and Davis 2018) – for a more comprehensive literature review, see Bernard (1999), Chan et al. (2006), Fonseca et al. (2019), and Schiefer and van der Noll (2017). Besides the definition by Schiefer and van der Noll (2017), I recall Langer et al. (2017) and Acket et al. (2011), who highlight the importance of perception in contrast to objective measurements. Thus, I explore social cohesion as the crucial system function by elaborating three of its major constituents: shared identities, mutual trust and perceived equalities (see Fig. 3.1). To reduce complexity and better illustrate the interlinkages, I selected two key phenomena per constituent deemed relevant by the literature for social cohesion; I excluded many other phenomena so as not to overload the SCCM.

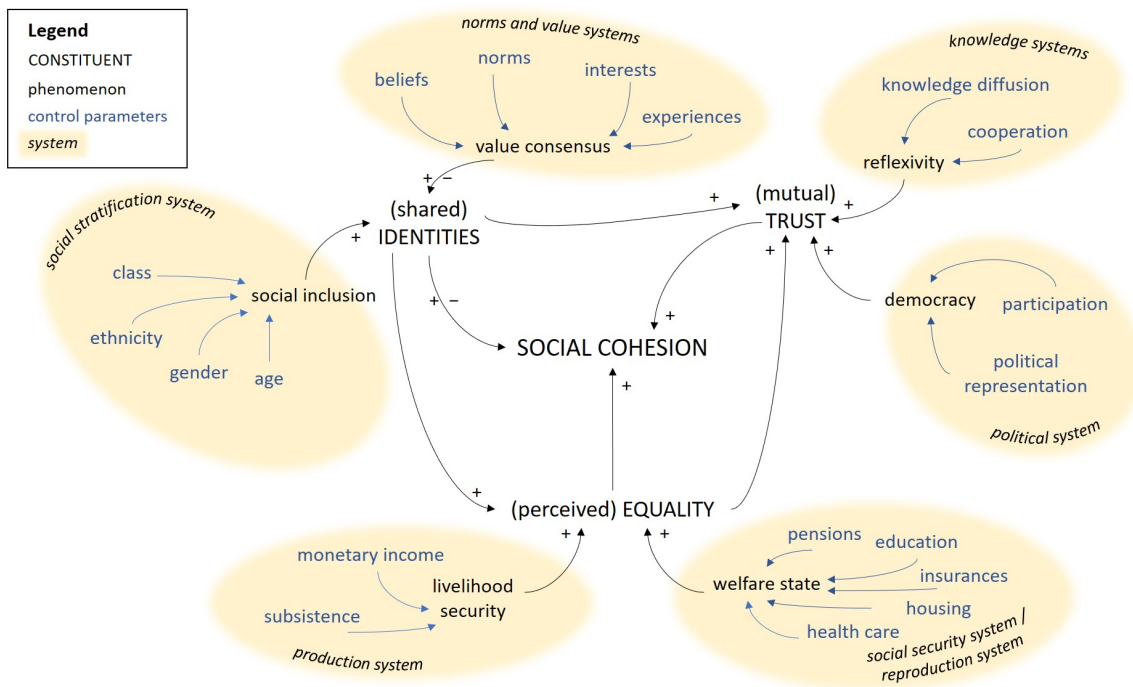


Figure 3.1: Social cohesion conceptual model (SCCM) with constituents of social cohesion (upper-case), phenomena (lower-case, black), control parameters (blue) and respective social sub-system (highlighted in yellow); '+' and '-' respectively indicate increasing or decreasing dynamics (own elaboration).

Table 3.2: Summary of social cohesion constituents, respective phenomena, sub-systems, control parameters, drivers, indicators and coupled feedback mechanisms. Lower-case letters (a–o) and numbers (1–7) refer to the process diagram (Fig. 3.2) (own elaboration).

Constituent (I)	Phenomenon (II)	Sub-system (III)	Control Parameter(s) (IV)	Drivers (of control parameters) (V)	Indicator (of impact) on SC (VI)	Feedbacks / Coupling ('→' – coupling with other control parameter) (VII)	Rule (VIII)
(shared) IDENTITIES	Value consensus	Norms and values system	Beliefs, norms, interests, experiences	(Lack of) commitment to general values (a), compliance with expectations of others (b), impunity	Non-adherence to norms, presence of violence/crime/assassinations	Normalization of non-adherence, group pressure, fear (victim) of reporting crimes leading to increase in impunity and less fear (perpetrator) of being reported (→ subsistence, monetary income)	Only those actually sharing societal power need to develop consistent societal values (Mann 1970)
	Social inclusion	Social stratification system	Class, ethnicity, gender, age	Migration (acculturation/alienation) (c), income distribution (d), access to public policies (e), demographic dynamics (f)	Rate of access to public policies, number of public policies directed at marginalized groups, solidarity action, riots, rates of racist and xenophobic action, suicides, internet access, migration rates	Repeated marginalization due to intergenerational inaccessibility of public policies (→ monetary income, housing, health care, education, pensions, insurance, agency/political representation and knowledge diffusion)	"Winner takes all"
(perceived) EQUALITY	Livelihood security	Production system	Subsistence, monetary income	Supply/harvest/extractive activities (g), demand (h), employment (i), spreading technologies (j)	Diversity of income sources, poverty rate, employment rate (of young people), number of producers, amount of additional income sources, family organization	Unemployment or reduced harvest leading to exploration of alternative income sources (→ norms, interests)	Those who have experienced a favorable lifestyle are less likely to turn back to their former lifestyles (Hoelle 2015)
	Welfare state	Social security system, Reproduction System	Housing, health care, education, pensions, insurance	Public policy (1), demographic dynamics (f)	Life satisfaction, happiness, infant mortality, life expectancy	Repeated marginalization due to intergenerational accessibility of public policy (→ monetary income, agency/political representation and knowledge diffusion)	Downward spiral of poverty (Bradshaw 2007)

Constituent (I)	Phenomenon (II)	Sub-system (III)	Control Parameter(s) (IV)	Drivers (of control parameters) (V)	Indicator (of impact) on SC (VI)	Feedbacks / Coupling ('→' – coupling with other control parameter) (VII)	Rule (VIII)
(mutual) TRUST	Democracy (social organization)	Political system	Participation, political representation	Political efficacy (2), capabilities/power (k), options/actions (l), (dis)enchantment with policies (m), corruption (3), law enforcement (4)	Political and civic participation (voting participation), coalition formation, adequate representation of people and their interests	Nepotism repeatedly leading to one-sided representation, frustration with current public system leading to poor voting participation and consequent poor representation of interests and further frustration (→ knowledge diffusion, norms, beliefs, interests)	Those with the most powerful networks gain more power, trust in state institutions is not based on state-structures but on specific people/contacts (Schönenberg 2002)
	Reflexivity	Knowledge system	Knowledge diffusion, cooperation	Institutional (social) learning (n), institutional (political) learning (5), loss of local knowledge (o), adaptive land system reforms/planning (6), global governance mechanisms (7), spreading technologies (j)	Participation in global governance forums, rate and speed of translation of global norms into local policies, interactions between state and non-state actors, integration and revitalization of local knowledge, use of new technologies (including knowledge-building to use them)	Institutional (both social and political) learning leading to adaptive management of changing environmental conditions, lack of knowledge diffusion leading to path dependencies (→ agency, political representation, subsistence economy, beliefs, norms, interests, experiences)	The more reflexive the institution, the better anticipation of future changes and preparation for them (Dryzek 2016)

3.4. THE NEXUS OF SOCIAL COHESION AND LAND SYSTEM CHANGE IN SES

Column I-IV in Tab. 3.2 summarize and systematize the constituents (column I) of the SCCM from Fig. 3.1, as well as the related phenomena (column II), the respective sub-systems (column III) and control parameters (column IV). Each selected key phenomenon is part of a different sub-system of the social system: 'value consensus' (norms and value system) and 'social inclusion' (social stratification system) are the most relevant phenomena for shared identities; democracy (political system) and reflexive institutions (knowledge system) are the most relevant phenomena for mutual trust; livelihood security (production system) and the welfare state (social security system / reproduction system) are most relevant phenomena for perceived equalities. Each phenomenon is controlled by specific parameters (marked in blue).

The quality of the system structures is impacted by drivers (column V) which produce characteristic behaviors of the control parameters within the social sub-system and consequent decreasing or increasing shared identities, mutual trust and perceived equalities. Indicators (column VI) can be useful proxies of social functioning by describing and connecting the dynamics of drivers, control parameters, phenomena and their impact on social cohesion as the crucial system function. While indicators are formulated wide-ranging here, region-specific indicators can be integrated into the framework, allowing for the uptake of contextual historically-situated properties, such as power imbalances between different actors, or cultural particularities such as particular income sources. The indicators describe coupled processes and feedbacks (column VII) which give information about the rules (column VIII) according to which the system functions.

3.3.4 The Significance of Scales in the SCCM

The drivers mentioned in Tab. 3.2 include processes or events that are named in the literature as 'perturbation', 'disturbance', 'pulse', 'rump', 'slow-onset' or 'fast-onset' events. These drivers are "results of social, political, cultural, economic and environmental change" (Adger 2000, p. 347) and put stress on the system's functions on multi-directional spatial, temporal and organizational scales. Fig. 3.2 shows a spatial-temporal systematization of social processes that drive land system change (used here as an example of a major SES dynamic) and further introduces an organizational scale along group-level (yellow) and state-level (grey) processes.

This visualization facilitates the indication of comparability of different driving processes and indicates which interrelations can be analyzed and where scale adjustments have to be done prior to the analysis. Such an adjustment is necessary, when processes differ across one or several orders of magnitude and hindering comparison and identification of meaningful interconnections.

Comparison of these processes on similar scales can be done following Peterson et al. (1998) and Clark (1985), to create valuable knowledge of the impact of social cohesion on land system change and vice versa within and across different scales. While a detailed and systematic comparison is beyond the scope of this paper, the following sections will lay out an argumentation line about how the SCCM can contribute to the inclusion of social cohesion in SES considerations on land system change with the case study providing an illustration of the proposed argumentation.

3.4 The Nexus of Social Cohesion and Land System Change in SES

3.4.1 The Regional SES Approach

I choose a regional perspective to bridge local social-system analyses, often conducted through individual case studies and broader global analyses. This regional perspective aims to facilitate the combination of a detailed analyses of several local social sub-systems while allowing for

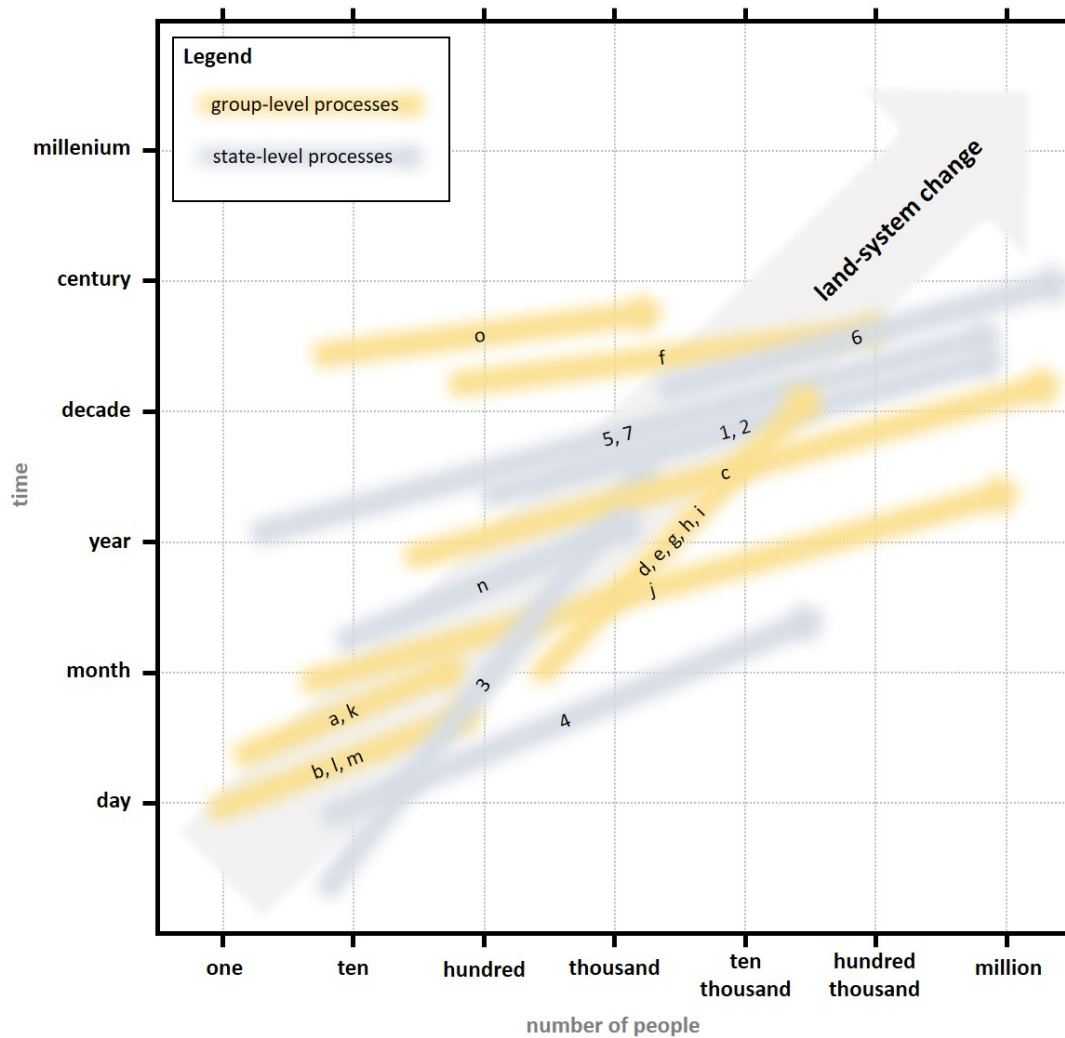


Figure 3.2: Driving forces (processes) impacting control parameters of social cohesion phenomena. Numbers (1-7) and lower case letters (a-o) refer to Tab. 3.2 (own elaboration).

comparison on a regional scale. This regional contextualization of local analyses may foster their relevance in a global perspective. At the same time, the aim is to keep a degree of simplicity that allows for a deep understanding of processes within and between systems while preventing a reductionist perspective on just one sub-system. Thus, I define the term 'regional' here as corresponding to the boundaries of the social-ecological sub-system under consideration to embrace all dynamics relevant for land system change within this SES. These boundaries do not necessarily correspond to political or administrative boundaries. However, the consideration of administrative boundaries in a second step adds more complexity to the system analysis and allows cross-country comparisons within one SES, where applicable. Thus, I focus on two levels of analysis: (1) within the boundaries of the SES, and (2) within the administrative boundaries. Such a two-level regional analysis goes beyond the investigations of local SES and is particularly valuable because:

- (a) Human decisions depend on societal structures, norms and values within cultures: traditions and worldviews that cannot be globally generalized;
- (b) Human societies are, to very different degrees, directly dependent on their ecological environments, leading to very distinct human-nature relationships and corresponding actions;

3.4. THE NEXUS OF SOCIAL COHESION AND LAND SYSTEM CHANGE IN SES

- (c) Interconnected or cascading dynamics within regional SES can aggregate and create critical regional conditions before appearing on a global scale; and
- (d) Environmental governance and natural resource management mostly occur on local to regional scales, guided by regional or national development planning.

The latter is especially relevant for the increased policy impacts of SES research since a regional perspective can increase complexity thinking in governance institutions and policy making (Dearing et al. 2014). Thus, this approach of focusing on regional SES processes will more likely become relevant for policy design throughout environmental governance and has the potential to transform the direction of regional development. While the indicators presented as inputs to the SCCM are rather broad and are based on the literature review, the model is open to inputs on regional cultural and societal specifics and hence avoids a 'one-size-fits-all' framework.

3.4.2 Connecting Regional Social Cohesion and Land System Change

In Fig. 3.3, I provide a framework in which the relationship between land system change and social cohesion can be investigated and in which data obtained through the SCCM could be integrated for a better understanding of social dynamics within SES. I argue that land system change and social cohesion are related through interactions with ecosystem services (ESS), human agency and reflexive institutions. These interactions can be understood as ESS being the independent variable, social cohesion being the dependent variable and human agency and reflexive institutions being the intervening variables depending on the level of analysis (compare with Tab. 3.1: both humans and institutions are considered as agents within the social system while human agency operates more on the inter-group level while reflexive institutions operate on the group-state level).

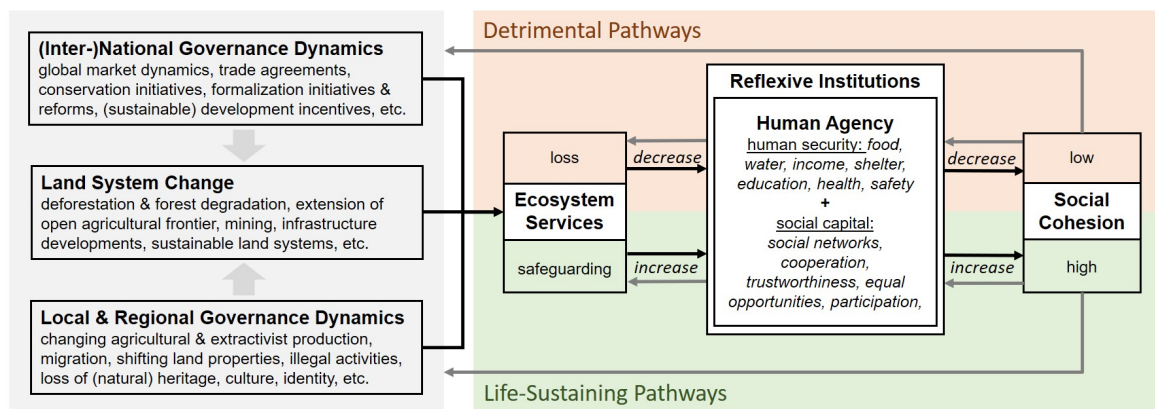


Figure 3.3: Scheme of relationships between land system change and social cohesion, connected through ecosystem services and human agency (own elaboration based on Froese et al. (2022b) and Scheffran et al. (2012b)).

While interconnections of land system change and ecosystem services have been largely investigated in the SES literature (Andersen 2015; Nepstad et al. 2008; Nobre et al. 2016), less attention has been given to the interconnections between these processes, human agency/reflexive institutions and social cohesion. I understand human agency here following Betsill et al. (2020, p. 3) as the "understandings of how [...] diverse actors exercise authority in steering society [...] as well as their capacity to deliver effective, legitimate, and equitable environmental governance". Reflexive institutions at the same time, can be understood as interactions of human agency leading to dynamic transformation of institutions along adaptive management processes, requiring constant knowledge diffusion and cooperation (Dryzek

2016). Consequently, two complementary questions arise from the scheme of relationships presented in Fig. 3.3:

- (1) How does land system change impact social cohesion though their impacts on human agency/reflexive institutions? (forward loop (black arrows) in Fig. 3.3)
- (2) How can the impacts of social cohesion on land system change be systematized? (backward loop (grey arrows) in Fig. 3.3)

The impacts under consideration can both foster and undermine social cohesion. Thus, I distinguish the interconnections within the framework into two broad pathways: detrimental and life-sustaining. Detrimental pathways describe land degradation and the related loss of ecosystem services and the potential of detrimental path dependencies. Life-sustaining pathways describe processes of sustainable land systems, safeguarded ecosystem services and life-sustaining path dependencies.

The terms 'detrimental' and 'life-sustaining' are used here to evade human-centered connotations of 'sustainable' – criticized by Díaz et al. (2015) – but instead value human and non-human life. This understanding is not new and has been integral to the Kichwa cosmovision in the Amazon as understood by Ramón Valarezo (2014), cited in Herrera (2020, p. 318), as 'human being as "just another component of nature and not as the pinnacle of creation, destined to dominate it"' ('ser humano como "un componente más de la naturaleza y no como la cúspide de la creación, destinado a dominarla"'). I thus take an integrated perspective, assuming that humans are part of nature and recognizing that a holistic approach is necessary for understanding the interconnectedness of the ecological, economic, and social sub-systems of the Earth System (Costanza et al. 2007).

The framework considers local and international governance mechanisms as land system change is governed by the interplay of local and regional governance dynamics with national and international governance (grey box). Local and regional governance include agricultural or extractive production as well as informal or even illegal activities and local or regional state regulation and control. (Inter-)National governance comprises global market dynamics and global governance instruments such as the United Nations Framework Convention on Climate Change (UNFCCC) or the Convention on Biological Diversity (CBD), certification schemes such as the Forest Stewardship Council (FSC) or transparency initiatives such as the Extractive Industries Transparency Initiative (EITI). The distinction of governance scales is important here because related processes can also occur on different scales. For example, Schönenberg (2019) gives examples of global governance processes having local impact. These local to global governance dynamics impact land use decisions, which in turn impact the ecosystem services of the respective land system.

The impact of land system change on the respective ecosystem services can also be described in term of their supporting or undermining effects on human agency and be distinguished by their contribution to life-sustaining and detrimental pathways, as exemplified in Tab. 3.3.

These impacts comprise provisioning and cultural ecosystem services since these directly affect aspects of human agency, such as threatening people's social capital through the loss of habitat or threatening human security through the loss of income or the provision of food and water. Such impacts on human agency could accumulate and, depending on the degree of social resilience, decreasing or increasing social cohesion. I understand 'social resilience' in line with Schilling et al. (2017, p. 4) as "the ability of a system [for this paper a group, community or institution] to withstand, recover, and learn from external disturbances." Using social resilience, I refer to 'situated' social resilience. Such a perspective respects the "recursive relationship between knowledge, agency and context mediated by power, culture and history" (Cote and Nightingale 2012, p. 484). This facilitates the understanding of underlying system

3.4. THE NEXUS OF SOCIAL COHESION AND LAND SYSTEM CHANGE IN SES

Table 3.3: Impacts of land system change on ecosystem services and their impacts on human agency (exemplified).

Examples of Ecosystem Services	
Supporting Human Agency (life-sustaining)	Undermining Human Agency (detrimental)
Source of identity, heritage, spiritual and religious experiences	Loss of place related experiences, loss of sense of belonging, loss of spiritual or religious experiences
Information for education and research	Loss of traditional (ecological) knowledge and loss of places for (practical) education and research
Source of mental restoration/well-being and health, recreational value	Pollution related health hazards, stress and being mentally unwell
Place-based inspiration for the arts, aesthetic values	Loss of place-based aesthetic values and sources of creativity
Economic livelihoods (extractivists, agricultural, tourism, etc.)	Loss of economic livelihoods (extractivists, agricultural, tourism, etc.)
Provision of food and water	Malnutrition and health hazards
Provision of raw material, medicinal plants, pharmaceuticals	Lack of shelter, (monetary) income and health hazards
Provision of ornamental and genetic resources	Lack of (monetary) income, health hazards

structures that influence the ability of people and institutions to act and are thus relevant for analyzing disturbances of human agency and the creation of reflexive institutions.

3.4.3 Conceptualizing Tipping Points of Social Cohesion and Land System Change

In this section, I describe how the conceptualization presented in Fig. 3.3 can facilitate the analysis of social tipping points, distinguished along the pathways: life-sustaining tipping points and detrimental tipping points. I base my elaboration on widely used approaches to tipping dynamics (Lenton 2013; Otto et al. 2020; Scheffer et al. 2003).

Following Lenton’s (2011) tipping logic, the major tipping element is the regional SES while the social component (sub-system) is conceptualized as the social tipping element. The parameters controlling social cohesion as the crucial system function can be transparently combined into a single control parameter, here, the ability of the social system to govern change and transformation (Sen 1985); in other words, human agency (inter-group level) and reflexive institutions (group-state level). The control parameter includes a critical control value which is defined as the value at which the control parameter reaches a point at which the crucial system function experiences an abrupt/non-linear change after some observation time (Lenton 2013). In the system under consideration, this critical control value comprises social resilience (inter-group level) and critical reflexivity of formal and informal institutions (group-state level), meaning the dynamic transformation of institutions to overcome path dependencies and to react to the ever increasing dynamic and unstable conditions of the Anthropocene. Consequently, life-sustaining and detrimental social tipping points can be framed as extreme values of varying social resilience and varying reflexivity of institutions. Tab. 3.4 summarizes the introduced terms and definitions:

The spatial, temporal and organizational variance as described in section 3.3.4 requires a cross-scale approach (Dryzek 2016; Peterson et al. 1998). Hence, social resilience and institutional reflexivity increase when the adaptive capacity builds on diverse capabilities to govern change and transformation within a particular scale due to an overlap of potential options for adaptation. These effects can be reinforced across scales following the same underlying functions. Stabilizing effects strengthen the functions of the current state of the social system and are thus the most relevant characteristics. Nevertheless, it is important to note that ‘stability’ is not necessarily understood positively, such as contributing to life-sustaining pathways.

Table 3.4: Summary of tipping dynamics within a regional social system (own elaboration based on Lenton et al. (2008)).

Major tipping element (a large-scale sub-system of the earth system)	Regional social-ecological system
Tipping element (a sub-system of the major tipping element)	Regional social system
Crucial system function (main property of the system)	Social cohesion (comprising shared identities, mutual trust and perceived equalities)
Single control parameter (parameter that controls the crucial system function)	Human agency (inter-group level) Reflexive Institutions (group-state level) → capabilities to govern change and transformation)
Critical control value (critical value at which the crucial system function experiences an abrupt change)	Social resilience (inter-group level) Critical reflexivity of formal and informal institutions (group-state level)
Time scale of change	Days – years

Rather, stability of the current state can also be an indicator of deadlocked dynamics on a detrimental pathway.

In contrast, the cascading effects or self-enhancing feedback mechanisms weaken the functions of the system’s current state and challenge its adaptive capacity and could ultimately lead to a crossing of a tipping point. Like the ambivalence of stability mentioned above, the weakening of these functions does not necessarily denote a detrimental pathway but may indicate the overcoming of deadlock situations and the change of pathways.

Research by Langer et al. (2017) has already indicated that social cohesion may serve as an aggregated early-warning indicator for social tipping points. In a national-level analysis, they found that countries that experience a range of different violent conflicts in a year then have low levels of social cohesion. However, more research is needed to complement the first systematization alongside the social cohesion model presented to indicate potential early warning indicators of social tipping points.

3.5 Illustration: The Southwestern Amazon

3.5.1 Methods

The systematization and development of the social cohesion model as well as the selection of crucial functions and respective agents and interconnections was informed and inspired by various field activities at the tri-national border of Peru, Brazil and Bolivia in the Southwestern Amazon, also known as the MAP region: (1) two living labs (Xapurí, Brazil; San Antonio, Bolivia, both September 2019), a world café (Rio Branco, Brazil, September 2019), a web-seminar (September 2020) and two scenario panels (Rio Branco, September 2019; and online, January 2021), as well as expert interviews during field trips (June and September/October 2019) and virtual peer-discussions during a post-graduate course with practitioners from the region (September 2020 to March 2021). All these events comprised a number of different knowledge holders from the research region, including representatives from the local and regional governments, NGOs, academia as well as local associations. While the empirical data collected during these activities are not providing systematic data for the application of the SCCM, they serve well for the illustration and the showcasing of the potential of the model. In addition, this illustration will guide the development of future research activities that will collect systematic data on the SCCM.

3.5.2 The MAP Region

The case example is located in the southwestern Amazon at the border region of three sub-national entities: Madre de Dios in Peru, Acre in Brazil and Pando in Bolivia. It is known for its exceptionally high biological diversity and its substantial social diversity, including indigenous peoples and traditional forest extractivists as well as recent migrants who include colonists, ranchers and miners, along with growing urban populations (Perz et al. 2015). Due to their remote location and inaccessibility, the three states face political and economic marginalization from the political centers of Lima, Brasília and La Paz, which are somewhat disconnected from Amazonian territory. These disconnections perpetuate a century-old perception of the empty Amazon being "rich in biodiversity and resources but empty of people" (Salisbury et al. 2012, p. 106).

Over the last two decades, the region has undergone various rapid social-ecological transformation processes which are endangering regional livelihood security. These processes are driven by:

- (i) Environmental and regional climate change, with unpredictable rainfall leading to droughts and floods (Lovejoy and Nobre 2018);
- (ii) Economic development patterns, such as anthropogenic land system change, agricultural intensification and ongoing infrastructure expansion (Perz et al. 2015);
- (iii) Political agendas such as land reforms and formalization processes regarding access to land and natural resources (Damonte 2018).
- (iv) Societal phenomena such as lifestyle changes (Hoelle 2015), population growth, migration and criminalization (drug trafficking, gang activities) (Coutinho 2019);

3.5.3 The MAP Social-Ecological System

In this illustration, the MAP region is systematized as the major SES under consideration. I also account for the MAP-region as a sub-system of the overall Amazon SES which has been identified as a major tipping element of the Earth System (Nobre and Borma 2009; Steffen et al. 2018). This systematization allows me to frame the regional conceptual approach within discussion of global-scale tipping elements. To standardize the unit of analysis and narrow the research area, workable system boundaries of the MAP SES have been identified which comprise those parts of each sub-national entity closest to the tri-national border and corresponding to the regional approach (see section 3.4.1). Fig. 3.4 shows the MAP region and the specific system boundaries (regional SES & administrative boundaries).

To account for different land systems and the corresponding diversity of social structures, gradient ranging from primary forest within a natural/extractive reserve to high intensive land use along the interoceanic highway in each of the three states has been selected. The highway connects the three provinces with the rest of the continent and is a major driver of regional economic development and consequent rapid land system change (Southworth et al. 2011). As starting points of the gradient with areas of primary forest, the three reserves of Reserva Nacional Tambopata in Madre de Dios, Reserva Extrativista Chico Mendes in Acre and the Reserva Nacional de Vida Silvestre Amazónica Manuripi in Pando have been selected. Hence, when referring to the MAP SES in the following section, I am referring to the SES within these operationalized system boundaries of the three reserves, their buffer zones and the agrarian frontiers adjoining the interoceanic highway.

The description of the regional SES enables me to define the boundaries of the SES within similar constitutive ecological but different social systems. The sub-systems of the regional SES are hereby called 'tipping elements'.

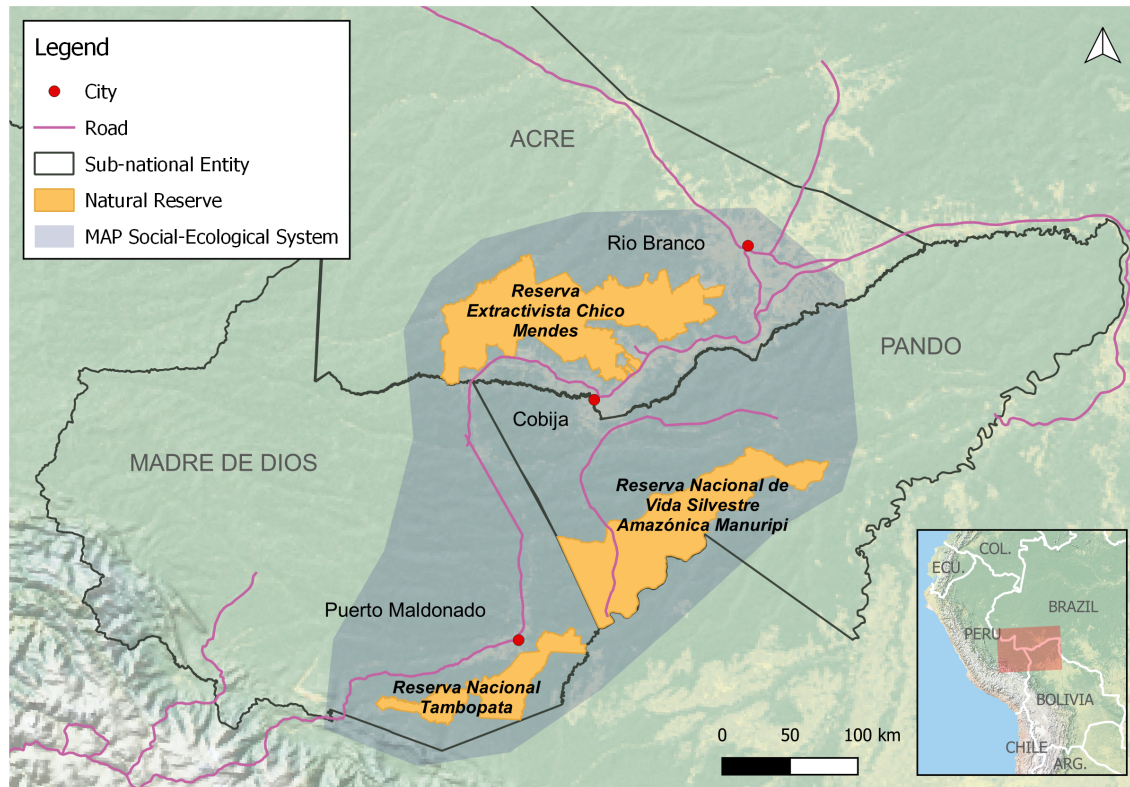


Figure 3.4: Map of the MAP region (map created with the software QGIS v.2.18 and data from OpenStreetMap).

Fig. 3.5a depicts how the MAP SES is conceptualized with the tipping elements being the MAP soil ecosystem, the MAP (rural) economy, the MAP society and the MAP regional climate system. White boxes indicate the crucial system function of the respective sub-system which are described and analyzed in more details elsewhere. Here, I only focus on the social sub-system. In contrast to many other figures on SES, which often indicate social and ecological systems as separate or overlapping circles (criticized also by *Reyers et al. (2018)*), Fig. 3.5 highlights an integrated understanding of the different sub-systems in this framework. It follows the argument that, in addition to large-scale human impact on ecosystems and climate systems in the Anthropocene, social and economic systems are always embedded and building on ecological and climate systems and can therefore not be analyzed in isolation.

Fig. 3.5b zooms into the social sub-system and sketches the structure of the MAP social system, its agents and their placement within inter-group and group-state level interconnections. In the literature, these dynamic interconnections are often depicted as horizontal (inter-group) and vertical (group-state) interactions. However, this duality seems to lack the flexibility to include the often interwoven and blurry power dynamics within regional governance systems. Therefore, I generally follow the dual depiction but break it down into two 'diagonal' dynamics. This is useful for including the state capture of non-state organizations and lobby groups and the opposite dynamics of particular groups that fill governance roles and provide services in exchange for authority in spaces where the state is absent.

3.5.4 Land System Change and Social Cohesion in the MAP Region

In the case of the MAP region, social structures as well as the land system structures are shaped very distinctively by the different histories and political systems of the three countries. These results were expected. Less expected was the fact that the land systems in the three

3.5. ILLUSTRATION: THE SOUTHWESTERN AMAZON

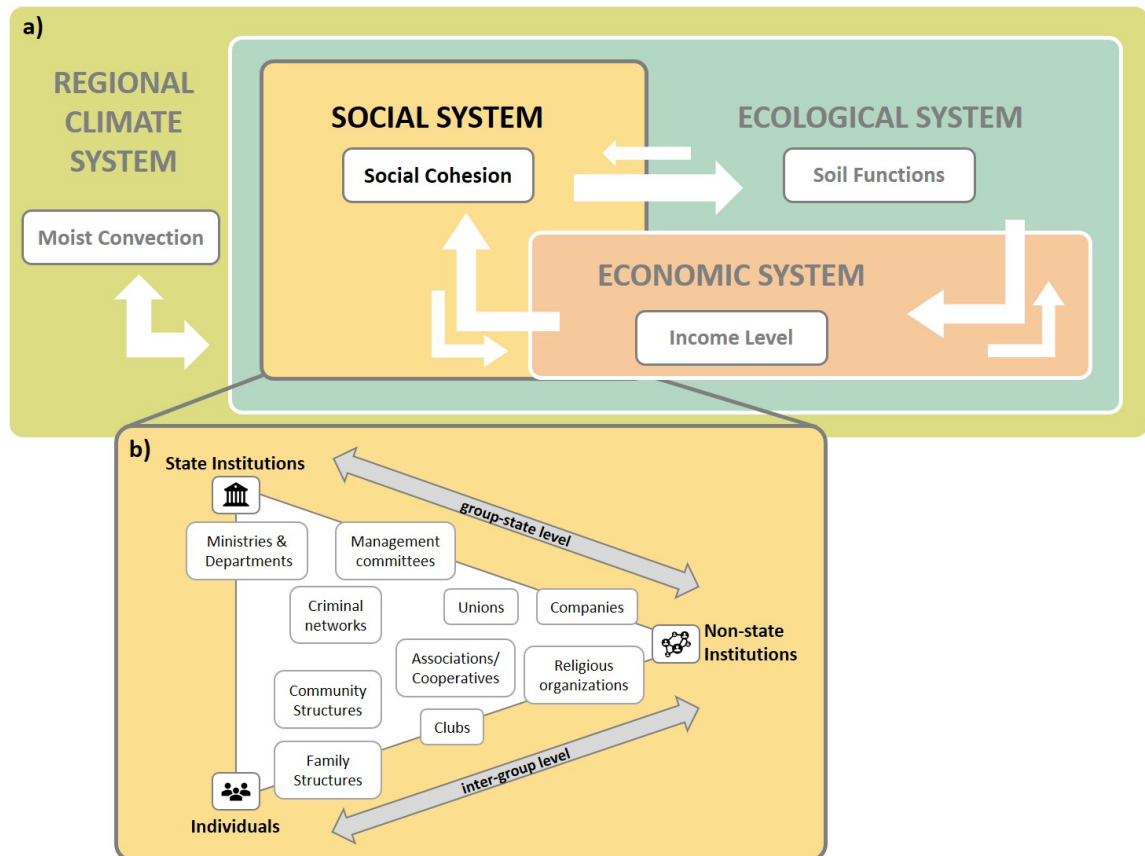


Figure 3.5: (a) Tipping elements and respective crucial system functions. (b) Structure of the social system, its agents (example: MAP region) and their placement along inter-group and group-state level interconnections (own elaboration).

sub-national entities and in the three protected areas and their surrounds were quite different in condition. This can be attributed to the different land system history of those countries. One could thus say that their current conditions could be seen as different temporal stages of land system change. In all three cases, land-system change occurs parallel to changes in the social system. Such dynamics are not new and can be observed throughout history (Urzedo and Chatterjee 2021). Thus, it is important to take the history of the regional context into account when applying the presented framework. I would like to note here, that the following section should be read as illustration which is neither complete nor systematically applying the framework provided in Fig. 3.3, but is deemed useful to flesh out the framework with some practical examples.

The land system of Pando in Bolivia is still quite pristine and cattle ranching, extensive agriculture and gold mining only occur on a very small scale. Nevertheless, large-scale infrastructure projects (Perz et al. 2015), particularly plans for highways through pristine forests and indigenous territories, are currently under development. One example is the road connecting the current road through the Reserva Manuripi at its southern end in Chivé with La Paz. This highway is favored by development actors, because it would strongly reduce travelling time between Pando and La Paz, which is currently only accessible through roads that pass Cuzco and Puno in the Andes (Southworth et al. 2011). At the same time the road would have a large impact on ecosystem services of the forest, with a potential negative effect on traditional livelihoods while at the same time providing the region with market access, which could attract large scale investors of the agroindustry. Since the road is not under construction yet, impacts are yet limited (Chávez et al. 2005). Nevertheless, it would be

interesting to analyze the impact of planning and potential later development processes on human agency and shifting power imbalances between regional development actors and local communities and how the resulting social cohesion dynamics influence decisions on the land system.

In and around the Reserva Extractivista Chico Mendes in Acre, Brazil, the land system has been highly impacted by the extension of the agricultural frontier (Klingler and Mack 2020), and particularly around conflicts related to increased cattle ranching and consequent invasion of land belonging to the extractivist reserve. New formal and informal coalitions of cattle ranchers are legitimizing practices that were previously considered environmental crimes. These changing activities not only lead to a loss of forest cover but also alter extractivists' traditions and their long-term livelihoods. This example shows, that distancing, or in other words, reduction in social-bonding through lifestyle changes (e.g., from extractivists to rancher) reduces the inter-group social cohesion leading towards detrimental developments. Another example of negatively stabilizing dynamics of non-reflexive institutions is the loosening of environmental legislation through Brazil's neoliberal government and the consequent 'stability' of impunity contributing to increased deforestation and the 'development of the Amazon' leading towards detrimental pathways as well.

In Madre de Dios in Peru, more extensive agriculture, particularly monocultures such as papaya and palm oil, can be observed. At the same time, experimentation with agroforestry systems for more sustainable production is on the rise due to some (limited) government and private incentives. This could potentially lead towards life-sustaining pathways. Nevertheless, the largest and most distracting land system change in Madre de Dios is illegal gold mining (Damonte 2018), which not only causes large scale destruction of the forest in the buffer zone – partly within the Reserva Tambopata – but is also leading to large scale change of societal dynamics due to massive immigration to mining camps and related businesses building up around the mining camps (Cortés-McPherson 2019). These not only include services related to mining, such as fuel and mercury trading, but also illegal activities such as human trafficking, prostitution, and fuel and drug trafficking. These examples are the most drastic observation on reduced social cohesion, materialized in criminal structures that function outside of the state's monopoly on power. Such criminal structures create parallel structures that bypass or even infiltrate the state and thus drastically limiting human agency and the creation of reflexive institutions through aggression and the threat of violence (Schönenberg 2002).

In all three cases, access to resources is a major driver of social dynamics, and following the SCCM, impacting all three constituents of social cohesion: (1) (shared) identities are lost, where traditional extractivists cannot execute their traditional practices due to threats from illegal land invasion; (2) (mutual) trust is threatened when land conflicts over super-positioned land rights escalate and trust in the state cannot be built because it does not fulfil its function of protecting its citizens or ensuring well-being; (3) perceived equalities are reduced when access to the aforementioned resources is not provided transparently. In addition, these phenomena can interact with phenomena and sub-systems of other tipping elements and mediate the access to resources of other tipping elements: natural resources, land and water (ecologic system) or markets and credit schemes (economic system).

Whether such developments lead to the crossing of social tipping points is yet to be seen. Nevertheless, both detrimental and life-sustaining developments can be accelerated by external disturbances such as the COVID-19 pandemic. To give one example: While the pandemic weakened the functions of the social system's current state, it led groups that were previously without contact or were competing into cooperation against the spread of the pandemic. Such local cooperation was self-enhanced throughout the ongoing global pandemic, advancing the cooperation of local groups with national and even international groups (see Chapter 7 published as Froese et al. (2022b)).

3.6 Discussion and Conclusion

Current detrimental human actions are not only undermining ecosystems and contributing to the loss of ecosystem services but also threaten the viability of contemporary human societies. By proposing the SCCM in this paper, I aim to contribute to an incorporation of societal dynamics into SES dynamics and, more widely, into the discussion about Earth System dynamics. The conceptual framework provided, aims to bridge the SCCM with current research on land system change in SES and could guide future research on interconnections between local social cohesion dynamics and land system change. This knowledge could inform policy makers in their decisions on strengthening social cohesion to increase coping abilities of communities in the face of multiple social-ecological crises. Furthermore, the categorization of processes into life-sustaining and detrimental pathways facilitates the movement of investigated phenomena towards detrimental or life-sustaining tipping points and can provide orientation towards windows of opportunity for transformation. The framework is illustrated by an example from the Southwestern Amazon. Nevertheless, it has enough flexibility to be applied in other regions.

This SCCM is an abstraction and simplification of reality, so it has limitations that must be addressed in order to remain useful for research and policy making. Firstly, it seems at first sight very complex. With particular regard to social cohesion, the model narrows down the wide-ranging understandings of social cohesion to three constituents. Nevertheless, the systematic approach also gives meaning to the often synonymous or metaphorically-used terms which might, in their application, seem complex but ultimately deepen the analysis of social cohesion as a crucial system function.

The task for further research is to apply the model within the proposed framework, ameliorate its structure where necessary and, in the best case, produce comparable analyses of social cohesion in different regions and strengthen social cohesion research within the Earth System research community. By offering a regional perspective, the framework can close the gap between local social-system analyses, including context-specific knowledge and properties, and broader global analyses. As a next step to move beyond human-centered connotations, it would be interesting to include non-human agency and its impact on social cohesion within this framework, changing the perspective towards 'social-ecological cohesion'.

In conclusion, this systematization of social cohesion, and the identification of its drivers, indicators and related feedbacks, facilitates determination of the interval in which a critical value for drastic shifts within the system is anticipated. Such data would facilitate the identification of cascading dynamics within the regional SES and could guide early identification of crossing 'detrimental tipping points' or of windows of opportunity for crossing 'life-sustaining tipping points'. This knowledge can inform decision makers in particular at regional levels to develop adequate governance options.

4 | A TIPPING MULTIVERSE FRAMEWORK: ASSESSING TIPPING POINTS ACROSS SUB-SYSTEMS IN A SOCIAL-ECOLOGICAL SYSTEM UNDER CHANGE

4.1 Abstract

Humans play an interconnecting role in social-ecological systems (SES), they are part of these systems and act as agents of their destruction and regulation. This study aims to conceptualize potential cascades of tipping dynamics, via (1) the application of a global tipping points (TP) concept to a regional SES, and (2) the systematic assessment of interactions and feedbacks within it by developing a proposed ‘Tipping Multiverse’ framework. We take the southwestern Amazon as an example for tropical regions at large and have identified key underlying sub-systems within the study region: the soil ecosystem, the household livelihood system, the regional social system and the regional climate system, which are interconnected through a network of feedbacks. We consider these sub-systems as tipping elements (TE) within our analytical framework, which when put under stress, can cross a tipping point (TP), resulting in a qualitative and potentially irreversible change of the respective TE. By systematically assessing linkages and feedbacks within and between TEs, our proposed Tipping Multiverse Framework can provide an entry point for assessing ‘tipping cascades’, which means that the crossing of a TP in one TE may force tipping of another TE. Such a joint analysis of interactions and potential cascading TPs promotes a better understanding of human-nature interactions and critical linkages within regional SES that may be used for monitoring or intervention purposes, inform policy making about complex interlinkages and thus enhance resilience of regional SES.

Keywords: tipping matrix, cross-impact matrix, feedbacks, soil functional diversity, livelihood strategy, social cohesion, moist convection, southwestern Amazon

4.2 Introduction

While the Earth System, as a major social-ecological system SES, has sustained global human wellbeing throughout the Holocene, its sustaining functions are being put under stress by human activities and their consequences, such as climate change, land use and land cover change (LUCC) and the loss of biodiversity and associated ecosystem services (IPBES 2019; IPCC 2014b). These processes reduce "the safe and just operating space for humanity" (Dearing et al. (2014, p. 227) see also Rockström et al. (2009a, p. 472)) and have driven a

transition into unstable environmental conditions in the Anthropocene (IPCC 2022b; Steffen et al. 2018). The scientific discourse about the 'Anthropocene' asserts that investigation of the Earth System nowadays is only feasible considering human impacts (Donges et al. 2017). The integration of human interaction with the environments is conceptualized in the literature on SES, which exist at different scales and form sub-systems of larger SES (Reyers et al. 2018). SES assume that environmental, economic and social (including cultural and political) sub-systems are interconnected (Folke 2006), e.g., a disturbance in a sub-system may affect others, via self-amplifying or stabilizing feedback loops that operate within or across sub-systems (Hamilton et al. 2022; Senge 1991; Stermann 2002). Interactions may not be linear and lead to rapid, hardly predictable and potentially irreversible system transformation which is also referred to as tipping point (Lenton 2013). Approaching and eventually crossing such tipping points (TP) happens when disturbance lead to internal self-amplifying feedback loops (Lenton et al. 2008).

We acknowledge that human and natural systems operate at very different scales and with different underlying mechanisms of feedback-driven non-linear abrupt changes, in particular with respect to agency and networking behavior (see Betsill et al. 2020; Steffen et al. 2018; Winkelmann et al. 2022). While dynamics and feedbacks have been investigated for the Earth System as a major SES (Franzke et al. 2022), our research strengthens the analytical foundation for regional SES analysis. However, a joint analysis of their interactions and in particular their potential cascading TPs is needed and useful not only to better understand human-nature interactions and relationships but also to formulate policy recommendations at a regional scale where impacts become visible and actions are being implemented (Dearing et al. 2014).

Therefore, the aim of this paper is to propose an analytical framework to (1) apply a global TP concept to a regional SES, and (2) systematically assess interactions and feedbacks within it. Thus, we apply the logic and terminology of climate TPs as proposed by Lenton et al. (2008) and develop it further to be applicable also to the interconnected tropical regional SES.

For the illustration, we apply our Tipping Multiverse framework to a regional SES, located at the tri-national border region in the southwestern Amazon, across the three states Madre de Dios (Peru), Acre (Brazil) and Pando (Bolivia), also known as the MAP region. The region comprises three different social and economic country situations but similar ecological conditions: the tropical humid rainforest, which is particularly important for the Earth System in terms of moist convection and its function as carbon sink and habitat to diverse social groups (Perz et al. 2013; Selaya et al. 2017). At the same time, measures to prevent the crossing of detrimental TPs, as well as measures to stimulate life-sustaining TPs, are mostly taken on regional scales, guided by national development planning of environmental governance and natural resource management (Agrawal et al. 2022). In addition, decision-making on regional scales depends on societal structures, norms and values within cultures, traditions and worldviews and very distinct human-nature relations that cannot be globally generalized.

To better understand the dynamics within the southwestern Amazon, we apply and adjust the TP terminology proposed by Lenton et al. (2008) and decompose the SES into our framework of sub-systems and respective interconnected TEs: (1) the soil ecosystem, (2) the household livelihood system, (3) the regional social system, and (4) the regional climate system. We first describe the key components and functioning of each TE before we identify linkages across them. Based on this description, we introduce the so-called tipping cascade (Lenton 2020; Sharpe and Lenton 2021), which describes the interdependencies between TE, i.e., the crossing of the TP of one TE may cause the tipping of another TE (and so forth). Finally, we demonstrate the cascading effect by describing one potential tipping pathway initialized by human disturbances originating from LUCC. The TP framework applied here can also be adjusted to other regional SES to contribute to a better understanding of complex

4.3. EXAMPLE: THE SOUTHWESTERN AMAZON

dynamic interconnections within and between individual TEs of different SES.

The paper is structured as follows: in section 4.3, we provide an overview over our example, the southwestern Amazon. In section 4.4, we introduce the Tipping Multiverse, by first describing the tipping point terminology for global Earth System analysis (4.4.1.1) and applying this terminology to the regional SES and developing the so-called ‘tipping matrix’ (4.4.1.2). In a second step, we focus on key linkages and the cascading effects among the TEs of the regional SES and develop the so-called ‘cross-impact matrix’ (4.4.2), which provides an entry point for assessing ‘tipping cascades’. We summarize the section with some limitations and implications for future research (4.4.3) and summarize our findings in section 4.5.

4.3 Example: The Southwestern Amazon

The MAP region (Fig. 4.1) is located in the Amazon Basin and is part of the Southwestern Amazon Moist Forests ecoregion (Olson et al. 2001) comprising an extension of about 31 million ha (Selaya et al. 2017). It is known for its vast areas of standing natural forests and its high biodiversity, its regulation function for regional and global climate processes (Arraut et al. 2012) and its substantial social diversity (Perz et al. 2013).



Figure 4.1: The MAP region in the southwestern Amazon (map created with the software QGIS v.2.18 and data from OpenStreetMap).

Since the 2000s, the MAP SES is undergoing rapid changes through heavy impacts of ongoing LUCC. The pavement of the Inter-oceanic Highway during the 2000s has triggered social, environmental, and economic processes with significant effects on increasing deforestation rates associated with road connectivity and migration (Southworth et al. 2011). Furthermore, gold mining has also significantly increased, posing major threats to biodiversity, landscape alterations, water quality, forest carbon stocks, and human health (Asner and Tupayachi 2016; Swenson et al. 2011; Velásquez Zapata 2020). Additionally, forest clearings through fires, agricultural activities, as well as regional climate change, such as droughts and floods, have

further increased pressure on regional SES (Da Silva et al. 2018; Perz et al. 2013; Schilling et al. 2021; Southworth et al. 2011).

The climate of the Southwestern Amazon (about 10°S) features the typical characteristics of the moist tropics which are low thermal seasonality with an average annual temperature of 26 - 27°C and a mean annual precipitation of 1500 - 3500 mm, declining from west to east and with dryer conditions during austral winter (June - September) and more humid conditions during austral summer (November - February). However, distinct intrinsic, i.e., natural, temporal variations such as El-Niño-Southern-Oscillation (ENSO), reinforce seasonal patterns resulting in both frequent droughts and extreme precipitation events (Aragão et al. 2007; Marengo et al. 2011; Souza et al. 2022; Sulca et al. 2018).

The soils of the MAP region are derived from a wide variety of parent materials, landforms, geomorphic elements, and soil age (Gómez et al. 2019; Quesada et al. 2011). The three provinces within the MAP region share the presence of strongly weathered soils being poor in weatherable minerals and nutrients and rich in iron and aluminum oxyhydroxides, such as Acrisols, Ferralsols, and Lixisols (Wieder et al. 2014). In the region of Madre de Dios, additionally, soils of floodplains (Fluvisols) and less weathered Cambisols are present and characterized by higher nutrient availability (Batjes 2016). According to Selaya et al. (2017) most of the region shows an elevation of 100 to 600 meters above the sea level and is considered submontane, while the predominant physiographic types are alluvial, i.e., ancient mostly not flooded or seasonally flooded floodplains, (43% Madre de Dios, 6% Acre, and 19% Pando) and terra firme forests (48% Madre de Dios, 80% Acre, and 78% Pando). Furthermore, the same authors report the above-ground biomass stocks have been estimated to range between 100 and 300 mg ha⁻¹, harboring great diversity of tree and palm species with high ecological importance. However, with future climate scenarios indicating more frequent and extensive droughts, an increase in the use of fire for new deforestation may lead to a potential increase in bamboo density and decrease in species diversity (Da Silva et al. 2021).

The regional social system is characterized by a high social diversity comprising indigenous peoples and traditional forest extractivists as well as recent migrants including settlers, ranchers and miners, along with a growing urban population (Perz et al. 2015). In addition, the region faces political and economic marginalization from the political centers of the three states due to their remote location and a low political will, resulting in a lack of law enforcement and thriving organized crime (Froese et al. 2022a). At the same time, the transition between rural and urban involves complex mobility pathways and multi-sited households as well as diverse economic and social relations. For example, it is common for a family to live in the city while some members work in the city and others frequently travel to their agricultural plot where they produce crops and fruits for subsistence or to sell on the market. These result in much more permeable categories of the 'urban' and 'rural' compared to other regions in Latin America.

Consequently, the household livelihood systems of the MAP region comprise a complex combination of activities, with the most prominent being the harvest of Brazil nuts. Açaí is collected in Acre and Pando, while formerly important rubber tapping is close to extinction due to a loss of marketability of forest collected latex. Hunting and collecting of non-timber forest products (NTFP) such as sap resins, oils and palm fruits is practiced for subsistence (Da Lima et al. 2020). Furthermore, crop cultivation, cattle ranching, and mining are important income sources, with distinct differences between the three regions. While Acre has a longer tradition of large-scale cattle ranch farming, partly due to federal cattle subsidies up to the year 1991 (Duchelle 2009; Valentim et al. 2002), Madre de Dios and Pando are largely characterized by small scale farming practices (mainly casava, rice, maize and beans). Illegal gold mining and deforestation for coca plantation as well as poaching are increasing in the whole MAP region with main emphasis in Madre de Dios, where also legal gold mining occurs on large scale (Espin and Perz 2021; Salisbury and Fagan 2013). This leads to negative

impacts in environmental, economic and social contexts (Asner et al. 2013; Duchelle et al. 2014b; Vadjunec et al. 2009).

4.4 The Tipping Multiverse Framework

We use the term 'Multiverse' to indicate the complexity of the tropical systems, i.e., regarding (i) interactions and feedbacks and (ii) potential pathways that a 'disturbances' could trigger. Additionally, we use the term Multiverse, to reflect upon the different contexts and histories that the sub-systems are embedded in and that shape the current state and sensitivity to disturbances of each sub-system.

The Tipping Multiverse Framework consists of two supplementing, structured approaches. First, the development of the Tipping Matrix (see Tab. 4.1 and section 4.4.1), which applies the global tipping point concept (Lenton et al. 2008) to the regional SES and its' four identified sub-systems (referred in the following as 'tipping elements' (TE)): the soil ecosystem, the household livelihood system, the regional social system, and the regional climate system. The tipping matrix defines the core components and functioning of each TE (in isolation) and structures information, relevant for researching tipping dynamics. Second, the development of the Cross-Impact Matrix (Tab. 4.2), by highlighting critical linkages and feedbacks between the regions' TE. Critical linkages and feedbacks are considered to affect key processes and features of TE, initially identified in the tipping matrix (see Tab. 4.1 and the crucial system feature and control parameters – shown in bold letters in Tab. 4.2). In this regard, the Tipping Multiverse framework supports interdisciplinary, cross scale research (of relevant processes within/between TE) on tipping dynamics in tropical SES. It provides an entry point for assessing potential cascading effects and dynamics in the Tipping Multiverse of the southwestern Amazon.

With the Tipping Multiverse Framework, we use the term 'link' for any interaction between TE and the term 'cascade', to refer to dynamic of tipping that follow after an initial tipping point in one sub-system has been crossed. In the following, we introduce the tipping matrix and the cross-impact matrix that together form the Tipping Multiverse.

4.4.1 The Tipping Matrix

4.4.1.1 The Tipping Terminology

We base our tipping matrix framework on Lenton's (2008) approach to tipping dynamics which defines a TE as a large-scale sub-system of the Earth system or, simply put, a sub-system of the Earth system, in which a small perturbation can trigger a large response. The *crucial system feature* is the main property of the system, in other words, the core feature or combination of sub-features through which the complex system can be defined (Lenton 2011). The parameters controlling the crucial system feature can be combined into a *single control parameter*, an independent variable. The control parameter includes a *critical control value*, defined as the value at which the control parameter reaches a point at which the crucial system feature experiences an abrupt/non-linear change after some observation time (Lenton et al. 2008). The critical control value remains difficult to predict and is currently a focus of research to identify early warning indicators to narrow down the interval in which a critical control value is anticipated (Dakos et al. 2015). Finally, *driving forces* are any natural or human-induced factor that causes a change in the controlling parameter and interact across spatial, temporal, and organizational scales. Likewise any complex system, SES may respond to driving forces showing *internal and external feedbacks* with the surrounding environment, when the outputs of a (sub-)system are forwarded as inputs, as part of a chain of causation producing loops with *stabilizing or self-enhancing* effects on the (sub-)system response (Anderson 1999; Lenton 2013). While stabilizing feedback mechanisms buffer the response of the system to a driving

force, self-enhancing feedback mechanisms act destabilizing, potentially causing the system to shift to a different state, thus facilitating the TEs to cross a TP.

4.4.1.2 Application of the Tipping Terminology to the Southwestern Amazon

Table 4.1: The Tipping Matrix for the four proposed TE in the Southwestern Amazon (own elaboration based on Lenton et al. (2008)).

regional social-ecological system in the southwestern Amazon				
Major tipping element (a large-scale sub-system of the earth system)				
Tipping element (a sub-system of the major tipping element)	Soil Ecosystem	Household Livelihood System	Regional Social System	Regional Climate System
Crucial system feature (principal properties of the system)	Soil functions (through plant water availability and nutrient provision)	Livelihood strategy (income and asset generating activities, legal vs. illegal, sustainable vs. unsustainable)	Social Cohesion (comprising shared identities, mutual trust and perceived equalities)	Moist convection (land-climate interaction, i.e., land use and land cover affects evapotranspiration, cloud formation and precipitation)
Single control parameter (combination of control parameters that control the crucial system feature)	Belowground/aboveground functional diversity and redundancy	Profitability of livelihood portfolio	Reflexive capabilities to govern change and transformation (Human Agency)	Land use and land cover pattern
Critical control value (value of the control parameter at which an abrupt change occurs)	Diversity/redundancy of plant and microbial functional traits	Benefit cost ratio of livelihood portfolio	Critical reflexivity of formal and informal institutions	Ratio and shape of forest/non-forest cover
Driving forces (forces that impact the control parameter)	Droughts related to climate change; Land Use and Land Cover Change (LUCC)	Land use decisions, availability of ecosystem services (e.g., soil fertility), environmental variability, farm/forest output value, market prices, institutional constraints (e.g., land tenure security)	(Lack of) commitment to general norms and values, income distribution, access to basic services and public policies, political efficacy, corruption, presence of powerful criminal cartels, institutional (social/political) learning and knowledge holding capacity, land system reforms/planning, global governance mechanisms	Land use and land cover change

<p>Internal stabilizing feedback mechanisms (negative feedbacks) (this occurs when the output of a TE (process or mechanism) is fed back in such a way that it tends to reduce fluctuations in the output, caused by changes in the input or by other disturbances)</p>	<p>The soil-plant feedback mechanism (PSFM) is enhanced if there is a greater diversity of plant functional traits and soil microbial functional genes, promoting soil buffering functions.</p>	<p>Re-investments in current livelihood strategy. Households who could afford to reinvest part of their income in their current production activities could maintain such livelihood strategy.</p>	<p>Anti-corruption strategies and education enable civic participation. Stable income from cattle raising or monocultural crops confirms people's decision of lifestyle change.</p>	
<p>Internal self-amplifying feedback mechanisms (positive feedbacks) (this occurs in a feedback loop which exacerbates the effects of a small disturbance. That is, the effects of a perturbation on a TE include an increase in the magnitude of the perturbation)</p>	<p>Reduced aboveground (e.g., plant functional traits) and belowground functional diversity and redundancy (e.g., microbial functional genes) results in a reduction of the soil buffering functions that support water and nutrient supply.</p>	<p>Falling prices of agricultural products could lead to expanding agriculture at the expense of forests to maintain same level of income. Similarly, falling prices of forest and environmental products could lead to overharvesting and depletion of the natural resource base. The adopted changes in the livelihood strategy increases income which is then used to continue with the potentially unsustainable livelihood strategy. The depletion of the natural resource base could further strengthen the qualitative changes of the livelihood strategy.</p>	<p>Interrupted institutional learning (social & political) may lead to non-adaptive management of changing environmental conditions, which may lead to path dependencies and lack of knowledge which may lead to further interruption of institutional learning.</p>	<p>Reduced moist convection (i.e., reduced convective rain rates) increases the Bowen Ratio and again amplifies the reduction in moist convection. Reduced moist convection may cause transformation of the evergreen tropical rainforest into another (natural) vegetation type (LUCC) showing less diversity /structure causing decrease in evapotranspiration and moist convection respectively.</p>
<p>Indicators used to quantify qualitative change (indicators that measure the change of the control parameter)</p>	<p>Greenhouse gas emissions, nutrient contents and stoichiometry, microbial functional diversity, plant functional traits</p>	<p>Reliance on sustainable vs. unsustainable income sources; household livelihood security</p>	<p>Law enforcement/ implementation, degree of networked institutions, political interaction and participation, level of violence, illegal and informal activities, expansion of criminal networks, preferred lifestyle, life satisfaction/wellbeing, level of trust, level of perceived equality, etc.</p>	<p>Metric of forest cover and LUCC extend and patchiness</p>

The regional soil ecosystem

Soils are a key component of the Critical Zone of the continental surface, that extends from the atmosphere to bedrock, and ensures the functioning of the Earth’s ecosystems and the continuation of life on Earth (Brantley et al. 2007). Our assumption is that highly biodiverse and functional soils provide the underpinning of indispensable services that ensure the basis for sustainable economic livelihoods and societies. We choose the soils of the south-western Amazon region as *tipping element* and the soil buffering functions (i.e., supply of water and nutrients to plants) as *crucial system feature* in the soil-plant-human continuum. Soil resilience to the regional *driving forces* is based on the interplay between belowground and aboveground functional diversity and redundancies of different structural biotic components (*control parameters*). Functional diversity involves three interrelated and distinct plant/microbial components: (1) variety, i.e., how many different components occur; (2) the balance of how many of each type of component there are; and (3) disparity, i.e., how different the components are from each other (Barot et al. 2018; Birgé et al. 2016; Brinkman et al. 2010). While redundancy involves the diversity of below and aboveground replication of certain functions in a system. In this regard, redundancy provides a safeguard to ensure soil’s safe operation, by allowing plant/microbial components to compensate for the loss or failure of others (Fraccascia et al. 2018; Yachi and Loreau 1999). Maintaining functional diversity and redundancy may allow soils to perform the same task in multiple ways and respond with different capabilities to various driving forces, thus enabling persistence of its above/belowground elements and maintaining their stability under changing conditions (Jia and Whalen 2020; Jurburg and Salles 2015; Wertz et al. 2006).

Identifying and investigating the above and belowground feedback loops, provides insights into the mechanisms by which the soil system regulates itself. While *internal stabilizing feedback loops* (negative feedback loops) are likely to lead to a stabilization of both above and belowground biotic communities, internal *self-amplifying feedback loops* (positive feedback loops) may accentuate slight inequalities that lead to the dominance or exclusion of various biotic communities, thus, a partial impairment of the soil functions (Eisenhauer 2012; Lou et al. 2014). This identification of relevant feedback mechanisms maintaining or destabilising soil TE relies on scientific evidence accrued since the 1990s studying the plant-soil feedback mechanisms (PSFM) (Bennett and Klironomos 2019). Studies of the interaction mechanisms between the physical, chemical, biogeochemical and biological components of the soil system and the distinct plant communities have contributed to these findings (Ehrenfeld et al. 2005). The PSFMs have revealed their essential role in maintaining plant diversity, showing that primary production tends to increase in highly diverse plant communities, and that the beneficial correlation plant diversity-productivity seems to be reinforced over time (Thakur et al. 2021).

The soil physical factors that have the greatest influence on plant-soil interactions are water content, temperature and particle structure resulting from the aggregation of mineral grains. These properties not only affect plant growth but are also conditioned by the nature of that plant growth (Ehrenfeld et al. 2005). While chemical and biogeochemical interactions between plants and soil are more complex to unravel and analyze when compared to the physical properties of soils. The reason is that plant-soil chemical and biogeochemical interactions often involve complex mechanistic pathways involving soil chemical components, soil moisture, temperature and soil biota (Ehrenfeld et al. 2005; Mariotte et al. 2018; Wang et al. 2021). In this regard, van der Putten et al. (2016) identified the three major categories of soil biota shaping PSFMs: plant pathogens (microbial soil pathogens, herbivorous nematodes, insect larvae, and other invertebrates), symbionts (mycorrhizal fungi, nonmycorrhizal endophytic fungi, endophytic bacteria, nitrogen-fixing microbes, and plant growth promoting microorganisms), and decomposers (organisms involved in carbon and nutrient cycles that break down litter, root exudates, and soil organic matter). Each may have an

impact on plant development both directly and indirectly, by influencing soil physicochemical qualities such as pH, organic matter content, water holding capacity, temperature, and soil structure. Furthermore, a better understanding of aboveground-belowground feedbacks and underlying mechanisms will assist in better predicting and mitigating the consequences of human-induced global changes, improve restoration and conservation efforts, and promote the sustainable provision of soil ecosystem services in a rapidly changing world (van der Putten et al. 2013).

We hypothesize that soils will show an enhanced resilience to regional *driving forces* when they hold a greater diversity and redundancy of functional traits provided by aboveground/belowground components. We expect enhanced plant-soil feedback mechanisms (PSFMs), such as plant-mediated nutrient cycling and plant-microbial interactions, if there is a greater diversity and redundancy of plant and microbial functional traits. Reduced above and belowground functional diversity and redundancy will result in a reduction of the soil functions supporting water and nutrient supply to plants. We finalize the characterization of our soil TE by offering a suitable set of *indicators* used to quantify qualitative change in aboveground/belowground diversity and redundancy derived from the critical control values (Tab. 4.1).

The regional household livelihood system

The second TE in our tipping matrix is the household livelihood system. To define it we draw on the conceptual framework developed by Niehof and Price (2001). This system is composed by several subsystems, processes, activities, inputs, and outputs, and interacts with other systems such as ecological systems, markets, and social-cultural contexts. The system includes the family, farm, and household subsystems, and the process of 'householding' or 'household production', which entails the activities and inputs (resources and assets) used to satisfy the material needs of household members and generating the basis for meeting their immaterial needs. The system's throughput is determined by the processing, use, and management of these inputs. One of the main outputs of the system is livelihood security, when the household can provide for its members' needs in a sustainable way. Typically, there are numerous different activities targeted at securing and improving the livelihood. A household that gathers Brazil nuts, for instance, might also grow corn for their own consumption and to feed their chickens, as well as produce grains for the market (Duchelle et al. 2014a). Such activities are planned and structured based on strategies, which together with the decision-making (e.g., land use decisions) and management of strategies' implementation are part of the system's throughput.

In our matrix, we consider this strategy, or more specifically, the livelihood strategy, as the *crucial system feature*. The *parameters controlling* the livelihood strategy comprise: (1) livelihood assets (human capital, natural capital, financial capital, social capital, and physical capital), (2) structures and processes that affect livelihoods assets (e.g., market, policies, institutions, migration), and (3) livelihood outcomes themselves, that is, through a loop (e.g., more/less income, reduced/increased vulnerability, more/less sustainable use of land, improved/deteriorated income security) (DFID 1999). In the tipping matrix we focus on the profitability of the portfolio of activities as a key *control parameter* of the livelihood strategy.

In our matrix, the *critical control* value is the one at which a particular livelihood strategy will change qualitatively, say from a legal to an illegal activity-dominated strategy, or vice-versa. For example, a livelihood strategy that includes only legal activities will be maintained as long as this strategy is profitable. Once overall costs increase and outweigh the benefits, a household could switch its portfolio to include some illegal activities (Chaves et al. 2021; Vasco et al. 2017; Yonariza and Webb 2007). It is important to note that the costs will also comprise the risk of being fined or prosecuted by having committed crimes. The risk will depend on the governance context (Börner et al. 2015a). In the same way, benefits do

not only consider tangible ones but immaterial ones (Huynh et al. 2022). At the extreme, a household's livelihood strategy could completely switch to be based on illegal activities when these provide a significantly larger profitability than that provided by the legal ones. In theory, the trend could be reversed, from illegal activities to legal ones, if profits associated with legal activities increase again. However, as in all complex systems, other controlling parameters not exemplified here could come into play (e.g., cultural aspects, see for example Hoelle (2021)).

Several *driving forces* affect the profitability of the livelihood strategies. Examples are agricultural technologies (Angelsen and Kaimowitz 2001), levels of natural resource use (Coomes et al. 2004), historical conditions (Coomes et al. 2016), soil fertility (Heger et al. 2020) and the availability of other ecosystem services (Junqueira et al. 2016), environmental variability (Ajefu et al. 2020; Alfani et al. 2021; Börner et al. 2015b; Girard et al. 2021), farm/forest output level (i.e., productivity) (Klemick 2011), market prices (e.g., decline in Brazil nut retail prices) (Ubiali and Alexiades 2022), and institutional constraints (e.g., land tenure insecurity, encroaching) (Tseng et al. 2021).

The livelihood strategy as the crucial system feature plays a key role in determining potential feedback mechanisms within the household livelihood system (Girard et al. 2021). Re-investments in the current livelihood strategy can be considered as *internal stabilizing feedback mechanism*, if households that could afford to reinvest part of their income in their current production activities could maintain their livelihood strategy (Su et al. 2019). On the other hand, *internal self-amplifying feedback mechanisms* could be indicated, when falling prices of agricultural products lead to expanding agriculture at the expense of forests to maintain the same level of income (Angelsen and Kaimowitz 2001). Similarly, falling prices of forest and environmental products could lead to overharvesting and depletion of the natural resource base. The adopted changes in the livelihood strategy increases income which is then used to continue with the potentially unsustainable livelihood strategy. The depletion of the natural resource base can become an incentive for actors to rethink and change their livelihood strategy.

The regional social system

As a third *tipping element* in our tipping matrix, we consider the regional social system. We define the regional social system as corresponding to the boundaries of the social-ecological sub-system under consideration to embrace all dynamics relevant for LUC within this SES. These boundaries do not necessarily correspond to political or administrative boundaries. However, the consideration of administrative boundaries in a second step adds more complexity to the system analysis by introducing sub-systems that may differ substantially in terms of institutions and applicable laws, resulting land use pattern and vulnerabilities to external shocks, such as varying climatic conditions. At the same time, this differentiation facilitates the analysis of interactions between the different systems, through migration, flows of products, criminal networks, etc.

Land use change and related changes in soil functions and subsequent changes in livelihood strategies may impact the social fabric within the southwestern Amazonian regional society – and vice-versa. Hence, we consider social cohesion as the *crucial system feature* (see also Fonseca et al. 2019; Uzzell et al. 2002). The actors/agents between which cohesion is analyzed can be social sub-groups, such as indigenous peoples (ethnic groups) and traditional populations (extractivists, quilombolas, ribeirinhos, etc.), farmers, miners, youth and migrants, or political sub-systems such as resource governance or community leadership structures. To approach social cohesion, we orient our research along a definition by Chan et al. (2006, p. 290) as "a state of affairs concerning both the vertical and the horizontal interactions among members of society as characterized by a set of attitudes and norms that includes trust, a sense of belonging and the willingness to participate and help, as well as

their behavioral manifestations". We advance this definition through its systematic threefold constitution into (1) shared identities, (2) mutual trust and (3) perceived equalities – which have been widely discussed in the social cohesion literature (Bernard 1999; Chan et al. 2006; Dicks et al. 2014; Dragolov et al. 2016b; Green et al. 2009). These three constituents will be relevant when identifying the qualitative state and potential approaching of a TP within the regional social system.

The parameters that control social cohesion are manifold and can be subdivided into parameters of different sub-systems: (1) beliefs, norms, interests, experiences (norms and value system) (e.g., Holtug 2017; Mann 1970); (2) class, ethnicity, gender, age (social stratification system) (e.g., Lockwood 1999); (3) monetary income, subsistence activities (production system) (e.g., Coburn 2000); (4) pensions, education, insurance, housing, healthcare (social security system) (e.g., Berger-Schmitt 2002); (5) participation, political representation (political system) (e.g., Aall and Crocker 2019); (6) knowledge diffusion, cooperation (knowledge systems) (e.g., Green et al. 2009; Radzvilavicius et al. 2021). In the tipping matrix, we combine these parameters into one key *control parameter*: the reflexive capabilities of the social system to govern change and transformation (Dryzek 2016; Sen 1985) – in other words, human agency (Betsill et al. 2020). The control parameter includes a *critical control value*, which we define as the critical reflexivity of formal and informal institutions, meaning the dynamic transformation of institutions to overcome path dependencies and to react to the ever increasing dynamic and unstable conditions of the Anthropocene.

We will understand the tipping of the regional social system as ruptures in these functions of the social system. We hypothesize that the regional society is more resilient to *driving forces*, such as incoherent laws or lifestyle changes when social cohesion is generally high, i.e., more functions of the social system are fulfilled and the society holds capabilities to govern change, transformation, (and even crisis). These capabilities control what we defined as determining for a cohesive society: mutual trust, shared identities and perceived equality. Human agency is crucial for designing the adaptive capacities of the social system and depends on the critical reflexivity of formal and informal institutions to govern change and transformation to ensure the maintaining or creation of functions of the social system. Formal and informal institutions and governance structures are the ways in which people and societies organize themselves and their interactions with nature at different scales. They are the underlying steering elements of change and influence all aspects of relationships between people and the environment. Their effect can be positive or negative, either in absolute terms or context dependent. Thus, we conceptualize that a social TP is crossed after society experiences a qualitative change in the region's social fabric, e.g., through norms and value changes that reduce reflexivity and social learning within social groups or the crossing of critical reflexivity (meaning the escape of path dependencies) within formal and informal institutions. An additional layer of complexity is added through potentially catalytic drivers such as the social-economic effects of climate change and lately the COVID-19 pandemic (Froese et al. 2022b).

Within the regional social system, *stabilizing and self-amplifying feedbacks* are manifold and often strongly connected to the economic and the environmental system. In addition, due to the volatile and highly context specific nature of the regional social system, we include normative assumptions to determine a potential stable state of the system and respective *stabilizing feedback mechanisms* that alter or stabilize this state of the social tipping element. For the creation of human agency and the strengthening of reflexive capabilities, institutional learning (social and political) is crucial. Hence, the major *self-amplifying feedback mechanism* we consider in Tab. 4.1 is the interruption of institutional learning which may lead to non-adaptive management of changing environmental conditions which again implicates potential path dependencies and a lack of knowledge holding capacities (Dryzek 2016; Pickering et al. 2019). Other feedback loops, that contribute to the amplification of this major loop are manifold and only some examples can be mentioned here: (1) normalization of non-adherence

and group pressure may lead to inactivity and fear (victim) or unavailability of an independent body to report crimes which again may lead to increasing impunity and less fear (perpetrator) of being reported which may again lead to increasing non-adherence (Schönenberg 2002); (2) marginalization due to inaccessibility of public policies may lead to repeated intergenerational marginalization (spiral of poverty) (Bradshaw 2007); (3) unemployment or reduction of income may lead to exploration of alternative income sources and shifts in lifestyles and related norms and values (Hoelle 2017); (4) nepotism and the co-optation of power structures may lead to one-sided representation, or even state capture that may support further nepotism and increasing unequal access to resources (Damonte 2016); (5) frustration with current public system may lead to poor voting participation and consequent poor representation of interests which may lead to further frustration; (6) shifting control over democratic spaces may affect the agency of community organizations and further shift the control over democratic spaces (Carretero 2008).

The regional climate system

The fourth *tipping element*, that we consider in our tipping matrix, is the regional climate system. It is highly dynamic with strong self-amplifying feedback mechanisms (Staal et al. 2020b). The climate is a principal driver of environmental processes affecting the soil ecosystem TE, the household livelihood TE, and the regional society TE. In turn, particularly the regional climate is a process response system affected by regional environmental and societal changes such as agricultural expansion and intensification or infrastructure development (settlements, roads), which drive deforestation and fragmentation of natural ecosystems (LUCC). Regional LUCC drives regional spatial variations in thermally driven turbulent mixing, deep convection, and related cloud and precipitation formation (Rieck et al. 2014). Detailed systematic analyses of the influence of surface features and processes on the local hydrological cycle still suffer from lacking observational data (Böhner et al. 2020). However, the tight coupling between surface heterogeneities (i.e., human-made surfaces), moist convection and related atmospheric circulations is confirmed by simulations explicitly resolving local scale surface processes and moist convection (Rieck 2015). In this regard, we argue that diverse (i.e., species and structure rich) evergreen rainforest land cover types and their high primary production and evapotranspiration rates contribute greater to water recycling, i.e., cloud and precipitation formation than less diverse land cover types such as crop land, pasture or urban areas with their lower evapotranspiration rates.

In our matrix, we assume moist convection to be an integral *crucial system feature* of the regional climate system, not only controlled by the extent of forest cover but likewise by the pattern and size of forest and non-forested patches (*control parameter*). In accordance with our tipping matrix, the ratio and shape of forested and non-forested areas is considered as *critical control value*. We identify LUCC as *driving force* that impact our control parameter. Given that LUCC and especially deforestation alter the surface energy and moisture fluxes this will have significant consequences for the diurnal cycle of moist convection (D’Almeida et al. 2007). Ongoing LUCC and respective forest cover loss beyond the critical control value result in reduced moist convection (i.e., reduced convective rain rates), prolonged dry spells and increased droughts. It ultimately provokes *internal positive self-amplifying feedback mechanism* due to an increase in the Bowen Ratio (i.e., the ratio of sensible heat to latent heat transport from the ground to the atmosphere), further reducing moist convection. This feedback may cause a decline in primary production as well as a response e.g., in the composition, structure and diversity of forest systems, which again lead to less evapotranspiration, cloud and precipitation formation (Leite-Filho et al. 2021). The *indicator used to quantify qualitative change* is the quantity and patchiness of forest cover and LUCC activities.

4.4.2 The Cross-Impact Matrix

To analytically describe the multiple interactions between our four TE, we use a systematic approach (Tab. 4.2) that illustrates cross-linkages. A depiction of the Tab. 4.2 is shown in Fig. 4.2.

Tab. 4.2 can be read in two directions: (1) row-wise, where each row describes how changes in the TE (row) influence each key TE functioning (column), and (2) column-wise, where each column indicates how the functioning of the TE (column) is influenced by changes in each TE (row).

Table 4.2: Cross-Impact Matrix indicating the multiple interactions across tipping elements (**bold**: crucial system feature and control parameter (from Tab. 4.1), *italic*: linkages to other TEs) (own elaboration).

		<i>How TE (column) is affected</i>			
		Soil Ecosystem (A)	Household Livelihood System (B)	Regional Social System (C)	Regional Climate System (D)
<i>The effect of TE (row)</i>	Soil Ecosystem (A)		Changes in the quantity and quality of the <i>soil functions</i> lead to changes in primary productivity in the agricultural and environmental sectors . The profitability of the current livelihood portfolio is then affected as shown in its benefit cost ratio. Net benefits from the current livelihood strategy are reduced/increased and households might consider switching to new strategies. Context specific alternative strategies could include less sustainable or illegal activities.	Changes in <i>soil functions</i> may lead to decreasing/increasing buffering capacities for contaminants (e.g., mercury from artisanal gold mining) and consequently impact people's health and well-being . Changes in the access to specific places and their respective <i>materials of a healthy soil</i> may lead to a loss of knowledge, traditions and identity . These changes may impact household decisions regarding their <i>livelihood strategies</i> and traditional medicinal practices. Changes in <i>soil functions</i> and related productivity may lead to food insecurity and potential riots, if not buffered by the government.	Change in <i>soil functions</i> affects primary production on agricultural and natural land with respective impact on evapotranspiration rates and moist convection processes (without LUCC). However, strong changes in soil functioning may lead to LUCC and modified vegetation characteristics (e.g., diversity and structure of plant composition), which may strongly impact evapotranspiration and moist convection .
	Household Livelihood System (B)	Changes in the <i>livelihood strategy</i> leading to LUCC drivers change in <i>primary productivity</i> . LUCC associated to reduced aboveground functional diversity and redundancy will impact the belowground diversity and redundancy , thereby destabilizing the plant-soil feedback mechanism (PSFM).		Changes in the <i>profitability of the current livelihood portfolio</i> may lead to exploration of alternative income sources (e.g., cattle) and thus alter norms, values, interests and traditions of the respective people/community. If a certain threshold in the profitability is exceeded, people may migrate.	Changes in the <i>livelihood strategy</i> can directly drive LUCC ; i.e., when land-based ecosystems services become utilized (e.g., for improving the <i>benefit cost ratio</i> of the <i>household livelihood portfolio</i>). Respective changes in primary production and vegetation characteristics (e.g., diversity, structure and biomass), impact evapotranspiration rates and moist convection processes.

How TE (column) is affected

	Soil Ecosystem (A)	Household Livelihood System (B)	Regional Social System (C)	Regional Climate System (D)
The effect of TE (row)	<p>Changes in <i>lifestyle and governance</i> may lead to increase/decrease in land degradation through deforestation, agricultural practices, mining etc. (economic activities) affecting soil functions by reducing below-/aboveground functional diversity and redundancy, thereby destabilizing the plant-soil feedback mechanism (PSFM). Protection through public policies (<i>establishment of protected areas</i>) would favor conservation of soil functions by maintaining below-/aboveground functional diversity and redundancy.</p>	<p>Changes in <i>land use policies, and levels of corruption and crime (i.e., human agency)</i> may lead to less/more agricultural, forestry, and environmental profitability. The profitability of the current livelihood portfolio is then affected as the benefit cost ratio shows. For example, stronger law enforcement against illegal deforestation in the form of applied fines, will reduce the production of agricultural crops and income. Net benefits from the current livelihood strategy are reduced and households might consider switching to less sustainable or illegal activities. Impacts on <i>people's health and wellbeing</i> may impact household decisions with regard to their livelihood strategies.</p>		<p>Changes in <i>lifestyle</i> (e.g., perception to natural habitats) and <i>governance</i> (e.g., law enforcement for environmental protection) impact decisions on land use activities (non-economically driven, e.g., on the management of protected areas). They can drive LUC in the total amount as well as in spatial pattern with respective impacts on vegetation characteristics, evapotranspiration and <i>moist convection</i>.</p>
	<p><i>LUC</i> and <i>moist convection</i> affect soil functions by reducing below-/above-ground functional diversity and redundancy, thereby destabilizing the plant-soil feedback mechanism (PSFM).</p>	<p>Changes in regional climate patterns such as the duration of the dry season or precipitation levels (<i>moist convection</i>) through storms, heat damages or the shift in the production window. The profitability of the current livelihood portfolio is then affected by changes in its benefit cost ratio. For example, by increases in fertilizers demand or new seeds resistant to drier conditions. If the new costs exceed the current benefits, households will need to adapt.</p>	<p>Change in regional climate (e.g., <i>moist convection</i>) and <i>LUC</i> may lead to a change in lifestyle and governance (stop deforestation/creation of new protected areas) and the formation of new (informal) institutions (e.g., youth groups, NGO coalitions). Changing climatic conditions, in particular extreme events, may lead to civil protests for more government support/more governmental climate action.</p>	

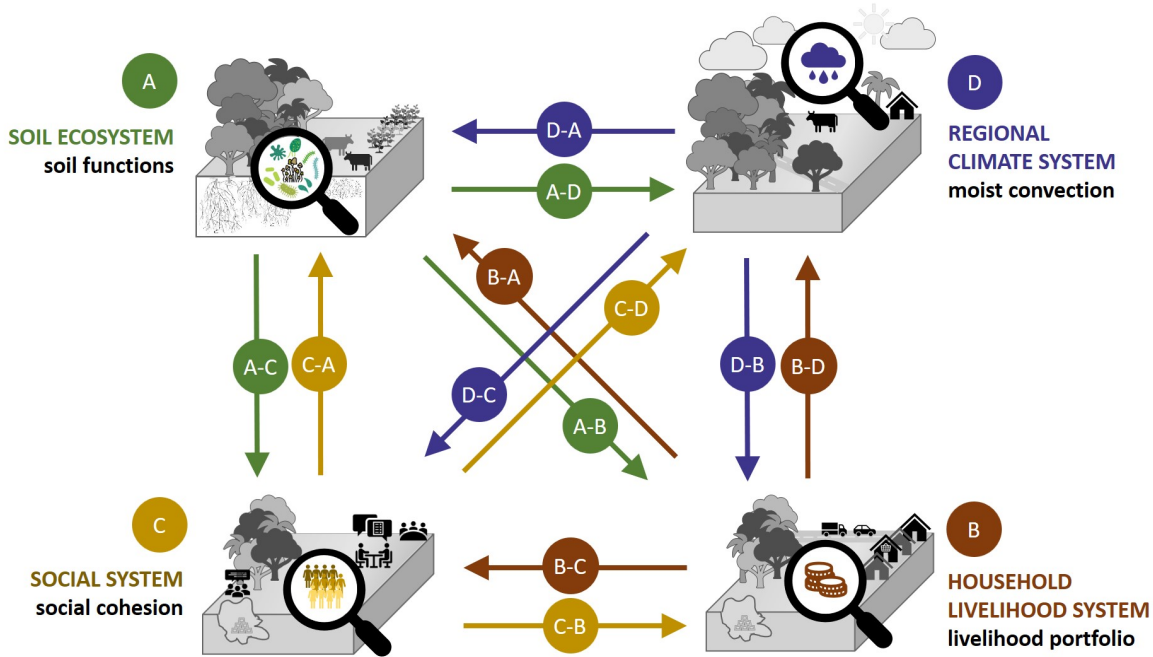


Figure 4.2: Depiction of the Multiverse in the southwestern Amazon, including selected tipping elements, respective crucial system features and cross-linkages (arrows) (own elaboration).

To illustrate the functioning of the Tipping Multiverse, we select one (among many) potential tipping pathways in the southwestern Amazon. In the following, we illustrate what a potential tipping cascade might look like. For simplicity we assume a two-phase like cascade dynamic emerging from linear unidirectional couplings of pairs of TE (i.e., from A to B, from B to C, and from C to D, see Fig. 4.2). That is, only after one TE tips, will the second TE tip (Klose et al. 2021). However, other dynamics, such as the domino cascade and the joint cascade could occur (Klose et al. 2021). Moreover, we recognize that multiple tipping cascade dynamics could simultaneously emerge from linear and non-linear bidirectional coupling of pairs of the TE.

As depicted in Tab. 4.1, we consider land use and land cover change as the starting driving force affecting the soil ecosystem TE (A) and triggering the tipping cascade. In particular, we assume such change as an outcome of the livelihood strategies of local households (e.g., forest conversion for agricultural expansion and increasing cattle herd size, logging, roads, and mining). Thus, such strategies lead to conversion of forests in order for the household to provide livelihood. Consequently, land use and land cover change may result in a reduction in functional diversity and redundancy above and belowground leading to PSFM destabilization and reduction in primary production. This can be aggravated when erosion comes into play, which may lead to the creation of bare soil elements in the landscape through certain land uses causing the TE soil to tip. A tipping soil system affects in turn the livelihood system (B) because the levels of production are constrained due to a lower primary productivity. Specifically, the reduced levels of production imply less income for the household, forcing it to adjust its livelihood strategy. Households can no longer reinvest in the same livelihood strategy and expand then their agricultural lands further in order to compensate for the reduced level of income in a feedback loop mechanism: less primary productivity leads to more forest clearing, which leads to less primary productivity and less income, which again leads to more forest clearing. At some point along this path, forest conversion will exceed the legal limits set by environmental laws. That is, households would have to make the decision to deforest more than allowed by the local laws and risk the chance of being caught and sanctioned. If the risk is taken, the livelihood strategy of the household changes to one that could no longer be considered legal and the household livelihood system (B) has also tipped. What follows

4.5. CONCLUSION

is the alteration of norms, values, interests and traditions of the households and communities affected. The outcome could be seen as the stable income from cattle raising or monocultural crops confirming people's decision of lifestyle change. Also, such economic transformations lead to out- and immigration, processes that further change the social system by changing lifestyle, culture and governance. In this sense the social system (C) has also tipped. At the aggregated level, that is, at the social TE, such changes feed back into household's land use decisions, amplifying the pattern of land use change (e.g., deforestation). Total increases as well as the spatial configuration of forest cover loss affect vegetation characteristics, evapotranspiration and moist convection, causing the tipping of the regional climate system (D). Reduced moist convection transforms the evergreen tropical rainforest into another (natural) vegetation type showing less diversity and/or structure causing further reductions in evapotranspiration and moist convection respectively. It further reduces precipitation and primary production on agricultural land.

As such, Tab. 4.2 provides an entry point for analysis on cascading tipping processes in the region's SES. We apply the term tipping cascade (Klose et al. 2021) to describe the interdependencies between the TE, i.e., that the stable state in one TE favors stability in the other TE. In contrast, the tipping of one TE may destabilize the crucial system feature of another TE and trigger its tipping once a threshold of the respective critical control values has passed. We assume that the direction and linkages in the tipping cascade are neither static nor linear. Instead, the tipping cascade may follow different multidimensional pathways, depending on the history and initial state of the TEs and the source(s) and strength(s) of the initial disturbance (driving force(s)) that causes stress to the TEs. Following this argumentation, the tipping of one TE may finally lead to the tipping of the entire regional's SES, hence tipping the multiverse.

4.4.3 Application, Limitations and Outlook

The Tipping Multiverse qualitatively describes relevant variables, features and interconnections within a regional SES in a common language applied across disciplinary boundaries. In this respect, it can guide monitoring programs or supplementing interdisciplinary empiric analysis on concrete causal-consequences and respective quantitative relationships. The framework itself does not provide empirical data and the potential tipping cascade is described as a hypothetical cascade. This means, that the interactions and pathways we describe are only some out of many more interconnections to be described. Hence, the framework can only inform decision-makers about the complexity of the system while specific policy recommendations cannot be derived from the Tipping Multiverse. However, a supplementing empirical analysis along the Tipping Multiverse Framework would allow concrete decision making in the light of tipping cascades. Hence, the provided framework can provide further information to the indication of early warning indicators (Lenton 2011). While the framework is limited in its complete depiction of reality, we believe that the simplification we take is necessary, to cover the different sub-systems in one framework. This means that we had to sacrifice detailed description of internal processes within each TE in order to focus on the interconnections between the TE. Nevertheless, the Tipping Multiverse bears the potential to be adaptable and transferable to other regional tropical SES and is therefore particularly relevant for interdisciplinary research approaches.

4.5 Conclusion

This study provides a Tipping Multiverse Framework to identify entry points to potential tipping cascades, via (1) the application of a global tipping points concept to a regional tropical SES (tipping matrix), and (2) the systematic assessment of interactions and feedbacks

within it (cross-impact matrix). In this regard, the Tipping Multiverse Framework supports interdisciplinary, cross scale research (of relevant processes within/between sub-systems) on tipping dynamics. Along the example of the southwestern Amazon we have identified the key underlying tipping elements (TE) and their interlinkages: the soil ecosystem, the household livelihood system, the regional social system and the regional climate system. The example from the southwestern Amazon shows the analytical potential of our proposed framework and advances the understanding of the regional SES by identifying core processes and functioning of each TE. The identified cross-linkages between the TE are considered to be a first step to the identification of potential tipping cascades. For a tipping cascade to be prevalent, the crossing of a TP in one TE leads to critical changes in another TE. Such dynamics are increasingly covered by in the literature, both in life-sustaining and detrimental directions (Franzke et al. 2022; Klose et al. 2021; Lenton 2020). The joint analysis of interactions and potential cascading TPs as proposed through the Tipping Multiverse Framework, promotes a better understanding of human-nature interactions and critical linkages that may serve to indicate early warning indicators for cascading tipping dynamics. Additionally, the Tipping Multiverse Framework can be applied for monitoring or intervention purposes or information for policy makers to better understand interconnections that are relevant to promote resilient SES.

5 | A POLITICAL ECOLOGY PERSPECTIVE ON RESOURCE EXTRACTION AND HUMAN SECURITY IN KENYA, BOLIVIA AND PERU

5.1 Abstract

This paper analyzes how the governance of non-renewable natural resources affects different dimensions of human security in local sites of extraction. We show how the analysis of human security can be embedded in a multi-scalar political ecology perspective to combine the strong suits of both approaches: a detailed, multidimensional assessment of impacts on the local scale with a critical transformative view on the interplay of power asymmetries mediating the distribution of costs and benefits across actors and scales. More specifically, we look at four of the most prominent 'glocal' governance instruments in extractive industries: participatory environmental licensing processes, indigenous prior consultation and free, prior and informed consent (FPIC), corporate social responsibility (CSR) programs and legal formalization initiatives. In theory, these governance initiatives should ensure local benefits and contribute to human security in three dimensions: (1) environmental security, (2) livelihood security and (3) safety and political security. However, our comparative analysis of 'glocal' governance institutions in oil and gas extraction in Bolivia and Kenya as well as in artisanal and small-scale gold mining (ASGM) in Peru shows that these institutions are rather ineffective in protecting the human security of local communities.

Keywords: human security, resource governance, political ecology, extractive industries, conflict

5.2 Introduction

Non-renewable resources, such as gold, oil and natural gas, are considered to be indispensable for global industries, but also for all kinds of everyday products. While these products are shipped around the world, negative externalities concentrate locally (LeBillon and Duffy 2018). For local populations, extractive projects often imply severe negative impacts, such as contamination, land dispossession or water shortage, which in turn can lead to contestation, conflicts and violence (Conde and Le Billon 2017). Providing insights into how the governance of natural resources can mediate their negative impacts, and benefit local communities while avoiding violent conflicts is an important task.

Studies show that existing governance arrangements ambiguously influence human security of local populations at sites of resource extraction (e.g., Grayson 2010). For instance, while the presence of police, military or private security forces in project areas may reduce violence,

new conflicts over the distribution of benefits can emerge within and between local populations (Arellano-Yanguas 2011). International organizations, policymakers and academia advocate for state-led participation and consultation mechanisms as means for conflict transformation, to guarantee rights and to avoid the 'resource curse' (e.g., Ahmadov 2014). However, studies in anthropology and political ecology have revealed that participation in the extraction sector has often not enabled effective participation and has instead been used to pave the way for expanding extractive frontiers (Schilling-Vacaflor and Eichler 2017). Local communities can also propose their own mechanisms to control extractive projects, such as communal environmental monitoring, or oppose projects by starting globalized campaigns (Paredes 2016). Further, non-governmental organizations (NGOs) can critically review state and company activities to make human rights violations visible (e.g., Global Witness) or contribute to establish new institutional rules (e.g., the Extractive Industries Transparency Initiative – EITI, Arond et al. (2019)). In sum, the literature alerts us that the effects of governance instruments depend on the power asymmetries and potential conflicts between the actors who can install and invoke – or neglect and undermine – the manifold formal and informal rules interplaying in each setting and across different scales (Campbell and Hatcher 2019).

Against this background, the paper purses a conceptual and an empirical aim. First, we want to show the benefits of embedding the analysis of human security in a multi-scalar political ecology perspective. This allows us to combine the strong suits of both approaches: a detailed, multi-dimensional assessment of impacts on the local scale with a critical transformative view on the interplay of power asymmetries mediating the distribution of costs and benefits across actors and scales. Second, we aim to contribute to the empirical understanding on how the governance of non-renewable extractive resources affects key dimensions of human security, namely environmental security, livelihood security, and safety and political security. More specifically, we compare the recently initiated oil extraction, mediated by corporate social responsibility (CSR) programs in Kenya, with instruments of participatory environmental licensing processes, including indigenous peoples' prior consultation and free, prior and informed consent (FPIC) about hydrocarbon activities in Bolivia, and the legal formalization of artisanal and small-scale gold mining (ASGM) in Peru. Comparisons of such diverse case studies are rare in research on extractive industries. We purposely bring these cases together to show that the combination of human security and political ecology is able to generate useful empirical insights in diverse contexts with different governance instruments, resources and regional contexts.

The paper is divided into six sections. Section 5.3 outlines the conceptual framework. Section 5.4 gives a concise description of our research design and methods, including the study area and data collection. Section 5.5 presents the results, including a description of instruments of 'glocal' natural resource governance in Bolivia, Kenya and Peru and analyzes impacts on human security. Section 5.6 comparatively discusses the country-specific findings through a political ecology lens before the final section (5.7) draws broader conclusions on how the multi-scalar political dynamics of 'glocal' governance instruments affect the human security of local populations exposed to resource extraction.

5.3 Conceptual Framework: Human Security Through a Political Ecology Lens

We share Engwicht und Grabek's (2019, p. 189) understanding of human security as being "[...] more than living free of conditions of violent warfare, but also implying access to basic goods and services, and the absence of a continuous threat of violent crime, loss of livelihood or authoritarian governance". The United Nations (1994), as the key actor promoting the concept, distinguished seven dimensions of human security, namely economic security, food security, health security, environmental security, personal security, community security and

political security. For the analysis in this paper we adopt the dimension of environmental security but aggregate the economic and food dimensions under livelihood security, and the health, personal, community and political dimensions under safety and political security (Fig. 5.1). Scholarship on human security has drawn on insights from environmental studies and development studies and the concept of human security has provided a useful analytical framework for interdisciplinary research across the natural and social sciences (Taylor 2013).

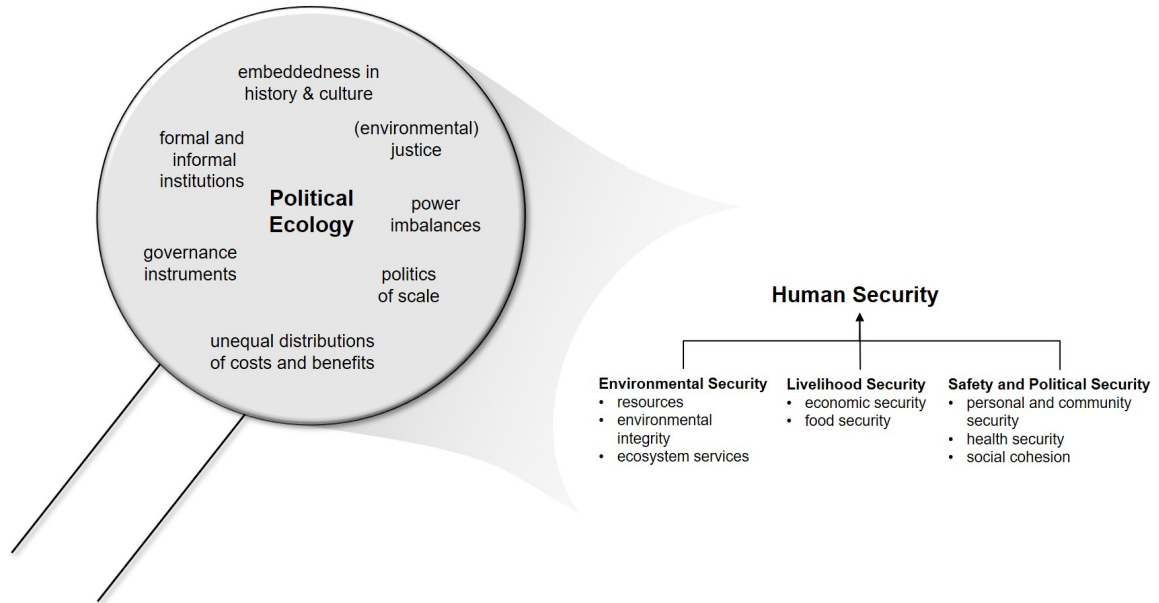


Figure 5.1: Conceptual framework (the authors).

We understand environmental security as the absence of risk or threat to the environment a person or community depends on and lives in (Vivekananda et al. 2014a). According to Bohle (2009), resources and income-earning activities as well as food supply and healthcare are essential for livelihood security. Lastly, we define safety as the absence of physical and psychological risk or threat to a person or community. The safety of a person is closely related to its political security, which we define building upon the Universal Declaration of Human Rights (United Nations 1948). Specifically, this entails ensuring the freedom of expression of cultural identity and the presence of strong social cohesion within and among social groups.

The concept of human security has been criticized for focusing too narrowly on the local level and on basic human needs while neglecting how they are impacted by political decisions and power imbalances (Chandler 2012; Taylor 2013). The sensitivity for power structures, political dynamics on and across scales, asymmetric distributions of costs and benefits, inequalities and the role of institutions beyond the local are particular strengths of political ecology (Perreault et al. 2015). We therefore embed the human security approach in a political ecology perspective (Fig. 5.1).

Resource governance is a complex entanglement of formal and informal institutions which can be invoked or undermined by actors in asymmetric power relations. More specifically, "natural resource governance can be understood as the norms, institutions, and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – including women, men, youth, indigenous peoples and local communities – secure access to, participate in, and are impacted by the management of natural resources" (Campese et al. 2016, p. 1).

Political ecologists have stressed that the focus on governance should not distort the attention from the fundamental asymmetries of the economic model underlying resource extraction and unequal distribution of costs and benefits on and across scales (Coumans 2019). In line with Swyngedouw and Heynen (2003), we conceive scales as constructed arenas of highly inter-

related activities (see also Neumann 2015). More specifically, scalar configurations comprise both regulatory order(s), for example geographical-institutional arrangements like states, local governance structures or international organizations, and networks of interlinked economic activities (Swyngedouw and Heynen 2003). Importantly, "scales are never set, but are perpetually disputed, redefined, reconstituted and restructured in terms of their extent, content, relative importance and interrelations" (Swyngedouw and Heynen 2003, p. 913). We embed the assessment of human security within identified processes, tensions and disconnects on and across different scales. Nevertheless, our perspective on these multi-scalar political dynamics goes beyond the understanding of "local conceptions of wealth, accumulation, resource and ecology being mere contextual" (Gilberthorpe and Rajak 2017, p. 190).

Based on the insights from the human security and political ecology literature, we use the concept of 'glocal' resource governance to explore how governance instruments travel across scales and shape local processes. In accordance with Bebbington et al. (2018) we do not conceive governance instruments and institutions as an independent, mediating variable, because such institutions are themselves a product of the same relationships that they mediate. In particular, understanding 'political settlements' – i.e., agreements among powerful actors that enable social order in a given country – is important, as they shape the ways in which governing relations are negotiated (Bebbington et al. 2018).

In line with Bebbington (2007), we understand conflicts and contestations surrounding resource extraction as 'glocal' spaces, which means that these processes are simultaneously globalized and localized. 'Glocal' does not only mean that resource governance operates in a top-down manner pressuring the implementation of globally designed policies at national and local scales. Rather, global policies are translated into and influenced by domestic contexts. Furthermore, 'glocal' resource governance also covers attempts of actors on the local scale to 'upscale' their initiatives or to 'jump scales' by referring to international norms or joining global alliances to gain voice in decision-making processes (Swyngedouw 1997). Within this analysis, we distinguish between formal initiatives on the local scale that arise from globally negotiated norms and informal or illegal activities of actors on the local scale, both of which shape resource extraction and its impacts at the 'margins of the state' (Damonte 2018, p. 1316) or in state absence (see also Bebbington 2007).

The framework developed for this paper purposely differs from other frameworks used to analyze the impacts of extractive industries, such as the sustainable livelihoods framework (Chambers and Conway 1992), the capitals and capabilities framework (Bebbington 1999) or human rights-based approaches (Götzmann 2019). The sustainable livelihoods framework focuses on the driving forces, pressures and impacts of livelihood related activities from a one-directional perspective of policy impact on livelihoods (Knutsson 2006), while the framework presented in this paper also takes into account political power relations and agency in a multi-directional and multi-scalar perspective. The capitals and capabilities framework applied to extractive industries promotes the importance of political economy and emphasizes the role of institutions in influencing livelihoods (Bebbington 1999). In contrast, the framework presented here provides a more comprehensive perspective on human lives focusing not only on the livelihood dimension but considering explicitly the integration of the environmental and social and political security dimensions. Human security and rights-based approaches both focus on the well-being of individuals and satisfaction of basic human needs. However, rights-based approaches, such as human rights impact assessments, have a comparatively narrow focus on human rights violations while missing out other impacts of the extractive industries. Furthermore, human rights-based approaches often limit their studies to document rights' violations while conceptually limiting individuals and groups to being people whose rights are violated. Going beyond this, our framework considers the agency of stakeholders (e.g., women and men in local communities, employees, etc.) and other actors (e.g., government, civil society and business actors) as well as their interactions across scales.

5.4 Methods

5.4.1 Case Studies and Comparison

The paper draws on extensive field research conducted independently from each other, in Kenya, Bolivia and Peru. For exploring the connections between 'glocal' resource governance and human security, the three study areas can be considered most diverse in terms of contrasting governance instruments and types of resource, while offering common ground in terms of the remoteness of the extractive sites and their 'glocal' connectedness.

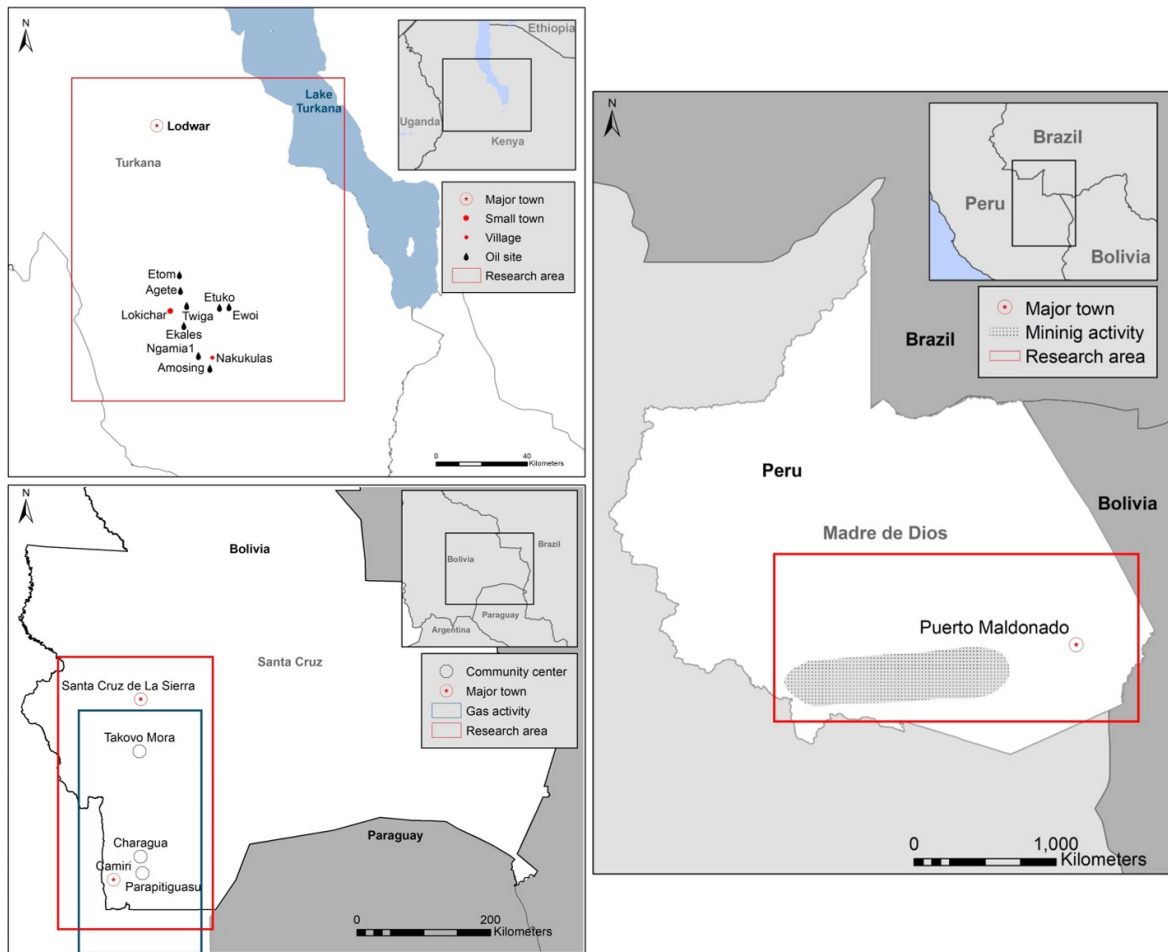


Figure 5.2: Study areas (Zulfiqar Ali Shah for the authors).

In Kenya, oil extraction has expanded relatively recently and governance instruments have mainly consisted of private initiatives. In Bolivia, the gas sector has undergone a nationalization process in the past two decades and diverse public and private governance initiatives have promised to reduce the negative socio-environmental impacts on indigenous and peasant communities. The Peruvian case study, in turn, analyzes the unfolding of formalization policies of artisanal and small-scale mining in the biodiversity hotspot Madre de Dios. With regard to human security, the selected case studies allow us to compare different risks and vulnerabilities in each of the three dimensions. For instance, the level of existing conflicts ranges from violent in Kenya to mostly nonviolent in Bolivia and Peru. The following sections provide more details.

In Kenya, the research was conducted in the northwestern part of the country. Most of the oil exploitation takes place around the town of Lokichar (Fig. 5.2). Nomadic pastoralism is the main livelihood in Turkana, while subsistence farming supplements pastoralism in West

Pokot (Greiner 2017). Water, pasture, land and livestock (mainly cattle, goats, sheep and camels) are the key resources for the Turkana and Pokot (Opiyo et al. 2015). While Turkana is one of the largest financial beneficiaries of the ongoing devolution process in Kenya, the county is still poorly developed in terms of formal education, health provision, road infrastructure, and formal employment opportunities (KNBS 2020). Poverty is widespread (KNBS and SID 2013). A challenge for formal investments and development in northwestern Kenya is the high level of insecurity caused by attacks on vehicles and violent conflicts (e.g., violent livestock raids) between various pastoral groups, especially the Turkana and Pokot. The conflicts have various drivers, but competition for livestock, water, pasture and land are crucial (Schilling et al. 2012). Environmental factors such as drought and increased rainfall variability are seen as contributing conflict factors (Detges 2014; Witsenburg and Adano 2009). Other authors have stressed the political dimension and elite influence and demarcation of boundaries as key conflict aggravators or drivers (e.g., Greiner 2013).

In Bolivia, field research was carried out in the indigenous Guaraní communities of the Chaco Region in the department of Santa Cruz, mainly in the communities from Charagua Norte, Parapitiguasu and Takovo Mora. The Chaco is an ecoregion with a high climatic variability and fragile ecosystems that have been threatened by a decrease of surface and subsurface water availability mainly caused by population growth, decreasing rainfall due to climate change, and the growing use of water by hydrocarbon and agribusiness activities (e.g., Aparicio-Effen et al. 2016). It is estimated that 85 percent of the country's gas reserves lie in Bolivia's Chaco area (Hinojosa 2012, p. 31). Many projects that explore, exploit and transport gas overlap with indigenous Guaraní territories and the Guaraní have participated in many prior consultation and environmental licensing processes (Bebbington 2012). Despite their decade-long experiences with gas extraction, the Bolivian census of 2012 shows that a big gap remains between the satisfaction of basic needs of the general citizenry of Santa Cruz and Guaraní people. While 23 percent of persons who identified as Guaraní, lacked access to piped water and 37 percent to electricity, only 6 percent of Santa Cruz's total inhabitants reported a lack of these basic services (INE 2012).

In Peru, research was conducted in Madre de Dios (MDD), a region in the country's south-east which belongs to the upper Amazon Basin. The region has been declared the Peruvian 'Capital of Biodiversity' (Law No. 26311) and is one of the world's biodiversity hotspots (Joshi 2016). The Interoceanic Highway has boosted the previously slow economic development (Dammert 2019; Southworth et al. 2011) and has led to an increase in population by 28.8 percent between 2007 and 2017. Gold is the most powerful commodity in the region. While impacts of large-scale mining (LSM) are covered by numerous studies (Arce 2014), informal and illegal ASGM mining (see 5.5.2) and its consequences have only recently received attention. Fueled by rising gold prices after the 2008 economic crisis and eased access to gold deposits through the interoceanic highway, ASGM has become a strong driver of deforestation (Caballero Espejo et al. 2018; Swenson et al. 2011). Additionally, mercury pollution poses serious threats to the environment and people. Further, invasions of illegal miners, governmental deficiencies and the lack of a unified cadaster system cause overlaps between contradictory concession types (mining, brazil nuts, eco-tourism, etc.) and land conflicts (Theije and Salman 2018).

5.4.2 Data Collection

In all case studies the data was collected through qualitative field research based on semi-structured interviews, focus group discussions (FGDs) and participatory observation (see Tab. 5.1). The villages and other research locations were chosen based on their exposure to and interaction with the resource extraction. This allowed us to analyze the effects of different levels of exposure and interaction on conflict dynamics. Within each community, women, men, elders, chiefs and other community leaders were interviewed to cover a broad spectrum

5.5. RESULTS

of perspectives. Interviews with representatives of the involved companies, NGOs and governments were conducted to compare and contrast their views with those of the communities (for more details see Flemmer and Schilling-Vacaflor 2016; Schilling et al. 2018a). FGDs were used to discuss issues that turned out to be contradicting in previous individual interviews. Data collection was structured along the three dimensions of human security and supplemented with questions on use and governance of resources as well as conflict dynamics. The data collected in the field was triangulated with the analysis of primary documents like policies, legal sources and reports provided by civil society actors, state institutions and corporations.

Table 5.1: Data collection (the authors).

	Kenya	Bolivia	Peru
Main interviewees	Community members, NGOs, Government of Kenya and Tullow	Community members, indigenous organizations, public and private hydrocarbon companies, state ministries, NGOs	Community members, indigenous organizations, NGOs, miners' federation, national and sub-national government
Research Period	3 months of fieldwork between September 2016 and February 2018	12 months of fieldwork between November 2011 and November 2015	7 months of fieldwork between April 2013 and October 2019
Number of interviews / focus group discussions	71 / 55	105 / 7	109 / 4

5.5 Results

5.5.1 'Glocal' Resource Governance in Kenya, Bolivia and Peru

In Kenya, the governance approach to oil extraction is top-down. The multinational oil company Tullow leases the land for oil extraction from the national government (Tullow 2019). This is possible because local communities use, but do not own the land (Government of Kenya 2016). Since the start of the devolution process in 2010, more financial resources and decision power (at least on paper) lie at the county level. According to Kenya's constitution, the revenues generated through selling Turkana oil are to be shared between the national government (70 percent), the county government (20 percent) and the local communities (10 percent) (Republic of Kenya 2010). However, reflecting the unequal power relations, the share for local communities has later been reduced to 5 percent (Daily Nation (2018a), see also Arellano-Yanguas and Acosta (2014)). As the financial benefits decrease from top to bottom, so does the local support of oil extraction.

Our research shows that the level of public participation is low and FPIC was not mentioned once by community members. In addition, currently "Kenya is neither compliant nor a candidate country [of EITI]" (Base Titanium 2019). FPIC and EITI play no role in the oil extraction in Turkana because there is hardly any pressure from the civil society that would push Tullow and the central government beyond publishing some oil and gas contracts (Open Government Partnership 2019). Tullow has commissioned several companies to carry out environmental impact assessments (EIA) but the quality and unbiasedness of the EIA reports is questionable (see Golder Associates 2018). In terms of CSR, Tullow uses diverse measures ranging from building school classrooms, setting up community resource centers with computers and internet access, providing water to several communities and offering temporary employment opportunities for unskilled labor.

Accordingly, the case study on Kenya focuses on corporate social responsibility (CSR) programs in the oil sector. Globally, CSR is part of international private businesses' self-regulation defining performance standards and codes of conduct (Sheehy 2015). While globalized fossil fuel and mineral sectors, dominated by multinational enterprises, established relatively au-

onomous transnational authority structures (Ruggie 2018), their CSR programs are led by ambiguous motivations and impacts on the local human security are uncertain (e.g., Grayson 2010).

In Bolivia, the natural gas sector has become the most important source of revenue for the country's economy (Kohl and Farthing 2012). The Bolivian government under President Evo Morales significantly increased the state's revenues from this sector through re-nationalization and high international prices. The growing revenues have partly been used to strengthen public corporations and to expand social policies – a combination that has contributed to shape power relations in the country in favor of extractivist agendas and to the disadvantage of indigenous rights and environmental protection (Bebbington 2013). There has been a wide gap between the constitutional recognition of Pachamama (Mother Earth) and the rights to *vivir bien* (good living) on the one hand and the advancement of a (neo-)extractivist political economic agenda on the other. Strong power asymmetries favoring economic interests have also manifested in the relations between state institutions, for instance between the powerful Ministry of Hydrocarbons and Energy and the rather weak Ministry of the Environment and Water (Bebbington 2013). Bolivia's domestic legislation and Bolivia's constitution (2009) foresee prior consultation processes with indigenous peoples and communities before gas activities can receive an environmental license and such processes have been implemented in the gas sector since 2007. However, critical research on prior consultation in Bolivia pointed to severe shortcomings of these processes due to legal and political limitations (Bebbington 2012; Flemmer and Schilling-Vacaflor 2016).

The case study on Bolivia analyses the interplay between participatory environmental licensing processes, prior consultation and free, prior and informed consent (FPIC) processes and human security in gas projects. Environmental licensing processes based on EIA gained international visibility during the United Nations Conference on the Environment in Stockholm in 1972, and in 1992, the UN Conference on Environment and Development resulted in a series of international laws and policies that encouraged signatories to incorporate the EIA as a national instrument (Wood 2002). While EIAs primarily focus on environmental impacts, repeated demands from NGOs and communities led to an incorporation of social and cultural impacts in the recent past (Glucker et al. 2013). Prior consultation and free, prior and informed consent (FPIC) should protect the rights of indigenous peoples' and local communities, particularly in the context of large-scale extraction or infrastructure projects. In international law, the International Labor Organization Convention 169 (ILO 1989) and the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP 2007) have established that participants get complete and non-biased information about the measures at stake. Further, processes are based on intercultural dialogue and either conclude with a binding agreement or the consent (or withholding of consent) of the participants (Rodríguez Garavito et al. 2009). The implementation of consultations and FPIC is globally most advanced in Latin America but highly contested between state governments and indigenous peoples (Wright and Tomaselli 2019).

The case study on Peru looks into the political dynamics of legal formalization initiatives of ASGM activities and human security. In theory, formalization policies seek to integrate informal ASGM into the formal economy and to make the activities socio-environmentally responsible (Salo et al. 2016). Since the early 2000s, formalization is the main instrument of governments (IGF 2017), big mining companies (ICMM 2016) as well as donors (CASM et al. 2010) and NGOs (Barreto 2011) for the ASGM sector. Some LSM companies actively finance formalization processes to stabilize gold prices, manage competition over mineral deposits and ameliorate the reputation of the environmental costs of mining (CASM et al. 2010).

Table 5.2: Key actors and interests (the authors).

Scale	Kenya		Bolivia		Peru	
	Key Actor	Interest	Key Actor	Interest	Key Actor	Interest
Global/ International	Tullow Headquarter	Maximize profits	Multinational corporations	Maximize profits, protect reputation	International Council of Mining and Metals (ICMM)	Control prices, supply and revenues through integrating informal mining into formal economy
National	National Government of Kenya	Smooth oil operations	National Government of Bolivia	Economic growth and revenues from the extractive industries, political power	High Commission for the Formalization of Mining (Presidency of the Council of Ministers)	Smooth implementation of the formalization process, state control of extraction and in extraction zones
	Tullow National Office in Kenya	Profits and revenues	Re-nationalized hydrocarbon corporation (YPFB)	Maximize profits, increase state control of extraction zones		
			Ministry of Hydrocarbons and Energy (MHE)	Resource extraction, compliance with contracts with companies and international agreements	Ministry for Mining and Energy (MEM)	Resource extraction, smooth implementation of the formalization process
			Ministry of Environment and Water (MMAyA)	Environmental protection, avoidance of conflicts with pro-extraction forces	Ministry for the Environment (MINAM)	Environmental protection
			Domestic NGOs	Environmental and/or human rights protection	National NGOs	Environmental protection and regeneration, human rights protection, research
		Indigenous lowland organizations	Indigenous peoples' rights, territorial control, economic benefits, and political influence			
				Armed Forces- DICAPI	Sanctions against illegal mining	

Scale	Kenya		Bolivia		Peru	
	Key Actor	Interest	Key Actor	Interest	Key Actor	Interest
Sub-national	County Government of Turkana	Share of oil revenues	Municipal governments	Support of (neo-) extractivist policies, share of gas revenues	MDD Regional Government	Smooth implementation of the formalization process
					Federation of Artisanal Miners in MDD (FEDEMIN), other miner associations	Divided opinions about formalization
					Native Federation of the Madre de Dios River and its Tributaries (FENAMAD)	Indigenous peoples' rights, territorial control, economic benefits, and political influence
Local	Village Chief and local communities	Employment, development, security, protection against externalities	Indigenous communities and their representative organizations	Indigenous peoples' rights, territorial control, economic benefits, and political influence; difficulties reconciling heterogeneous interests	Individual miners (formal, informal, illegal)	Divided opinions about formalization Informal miners: support of mining formalization; illegal miners: opposition against mining formalization
					Local population (non-miners)	Strong opposition against illegal mining, support of mining formalization

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In Peru, the mining industry is the central economic pillar with a topdown governance. The Ministry of Energy and Mines (MEM) is the main entity for defining concession areas and signing contracts. Big mining companies, organized in the powerful International Council of Mining and Metals (ICMM), promote and support ASGM formalization using a rhetoric of 'responsible and sustainable mining' (ICMM 2016). Since the early 2000s, the Peruvian government is implementing a formalization plan to govern informal and combat illegal ASGM. MDD is the most prominent place for ASGM. Concessions are mostly owned by individuals who either work on the concessions themselves or invite other informal miners for a fee. The Peruvian state uses three instruments to control ASGM (Damonte 2018): first, legal frameworks seek to oblige informal miners to obtain official certificates and a tax number and to elaborate environmental management and regeneration plans (National Plan for the Formalization of Artisanal Mining, 2011). This has had little effect and miners were given the chance to avoid sanctions by making a 'declaration of commitment' to the formalization process and pass from the category of 'illegal' to 'informal' until they comply with the requirements and become formal. Second, mining was limited only to certain areas ('mining corridor'). Third, the Peruvian government began to destroy illegal machinery and mining camps – in its most extreme form by bombing. This stirred protests which led to the political organization of miners and blockades of the formalization process (Damonte 2018).

Table 5.2 summarizes the key actors and their main interests. We understand key actors as those with decision-making power and those being most affected by the decisions.

5.5.2 Human Security

5.5.2.1 Environmental Security

In northwestern Kenya, the environmental security of pastoral communities largely depends on the availability of clean water for human and livestock consumption as well as land for (temporary) settlements and pasture (Schilling 2019). As part of its CSR efforts and to improve relations with local communities, Tullow has set up water tanks along the main road and in nearby communities (interview with Tullow community coordinator in Lokori, 14 September 2016.). The drinking water situation is improved, as long as Tullow provides water. While communities appreciate this, it creates heavy dependencies and the sustainability and reliability of the water supply is questionable.

In general, oil exploitation threatens communities' water security, both in terms of quantity and quality. Tullow acknowledges that the extraction of one barrel of oil requires three to four barrels of water (IRIN 2017). Hence the communities and Tullow compete for the same resource, although with very different capabilities. Additionally, oil spills endanger the quality of groundwater. Other risks to water and land include non-aqueous phase liquids and dumping of oil wastes without proper sealing and treatment (EPA 1993). These effects and risks have also been identified by one report commissioned by Tullow (see Kurrent Technologies 2015) while another one finds that the effects of the oil operation on the quantity and quality of water "are considered to be negligible" (Golder Associates 2018, p. 15). During field research, the pollution of water and land did not feature strongly in the responses of community members because production had not started at that time.

Oil exploitation has a (potentially) large impact on land rights. Tullow has a license for about 32,902 km² of land in Kenya (Tullow 2019). The oil sites, mostly located in Turkana County, are fenced and hence not accessible for the communities and their livestock. A 892 km long oil pipeline is being constructed to run from the oil exploitation site across the country to the coast (WWF 2019) and is contributing to the already highly contested issue of land use and land rights in Kenya (Greiner 2017).

In Bolivia, indigenous organizations like the Assembly of the Guaraní People (APG) have claimed collective land titles, particularly since the 1990s, with the aim to control and self-

govern their territories (Postero 2007). Until 2010, the Guaraní have been granted 1.5 million ha of collective land titles, which represent almost 33 percent of their original land claims (Chumacero 2011). However, Guaraní lands have been crisscrossed by gas-related activities like seismic explorations, gas pipelines, gas wells and workers' camps in the past decades. These activities have fragmented and reduced Guaraní territories (Bebbington 2012). EIA and prior consultation processes turned out rather ineffective for upholding territorial control and integrity, as these instruments focus on single projects but do not consider cumulative impacts. In some cases, the Guaraní have demanded granting of alternative land titles in addition to monetary compensation – without success. Besides, EIA and prior consultation processes both draw on the state's interpretation of legally established land rights, in disrespect of the broader Guaraní territorial perspectives (interviews in Guaraní communities from Charagua Norte, Takovo Mora and Parapitiguasu). Thereby, EIA and prior consultation processes tend to tip the power balance in land conflicts to the disadvantage of indigenous communities' claims and interests.

The negative impacts of hydrocarbon activities on water quality and quantity have been a main concern of Guaraní communities, voiced in all analyzed prior consultation processes. In several cases, the Guaraní demanded impact analyses on subsurface water reserves and larger distances to detonations from seismic explorations (MHE 2013). However, companies have often disrespected the established distances. Further, the communities' demand for better data about subsurface resources has been rejected by the operating companies and the state ministries with both arguing that such studies would be too costly (Flemmer and Schilling-Vacaflor 2016).

In Peru, the environmental security of rural communities in MDD depends heavily on ecosystem services, e.g., the availability of fertile land and clean water for agricultural production as well as on intact forests for the extraction of forest products, such as brazil nuts. Rapidly expanding ASGM activities, most of them illegal, have severely affected the local populations' access to land (Damonte 2018). Illegal miners, many of them migrants from the Andes, pursue land invasions and associated deforestation on forest or mining concessions in order to settle and/or to engage in mining activities (Swenson et al. 2011). Often, the concessionaries fear violence and are therefore reluctant to expel the invaders or to file a complaint. Nevertheless, the concessionaries are responsible for the integrity of their concession, and thus obliged to impede land invasions. In case of non-compliance, the government charges a fine. Hence, concessionaries suffer from the negative consequences of land invasion and, out of fear, do not use governance mechanisms that were originally designed for protecting their rights.

Water quality is at risk through the contamination of surface and subsurface water. Every year, approximately 50 tons of mercury from auriferous mining are released to the terrestrial and aquatic ecosystems and the atmosphere in MDD (Brack Egg et al. 2011). Local populations in MDD and downstream water users suffer the negative socio-environmental consequences of this pollution (SPDA 2014). Special regenerative and decontaminative treatment would be required before soil and water could be used again. However, such treatments are still in a phase of experimentation and rarely implemented (MINAM 2017). Inadequate sewage and waste facilities in often provisional mining settlements further contribute to deteriorating water quality (Fraser 2009).

5.5.2.2 Livelihood Security

In Kenya, cattle, goats, sheep, and occasionally camel, are the main sources of food for the pastoral communities (Opiyo et al. 2015). Section 5.5.2.1 has shown that oil exploitation poses significant risks to water, land, and pasture resources, which in turn can negatively affect the livestock and hence food security of the pastoral communities. However, during the fieldwork period, negative effects on food security were not a strong concern of the communities. Some community members reported a loss of livestock due to accidents with vehicles moving towards

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and leaving the oil sites (see also Schilling et al. 2015).

Opportunities to generate income from formal employment are highly limited in Turkana. Since the oil discovery in 2012, employment opportunities have increased. However, the need for unskilled labor is highest during the development phase and lower during the exploration, appraisal and production phases of oil (Cairn Energy 2014). Tullow's Ngamia and Amosing fields have already reached the production phase (Fig. 5.2 and Tullow (2019)). According to a chief of a nearby village, local employment peaked in 2014. Since then, direct employment opportunities are limited to jobs like security guards, road marshals as well as community liaison officers and community relations' officers (see Schilling et al. 2018a). In addition to these direct employment opportunities, indirect opportunities have opened up as the region attracts more people and the demand for accommodation and food rises. This is particularly visible in the quickly growing town of Lokichar. While the effects of oil on livestock can be expected to be negative, the new income opportunities have the potential to strengthen the livelihood security of local populations.

In the Bolivian Guaraní territories, the area available for agricultural purposes, livestock raising, hunting and collecting medicinal plants has decreased due to numerous gas extraction activities (interviews in Guaraní communities). Food security is further at risk as subsistence agriculture and livestock raising has become more difficult under (temporal) water scarcity. Local subsistence agriculture has increasingly been substituted by the consumption of processed food, which has had negative health impacts on local populations, such as an increase of malnutrition and obesity (interviews in the communities from Takovo Mora).

Furthermore, in several prior consultation processes, Guaraní communities reported that noise and the increased movement of people scare away the animals they hunt. EIA studies use to argue that animals would only migrate temporarily, classifying this impact as minor and reversible (MHE 2013). Environmental NGOs have supported the Guaraní's position, arguing that many out-migrating wild animals end up occupying marginal ecological spaces or competing with other species, whereby their reproduction ability might be affected (Ribera Arismendi 2008).

In general, the identification of negative, irreparable and long-term consequences of hydrocarbon projects has played an important role in consultation processes, as companies are required to compensate communities for such impacts. Negotiations between Guaraní and companies have been based on impact quantification (Bebbington 2013) in order to establish equivalences between a loss of livelihood and monetary compensation and investments. However, local populations have criticized the compensation payments. For instance, a Guaraní authority explained: "well, from our perspective these compensation payments are like the crumbs of bread. We cannot do much with this money and in the end what we feel most are the damages that such compensations have caused within our communities and organizations" (interview in Parapitiguasu, 30 October 2013). Furthermore, available jobs offered mainly to young Guaraní men have mostly been temporary, physically demanding and unqualified.

In Peru, land invaders often destroy the livelihood assets of the concessionary, which might have been reserved for future use (Bebbington and Bury 2009). Thus, intergenerational food security is at risk. Destruction and pollution of soils and bioaccumulation of mercury in aquatic organisms pose a risk for the population's food security whose diet heavily depends on fish. In addition, people's health is threatened by atmospheric mercury pollution that causes heavy respiratory diseases.

In terms of income security, mining activities are lucrative as the demand and price for gold are high. However, due to rising governmental intervention on illegal mining areas and increasing pressure to formalize (Damonte 2013), miners fear income insecurity. Cortés-McPherson (2019) adds that mining is not exclusively a poverty-driven activity but an activity for livelihood diversification that has provided opportunities for 'capital interests'. Through mechanization of their activities and employment of work forces, some mining entrepreneurs

have managed to accumulate capital. Additionally, a new elite of miners has gained political influence in the local government, shaping decision-making in favor of their business interests. For example, the former head of MDD's regional government was the director of the Mining Federation of MDD (FEDEMIN) before taking office in 2015. Thus, the local government supported miners' interests, for example by constructing roads to mining camps (Cortés-McPherson 2019).

For informal miners and those 'in process of formalization', the highly bureaucratic formalization procedure appears complicated, long and expensive (Damonte 2018). This could pose a risk to their income security as fees for accreditation and approval by the Environmental Management Correctives as well as for the consultants developing formalization plans are high. Additionally, the miners report fear of 'being exploited by the state' through taxes on formalized revenues. While miners 'in process of formalization' are required to abandon mercury and cyanide products, incentives and funding schemes for clean mining technologies are lacking.

5.5.2.3 Safety and Political Security

In northwestern Kenya, the greatest threats to the communities' safety and political security are violent conflicts between pastoral groups, mainly the Turkana and Pokot (Schilling et al. 2012). Oil exploitation affects intercommunal conflict dynamics and the security situation. Community members reported that around the oil sites the security situation has generally improved because of the presence of private security companies and Kenyan police forces protecting the oil sites. However, Tullow has also hired the so-called Kenya Police Reserves (KPRs), originally in charge of protecting the communities, to instead protect sites of oil exploration and extraction. Respondents claimed that without the KPRs, the vulnerability of some villages to attacks by other pastoral groups has increased (see also Daily Nation 2018b). Further, oil exploration has partly led to violent conflict between the local communities and Tullow. These are mainly driven by communities' unfulfilled employment expectations (see Schilling et al. 2018a). Many community members expressed their frustration about the mismatch between the demand for and supply of unskilled labor, by blocking access roads to oil sites and entering them forcefully in order to lend weight to their claims for jobs and security (see also Daily Nation 2018c). These incidents are usually resolved nonviolently, but the situation can escalate, especially as traffic with oil trucks is increasing. The social cohesion within and between Turkana communities is mostly affected by competition and disputes over tenders to provide transport services for Tullow. During an interview with a group of youth and vehicle brokers in Nakukulas, corruption and ownership of cars were key concerns.

In Bolivia, prior consultation and EIA processes provide better information about planned extraction projects to local communities and create participatory spaces between local communities and the state. However, these processes have not fulfilled the expectations of Guaraní communities as our interviews indicate. In the past few years, Guaraní people mobilized because of perceived injustices surrounding hydrocarbon activities, such as new Supreme Decrees limiting their right to prior consultation, environmental degradation and small compensation payments. In several instances, the police violently repressed protests and road blockades. Especially the human rights violations against the Guaraní communities from Takovo Mora in October 2015 were heavily criticized by the Bolivian Ombudsperson (Defensoría del Pueblo 2016). These communities have only achieved formal land titles for a minor part of the land they originally had claimed. The state and hydrocarbon corporations have taken advantage of tenure insecurity for neglecting the Guaraní's rights to prior consultation and compensation. Furthermore, the state and the corporations led negative media campaigns portraying the Guaraní from Takovo Mora as blackmailers and blockers of the countries' development (Schilling-Vacaflor 2017).

In turn, Guaraní people in favor of gas extraction have often been offered employment and

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benefits. Such practices have contributed to internal divisions and conflicts among Guaraní communities and to a weakening of local social organizations (Schilling-Vacaflor and Eichler 2017). In several prior consultation processes the Guaraní stated that their relations with the companies and the compensation payments have shattered their organic structures by creating pressure over authorities and promoting corruption (MHE 2013). Such dynamics negatively impact the Guaraní's social cohesion. In the long run, weak and divided organizations will have a reduced capacity to defend their claims and to uphold their rights.

In Peru, poor and unsafe working conditions, including a lack of safety equipment when using mercury and strong water pumps, pose a risk to the physical well-being of workers in ASGM. Especially on illegal mining sites, workers are exploited under slavery-like conditions and women are forced to work as prostitutes with cases of human traffic being reported (Ojo Público 2019). Violence has occurred when neighboring concessionaries and landowners received threats and were physically attacked by illegal miners after filing complaints about land invasions. Unclear governmental responsibilities add to the insecurity in such cases, as competencies are ambiguous and police forces are not well equipped to be effective against larger invasions. Such land invasions can also deprive the concessionaries or indigenous communities of a source of cultural identity when primary forests are irretrievably destructed (Bebbington and Bury 2009).

Social cohesion in MDD is at risk because of two strong opposing interest groups: those in favor and those against ASGM. The region has a strong alliance between environmental groups and indigenous organizations supported by Peruvian and international funds (Damonte 2016). Additionally, the ways of how mining should be conducted and controlled is highly contested. While previous regional governments were in favor of miners and supported mining activities, the current regional government, which took office in 2018, is emphasizing actions for formalization and against illegal mining. A critical point is the unequally distributed capacity to cope with environmental impacts and land loss. While miners have the capacity to bend or ignore environmental standards and gain income to buy supplies, such as bottled drinking water and food, rainforest communities are much more vulnerable to contamination, because they frequently live from subsistence farming, hunting and fishing and have no or little monetary income (see Tab. 5.3 and Crovetto (2003)).

5.5.3 Brief Summary of Results

In all three cases, government institutions were unable or unwilling to protect the human security of local communities against the externalities of resource extraction and did not ensure their benefits (Tab. 5.3). While short-term improvements of water security have been found in Kenya, overall environmental security is undermined in all three cases as extractive industries and communities compete over water, in addition to pollution of water and soils by mercury in Peru and oil spills in Kenya. This destabilization of environmental security has knock-on effects on people's livelihood security and income opportunities from resource extraction are not secure and high enough to offset these impacts. In Bolivia and Kenya, this means a problematic trade-off for local communities between short-term economic benefits to compensate longterm losses of territorial and environmental integrity. In Peru, local communities are not only the most exposed to negative externalities. They are also mostly excluded from the benefits as most of the miners are migrants. This causes tensions and conflict between the local communities and the newcomers. The failure of governance mechanisms to mediate negative impacts, benefit local communities, and avoid conflicts has multiple causes, ranging from a lack of policies and non-implementation (as in Kenya) to opposition of sub-national governments and ASGM miners against the implementation of policies (as in Peru) or corporate capture of participatory mechanisms and non-enforcement by the state (as in Bolivia). Our findings point to general patterns of the limits of governance instruments in the extractive industries in remote areas in the Global South, where benefits of local communi-

ties can mostly be found in the economic domain (leading to ambivalent outcomes regarding livelihood security), and governance instruments fail to protect environmental security. In turn, social and political security has been weakened in many places as the governance of the extractive industries tends to exacerbate different types of conflicts and divisions, for example between the supporters and opposers of the resource extraction or over the distribution of benefits.

Table 5.3: Summary of effects on human security (the authors).

Human Security	Kenya	Bolivia	Peru
Environmental Security	Improved water security in short term, but undermined in long term. Overall negative.	Fragmentation of Guarani territory, reduction of lands, loss of water quality and quantity, soil erosion. Overall negative.	Large-scale destruction of land, soil and water resources. Overall negative.
Livelihood Security	Improved employment and income opportunities, but environmental externalities negatively impact livestock. Overall ambivalent.	Reduced food security, loss of access to land. Access to compensation, benefits and employment but no long-term improvements. Overall ambivalent.	Improved income opportunities for miners but environmental and livelihood externalities on adjacent communities. Overall ambivalent.
Safety and Political Security	Improved security around oil sites but less security in communities where KPRs have left. Overall negative.	Repression and threats against persons opposing gas projects. Loss of social cohesion due to conflicts and unequal economic benefits. Overall negative.	Unsafe working conditions, reduced social cohesion through conflict of interests between miners and non-miners. Overall negative.

5.6 Discussing the Political Ecology of Human Security

In this paper we apply a political ecology lens to analyze how the governance of non-renewable natural resources affects different dimensions of human security in local sites of extraction – in short, the political ecology of human security. Our research confirms the central argument of the literature on political ecology that the unfolding of globally designed instruments, such as EIAs, prior consultation and consent processes, CSR programs and globally promoted formalization initiatives, strongly depend on both national and local contexts, as well as the properties of the extracted natural resource (see also Perreault et al. 2015). For instance, the fact that the voice of local communities in northwestern Kenya has received little public and media attention, made it easy for the central government to avoid state-led governance instruments like prior consultation processes or public participation in environmental licensing. In contrast, in Bolivia, after the collapse of the last government of the Pacted Democracy under President Gonzalo Sánchez de Lozada in 2003, indigenous and social movements gained discursive and political power (Bebbington et al. 2018). In this context, new governance instruments like prior consultation and participatory environmental licensing processes were adopted. However, the power asymmetries within the Bolivian state that are inclined towards a pro-extractive agenda help to explain the limitations of new governance instruments for enabling human security in the context of transnational resource extraction. In Peru, the formalization process of ASGM is a globally supported initiative which the central national government tries to impose on a complex set of informal and illegal resource extraction sites (see also Salo et al. 2016). The regulation of ASGM divides the local population and the historical trajectory of exploitation, in combination with high levels of corruption, have led to a local regime of gold mining which further enhances power asymmetries between vulnerable indigenous populations, local elites, and Andean settlers. Thereby the formalization process has had little success in limiting negative impacts on human security and fueled conflict.

5.6. DISCUSSING THE POLITICAL ECOLOGY OF HUMAN SECURITY

The examples from our case studies show that formal governance instruments and progressive domestic legal designs do not guarantee improvements in the human security of local populations. Instead, we show that the decisive forces lie in the surrounding local and multi-scalar power relations. The governments of all three countries have a high interest in revenues of extractive industries, and design and implement their governance regimes according to global business standards with a view to attracting large-scale projects and foreign capital. In Kenya, domestic legal frameworks for environmental licensing could function as a safeguard against environmental pollution but they have only been implemented in a tokenistic manner. EIA studies have been administered in a non-transparent way and public participation has been absent. These very weak public policies exclude local voices from public decision-making and leave the mediation on human security impacts almost exclusively to sporadic and ad-hoc CSR initiatives. Corporations are almost unsupervised and – as observed in other, foremost African contexts – can establish projects of ‘enclave extraction’ (see Ferguson 2006) without being held responsible for impacts on local communities. In the meantime, the state focuses on providing security for smooth business operations. Public pressure exerted by a stronger civil society could force the Kenyan government to join the EITI which in turn could be an important step towards more transparency.

In Bolivia, the state formally established public supervision of companies and progressive participatory processes, and, at least formally, local populations have a much stronger role in resource governance. The country has translated global norms on environmental licensing and indigenous peoples’ rights to prior consultation and free, prior and informed consent (FPIC) into domestic legislation and implemented them. Prior consultation and EIA processes provide better information about planned extraction projects to local communities and create participatory spaces between local communities and the state. However, our case study shows that the responsible state ministries, together with extraction corporations, have used these instruments to foster a proextraction agenda and smooth operations by establishing a legitimizing facade, while disregarding the protection of natural environments and silencing communities’ social claims. Here, progressive legal instruments such as prior consultation and FPIC, are not necessarily an indicator for the mediation of impacts on human security, but state administration – in partnership with corporations – can advance an instrumental use of governance initiatives without significantly improving the situation locally. Overall, due to corporate capture, governance mechanisms have not effectively mediated negative impacts or changed the nature of extraction projects.

In Peru, different to the centralized resources in Kenya and Bolivia, the government of MDD uses a formalization process to gain authority over scattered ASGM activities and control their human security implications. A well-functioning formalized ASGM sector, is expected to be beneficial in particular to the economic and personal as well as community security of formalized miners. An increase in market value of gold due to a decrease in supply would enhance economic security. In addition, personal security would be improved by providing safer working conditions and community security would increase by stopping threats and invasions of illegal miners on formerly recognized concessions. While the central government has forcefully sanctioned illegal mining, enforcement of legal formalization is low, due to the economic importance and political influence of miners. Nevertheless, some mining associations support formalization, have abandoned mercury, and have started legal procedures to gain state protection and avoid (military) state sanctions. However, local populations negatively impacted by ASGM activities do not have a voice in the regulation process, fear the miners, and often lack the necessary economic income to compensate their losses. Thus, while enhancing some environmental standards, the imposition of governance instruments also leads to a higher risk in the livelihood and political security of the local populations. In addition, the unsustainable informal practices that have de facto governed MDD’s ASGM sector before the state’s interventions and local power asymmetries continue

to be deeply inscribed in the sub-national political landscape dominated by miners.

Nevertheless, other studies have indicated merits of participatory environmental licensing processes, FPIC, CSR and legal formalization initiatives for human security (Engwicht and Grabek 2019). For example, Lompo and Trani (2013) show that CSR measures by an oil company have improved basic capabilities and subjective well-being of at least some groups affected by oil exploitation in the Niger Delta. Similarly, our findings from Kenya and Bolivia identify some community benefits from CSR measures ranging from short-term employment and monetary compensations to new school classrooms, and access to computers and water. However, these opportunities and benefits are limited in scope and time and they create new dependencies on the companies and asymmetries in local power structures (see also Bebbington 2010).

While this study analytically distinguishes between the local, national and global scales, it is worth mentioning that these scales interpenetrate and co-constitute each other. For example, state entities and corporations, in many cases together with local pro-extraction actors, form resource assemblages that create downward pressure on communities and on actors who are critical of extraction (see also Bebbington et al. 2014). This reveals a contradiction inherent in many governance mechanisms which should protect the rights of the most vulnerable and marginalized groups, but end up disempowering them even more (Flemmer and Schilling-Vacaflor 2016).

Some methodological reflections can be made. We find that the human security approach has two strengths. First, this approach places the local populations at the center of the analysis. This is highly useful as a key intention of our paper is to contribute to an understanding of how local populations can be better protected from the externalities of resource extraction while creating local benefits. Second, the concept of human security is instrumental for structuring our analysis and understanding of how resource extraction impacts human security of local communities in its multiple dimensions – environmental security, livelihood security, and safety and political security.

However, without integrating political ecology into the analysis, our study would have been limited to describing the symptoms of vulnerability, without addressing their underlying causes and related sociopolitical processes (see Taylor 2013). Had we only used the human security approach, we would have missed the power dynamics, modes of exclusion, inequalities and the role of institutions cutting across scales. Consequently, there would have been the risk of depoliticizing or even securitizing livelihoods leading to a justification of top-down interventions.

5.7 Conclusions

Applying a political ecology lens to human security, we find that 'glocal' resource governance often reproduces, amplifies or creates power imbalances and divisions on and between different scales. Our study shows that in all three cases the winners of the resource extraction can mostly be found at the national and international scale while local communities hardly benefit and are left unprotected against externalities. The human security approach was instrumental in structuring our analysis of local impacts and to understand how strongly the environmental security, livelihood security, and safety and political security of the local communities have been impacted by resource extraction. The political ecology lens sensitized us for power structures, political dynamics on and across scales, and hence enabled us to analyze the distribution of costs and benefits, inequalities and the role of institutions. Overall our study shows that human security and political ecology are not on opposite ends but rather approaches that can be usefully combined. Our study further contributes to the existing research by stressing the importance of one underlying question: "governance by whom and for whom?". For future research it is therefore promising to analyze how local communities can

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be meaningfully integrated in the design of conflict-sensitive 'glocal' governance instruments that protect local communities from externalities while ensuring that they strongly benefit from resource extraction, both in the short and long run. We conclude that a political ecology perspective on human security is not only mutually beneficial in conceptual terms but a necessary step towards transforming unequal conditions of resource extraction and (ultimately) improving the lives of affected communities.

6 | CONFLICTS OVER LAND AS A RISK FOR SOCIAL-ECOLOGICAL RESILIENCE: A TRANSNATIONAL COMPARATIVE ANALYSIS IN THE SOUTHWESTERN AMAZON

6.1 Abstract

People in the department of Madre de Dios/Peru, the state of Acre/Brazil, and the department of Pando/Bolivia experience similar conflicts over land, land use, and access to resources. At the same time, each conflict reveals distinct characteristics and dynamics, arising from its history, legal regulation, institutional (in-)capacities, and culturally diverse local populations. The aim of this paper is to better understand the main drivers of social-ecological conflicts over land in and around three protected areas in this transboundary region, known as MAP, and to analyze how (environmental) institutions influence these drivers. The paper is based on a literature review and expert interviews; it focuses on conflicts around (1) gold mining in Madre de Dios, (2) extensive cattle ranching in Acre, and (3) access to communal land in Pando. Using theories of conflict research, expanded by a political ecology perspective and insights from stakeholder and expert interviews, we find that the major conflict drivers are (1) land tenure and access to land and natural resources, (2) identity and lifestyle driven transformations, (3) state and market driven agendas, and (4) networked illegal and criminal activities. Through a comparative conflict analysis, we develop four recommendations to strengthen the creation of reflexive institutions that may be able to foster social-ecological resilience in the region: (1) The clarification of responsibilities between governance institutions and their financing; (2) the awareness raising for existing power structures and opening spaces for enhanced local participation; (3) the breaking of corruptive cycles while developing economically, ecologically, and socially sustainable livelihood opportunities; and (4) taking the continuous reproduction of illegal activities into account while clarifying responsibilities, raising awareness, and breaking corruptive cycles. The results of our research therefore not only contribute to a better understanding of conflicts in the MAP region and the wider scientific literature on social-ecological conflicts and governance, but it is also the first paper that identifies entry points and prerequisites for the transformation from reactive to reflexive institutions in Amazonian societies.

Keywords: social-ecological conflict, reflexive institutions, land use change, MAP region, Madre de Dios/Peru, Acre/Brazil, Pando/Bolivia, criminal networks, Amazon

6.2 Introduction

Access to and control over natural resources play a key role in land use conflicts in the southwestern Amazon (CPT 2020). Often, formal and informal institutions govern access and distribution of natural resources, and thus directly or indirectly shape and influence the conflict potential in the region (Schilling et al. 2021). While these institutions have undergone many restructuring processes through sometimes fast changing governmental frame conditions throughout the past century, underlying structures have mostly remained centralized. These centralized structures were manifested through processes of colonial continuities that often resulted in deadlocked institutional stability during mostly stable environmental conditions of the Holocene. We would like to highlight here that 'stability' is not necessarily understood positively, such as contributing to human well-being. Rather, stability of the current state can also be an indicator of unjust or inadequate dynamics. In combination, these global stable conditions resulted in more or less stable social-ecological systems (SES) (Rockström et al. 2009b), although regional SES were highly threatened through colonial and neo-colonial practices, e.g., (Smith et al. 2020; Soga and Gaston 2016; Whyte 2018).

The erosion of this social-ecological stability through increasing human interference with the Earth System during the Anthropocene deprives the foundations of these formerly stable structures. Consequently, arising governance challenges call for the dynamic transformation of institutions on comparatively short timescales. We understand governance here alongside Arguedas (2019) and Saunier and Meganck (2009) as the process by which the state, non-state institutions, and civil society interact to make decisions, formulate and implement policies, exercise agency, and pursue other types of actions in the common interest. In the literature, the required institutional transformation is referred to as the development of reflexivity within institutions (Whyte 2018). Reflexivity can be created through adaptive management processes fostering proactive agency instead of mere reactive management of change, or as Dryzek (2016, p. 942) puts it 'being or becoming' a different institution rather than simply 'doing' something different. This process requires the development of new reflexive governance competencies as it has been argued by McKay et al. (2017) who developed a diagnostic tool to measure them. Such reflexive competencies enable institutions to react dynamically and iteratively to changing conditions and hence are one condition for the creation of resilient institutions.

At the tri-national Amazonian border of Madre de Dios/Peru, Acre/Brazil, and Pando/Bolivia – also known as the MAP region – the neighboring geographic spaces share similar ecological characteristics. However, their social, economic, and historical properties are very different (Salisbury and Weinstein 2014). The MAP region contains large areas of primary forest often under unclear land tenure systems, facing at the same time increasing pressure through extending agricultural, mining, and infrastructural developments. These activities are sometimes well connected to activities of organized crime (Schönenberg 2002). The three subnational entities share the occurrence of conflicts over land use and access to resources in and around protected areas (PA); however, the distinctiveness of each conflict arises from both the evolution of governance institutions and the different social-cultural systems in each country. Little is known about this interplay of governance from formal and informal (environmental) institutions within differing social-cultural environments and their impact on social-ecological conflicts over land in the MAP region. Therefore, this paper aims to answer the question: What are the main drivers of social-ecological conflicts over land in and around three protected areas in the MAP region and how do (environmental) institutions influence these drivers? Addressing this question is important because land use conflicts, potentially developing into violent ones, have a greater impact on people who depend on land to secure their livelihoods (Schilling et al. 2017). Therefore, understanding environmental governance is important in preventing and mitigating conflicts and is thus highly relevant for people's and nature's well-being. This paper therefore not only contributes to a better understanding

of conflicts in the MAP region and the wider scientific literature on social-ecological conflicts and governance, it is also the first paper that identifies entry points for the transformation from reactive to reflexive institutions which can strengthen the resilience of rural and disadvantaged population in Amazonian societies. Approaching social resilience from a conflict perspective is a special case, as conflicts and how they are dealt with can be seen as both a challenge for and measure of social resilience. By focusing on conflicts related to land and the environment, we draw the connection between social and ecological resilience and thus follow the demands formulated by Daring et al. (2022) to contribute to the distinct knowledge on social resilience, that is relevant for re-relating people and nature.

We embed our conflict analysis within a social-ecological perspective to account for the deeply intertwined human-nature relationships in the MAP region and the corresponding impossibility to separate the conflict analysis from SES dynamics. Consequently, we use the term social-ecological conflicts (see also Rechciński et al. 2019). Particularly, we focus on three conflicts over land use in and around PAs, one in each sub-national entity: (1) illegal gold mining in Madre de Dios, (2) extensive cattle ranching in Acre, and (3) access to communal land in Pando.

The article is structured into four sections: In Section 6.3, we introduce the research region and our analytical framework and describe our methods. In Section 6.4.1, we present our results starting with an overview of institutional governance structures of the respective PAs followed by a contextualization of these dynamics and their tensions with prevalent organized crime. Section 6.4.2 continues with the comparative analysis of the social-ecological conflicts over land use along four major conflict drivers. In Section 6.5, we discuss those conflict drivers and how they are affected by formal, informal and illegal institutions. Section 6.6 closes with a summary on the contribution of our research on understanding conflict drivers in the MAP region and the lessons learnt for the design of reflexive institutions.

6.3 Materials and Methods

6.3.1 The Research Region

Our research region is located in the southwestern Amazon (see Fig. 6.1). The transboundary MAP region has a high social, environmental, and economic diversity and is characterized by an abundant biodiversity, including large parts of primary forest, an advancing agricultural frontier, difficult accessibility, and consequently a scarce state presence (Damonte 2021; Klingler and Mack 2020). Currently, the extraction of non-timber forest products (NTFP), such as Brazil nuts, açai, and to a lesser degree also rubber, is a major formal economic activity in the MAP region and the most important regional labor market.

For many years, the remoteness of the MAP region and its lack of infrastructure kept the region's resource richness and species diversity at stable levels providing livelihoods for indigenous and traditional communities. Nevertheless, since the 1960s, an improved road infrastructure made previously inaccessible areas accessible, leading to immigration from neighboring departments/states and the expansion of agricultural activities, local trade, and increased natural resource extraction (Southworth et al. 2011). Hence, over the last decades, the MAP region has been facing drastic transformations in land use patterns, which have had repercussions on biodiversity management and access to natural resources, in particular on NTFP: On the one hand, environmental conservation zones have been consolidated and are being managed by indigenous and extractivist populations as well as (non-)governmental agencies, with each actor assuming different responsibilities (Rodriguez-Ward et al. 2018). On the other hand, illegal timber and mineral exploitation and increasing cattle ranching are activities that define the landscape and represent a challenge for conservation measures, local populations, and regional governance (Ruiz Agudelo et al. 2020). In addition to these land use changes, the

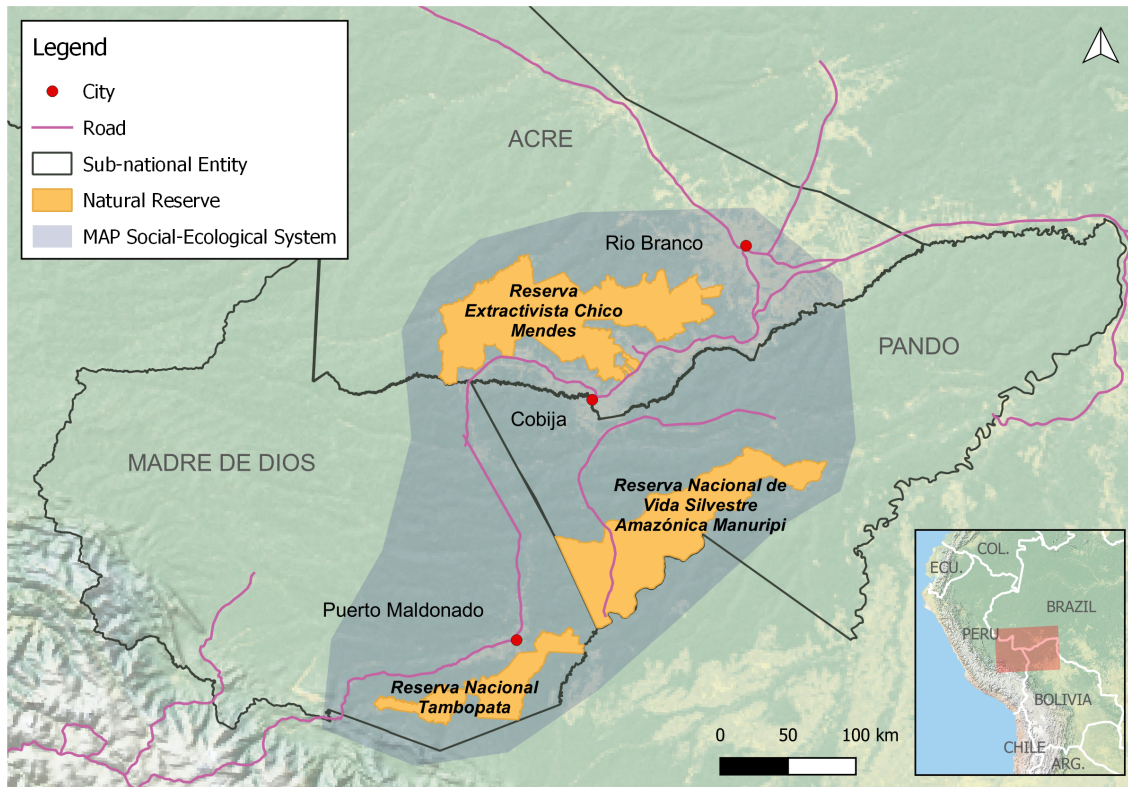


Figure 6.1: Map of the research region in the southwestern Amazon (map created with the software QGIS v.2.18 and data from OpenStreetMap).

effects of regional climate change, such as a prolonged dry-season length and increased drought frequency, threaten the resilience of the regional ecosystem (Boulton et al. 2022). Together with larger-scale regional development plans, these changes impose risks to the resilience of the MAP social-ecological system (Nobre et al. 2016).

For the land-use conflict analysis in this article, we compare three PAs and their buffer zones within the MAP social-ecological system: The Tambopata National Reserve in Madre de Dios, the Chico Mendes Extractivist Reserve in Acre, and the Manuripi National Amazonian Wildlife Reserve in Pando.

The Tambopata National Reserve is located south of the Madre de Dios River in Madre de Dios. It covers an area of 278,284 hectares, surrounded by a buffer zone of 186,450 hectares (INRENA 2003). The PA was designated in 2000 by Supreme Decree No. 048-2000-AG with the objective to protect the wild flora and fauna, conserve natural and cultural resources, and investigate the potential use of natural resources. This aimed at facilitating the participation of neighboring populations in the management of these resources and promoting the sustainable use of Brazil nut trees (DS N°012-96 AG) (MINAM 2000). However, the resilience of the ecosystem and the population that depends on its natural resources are threatened by illegal gold mining and drug trafficking (Praeli 2021).

The Chico Mendes Extractivist Reserve (Sustainable Use Conservation Unit), in the following referred to as ResEx Chico Mendes, is located in the state of Acre, and covers an area of 931,537 hectares, including seven municipalities and a population of almost 2000 families. The reserve belongs to the PA category of Extractivist Reserves, which are territorial administrative spaces that aim to guarantee the sustainable use of natural resources and protect the livelihoods and cultural lifestyles of the traditional forest peoples (Plano de Manejo da Reserva Extractivista Chico Mendes) (ICMBio 2006). It was created in 1990 and named after Francisco 'Chico' Mendes, a trade union leader and rubber tapper who stood up for the

rights of the traditional communities in the reserve and was assassinated in 1988 by large landowners. At that time, these landowners represented the wish for land use change towards large farms/properties, which is still one of the major reasons for land conflicts in the region (Hoelle 2015).

The Manuripi National Amazonian Wildlife Reserve is located in the Manuripi province in the west of the department Pando, covering an area of approximately 747,000 hectares. Its main objective is to protect the Amazon rainforest ecosystem, watersheds, flora and fauna species, and to promote the integral and sustainable use of forest resources to improve the lives of the local population (Plan de Manejo de la Reserva Nacional de Vida Silvestre Manuripi 2012–2022) (MMAyA et al. 2012). The reserve was created in 1973 and is home to ten communities with approximately 1700 inhabitants. The livelihoods are based on small-scale agricultural and livestock activities, subsistence hunting and fishing, as well as açai and Brazil nut extraction, among other NTFPs (MMAyA et al. 2012).

6.3.2 Analytical Framework

The overall aim of this research is to better understand social-ecological conflicts in the research region. Hence, social-ecological conflicts are considered the causal phenomena in our analytical framework (see Fig. 6.2). Following Scheffran et al. (2012a), we understand conflicts as social processes involving at least two parties (individuals, groups, state actors, etc.) acting according to diverging interests over a conflict item. Unequal actor constellations and imbalanced power structures among the conflict parties as well as their capacities to use the social structures impact the agency of conflict actors and thus increase the potential for asymmetry within the conflict (Bonacker 2005). Power in relation to power imbalances is understood here as an actor-specific resource that we approached in its relation to societal change, following Avelino and Rotmans (2009). In this sense, power relations are crucial in long-term processes of structural change and thus essential for the creation of reflexive governance capabilities within and across institutional structures.

Social-ecological conflicts are the causal phenomena resulting from the interplay of conflict drivers (independent variable), the intensity of land use (dependent variable), and the reflexivity of institutions (intervening variable). Taking into consideration the social and spatial aspects of the conflicts, we were able to identify the first drivers of conflicts through the literature review. The interviews conducted further helped us fill in the gaps where institutions have the capacity to act, in order to guarantee the equal or regulated access to natural resources in the three PAs. As a result, we identified the following four main drivers in the MAP region: (1) land tenure and access to land and natural resources, (2) identity and lifestyle driven transformations, (3) state and market driven agendas, and (4) networked illegal and criminal activities. These drivers are strongly impacting the intensity of land use and people’s access to natural resources. Formal institutions intervene in this relationship with the implementation of governance measures. Depending on their capabilities, these institutions act in either reactive or reflexive manner. At the same time, informal and illegal institutions intervene, empowered by a lack of law enforcement, impunity, and alternative governance structures at the margin of the state. These informal and illegal institutions often demonstrate a higher degree of reflexivity than the (negatively) stable formal institutions. Here, we particularly consider national and transnational organized crime structures as the underbelly of the reflexivity of institutions. The criminal cycle (orange) and its interfaces with relevant elements of the SES (gray) are considered as antecedent and catalytic conditions for conflict drivers, the reflexivity of institutions, and the intensity of land use.

With land in and around PAs being the conflict item, we find it particularly useful to follow Rechciński et al. (2019), and combine two aspects of conflict analysis which are often addressed separately: the spatial and the social-relational aspects. The spatial aspect of conflict analysis is particularly relevant since conservation measures, such as declaring an

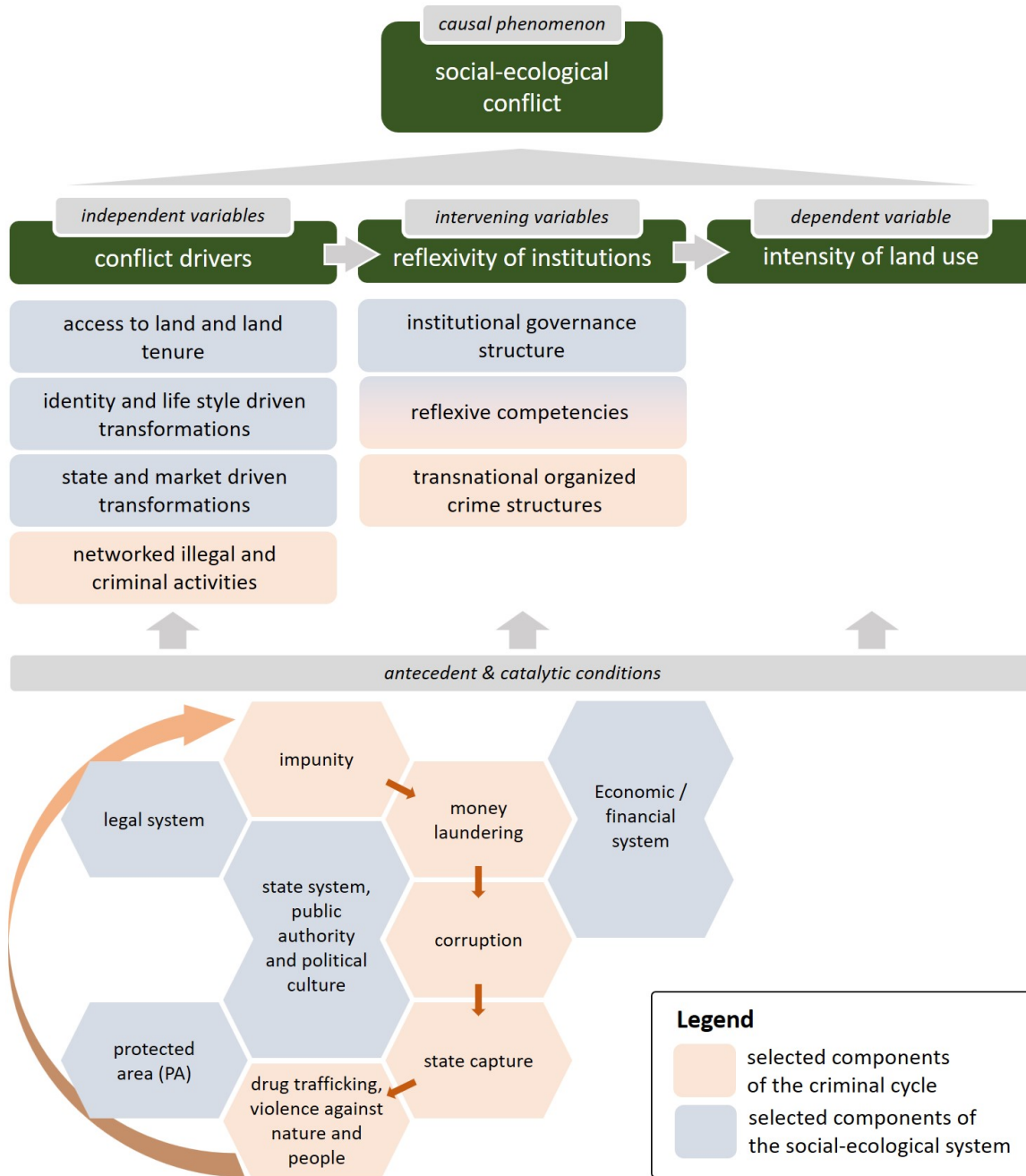


Figure 6.2: Framework for analysis of social-ecological conflicts (own elaboration).

area as protected territory, are always related to space and have an impact on social actors connected to those spaces. This aspect is addressed by defining the boundaries of the social-ecological system (see Fig. 6.1) and conducting the conflict analysis within these boundaries. We problematize the fact that both PAs and governmental institutions in the MAP region are located far away from the political centers of the three states, which can have implications in the regional governance. According to Guarini (1995), space can be theoretically organized in center and periphery, reflecting a hierarchization of space and, above all, identifying the power structures connecting these spaces. In this sense, we recognize that there are power relations that permeate geographical spaces. Therefore, we propose to distinguish between the following concepts: states and regions. According to van Langenhove (2013), a region is a geographical space that cannot be called a state and yet to some extent has the characteristics of a state. This means that a region can have an own political agenda and an institutional

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structure that is linked to the central state in two ways: as a support, but sometimes also with a tendency to distance itself from it (van Langenhove 2013), though always embedded in the structures of the central state (Abers et al. 2014). The social-relational component is addressed by taking a political ecology perspective focusing on the actors' interests and networks as well as inequality and political dynamics on and across different scales (Schilling et al. 2021). These scales are prevalent in our framework within the identified conflict drivers and intervening institutions (see Fig. 6.3).

Political ecology recognizes the relationships between humans and the environment, and facilitates the uncovering of asymmetric distribution of power over resources (Paulson et al. 2003). This emphasis on the participation and capabilities of different actors in environmental governance links political ecology with institutional approaches that emphasize democratic institutions, transparency, and accountability in the management of social-ecological systems (Forsyth 2011). Additionally, a political ecology perspective facilitates the integration of highly entrenched illegal and criminal activities. Hence, we find political ecology well suited to analyze the complex entanglements of formal, informal, and illegal institutions in our three case studies.

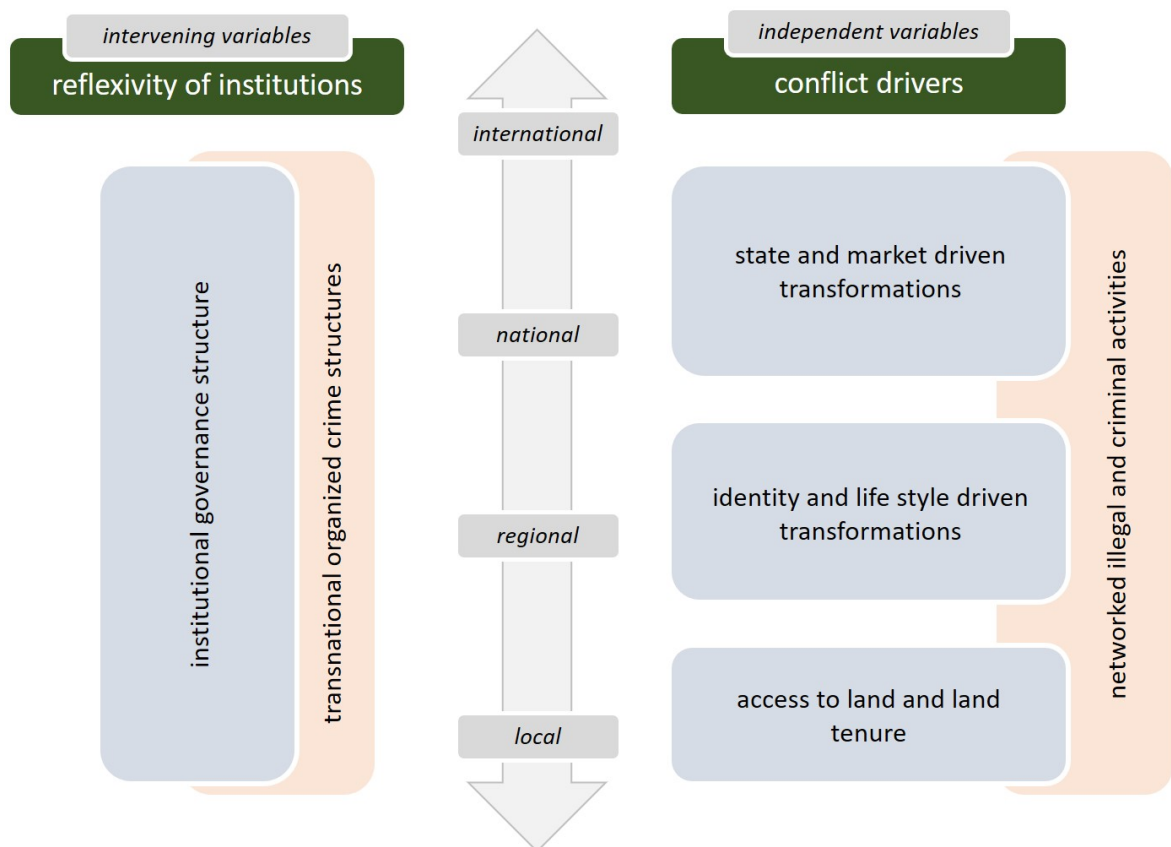


Figure 6.3: Schematic depiction of conflict drivers and reflexive institutions on and across different scales, following political ecology theory (own elaboration).

The comparative analysis conducted in this paper allows us to take a regional, trans-boundary perspective which sets the local analysis into a wider regional context and enables us to identify commonalities and difference of social-ecological conflicts throughout the three selected PAs in the MAP region.

6.3.3 Data Collection

The peer-reviewed literature on the case was collected through a structured Web of Science search. This systematic peer-reviewed literature review was complemented with gray literature such as reports from environmental and social NGOs and media reports.

The empirical data collections include ten semi-structured key-informant interviews with representatives from institutions. Some interviewees were selected on the basis of their position as key stakeholders either for decision-making in the PAs or for the conflicts themselves. In addition, we identified interviewees based on knowledge regarding the conflict lines in the region. We conducted interviews to understand the dynamics of the conflicts under the influence of actors across the local, regional, national, and international scale, and because our interview partners occupy different positions in and around the conflict under study in every country. For this purpose, guiding questions were formulated to allow the interviewee to talk about the panorama of land use conflicts and illegal activities in each PA, the actors involved and their interests, as well as the possible causes of these conflicts and their impact. In addition, the way in which the interviews were designed allowed the interview partners to talk about the role of environmental and other formal and informal institutions in the conflict dynamics. In Madre de Dios, we conducted three key-informant interviews with representatives of the Regional Mining Association, the Regional Direction for Mining and Energy, and the Management Committee of the Tambopata National Reserve. While these three interviews were held in person in September and October 2019 before the COVID-19 pandemic, all other interviews had to be held virtually due to limited travel opportunities. This situation posed a limitation for further empirical work, as we were only able to interview those stakeholders and experts who had access to communication via Internet. In Acre we conducted four key-informant interviews with a representative of the Chico Mendes Committee, a civil society actor working with the people in the Chico Mendes Extractivist Reserve, an environmental law expert from academia, a Federal Police Officer, and a representative of the Chico Mendes Institute for Biodiversity Conservation (ICMBio). In Pando, we conducted three interviews with a park ranger of the Manuripi National Amazonian Wildlife Reserve, a missionary working in the area for more than 20 years, and a community leader from within the reserve. The collected data were analyzed using the software MAXQDA combined with manual coding. In a first round of analysis, major conflict drivers identified from the literature were confirmed through the interview results. In a second round, all available data were coded along the four identified conflict drivers as well as the relevant governance actors and their functions.

We chose this data collection approach of combining a literature review with key-informant interviews from different sectors to embark into a differentiated understanding of the conflict drivers while at the same time accounting for historically grown institutional structures and forms of land use. We are aware that the number of interviews is limited and not able to provide comprehensive knowledge on each of the covered conflicts. Nevertheless, we believe that this approach enabled us to identify the major conflict drivers and thus provides entry points for further interviews and analysis in each of the three cases. Aside from the limited number of interviews, it would have been possible to add another research method, e.g., a quantitative approach based on conflict data. However, given the complexity and comprehensiveness of the subject matter and the geographical area that the article is covering, there are limits to the number of methods one can apply.

6.4 Results

6.4.1 Institutional Governance Structure

6.4.1.1 Governance of Protected Areas in the MAP Region

In Madre de Dios, the National Service of Natural Areas Protected by the State (SERNANP) administers 44.6% of the territory classified as PAs, including the Tambopata National Reserve (Mathez-Stiefel et al. 2020). The SERNANP is an administrative institution of the Ministry of Environment. However, SERNANP does not have the power to make decisions regarding high-impact land uses such as mining, even though mining in the buffer zone of the Tambopata National Reserve directly affects the reserve’s dynamics. This is due to the fact, that mining concessions are under the responsibility of the National Ministry of Energy and Mines (MINEM), and artisanal and small-scale mining (ASM) is under the responsibility of the Regional Directorate of Energy and Mines (DREM). The management of the Tambopata reserve is under the responsibility of a management committee which is composed of governmental and non-governmental organizations (SERNANP 2019).

In the case of the Chico Mendes Extractivist Reserve in Acre, management is under the responsibility of the Ministry of Environment (MMA), specifically under the Chico Mendes Institute for Biodiversity Conservation (ICMBio), which is responsible for monitoring if the area is being used according to the law. However, decision-making within the reserve is conducted by a Deliberative Council, presided by the ICMBio, and composed of elected community representatives. The council assumes legislative and executive functions, decides on the approval of land-use regulations – which are elaborated jointly with residents and governmental and non-governmental agencies – and also carries out actions for the development of the reserve. Furthermore, the management plan of the ResEx Chico Mendes dictates the regulations on cattle raising in the extractivist reserve, allowing livestock as a complementary activity and establishing the size of the areas that might be destined to the activity (ICMBio 2006; Maia et al. 2016).

The Manuripi reserve is under national administration and managed by the National Service of Protected Areas (SERNAP), a decentralized institution of the National Ministry of Environment and Water (MMAyA) that has management autonomy (Adrián 2015). However, while the Forest and Land Agency (ABT) is in charge of the control processes, the National Agrarian Reform Institute (INRA), under the Ministry of Rural Development and Land (MDRyT), is responsible for the regulation and titling of the protected area and its surroundings (MMAyA et al. 2012).

These distinct situations in the three reserves under consideration reflect the complexity of the MAP region and the individuality of the institutional setting in and around each PA. Due to the large number and diversity of actors involved in environmental governance, the management of PAs and their natural resources often face conflicting interests of different groups that aim to use and/or protect the same resources for different purposes (Reed et al. 2009). Here, institutional conflicts begin, on the one hand, on the legal-jurisdictional level, and on the other, on the socio-cultural level when certain groups voluntarily or involuntarily ignore the rules of the PAs and their surroundings (Maia et al. 2016). Nevertheless, social relations and power relations within the PAs are established through many other variables: political, economic, social, and environmental relationships. Due to its peripheral location, such dynamic relationships gained importance in particular during the pandemic accompanied by an aggravated perceived absence of the state. In addition, governance is challenged and conflicts are exacerbated by the occurrence of extreme weather events such as drought periods (Burton et al. 2022), extreme flooding events (Dolman et al. 2018) or, wildfires (Da Silva et al. 2020).

6.4.1.2 Tensions between Social-Ecological Governance and Organized Crime

Organized crime (OC) is the so-called 'white elephant' present in the social-ecological system in the MAP region. In particular, deforestation and illegal land occupation are often correlated with corruption and impunity paid for with money from illicit activities, such as drug trafficking and illegal gold mining. The underlying dynamics of criminalization have push and pull factors impacting local societies, which try to keep pace with change by adapting their respective livelihood strategies (Schönenberg 2002). These include overexploitation of shared natural resources, introduction of new economic activities, and involvement in illegal and/or criminal activities. The MAP region, being a border region, is particularly prone to activities of OC, as many major rivers and land routes, such as the interoceanic highway traverse the region and serve as disputed trafficking routes (El Deber 2022; Goldstein 2015). Even small roads such as the road to the village of Chivé, which is located 165 km from Cobija within the Manuripi reserve, serve as trafficking routes; already in 2000, the Mobile Police Unit for Rural Areas (UMOPAR) seized a shipment of 183 kilos of cocaine base paste ready to crystallize (ANF 2000). The national director of the Special Force against Drug Trafficking (FELCN) said that the drugs came from the Peruvian town of Puerto Maldonado and were transported to Brazil and Argentina (ANF 2000). In addition, the criminal network between Brazil and Bolivia is well established. The State Secretary for Public Safety, present at the Brazil/Bolivia Border Security Meeting in October 2021 in Rio Branco (AC) commented: "Criminality does not choose a place, it hides in Santa Cruz, Beni and Pando, the criminals [...] are well connected and we need to organize ourselves. Aircrafts are stolen [...] for contraband and drug trafficking. We need the exchange of information to qualify our investigations" (O Documento 2021).

Since 2012 criminal factions from southern Brazil are opening up new branches in the MAP-region. Peaking after the separation of Comando Vermelho (CV) and Primeiro Comando da Capital (PCC) in 2016, the factions engage in hostile takeovers against each other and with local gangs such as Bonde dos 13 in order to control the transnational drug routes passing through Pando and Madre de Dios to Acre (Fonseca 2020; MPAC 2021).

For example, urban gangs and rural land grabbing activities are connected through the forced alliance of local gangs such as the Bonde dos 13 in Acre with the powerful faction Comando Vermelho. At the same time, the Primeiro Comando da Capital is forming the new NarcoSul Cartel expanding its connection to Paraguay. In Peru, the competing faction CV is establishing links with the local gang, Los Hostiles de la Amazonía. The crimes committed are drug and human trafficking, illegal extraction of natural resources, transport, commercialization and laundering of timber, falsification of forestry transport guides and papers, bribery, and evasion of checkpoints (Timbercheck 2020). On 25 August 2020, a mega-operation carried out by the High Complexity Crime Investigation Division (DIVIAC) of the Peruvian Police confronted an extensive timber trafficking network (Fiestas 2021). This criminal network is made up of at least 29 public officials, employees of the tax office (SUNAT), regional forestry directorates, prosecutors, police, and station guards (Calloquispe Flores 2020).

6.4.2 Drivers of Land Use Conflicts

The MAP region is permeated by conflicts related to land use and resource extraction. From 2017 to 2018, the Pastoral Land Commission (CPT) counted five land use conflicts in Madre de Dios with more than 200 families involved (CPT 2019). In Acre, the most populated state in the region with about 894,000 inhabitants (IBGE 2020), the CPT counted 124 land conflicts with more than 10,000 families involved. This is the highest number of land conflicts recorded within the MAP region (CPT 2020). In addition, for the same period, the CPT documented about 20 land use conflicts in Pando with 150 families involved. In Pando and Acre, the main actors affected by the conflicts are peasants, traditional communities, and

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small farmers, while indigenous communities are most affected in Madre de Dios.

In the following analysis, we focus on conflicts in and around three selected protected areas in the MAP region. In all three cases, conflicts often evolve around questions of "who can use which resources, how, and to what extent?" During the analysis, we identified four main conflict drivers along which we conduct the comparison in the following sections: (1) Conflicts driven by land tenure and access to land and natural resources; (2) conflicts mainly driven by identity and lifestyle decisions and related societal transformations; (3) conflicts driven by the state and the market and related agendas; and (4) conflicts driven by networked illegal and criminal activities.

6.4.2.1 Land Tenure and Access to Land and Natural Resources

All three reserves have in common that they aim to support the traditional extractivist lifestyle in the region (ICMBio 2006; MMAyA et al. 2012; SERNANP 2019). Nevertheless, different forms of access and land use rights are granted and different stages of degradation can be observed within the reserves and their buffer zones (Duchelle et al. 2010). In addition, the seasonal access to Brazil nut, the primary NTFP product, is being regulated quite diversely in the three different regions. The impacts of those formal and informal rules have yet to be closer assessed but that is beyond the scope of this paper.

In the Tambopata Reserve, access, housing, and use of the forest is prohibited within the reserve with only a few exceptions. Access is granted to certain indigenous groups that live outside the area but are allowed to enter the reserve for fishing, hunting, and the collection of NTFPs. Nevertheless, extraction quotas regulate extraction. During one of the interviews, those quotas are claimed by the indigenous peoples to be too strict to sustain their livelihoods due to growing communities. At the same time, parts of the reserve are licensed for Brazil nut harvesting to individual concession owners (SERNANP 2019). These people and their workforces are allowed to access the reserve for harvesting and managing their concessions. In addition to threats through invasion of illegal mining, the complexity of the mining conflict lies in the Mining Interdiction Law approved by the Council of Ministers, and the ecological-economic zoning of Madre de Dios, which is emitted by the Regional Ordinance issued by the Regional Government of Madre de Dios (GOREMAD) (Damonte 2018). This ordinance determines the mining exclusion zones, which pushed many groups, that historically occupied the territory and conducted artisanal and small-scale mining, into illegality with no option to formalize their activities. This situation escalated until communities were being violated by operations carried out by the Peruvian Police, the General Directorate of Coast Guard and Coast Guard of Peru (DICAPI), and the Ministry of Defense, especially in the reserve's buffer zone (Damonte 2021).

In comparison, in the ResEx Chico Mendes, the core of the conflicts arise from the advance of cattle ranching activities and the invasion of the land where traditional populations live (Choma 2017; Pantoja et al. 2010). Cattle ranchers organize formally and informally to legitimize practices that were previously considered an environmental crime and are not allowed inside the reserve according to the Management Plan of 2006 (ICMBio 2006). As a consequence, the reserve loses forest cover and traditions and insidiously reformulates the idea of sustainable livelihoods. One interviewee reports that a scheme to foster this process is to transfer a herd of cattle to graze within the ResEx for three years, with a certain percentage of calves set as payment for each year. As a result of this practice, new herds of cattle build up throughout the ResEx and new pastures have to be established. Additionally, the strong in-migration of Rondonian small-scale cattle ranchers without knowledge of the extractivist use-concept of the ResEx Chico Mendes threatens common lands and created an illegal land and labor-market within the reserve.

The Manuripi reserve is experiencing a constant growth in demand for land, due to population growth and migration inflows (Cronkleton et al. 2009). The families that appear on

the community land allocation lists have rights to cultivation areas and Brazil nut harvesting areas, but the new and growing families, those that are not on the allocation lists, usually do not have access to land and are dependent on the families with access to land. This situation is confirmed by an interviewed park ranger: "There is a greater demand for land from the communities living within the reserve because they have children, their children grow up, and their children demand land, and this causes internal conflicts". In addition, some land allocation policies require a proof of residence of more than five years, keeping recent migrants from legal allocation of land (Cronkleton et al. 2009). This situation generates conflicts within the communities when the migrant or growing families expect or even illegally occupy public lands or transform forested land within the reserve into agricultural land.

6.4.2.2 Identity and Lifestyle Driven Transformations

With the pavement of the interoceanic highway, which is directly adjacent to the buffer zone of the Tambopata Reserve, life has changed drastically in the south and east of Madre de Dios. While it took days to travel from Cuzco in the Andes to Puerto Maldonado, the regional capital of Madre de Dios, the distance is now covered in little more than six hours (Southworth et al. 2011). This large infrastructural development drove migrants from the Andes to Peruvian lowlands on the search for better livelihoods. In addition, gold deposits were found in the 2000s and the so-called second mining boom attracted about 30,000 miners (Scullion et al. 2016). Increasing gold prices led to an increment in the number of inhabitants from 64,460 in 1993 (Hunter 2016) to 141,070 inhabitants in Madre de Dios in 2017 (INEI 2018). The expansion of human activities, especially artisanal and small-scale mining, contributed to land degradation and illegal deforestation and is responsible for the total loss of 208,000 ha of primary forest between 2002 and 2020 (Asner et al. 2013; Global Forest Watch 2022). Further, gold mining increases mercury discharges into the environment, affecting soil and water quality, endangering fish stocks, and posing a health risk to people living close to or downstream of mining sites (Brack Egg et al. 2011; Velásquez Ramírez et al. 2020). The progression of the mining economy in the region fostered a relocation of material and labor force into the mines. These developments were accompanied by increasing illegal and criminal activities from land invasion for illegal mining to activities in the shadow economy of mining such as human trafficking for workforce, prostitution, or entanglements with smuggling activities, e.g., gasoline for pumps and dredges (Damonte 2018; Ojo Público 2019). One interviewee states that generally, the profits from illegal activities mostly benefit those with power to capitalize on the profits, however, it is the livelihoods of local communities living in the area that are drastically affected. Many people, in particular those having lived for more than one generation in the region, do not consider themselves as miners (as being their identity) even though they partially work in the mines. Instead, mining is more considered one option for livelihood security that people fall back on when other income sources diminish (e.g., due to low prices of Brazil nuts) or when an additional income is needed (e.g., for covering medical bills). At the same time, a new elite of miners evolved from the initial waves of mining migrants, who gained important political representation over the years and consider themselves as miners (MMAyA et al. 2012).

In Acre, the most prevalent conflicts over identity and cultural values revolve around the extractivist versus rainforest cowboy culture (Hoelle 2015). One interviewee confirms that the Chico Mendes Extractivist Reserve is affected by internal conflicts between residents over the use of land, in particular cattle, the role of regional cooperative CooperAcre and the legacy of Francisco 'Chico' Mendes, whose assassination had great impact on the Amazon conservation movement. During the government of the Workers' Party (PT 1999–2019) already in 1999, the idea of a forest citizenship or floristanía was implemented (Castelo 2020). This move sought to strengthen the extractivist sector in the state through public policies that benefited populations dedicated to the collection of Brazil nuts and rubber, among other

NTFPs. However, the promotion of one economic activity at the expense of another begins at the ideological-economic level, materializes in new laws and public policies that focus on agriculture and cattle ranching, and has repercussions on the local culture and economy (see also Section 6.4.2.3). For an interviewed representative of the Chico Mendes Committee, the problem "is the constant invasion of internal migrants, mostly from Rondônia (Brazil), oriented towards cattle ranching", which is aggravated by the constant political omission and the fact that young people show no interest in the extractivist lifestyle: "if young people do not feel part of it, the reserve will end".

In the Manuripi reserve and the buffer zone, in contrast, inhabitants aim to continue traditional lifestyles. However, the framing conditions set by the current management plan, illegal in-migration, and plans for new infrastructure developments counteract these aspirations (MMAyA et al. 2012). In addition, one interviewee reports that the general attitude towards Brazil, which is often seen as the powerful 'big brother', is somewhat put into perspective as some inhabitants of the frontier region are descendants of Brazilian immigrants and, e.g., continue to speak Portuguese as a second language. While people generally aim to continue an extractivist lifestyle focused on the extraction of Brazil nuts, one interviewee reports that the young generation in the region aims to shift from Brazil nut extraction to açai extraction and value creation in hope of increasing revenues.

6.4.2.3 State and Market Driven Agendas

The pavement of the interoceanic highway mentioned above also fostered the development of the tourism sector in Madre de Dios and facilitated the export of NTFP from the MAP region to national and international markets (Doan 2013). According to the Central Reserve Bank of Peru, in 2020, gold production in Madre de Dios reached 2 tons, while total gold reserves in the department are estimated to reach 56 tons (Banco Central de Reserva del Perú 2022). This sector is characterized by artisanal and mostly illegal gold mining, hence the formalization process of gold miners in Madre de Dios has been driven on two levels: firstly, in line with market requirements and requirements of non-governmental organizations such as the Swiss Agency for Development and Cooperation in Peru (COSUDE) and the International Labor Organization (ILO) at the international level, both promoting the improvement of management practices in addition to voluntary formalization processes (Baraybar Hidalgo and Dargent 2020); and secondly, related to the emergence of a new elite evolving from the initial waves of mining migrants, who gained important political representation over the years (Cortés-McPherson 2019). With the implementation of the Formalization Law, the design of measures and instruments was left to the Ministry of Energy and Mines (MINEM), and subject to the approval of the Ministry of Environment (MINAM); however, its implementation was assigned to GOREMAD. Nevertheless, one interviewee confirmed that due to the recent decentralization process, the regional government did not have the necessary resources or experience, resulting in a lack of funding for entities such as DREM and a conflicting relationship between actors at the regional and national level (Rodriguez-Ward et al. 2018). A second interviewee adds that these conflicting relationships are reinforced through the hybridization of publicly elected positions across the institutional spectrum, as they are obtained by members of associations such as the Federation of Miners of Madre de Dios (FEDEMIN).

In Acre, the interviewees highlight the conflicts between extractivists of NTFPs and state institutions in favor of 'progress' – meaning agro-industrial and infrastructural developments requiring large extensions of land – and against the protection of the reserve. There is disagreement between local actors regarding the worth of conserved forest, as for some institutions, this is not producing profit. The ResEx Chico Mendes had been experiencing pressure due to cattle ranching and large-scale agriculture already before the reserve was formally established (Maia et al. 2016). Since then, large parts of the area have been degraded due to illegal logging and deforestation for those activities. Although the population of the ResEx Chico Mendes is

traditionally dedicated to NTFP extraction, weak markets and resulting low prices for NTFPs represent threats to peoples' livelihoods (Maciel et al. 2019). These dynamics directly impact the environmental governance of the reserve (Avelino and Rotmans 2009; Guarini 1995). As a consequence, cattle ranching is gaining importance in the overall region and is seen as an economic alternative and reliable income source among extractivists. At the same time, the Federation of Agriculture and Livestock of the State of Acre (FAEAC), political actors and the public power in general have made great efforts in favor of laws that modify the use of the reserve and even its territorial limits, e.g., (Rocha 2019). Consequently, extractivism of NTFPs has been discouraged by governments (Calderon 2013), as the promotion of one economic activity is often accompanied by public policies that weaken some economic sectors, in this case the NTFP's economy. One interviewee highlighted the interdependence of the economic logic, human-nature relations and political support: "After the collapse of the cultural logic of the mixed economy, complemented by extractivism, the purely economic logic of business management gives way to a purely economic logic. [...] Nature only survives if there are people who know it and live from it. [...] Although the economy of agro-extractivism is actually more profitable than that of monoculture and can even be modernized through access to the Internet, a transformation towards monoculture or cattle grazing is taking place, as the entire support structure of the state and the market are adapted to the latter".

In Pando, the main tensions arise around several supreme decrees that have been approved by the central government and that authorize hydrocarbon exploration and mining concessions in protected areas and buffer zones. According to a report of the Documentation and Information Center in Bolivia (CEDIB), 31.6% of the territory of the Manuripi Reserve is potentially affected by the hydrocarbon exploration, putting the communal rights, land, and the livelihood of indigenous and extractivist populations under pressure (Jiménez 2013). As indicated by a researcher at the Latin American Center for Social Ecology, "there is tension between the Bolivian constitution, which grants rights to Nature and Mother Earth, and on the other hand accepts the commercialization of nature" (Gudynas 2021). In addition, illegal exploitation of timber, forest meat, and other forest resources thrive, due to budgetary restrictions for park rangers of more than 50%, weakening law enforcement within the reserve. According to a community leader, "the poor coordination of the authorities representing the state (the area's director and the local stakeholders represented by the management committee)" are aspects that exacerbate conflicts within the reserve, and he expresses that "to resolve or reduce conflicts, they would recommend a director who knows the area's problems and the protection corps to do a thorough job in compliance with current regulations". Such actions have not been done before, since in recent years, the directors of the area have been chosen by hand, and not by competence and merit.

6.4.2.4 Networked Illegal and Criminal Activities

In Madre de Dios, criminal activities concentrate around the increase of illegal gold mining due to rising prices on the global market, illegal logging, and illegal timber-trading due to weak law enforcement and growing corruption. The miners who were relocated from Tambopata National Reserve in the 'Operation Mercurio' in 2019 are said to have mostly returned. According to Pablo de la Flor, executive director of the National Society of Mining, Petroleum, and Energy (SNMPE), legal mining exports fell by 65 percent in April. Official operations have had to join the quarantine, which has allowed illegal miners to grow in their place (Saffon 2020). At the height of the pandemic, the High Complexity Crime Investigation Division (DIVIAC) of the Peruvian police uncovered a crime-network, Los Hostiles de la Amazonía, dedicated to the trafficking and illegal trade of timber from Madre de Dios to Cusco, Arequipa, and abroad. At present, the DIVIAC assumes that there are about 50 people, including the Governor of Madre de Dios, further regional government officials, police chiefs and officers, employees from the National Superintendency of Tax Administration (SUNAT) and specialized

6.5. DISCUSSION

environmental prosecutors, businessmen, and other people involved in this case of corruption and timber trafficking in Madre de Dios (Fiestas 2021).

In Acre, the interviewee from the Federal Police confirms that "the backbone of organized crime in the MAP region is drug trafficking and money laundering, mostly by large agribusiness companies", and describes how the destruction is financed: "Selective logging of precious woods creates the capital to illegally take larger tracts of land and establish a system of slave labor for logging". Another source of funding for environmental crime is illegal gold mining. "Illegal grazing leases in protected areas is another land grabbing strategy". The interviewee from ICMBio-Acre highlights the combination of invasions of large, medium, and small cattle ranchers from both within Acre and from outside, e.g., from Rondônia and Mato Grosso through the highway BR 364. This process is accompanied with "death threats, lack of support for sustainable production, occupation, cocaine routes, and the presence of factions" highlighting the increasing criminalization of the rural area by city gangs and criminal factions, such as the PCC and CV.

In the Manuripi reserve, forest resources are highly coveted causing illegal logging and extraction activities. This situation is explained by the community leader and the park ranger: "There are many problems with Peruvian nationals who illegally enter through the border and carry out illegal logging activities". The area under greatest pressure within the Manuripi reserve is located along the Peruvian border. Because of long distances, park rangers have difficulty patrolling and controlling the area. At the same time, SERNAP's options are limited due to shared responsibility with other governance actors. While the police and justice system are responsible for arresting and sanctioning illegal logging activities, SERNAP only has the responsibility to confiscate tools and goods, such as timber or Brazil nuts. Three interviewees mentioned that "there is no coordination between the departmental, municipal, and national levels, so the park rangers' capacities are diminished".

6.5 Discussion

The geographic location of the three PAs has social and ecological implications. On the one hand, the three subnational entities of the MAP region took longer to be occupied by extractive industries than other regions closer to the capitals and economic centers of the respective countries. Thus, being located in the periphery protected the MAP region from extensive development, at least for some time. However, the advancing agricultural frontier and other increasing extractive activities are driven by actors that take advantage of the peripheric and thus distanced location from the authorities and from national perception, but also from actors who feel they receive no support from the government to carry on with traditional and sustainable activities, such as collecting NTFPs. In this sense, the remoteness of public ministry offices and other institutions dedicated to land use regulation and conflict mediation make land conflicts more common and difficult to resolve in the MAP region. Four main drivers of social-ecological conflicts can be identified.

First, regarding land tenure and access to land and natural resources as a conflict driver, we can observe that superposition of concessions and tenure as well as overlapping responsibilities of governance institutions that are responsible for territorial organization create legal uncertainty. This legal uncertainty implicates that people who officially were granted the right to access land, e.g., indigenous people, extractivists, etc., are in fact hindered from doing so, either due to claims or even threats of land owners, both mentally and physically, by illegal land invaders. The challenge of protecting indigenous peoples' land rights in the region is well known as for instance pointed out by Pereira (2021). Control of PAs is difficult throughout the MAP region because the three PAs are administered at the national level and are located on the periphery of the three countries, with police and prosecutor's offices often located in the departmental capitals (see also Iranzo and Caballero 2020).

Furthermore, these institutions often have small budgets and low capabilities to fulfill their responsibilities (see also Cardona et al. 2022). The three PAs therefore share the same lack of accessibility, and the institutions share a lack of resources, which can have repercussions on the law enforcement and intensity of conflicts. If the mediation cannot be carried on by the institutions, the population living in the reserves assume the responsibility of confronting or preventing the conflicts that arise. In the case of the ResEx Chico Mendes and the Manuripi Reserve, we observed that they can be characterized by relatively active social-political participation within the PAs, as the populations are organized locally through committees and associations, and can thus influence reactions to pressure by external actors and agendas. In the case of the Tambopata reserve, the fact that in large parts of the reserve, there is no population living there, makes the area more vulnerable to undetected land invasions and external interests. Therefore, a clarification of responsibilities among governance institutions, the transparent communication of these responsibilities to local communities, and the bond between people and territory, i.e., human–nature relation, seem to be a necessary precondition to mitigate social-environmental conflicts around land tenure and access to land and natural resources.

Second, comparing identity and lifestyle driven transformations as a conflict driver, we see that the pavement of the interoceanic highway had large implications for migration to the entire MAP region. Consequently, the demand for land increased and land use changed. While the populations of Pando agreed to use only certain territory for economic activities, migrants from other regions express their need for land, resulting in demographic and resource pressure. These are often accompanied by changes in land use types as migrants applied other land use practices, be it mining, cattle, or large-scale monoculture, which were not traditional activities in the MAP region (see also Hajjar et al. 2019). In the short term, these income sources, promising prosperity and prestige, appeared attractive to people in the MAP region, creating an aspiration for leaving an expendable life of extractivism towards a better life and a consequent shift in identity and culture. At the same time, sustainable development actors in the region promote the extractivists lifestyle as the region’s solution to much of the regional as well as global social-ecological challenges (e.g., regional and global climate change). This promotion, in particular if formulated by international organizations, is perceived by other actors as hindering development of the region, and implicitly recreating colonial continuities under the umbrella of sustainable development. At this point, both formal governmental and non-governmental institutions require a re-thinking of power structures and awareness raising. Power for decision making and allocation of funds must be given to local decision makers who have the best knowledge of the region, a point also raised by Cardona et al. (2022). At the same time, awareness of the implications of regional climate change has to be raised to enable these decision makers to take informed decisions while making the consequences of environmental degradation on the local social-ecological system tangible.

Third, state and market driven agendas influence the previously described conflict drivers, supporting economic activities which offer some economic stability and the safe-guarding of local livelihoods, although not for all actors involved. In addition, all parts of the MAP region experience pressures by external market actors and political development agendas, promoting new economic sectors at the expense of traditional economic activities, such as recollecting NTFPs and adjusting laws and regulations accordingly. These pressures are enhanced through increasing power imbalances as mining associations in Madre de Dios and large agro-business associations in Acre have gained a lot of political representation and occupy many local, regional, and sometimes even national government positions. In Pando, we observe the progressive discourse of the government giving rights to nature, using the concept Mother Earth (Madre Tierra) as their narrative, while incentivizing hydrocarbon explorations and exploitation of resources in PAs (see also Toledo Orozco 2022). At the same time, regulating and controlling agencies are underfunded and understaffed resulting

6.6. CONCLUSIONS

in a lack of law enforcement and a poor coordination between them. To overcome these conflict drivers, it appears necessary though almost impossible to break through the vicious circle of corruption, electing local experts in decision making positions and develop livelihood opportunities that are economically, ecologically, and socially sustainable for the region in the long-term.

Fourth, considering networked, illegal, and criminal activities as conflict drivers, it can be said that successful governance in the MAP region has to take into account the continuous reproduction of illegal activities. This way, criminal spaces, which will always exist in society, can be kept small enough to not completely counteract environmental governance. To this end, it is important to investigate the fine line between legal and illegal commercial networks. This is a point also raised by previous studies (e.g., Abello-Colak and Guarneros-Meza 2014). Understanding the interconnections of the drivers of criminalization is conducive to influencing effective prevention and enforcement decisions by authorities. The lack of institutional articulation emerges as a pattern in each sub-national entity of the MAP region. This problem hinders conflict resolution, making it difficult to create spaces for participation. As a consequence, there is an increase in distrust between actors participating at different levels in land governance structures. Associated with historical processes of violent occupation, these complexities end up favoring criminal spaces that are 'alive' and whose growth or reduction may be influenced by political and social action.

6.6 Conclusions

The aim of this paper was to better understand the main drivers of social-ecological conflicts over land in and around three PAs, Tambopata (Peru), ResEx Chico Mendes (Brazil) and Manuripi (Bolivia), and to analyze how (environmental) institutions influence the major conflict drivers: (1) land tenure and access to land and natural resources, (2) identity and lifestyle driven transformations, (3) state and market driven agendas, and (4) networked, illegal, and criminal activities. State institutions influence and partly enable and enhance these conflict drivers in the following way. Overlapping responsibilities of governance institutions and limited enforcement of regulations protecting and empowering rural and disadvantaged populations, enable external actors to (illegally) access and control resources in the PA. In part, this process is accelerated by an improved road infrastructure and a state agenda that favors development based on privatization over traditional economic activities based on collective land ownership rights. The already limited social contract between the populations in and around the PA and the central state is further undermined by the growing power of criminal networks which challenge the state authority.

For state institutions to avoid aggravating conflict drivers but instead better manage them or even contribute to conflict prevention and mitigation, a transformation from reactive to reflexive institutions and the development of new reflexive governance competencies is needed as Dryzek (2016) and McKay et al. (2017) have pointed out. Prerequisites for this would imply: (1) the clarification of responsibilities between governance institutions (and their financing); (2) the awareness raising for existing power structures and opening spaces for enhanced local participation; (3) the breaking of corruptive cycles while developing economically, ecologically and socially sustainable livelihood opportunities; and (4) taking the continuous reproduction of illegal activities into account while clarifying responsibilities, raising awareness, and breaking corruptive cycles.

In addition to identifying these entry points, the paper contributes to a better understanding of social-ecological conflicts in the MAP region and the wider scientific literature on conflicts and governance, particularly in PAs. While the character of each conflict differs depending on the actors involved and the reflexive capabilities of the involved institutions, the results presented in this paper point towards potential future conflicts in the MAP region. For

decision makers, the paper offers some advice on how (transnational) transformations and developments that undermine the resilience of rural and disadvantaged groups can be mitigated. Indeed, more research is needed to understand the role institutions play in allowing or even promoting the transformation of disruptive developments into strengthened social-ecological resilience of local communities. For future studies, it is also promising to analyze the impact of international and national non-governmental organizations on resource governance and conflict drivers in PAs. Finally, it should be noted that the described conflict processes and their drivers are not necessarily limited to the MAP region but are likely to occur in other PAs located far from the centers of governmental institutions. In addition, the interdependencies described only become visible with detailed knowledge of the local situation. Such knowledge is also highly relevant for conflict-sensitive implementation of protection measures, such as the current debate within the United Nations about protecting 30% of the planet's surface for safeguarding biodiversity and the climate. Such large-scale measures need to consider the local contexts and in particular ensure that the local population keeps or gains access to sustainable resource use in order to prevent or mitigate conflicts and thus empowering people to protect PAs even under increasing market and developmental pressure.

7 | BETWEEN COOPERATION AND CONFLICT: A SOCIAL-ECOLOGICAL PERSPECTIVE ON THE IMPACTS OF COVID-19 IN SOUTH-WESTERN AMAZONIA

7.1 Abstract

The COVID-19 pandemic is one of the great acute challenges facing humanity and we are only beginning to comprehend its consequences. This article aims to better understand the impacts of the pandemic on the interplay of land use change, ecosystem services, human agency, conflict and cooperation, with a focus on civil society organizations (CSO) and criminal networks. To achieve this aim, we first review the general literature and then focus on the south-western Amazon and, in particular, the border region of Peru, Brazil and Bolivia. We use a mixed-method approach based on literature review and stakeholder conversations. Our findings suggest that the pandemic is having mixed effects: on the one hand, governments use their power to impose restrictions on fundamental rights, limit the freedom of the population and undermine its agency. On the other hand, alternative structures to the central state, particularly strong CSO and criminal organizations, have gained power when governments have failed to fulfill people's needs. Overall, the pandemic acted as a catalyst of change, both globally and in the south-western Amazon.

Keywords: COVID-19, land use, human security, social capital, civil society, organized crime

7.2 Introduction

The COVID-19 pandemic has revealed increasing structural inequality and accelerated trends of social fragmentation around the world (Fellows et al. 2021). Already, marginalized social groups such as rural smallholders, indigenous peoples, migrants, and people without a fixed income or with jobs in the tourism and restaurant sectors have been particularly vulnerable to the impacts of the pandemic (e.g., Kaplan et al. 2020). Structural inequalities and some latent conflicts have intensified and the limited nature of government, civil society and private sector responses have further increased the criminal exploitation of nature and local populations (e.g., Stewart et al. 2021). Additionally, social divisions have opened the door to new conflicts, such as governmental restrictions on basic rights and protests against these. In a quarantined world, global interdependencies become particularly tangible when value chains and entire economic sectors collapse, triggering the erosion of livelihoods and the growth of inequalities (e.g., Bolaño-Ortiz et al. 2020). At the same time, the empowering value of indigenous

and traditional knowledges and locally rooted structures of self-organization raise hopes for constructive pathways to a post-pandemic world (e.g., Kaplan et al. 2020).

In this article, we aim to better understand the impacts of the pandemic on the interplay of land use change, ecosystem services (ESS), human agency, conflict and cooperation, with a focus on civil society organizations (CSOs) and criminal networks. We apply a social-ecological systems (SES) approach to foster an integrated understanding of COVID-19 as a disturbance to the system. SES can be understood as the interconnections between environmental, economic and social processes (Folke 2006).

The article is structured into five sections. The next section introduces the study's methodology, including its analytical framework. Section 7.4 reviews the impact of COVID-19 on existing land and societal transformation at a global level. Section 7.5 uses the example of the three states of Madre de Dios / Peru, Acre / Brazil and Pando / Bolivia – also known as the MAP region – in the south-western Amazon for a more detailed analysis. We have selected this region because of its roughly homogenous economic and environmental setting and, at the same time, its social diversity. This context facilitates an analysis of how different societies within similar environmental conditions cope with sudden disturbances, such as a pandemic. The article concludes by summarizing the lessons learnt that can strengthen social resilience to future crises.

7.3 Methodology

7.3.1 Data Collection

In addition to a comprehensive literature review on the impacts of COVID-19 in Peru, Brazil and Bolivia using the Web of Science, the paper draws on stakeholder conversations in the research region. We conducted two types of stakeholder conversations: firstly, we organized an online focus-group discussion in September 2020 (PRODIGY BioTip 2020) in which residents, scientists and representatives of non-governmental organizations (NGOs) from each of the three states in the MAP region participated. The virtual character of the focus group had the additional value of bringing participants from the three countries together, which would have been difficult during usual field research due to the remoteness and long distances that people would have had to travel. Secondly, we organized two virtual scenario panel discussions with representative stakeholders from government and NGOs. The first panel took place in Acre / Brazil in February 2021 (PRODIGY BioTip 2021a) and the second in Madre de Dios / Peru in July 2021 (PRODIGY BioTip 2021b). Both panels discussed the impact of the pandemic on previously defined drivers of change such as climate and land use change, land regulation, production and market orientation and migration.

7.3.2 Case Example

Our case example is located in the south-western Amazon, particularly the border region of the three states of Madre de Dios in Peru, Acre in Brazil and Pando in Bolivia – also known as the MAP region (see Fig. 7.1).

The economy in the region largely depends on the extraction of non-timber forest products (NTFP) such as Brazil nuts and açai. Additionally, major drug routes from Bolivia and Peru cross the region to European and African markets. After the rubber boom at the beginning of the twentieth century, rubber lost its economic importance and many collectors of NTFP substituted their losses with other forest products or with cattle ranching (Acre and partly Pando) and gold mining (mostly Madre de Dios and partly Pando). In general, mining (mostly illegal) is seen as a source of diversifying income and securing family income through the year and also during the pandemic. Since the 1990 s, eco-tourism in Madre de Dios has also

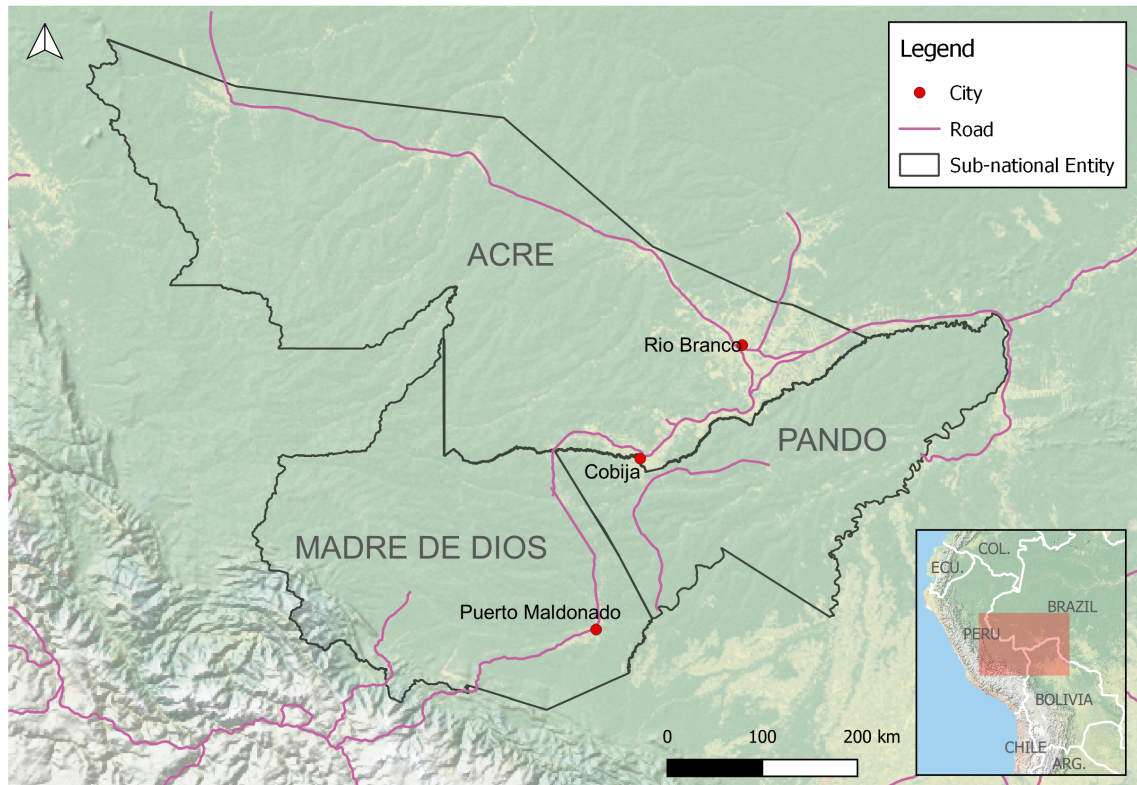


Figure 7.1: Map of the case study region in the south-western Amazon (map created with the software QGIS v.2.18 and data from OpenStreetMap).

boomed (Kirkby et al. 2011). In addition, rural smallholders grow vegetables and raise cattle for local markets in the economic centres of each state.

Before the pandemic, the region was dominated by generally high poverty rates, poor access to basic services and political instability (Bolivia), along with right-wing populism (Brazil) and high levels of corruption (UCSP 2020). Soon after the World Health Organization (WHO) characterized COVID-19 as a pandemic on 11 March 2020 (WHO 2020), the Peruvian government declared a national quarantine from 16 March (Government of Peru 2020), which included the closure of all borders and the suspension of international flights. The Bolivian government followed with a national quarantine on 21 March (Government of Bolivia 2020). People in both countries were confined to their houses to practise isolation and physical distancing. Permission to leave their houses for necessary matters, such as grocery shopping, was granted according to the last digit of a person’s ID number, indicating that people were to leave the house on only one day of the week. Strict curfews at night and during weekends were also imposed during the first weeks of the national quarantine in Bolivia and Peru, leading to a paralysis of almost all economic activities in both countries. The Brazilian government, however, followed a less strict approach: it closed borders to neighboring countries but continued international aviation services and did not impose a national quarantine.

In all three states of the MAP region, government communication about the pandemic often reached rural areas more slowly than unofficial, unverified and often contradictory information through obscure social media channels (Galhardi et al. 2020). This incomplete and changing information about the symptoms and overall treatment of COVID-19 discredited science and global health institutions and created insecurity among the population, who often could not follow fast-changing health scenarios at the beginning of the pandemic (Gonzales et al. 2020).

7.3.3 Analytical Framework

The framework focuses on the relation of land use change, conflict and cooperation that was suddenly disturbed by the COVID-19 pandemic because land use change, respective impacts on ESS, and human agency are crucial in determining recovery from a crisis and/or the potential processes of change after it (see Fig. 7.2). The framework draws on concepts from social-ecological systems literature and enriches them with a cross-scale analysis from the literature on political ecology (Schilling et al. 2021). The combination of these two facilitates the provision of knowledge on the behavior of social-ecological systems under the impact of a pandemic disturbance, respecting the "recursive relationship between knowledge, agency and context mediated by power, culture and history" (Cote and Nightingale 2012, p. 484).

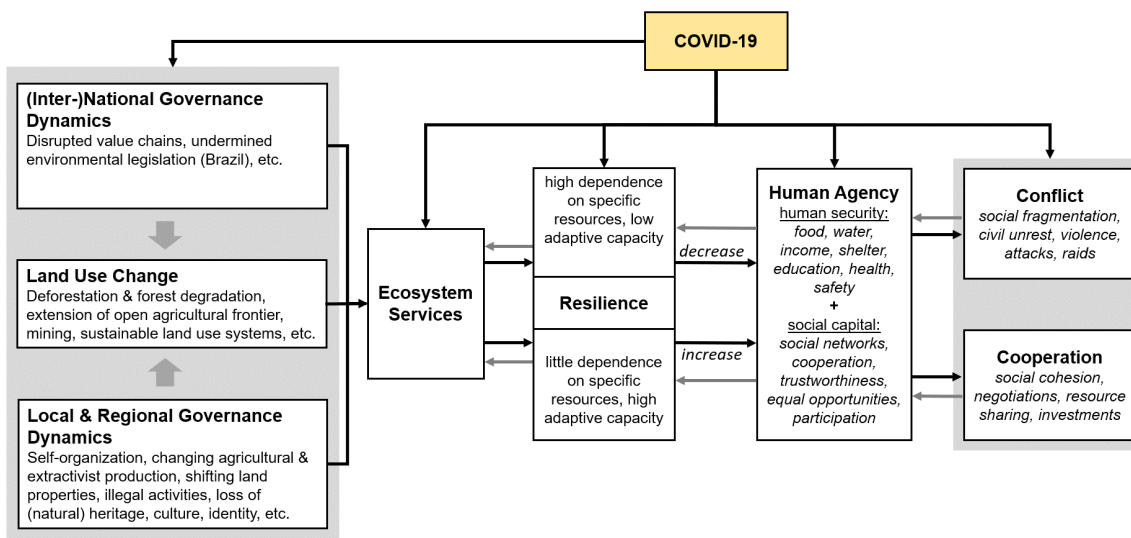


Figure 7.2: Analytical framework (own elaboration).

Land systems are governed by the interplay between local / regional governance dynamics and national / international governance (Veldkamp et al. 2011), whereby the interplay may reinforce or hinder effective governance (Schönenberg 2019). These local to global governance dynamics impact land use decisions, which in turn affect the ESS of the respective land system. We also refer in our analysis to the ambivalent character of criminal networks to examine the underbelly of those system structures (Schönenberg 2019).

The ESS under impact have direct and indirect effects on human agency, referring here to the ability of people and institutions to act in their specific context (Betsill et al. 2020). To encompass underlying system structures, we understand human agency here as a combination of human security and social capital (see Fig. 7.2). Human security describes the satisfaction of basic human needs while social capital describes social networks and social structures that members of a group can access to promote their interests (Schilling et al. 2021). Depending on their agency, people take decisions which result in conflict or cooperation and may consequently result in a weakening or strengthening of social cohesion. Vice versa, these dynamics may influence human agency.

The COVID-19 pandemic is a disturbance of the previously described interactions between land use change, conflict and cooperation. 'Disturbance' is understood here as a driver which is the "result of social, political, cultural, economic and environmental change" (Adger 2000, p. 347). This driver – here the pandemic – puts stress on the system's functions on multidirectional spatial and temporal scales and thus impacts the entire social-ecological system.

7.4 The Effects of COVID-19

Less than two years have passed between the outbreak of the COVID-19 pandemic in early 2020 and the writing this article. Hence, there is a limited number of studies and data available to discuss the effects of the pandemic on the interactions of land use, ESS, human agency, cooperation and conflict. Nevertheless, we present a preliminary overview of some of the existing findings.

7.4.1 COVID-19, Land Use and Ecosystem Services

On the one hand, the lockdown measures related to COVID-19 have reduced human influences on the environment and resources which, in turn, have shown some signs of recovery. Guha and Govil (2021, p. 1082) show that vegetation cover measured by the normalized difference vegetation index has "increased significantly during the lockdown period" in Raipur city, India. Similar improvements in vegetation cover were reported for Mumbai, Delhi, Kolkata and Chennai (Ghosh et al. 2020). In the Wadi Al-Batin tri-state desert, located in parts of Iraq, Kuwait and Saudi Arabia, the native vegetation coverage increased strongly as quarrying operations, camping and off-road vehicle movements declined during the lockdown (Al-Ali et al. 2021). Human-induced forest fires decreased during the lockdown in Nepal and in the Western Himalayas (e.g., Paudel 2021).

On the other hand, several studies suggest that more people used natural resources to secure their livelihoods because opportunities for paid labor were reduced (e.g., Hammad et al. 2021). For instance, higher logging rates were noted in Bangladesh (Rahman et al. 2021). A study of Sub-Saharan Africa shows that emissions from the burning of forests increased during the lockdown (Kganyago and Shikwambana 2021). In addition to higher pressure on communities to utilize forest resources, the capacity of authorities to prevent illegal activities and fight fires in the forests were limited due to COVID-19 conditions (Kganyago and Shikwambana 2021). Additionally, Vale et al. (2021) demonstrate that pandemic distractions and restrictions were used as opportunities to weaken environmental protection legislation in Brazil.

The results indicate two opposing developments for the provision of ESS. On the one hand, the provision of resources such as timber, fire wood, fish, plants and fruits functioned as a safety net upon which people could fall back after formal monetary income sources diminished (Eco-Lodge Owner in Madre de Dios 2021). At the same time, reduced human activities revealed the regulating potential of nature as studies show reduced air and water pollution (Roman-Gonzalez and Vargas-Cuentas 2020). On the other hand, increased use of natural resources threatened or destroyed ecosystems and reduced their potential to provide ESS (Vittor et al. 2021).

7.4.2 COVID-19 and Human Agency

We conceptualize human agency as a combination of human security and social capital, referring to the ability of people and institutions to act in their specific context (Betsill et al. 2020).

7.4.2.1 COVID-19 and Human Security

Overall, COVID-19 has negatively affected human security (Zavaleta-Hernandez and Rico-Becerra 2021). We focus in the following on the health, income and food dimension of human security.

The disease had the most obvious effect on the health dimension of human security. At the time of writing (in November 2021), 5.2 million people died after contracting the virus (Statista 2021b). With more than six thousand deaths per one million inhabitants, Peru has suffered

the highest COVID-19-related death toll (Statista 2021a). Several other countries in South America also have a much higher COVID-19-related death rate than in other regions (WHO 2021). In addition, the pandemic revealed structural discrimination in various countries, showing excess mortality – for example, for indigenous Brazilians (Soares et al. 2021), those of black ethnicity, people with learning disabilities and people who live in multi-occupancy dwellings (Joy et al. 2020).

The pandemic and the lockdown measures particularly affected the economic security of those without (long-term) employment contracts and those in the informal sector (see Webb et al. 2020). Due to the mobility restrictions, street hawkers were unable to sell their products or lost significant parts of their customer base (Turner et al. 2021b). A study from nine countries in Africa (Burkina Faso, Ghana, Kenya, Rwanda, Sierra Leone), Asia (Bangladesh, Nepal, Philippines) and Latin America (Colombia) shows that, on average, 65% of households experienced an income drop and were unable to sustain their pre-pandemic living standards (Egger et al. 2021). According to the latest estimate, the pandemic pushed 97 million people into extreme poverty in 2020.

Rising poverty also undermined food security. In addition to income losses, the supply side of food was impacted by the pandemic as agricultural production was reduced due to a lack of labour and disruptions of supply chains and transport systems (e.g., Swinnen and Vos 2021). Criminal groups partly took advantage of this situation while providing substitute governmental functions, including food relief and monetary assistance in peripheral regions (Aziani et al. 2021).

7.4.2.2 COVID-19 and Social Capital

In times of crisis, social networks, whether legal, informal or criminal (Cartier-Bresson 1997), play an important role. In the following, we first focus on CSOs before taking a closer look at organized crime.

COVID-19 brought the opportunity to reconsider the role played by civil society and young people as holders of social capital in building resilient and just societies (Allen et al. 2020). While governments declared a lockdown, forcing people to stay at home, the fact of not being able to meet together fostered CSOs and youth to find new ways of communicating (Ballén Robles 2021). The younger generations have a greater ability to learn how to use new technologies and tend to adapt to new situations more easily than older generations (Alcoba et al. 2021). In this sense, younger generations are important actors to include in the analysis of human agency during the COVID-19 pandemic. Social media and virtual platforms offered a dialogic virtual space where people could continue to meet and talk about community needs. In particular, the young used social media to make their needs and problems visible (Ballén Robles 2021) or to raise funds for their communities (Allen et al. 2020).

In several countries, lockdown measures were also used to restrict demonstrations and protests. At the same time, numerous CSOs found alternative ways to organize while focusing their efforts on providing urgent services, including food, medical services and information about the pandemic (CIVICUS 2020). The type of relationship between government and civil society prior to the pandemic was decisive for the degree of cooperation between the two actors during the crisis. On the one hand, CSOs – usually in rather authoritarian states, where they and grassroots organizations face limitations and restrictions based on laws and policies – had difficulty working with government institutions and with communities in need (Kövéer 2021). On the other hand, in countries where the state recognizes the role of civil society, the latter's social capital increased during the pandemic (Meyer et al. 2021). Consequently, the power shared between the state and civil society enabled CSOs to contribute to combating the difficulties arising from the pandemic.

An example of a government restricting CSOs participation during the pandemic is China, where its government continued controlling and restricting the activities of CSOs and thus

restricting the use of their social capital and the exercise of their agency (Sidel and Hu 2021). Nevertheless, the Chinese Communist Party made use of the social capital of selected CSOs, allowing them to raise money through 20 internet platforms assigned by the Ministry of Civil Affairs (Sidel and Hu 2021). Violence was used as a means of controlling civil society in, for example, Iraq and Uganda, where live ammunition was used against protesters demanding economic support, as well as in Nepal, where people protesting the government's handling of the crisis were beaten with batons (CIVICUS 2020). Reducing the financing of CSOs was another way of diminishing the scope of their action – for example, the Hungarian government decided to reduce its funding for three CSOs. Nevertheless, these government actions were more than compensated for when citizens showed solidarity and collected a larger amount of money than that cut by the government (Kövéér 2021). The use of technology to track COVID-19 also offered an opportunity to increase the surveillance of the population. This was used in countries as Turkey and China but also in more democratic countries like the UK (CIVICUS 2020). Generally, collaboration during the pandemic between CSOs, government and communities worked best where this network had already been established. The more trust that was built before the crisis, the better the collaboration (Meyer et al. 2021).

Little of the academic literature addresses new types of crime that emerged during the pandemic or analyses the roles of criminal groups in substituting governmental functions (Bondar and Zhukova 2020). Thus, we rely mainly on official statements of the concerned institutions and on press releases. At a forum convened by the Organization of American States (OAS) in May 2020, the director of the OAS Department of Transnational Organized Crime said that COVID-19 has become "a window of opportunity" for organized crime, particularly in Latin America and regarding the trafficking of medical supplies, development of cybercrime and social assistance to strengthen territorial control. The President of IBI Consultants commented that the "most alarming trend" is the ability of transnational criminal organizations (TCOs) to fill the gaps left by an absent state, replacing it as "a legitimate actor and service provider" (ISTOÉ Independente 2020). TCOs are managing diverse portfolios from trafficking drugs, humans, weapons, minerals and other illicit commodities to extortion, kidnapping for ransom, cybercrime and money laundering. Latin American crime groups have thus developed into "global criminal networks that are deeply entangled with public and private sectors across the region" (Cruz and Fonseca 2021).

7.4.3 COVID-19, Cooperation and Conflict

With reference to the COVID-19 pandemic, UN Secretary-General Antonio Guterres warned early on "that this is, indeed, the most challenging crisis we have faced since the Second World War" and that there is a risk that the pandemic "contributes to enhanced instability, enhanced unrest, and enhanced conflict" (UN 2020). Whether this is actually the case is hard to say, as only a few scientific studies have so far addressed the effects of the COVID-19 pandemic on conflicts. Tab. 7.1 provides an overview: two studies find a temporary reduction in violent conflict, mainly because the number of protests was reduced due to lockdown measures (Berman et al. 2021; Bloem and Salemi 2021). Specifically, Berman et al. (2021) find that shutdown policies reduce the likelihood of conflict by 9%. However, in poor countries and societies with a higher fractionalization along ethnic or religious lines, the reduction was not observed. Mehrl and Thurner (2021) even argue that governmental lockdowns have increased violent conflict in the Middle East. While these data provide valuable insights, data comparison should consider that data collection might be incomplete due to lockdown impacts on responsible institutions.

Fig. 7.3 confirms that the reduction of the number of all conflict types in the beginning of the pandemic is mainly driven by the reduction in protests. In most world regions, the number of protests declined between March and April 2020 and then quickly reached or even exceeded its pre-pandemic level (Fig. 7.3). This can also be seen in South America (ACLEDD 2021).

Table 7.1: COVID-19 effects on conflict (authors' compilation based on references shown in right column. For ACLED (Armed Conflict Location & Event Data Project) data see ACLED (2021)).

COVID-19 Effect on Conflict / Main finding	Geographic Coverage	Period Covered	Conflict Data	Reference
No effect or escalating effect.	Global	January '19–June '20	ACLED	(Polo 2020)
Overall reduction of conflict risk, particularly protests. No decline in the most fractured countries.	Global	January–April '20	ACLED	(Berman et al. 2021)
Temporary decline in conflict events, mostly driven by reduction in protests.	Global	July '19–October '20	ACLED	(Bloem and Salemi 2021)
No effect on global levels of armed conflict. Considerable regional heterogeneity. Decreases in Europe. Increases in the Middle East.	Global / regional	January '18–April '20	ACLED	(Mehrl and Thurner 2021)
Ambivalent: Increase of armed conflict in five countries and decreases in four countries.	Afghanistan, Colombia, India, Iraq, Libya, Pakistan, Philippines, Thailand and Yemen	January–June '20	ACLED	(Ide 2021)

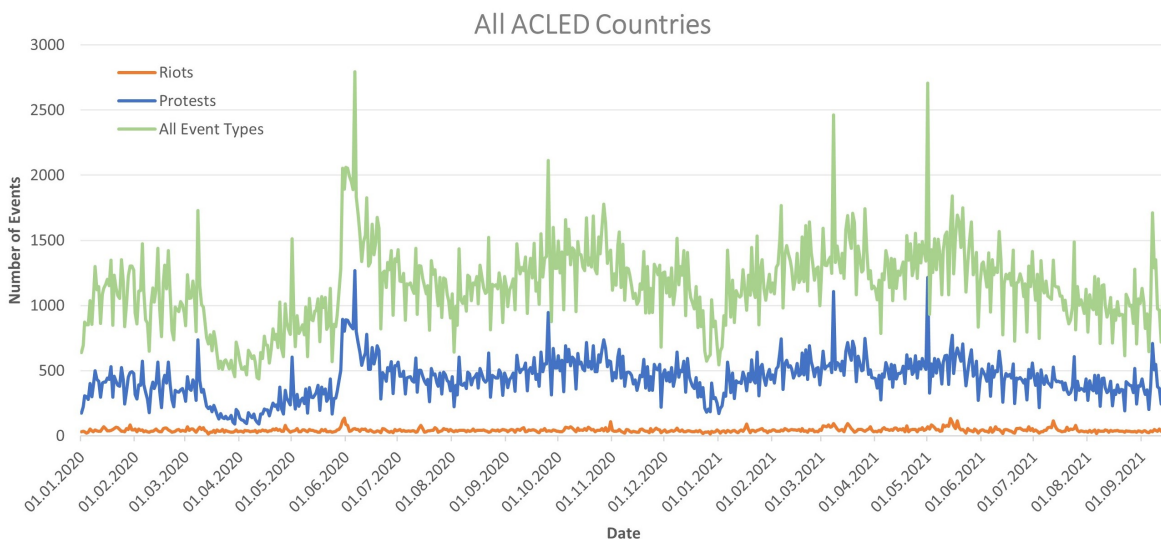


Figure 7.3: Violent events by type for all ACLED (Armed Conflict Location & Event Data Project) countries between January 2020 and September 2021 (Schilling / Shah based on ACLED (2021)).

Regarding the other types of conflict events, Ide (2021) finds that, during the pandemic, armed battle and explosion events increased in Iraq, the Philippines, India, Pakistan and Libya while decreases were noted in Afghanistan, Colombia, Thailand and Yemen. Generally, it is difficult to attribute a change in violent conflict events to the effects of the pandemic. However, with respect to violent attacks such as bombings, a possible explanation is that lockdowns and limited mobility made the logistics for an attack more difficult (e.g., Ide 2021). Furthermore, bomb attacks are likely to receive less attention when the main media focus is placed on the pandemic. Fig. 7.3 and some of the mentioned studies suggest that, in the short term, the number of conflict events decreased while, in the medium and long terms, the effects of COVID-19 increased conflict risks as the pandemic affected several root causes of conflict.

7.5 Insights from the Southwestern Amazon

The region has had ambivalent experiences during the pandemic. On the one hand, the region's remoteness prevented an early spread of the virus when the pandemic gained momentum (Coelho et al. 2020). On the other hand, less governmental support of healthcare and preventive measures increased the population's awareness of its peripheric location (e.g., Souza and Cassab 2020) and showed the inefficiency of the government. This not only raised feelings of abandonment among the population but also increased their distrust (UCSP 2020). In this section, we analyse the interactions of land use change, ESS, human agency, cooperation and conflict amidst a global pandemic in the MAP region. The section is mainly based on results from the stakeholder conversations, supplemented by the literature.

7.5.1 COVID-19, Land Use and Ecosystem Services

In response to the lack of transportation options and food supply, families diversified their agricultural production and prioritized the production of food and the collection of non-timber forest products for self-consumption and sale at local markets (Zimmerer and Haan 2020). In these markets, the demand for local products increased not only due to the lack of imported goods but also due to the increasing appreciation of their nutritional value. This increase in demand and the exploration of new (local) markets has, to a certain degree, counteracted the economic crisis.

Furthermore, some Brazil nut and açaí associations in Pando and Madre de Dios concluded direct contracts on small and medium fixed purchase quantities, providing extractivists with guaranteed income but not overloading them with high demands that they could not fulfill (PRODIGY BioTip 2021b). Some international companies bought up large amounts of product, stimulating local associations to acquire certification for sustainable forest, organic and fair-trade production in order to explore these new market opportunities. The rubber tappers in the Chico Mendes Extractive Reserve (RESEX Chico Mendes) in Acre further acquired a contract with a local company to increase the local value-creation of rubber. This contract has been perceived as a valid alternative to cattle raising in a time of crisis and has attracted extractivists and former rubber tappers to increase their production of rubber and join local cooperatives.

The increased appreciation of rubber among some extractivists in the RESEX Chico Mendes led some to engage less in deforestation and be less involved in retailing parts of their production units by rubber tappers (PRODIGY BioTip 2020). This can be seen as a small positive development during the pandemic. Nevertheless, the general decrease in revenues from non-timber forest products and the overall economic slowdown, as well as the restriction of most informal activities due to quarantine measures, led extractivists and informal workers to search for alternative sources of income, such as cattle raising, timber

extraction or illegal mining, leading to continuously high deforestation rates in the RESEX Chico Mendes (INPE 2021). Such increased illegal exploitation of resources and deforestation remained while most controlling authorities were forced to work from home instead of patrolling the forest (PRODIGY BioTip 2021b).

Such structural inequality and impunity led not only to accelerated criminal exploitation of nature but also to an increase in the assassination of environmental activists, in particular indigenous people who had no other choice than to patrol their land to safeguard against land grabbing (Stewart et al. 2021). Illegal trespassers, even from outside the MAP region, have also extracted timber and used fire to clear the forest for agriculture, mining and cattle farming while at the same time becoming "vectors of COVID-19 transmission" (Stewart et al. 2021, p. 1). Some Brazil nut associations in Madre de Dios encouraged their members to search for alternatives to timber extraction from their Brazil nut concessions during the pandemic in order to protect the standing forest on the concessions (PRODIGY BioTip 2020).

Among the proposed alternatives are, for example, agroforestry systems with cocoa planting (Lagneaux et al. 2021) and long-term planning that include planting timber products such as mahogany, cedar and tornillo trees on already deforested parts of their concessions. This would not only diversify income sources but also recover deforested areas and degraded soils. Other incentives, particularly for illegal miners, have been options for fish-farming, which is expected to serve the high market demand, providing revenues from less destructive activities, and thus has already led to some miners leaving the mines (PRODIGY BioTip 2020).

7.5.2 COVID-19 and Human Agency, Cooperation and Conflict

CSOs are crucial actors in the safeguarding of human security during the pandemic in the MAP region, while organized violent crime is a key risk to all dimensions of human security. At the same time, both CSOs and organized crime are alternative sources of social capital and expressions of alternative human agency. The following sections will first describe the pandemic impacts on human security in the MAP region and then focus on two main actor groups that exercise human agency and that impact cooperation and conflict dynamics in the region: CSOs and organized crime networks.

7.5.2.1 COVID-19 and Human Security

Human security was particularly affected due to the superposition of the COVID-19 pandemic with two consecutive climate extreme events. Firstly, extraordinarily little rainfall was recorded in 2020, leading to ecosystems degradation and causing threats to agricultural production (Woodwell Climate Research Center 2020). Secondly, in early 2021, the region – particularly Acre – experienced extreme flooding, which caused severe destruction to houses and infrastructure and forced people into crowded evacuation centers, increasing the risk of COVID-19 contagion (PRODIGY BioTip 2021a).

The health dimension of human security was already under stress, due to strong deficiencies in public health systems which had already been reported across the MAP-region before the pandemic (Menton et al. 2021). These included infrastructural deficiencies in the number of hospitals that were attending an increasing quantity of people, particularly since other diseases such as dengue were still very prevalent due to the 2019 dengue epidemic (PAHO 2020). In addition, inadequate or unavailable equipment such as ventilators and oxygen, as well as necessary personal protective equipment for clinic personnel, stressed the overburdened health system.

The Bolivian government declared the treatment of COVID-19 in public hospitals to be free of charge, eliminated customs tariffs on medical supplies and equipment and provided incentives to health care workers to increase their work hours by proportionally increasing payments (Cárdenas and Guzmán Ayala 2020). In Brazil, on the contrary, the pandemic

particularly hit indigenous people and those in remote areas which often lack access to health care and preventive supplies such as masks and disinfectant. In many cases, the Brazilian government failed to extend the healthcare system to remote regions, leaving this to private initiatives (Menton et al. 2021).

The economic dimension of human security was particularly affected by the pandemic's arrival in the MAP region during the Brazil nut collecting season. Due to travel restrictions, extractivists in Peru and Bolivia were not able to collect their harvest. This caused delays and accentuated the effects of low income from Brazil nuts (PRODIGY BioTip 2020). Already before COVID-19, the economic situation was under stress due to generally low international demand for Brazil nuts and concomitant low prices, which led to a reduction of pre-COVID-19 family income of 50–60% in all three regions.

In addition, the delay led to an overlap with the açai harvest and a consequent lack of workers. Enforced import and export regulations due to closed borders further hindered, and therefore reduced, the export of Brazil nuts to international markets. While the exported volume in Bolivia reached 4848 tons and a value of \$30 million between January and March 2019, the exported volume for the same period in 2020 was reduced to 4166 tons with a reduced value of \$22.5 million: a reduction of 14% in volume but 25% in value. In addition, activities that require an intensive labour force, potentially by migrant workers, are affected by mandated social isolation and restricted migration possibilities due to difficulties of displacement, including the crossing of national borders within the tri-national region and the lack of available hotels (PRODIGY BioTip 2020).

Another indirect impact of the pandemic is disrupted supply chains to the remote regions of the MAP region. Due to the quarantine, truckers who were transporting supplies of agricultural production faced severe difficulties such as a lack of restaurants and service facilities along roads (PRODIGY BioTip 2020). Due to the lack of transportation options and limited export opportunities, some processing facilities reduced their production or closed completely, leaving producers fearing that they would be left with their primary products.

Lower family income and disrupted supply chains additionally threatened food security in the region. The results of a survey among households on the effects of the emergency measures against COVID-19 in the northern Bolivian Amazon have shown that families in rural areas with diversified incomes have had fewer difficulties than families that depend on only one product (Araujo Cossío 2020). Similar results have also been reported from Madre de Dios and Acre. Families with diversified products were not only dependent on Brazil nuts but had small scale agricultural and agroforestry systems which fostered resilient conditions to balance the impacts of COVID-19. However, large parts of the rural population depend only on Brazil nuts. These were particularly affected by quarantine measures and depended on bonuses from the government or support from other institutions, especially NGOs in the region. Considering the situation of extreme poverty in Bolivia, such bonuses have been a significant support and inspired confidence in the government's reaction (PRODIGY BioTip 2020). In addition, CSO provided humanitarian aid through the provision of food baskets to families and to native and rural communities at risk. Others also provided seeds for annual cultivation or other means to increase families' food security.

7.5.2.2 COVID-19 and the Social Capital of the Civil Society – An Opportunity for Cooperation

Low Brazil nut prices fuelled social unrest by extractivists in Pando, to which the Bolivian government responded with a price agreement of 140 bolivianos per caja (ca. 23 kg). However, this price still did not meet the demands of traditional and indigenous peasants and led to further street blockades which were accentuated by measures taken by the government to restrict the contagion of COVID-19 (PRODIGY BioTip 2020).

The quarantine restrictions preoccupied CSOs and associations because some of their core

activities, such as meetings, networking and assemblies of people to discuss action, were no longer possible (PRODIGY BioTip 2020; PRODIGY BioTip 2021a). Nevertheless, individuals and CSOs were among the most active throughout the pandemic in supporting people in their basic needs, communicating relevant information about the pandemic and, in the absence of the state, taking governance actions and structuring self-organization. Whenever possible, CSOs have organized themselves virtually (PRODIGY BioTip 2021a; PRODIGY BioTip 2021b).

In the absence of monetary income, communities reinforced ancestral practices such as trade exchange. After the quarantine was loosened, production surplus was also sold on local markets. This particularly strengthened the food system in urban areas, especially in Cobija. To assist families in urban areas who did not have access to land for food production, the community organized common soup kitchens. These activities of solidarity and communal governance strengthened communal networks and served as communication and information platforms on health and production topics or for the exchange of traditional knowledge on how to treat the symptoms of COVID-19. In addition, social control based on communal norms fostered the implementation of physical distancing measures (PRODIGY BioTip 2020).

Extractivist communities developed strategies to strengthen their local cooperatives and associations in the face of rising social inequality and the lack of public policies and support by state and federal governments. As well as the need to diversify their products in reaction to unstable markets, CSOs in Acre saw the need to organize campaigns to attract global attention in the absence of national government assistance to the needs of the population. One example is the joint campaign of the NGO SOS Amazônia, the National Council for Extractivist Populations (Conselho Nacional das Populações Extrativistas – CNS), the Chico Mendes Comité and the Commission for Indigenous People in Acre (Comissão Pro-Índio do Acre). The campaign called "People of the Forest against COVID-19" is a global campaign to support extractivist and indigenous people in Acre.

Such organization of civil society actors has provided indigenous people with access to basic items for protection against COVID-19. Many indigenous people are already experienced in organizing themselves and supporting each other due to poor government attention over recent decades. Specific protection mechanisms in the current crisis include running their own education and information campaigns on social media, such as podcasts on behavioral recommendations or asking communities to share their actions via video under #Combate-CoronaNaAldeia (Fight Corona in the Village).

Another example of alternatives is that of extractivist associations in Pando which adopted strategies such as selling personal assets (for example motor bikes) or taking out loans to afford an açaí production plant and the required equipment to follow the protocols for biosafety against COVID-19. Additionally, the virtual 'Youth of the Future' festival connected youth from Bolivia, Peru and Colombia to speak about their actions to minimize environmental impacts and to mitigate the risk to the environment in times of pandemic (PRODIGY BioTip 2020).

Some CSOs in Madre de Dios joined forces with all and any relevant bodies, including regional and local governments or even the national government to develop and disseminate information. However, CSOs criticized the slow decision-making processes of government entities. These organizations thus joined forces to develop communication products to inform people about COVID-19, to sensitize the population and to limit fake news spreading through unofficial social media channels. Printed materials with information about the spreading dynamics of the virus and preventive measures against contagion were distributed and translated into different indigenous languages.

Additionally, this information was distributed through various media channels, newspapers, radios or podcasts. Some NGOs particularly worked for the rights of indigenous people and their safety as they were particularly vulnerable to the virus. Other services provided by

and for civil society include programs and spaces for information and exchange about mental stress management or sexual violence during the pandemic.

Youth in the region were particularly affected by the shift of their educational activities to the virtual space. Teachers as well as students had to readjust to the new situation which revealed the great disparity in access to computers or permanent internet at home. This digital divide has not only been revealed in terms of access to technology but also in knowledge of managing these technologies (Robinson et al. 2020). This created a perception of 'double quarantine' – confinement at home without the ability to at least 'go out' virtually. In addition, two surges of migration have been observed. One from rural to urban areas in search of better health services and faster attention after infection. The other is the return of students from urban centres to their rural families for reasons of prevention and protection from contagion.

The relationship between civil society and the state in all three states is somewhat ambivalent. On the one hand, the population has complied with norms and the dispositions that have been established in relation to prevention and protection during the rigid quarantine. On the other hand, news and opinions questioning governmental responses have been disseminated through social media networks, particularly on non-transparent issues such as provision of equipment for health workers and deficiencies in health infrastructure and personnel. This 'control' mechanism occurred from the municipal to the international level and generated pressure and questions about governmental actions. At the same time, these media offered space for the fast transmission of information as well as the articulation of ideas and proposals. This ambivalence of the relationship between the state and civil society led to a rather fragmented and overlapping situation of 'lead agencies' which were managing the COVID-19 pandemic, when the functions of relatively new institutions which faced budget constraints and high corruption rates are replaced by local CSO networks, such as unions, churches or NGOs (PRODIGY BioTip 2021a).

7.5.2.3 COVID-19 and the Social Capital of Organized Crime – A Catalyst of Conflict

The COVID-19 pandemic has had ambivalent impacts on existing crime structures in the MAP region which are intertwined with very diverse illegal activities such as drug trafficking, illegal gold mining, illegal logging, human and arms trafficking, land grabbing and generally with violence.

Representatives of public security in Acre confirm that the police are mainly concerned with the management of the pandemic. The recovery of stolen oxygen cylinders and the management of extreme floods between February and April 2021 especially absorb the already scarce capacities of the security apparatus (Governo do Estado Amazonas 2021). In addition, corruption has flourished: indigenous leaders denounced the sale of 106 doses of Coronavac destined for the Yanomami Indigenous Land to miners in exchange for gold by employees of the Special Secretariat of Health (SESAI). Hence, facing a largely absent state, environmental crime and violence have increased.

A study by the Brazilian Forum for Public Security (FBSP and IMAZON 2021) shows that, in 2020, the nine states in Amazônia Legal (administrative unit) had higher homicide rates than the national average. While Brazil had 23.9 deaths per 100,000 inhabitants, the Amazonian states reported 29.6, with Amapá (41.7), Acre (32.9) and Pará (32.5) standing out as the deadliest (FBSP and IMAZON 2021). In absolute numbers, the survey shows that 8,729 intentional violent deaths were reported in communities of Amazônia Legal in 2020 (FBSP and IMAZON 2021). These numbers also show, that organized crime grew strongly in the Amazon and also in the MAP region after the São Paulo criminal organisation Primeiro Comando da Capital (PCC) and the Comando Vermelho (CV) from Rio de Janeiro started to claim drug-trafficking routes in the Amazon. When the two factions split up in 2016,

new alliances with local criminal factions operating in the Amazon were created. While the PCC gained power in Paraguay in mid-2017, the CV began controlling parts of the corridor transporting drugs from Bolivia, to Brazil, Europe and Africa. Since the beginning of the pandemic until now, gang wars over territorial control have been fought mainly between the CV and the previously dominating Acrean gang *Bonde dos 13*.

Rising international gold prices and weak law enforcement have led to the intensification of illegal mining driven by criminal organizations in 2020 taking advantage of the already established routes for drug trafficking in the region. While transnational routes of accompanying cargos were impacted by closed borders, illegal means of transportation using rivers or private airstrips were not impacted. This resulted in an increase of armed attacks against traditional communities, especially indigenous peoples. The increased flexibility of access to weapons and the weakening of environmental enforcement agencies were also crucial to this explosion of criminality in the Amazon (Vale et al. 2021). The Bolsonaro government's ignorance of illegality in the Amazon further facilitates criminal exploitation and is detrimental to the integrity and protection of local communities and indigenous peoples.

In Peru, illegal gold mining increased due to rising global prices. Similarly, illegal logging and timber-trading increased because of weakened law enforcement and growing corruption (Smith-Roberts et al. 2021). The miners who were relocated from Tambopata National Reserve in 2019 during a large-scale military intervention against illegal mining – also known as Operation *Mercúrio* – are said to have mostly returned. According to Pablo de la Flor, executive director of the National Society of Mining, Petroleum and Energy (SNMPE), legal mining exports fell by 65% in April 2020. Official operations were stopped during the lockdown, allowing illegal mining to grow (Saffon 2020). At the height of the pandemic in October 2021, the High Complexity Crime Investigation Division (DIVIAC) of the Peruvian police uncovered a criminal network known as *Los Hostiles de la Amazonía* which was dedicated to the trafficking and illegal trade of timber from Madre de Dios. At present, DIVIAC assumes that there are about 50 people, including the Governor of Madre de Dios, further regional government officials, police chiefs and officers, employees from the National Superintendence of Tax Administration and specialized environmental prosecutors, businessmen and other people involved in this case of corruption and timber trafficking (Fiestas 2021).

In Bolivia, concerns during the pandemic concentrated on curbing transnational criminal activities at the Bolivian-Brazilian borders since Brazilian criminal factions had begun to establish themselves in Bolivia. In 2021, the State of Acre signed a partnership with the Department of Pando in Bolivia seeking to expand this alliance against criminal organizations with the Brazilian states of Rondônia, Mato Grosso and Mato Grosso do Sul. However, the number of cases of criminal activities has increased considerably in 2020, indicating a widespread paralysis of the security apparatus in Pando (INE 2021).

7.6 Conclusion and Outlook

The aim of this paper has been to better understand the impacts of the pandemic on the interconnections of land use change, ESS, human agency, conflict and cooperation, with a focus on civil society organizations and criminal networks.

While it is obvious that the human security of already vulnerable groups which lack formal employment contracts and social and health insurance has been negatively impacted by the pandemic, the effect on violent conflict seems to have been temporary. During the lockdowns, which first occurred in most countries in March and April 2020, the number of conflict events decreased, mainly because the number of protests declined. After that, the level of violence reached pre-pandemic levels in most world regions.

Our case analysis supports the global results by showing that marginalized social groups in the south-western Amazon are particularly vulnerable to the impacts of the pandemic. In

7.6. CONCLUSION AND OUTLOOK

a politically and economically peripheral region, the increasing risk of socio-ecological conflict calls for a potential-oriented approach to global connectedness, the importance of solidarity and a lively democratic discourse that fosters cooperation and, thus, social cohesion. Civil society actions have been an essential strategy in the fight against COVID-19, not just in the health sector but also in the economic, political, social and cultural realms. It can be concluded that the pandemic not only brought social distancing but, at least in some places, also triggered an alliance of the people of the forest who united with environmentalists, NGOs, researchers and artists for mutual empowerment. However, it must also be noted that the pandemic has consolidated and partly renewed criminal structures, while the already weak state has fallen further behind due to additional tasks managing the pandemic and other disasters such as floods. Massive investment in environmental regulation and public security in the Amazon are promising approaches which could reverse this development.

In times of COVID-19 and generally in times of crisis, strengthening local value chains and local value production while engaging with global civil society through supportive networking campaigns provides a glimpse of what Goffman (2020, p. 48) calls "a new kind of glocalization" in which people value the local while strengthening global awareness. Further research could systematize the impact description given in this article and further analyse potential feedback loops between impacts and responses. Such an analysis could foster a better understanding of the complex reactions of social-ecological systems to sudden disturbances, of which a pandemic is just one example.

8 | SYNTHESIS

This chapter aims at concluding and operationalizing the key findings of the previous chapters. Therefore, this chapter first summarizes the key findings of this research (section 8.1) and relates them to the major research question presented in section 1.1. Second, this chapter draws overarching conclusions from the presented findings and indicates the contribution to the research field, both empirically and theoretically (section 8.2.1). Further, this chapter formulates policy recommendations that arise from the key findings and targets them to different stakeholder groups (section 8.2.2). Finally, the last section of this chapter presents ideas for potential future research activities (section 8.3).

8.1 Summary of Research Findings

As global change is accelerating, it becomes increasingly important to better understand the potentials of governance actors on local to global scales, not only in reacting to ongoing changes in the Anthropocene but also in reflecting upon potential future ones. Such reflexive potentials are likely to increase the scope of action that governance actors may have in the future and prevent deadlocks and path dependencies. Therefore, the main research question of this thesis was: "How does governance shape pathways towards co-operative or conflictive social-ecological tipping points?"

Research on governing tipping points (both ecological and social), and particularly research on social-ecological tipping points is still in its early stage. Many uncertainties, especially concerning narrowing down the range in which a tipping point occurs and developing early warning mechanisms, still exist in all research disciplines that deal with tipping points. Nevertheless, some important points can already be made.

While reviewing the nexus of climate change, land use, and conflict, we found an extensive body of literature on direct effects, for example, drought-related land use conflicts, with diverging opinions on whether global warming increases the risk for conflicts or not. Adding the perspective of indirect implications, we further identified research gaps, and also a lack of policy recognition, concerning the negative externalities on land use and conflict through climate mitigation and adaptation measures (Chapter 2).

Taking a social cohesion perspective into the analysis is beneficial to shift the focus from the problem-oriented perspective of vulnerabilities to global change and potential resulting conflicts to a solution-oriented perspective of enhancing agency and resilience to strengthen collaboration. The SCCM takes a system's approach to social cohesion and thus prepares the concept of social cohesion for the incorporation of societal dynamics into SES dynamics. Consequently, the provided conceptual framework aims to bridge the SCCM with current research on land system change in SES and thus relates the different strands of theoretical and conceptual approaches. At the same time, the framework provides orientation along the categories of life-sustaining or detrimental pathways, that could ultimately lead to respective life-sustaining or detrimental social-ecological tipping points (Chapter 3).

The Tipping Multiverse Framework took up this idea and enhanced it with a more detailed perspective on the soil ecosystem and the household livelihood system to identify entry points

to potential social-ecological tipping cascades. The framework proposes a two-step approach that first applies a global tipping points concept to a regional tropical SES (tipping matrix) and second systematically assesses the interactions and feedbacks within it (cross-impact matrix). As such, the Tipping Multiverse Framework offered two matrices that can advance the understanding of regional SES by identifying core processes, functioning, and links in each TE and thus provide entry points to identify potential tipping cascades across SES sub-systems (Chapter 4).

Both, chapter 3 and 4 build on the example of the southwestern Amazon to identify the key underlying sub-systems and their interlinkages: the soil ecosystem, the household livelihood system, the regional social system, and the regional climate system. The example shows the analytical potential of both proposed frameworks in advancing the understanding of social-ecological tipping points and potential tipping cascades in a regional SES.

Moving to the results of the empirical research and zooming in on questions of governance by applying a political ecology lens to human security, we find that 'glocal' resource governance often reproduces, amplifies, or creates power imbalances and divisions on and between different scales. Our results show that in all the cases in Kenya, Bolivia, and Peru, the winners of resource extraction can mostly be found at the national and international scale while local communities receive little benefit and are left vulnerable to externalities. The human security approach was useful in structuring our analysis of local impacts and comprehending the extent to which resource extraction has impacted local populations' safety and political, economic, and environmental security. The political ecology perspective made us more aware of power structures and political dynamics on and across scales, which made it possible for us to examine disparities, the function of institutions, and the distribution of costs and benefits. Overall, our research demonstrates that political ecology and human security are not mutually exclusive but rather complementary approaches. Hence, our study contributes to the existing research by stressing the importance of one underlying question: "governance by whom and for whom?" (Chapter 5).

This question raised the demand to understand the underlying dynamics of resource governance and resulting conflicts. Chapter 6 embarked on this question by analyzing how (environmental) institutions influence the major drivers of social-ecological conflicts over land in and around three protected areas, Tambopata (Peru), ResEx Chico Mendes (Brazil), and Manuripi (Bolivia). The main drivers comprise (1) land tenure and access to land and natural resources, (2) identity and lifestyle-driven transformations, (3) state and market-driven agendas, and (4) networked, illegal, and criminal activities. We found that state institutions, in particular, have the following effects on key conflict drivers: Overlapping responsibilities of governance institutions and limited enforcement of regulations protecting and empowering rural and disadvantaged populations, enabling external actors to (illegally) access and control resources in the PA. In part, this process is accelerated by an improved road infrastructure and a state agenda that favors development based on privatization over traditional economic activities based on collective land ownership rights. The already fragile social contract between the residents of the PA and its surrounding areas and the central state is further weakened by the expanding influence of criminal organizations that oppose the state's authority. For state institutions to avoid aggravating these conflict drivers but instead better manage them or even contribute to conflict prevention and mitigation, a transformation from reactive to reflexive institutions and the development of new reflexive governance competencies is needed (Chapter 6).

This need for reflexive governance becomes particularly visible when sudden disturbances or shocks impact the SES. In chapter 7, we analyze the impacts of the COVID-19 pandemic, which has been a major global disruption, on the interconnections of land use change, ecosystem services, human agency, conflict, and cooperation, with a focus on civil society organizations and criminal networks. Our analysis embarks from a global analysis and adds a

8.2. CONCLUSIONS

regional and context-specific perspective on southwestern Amazonia in a second step. While it is apparent that the pandemic has had a severe influence on the human security of already vulnerable populations who lack formal employment and social and health insurance, the effect on violent conflict appears to have only been ephemeral. During the lockdowns, which first occurred in most countries in March and April 2020, the number of conflict events decreased, mainly because the number of protests declined. After that, the level of violence reached pre-pandemic levels in most world regions. Our case analysis supports the global results by showing that marginalized social groups in southwestern Amazonia are particularly vulnerable to the impacts of the pandemic. In a politically and economically peripheral region, the increasing risk of social-ecological conflict calls for a potential-oriented approach to global connectedness, the importance of solidarity, and a lively democratic discourse that fosters cooperation and, thus, social cohesion. Civil society actions have been an essential strategy in the fight against COVID-19, not just in the health sector but also in the economic, political, social, and cultural realms. It can be concluded, that the pandemic not only brought social distancing but, at least in some places, also triggered an alliance of the people of the forest who united with environmentalists, NGOs, researchers, and artists for mutual empowerment. However, it must also be noted that the pandemic has consolidated and partly renewed criminal structures, while the already weak state has fallen further behind due to additional tasks managing the pandemic and other disasters such as floods (Chapter 7).

In response to the overarching research question, it can be said, that the reflexivity of governance is crucial to foster cooperation and preventing conflicts in the realm of social-ecological systems. By not only reacting to already occurring changes but also reflecting upon potential future changes, governance can shape transformation pathways away from the detrimental and towards life-sustaining pathways. It can do so, by exercising agency across scales to avoid the crossing of detrimental social-ecological tipping points but rather to trigger life-sustaining tipping points that contribute to global social-ecological well-being.

8.2 Conclusions

8.2.1 Overarching Conclusions and Contribution to the Research Field

The evidence presented in this thesis leads me to the following overarching conclusions. First, for state and non-state institutions to avoid aggravating conflict drivers, but instead better manage them or even contribute to conflict prevention and mitigation (conflict sensitivity), a transformation from reactive to reflexive institutions is needed. This corresponds to the call for new reflexive governance competencies by Dryzek (2016) and McKay et al. (2017). In addition, the consideration of governance scales is crucial to determine the character of reflexivity needed.

Second, on a more concrete note, understanding conflict drivers in SES and how they are shaped by state and non-state governance is essential to develop institutional reflexivity, which is highly context-specific, embedded in historic institutional relations and power structures, and thus highly dependent on the involved actors. Hence, I join other authors in warning against climate adaptation and mitigation measures, brought forward in global governance fora, to become "green grabbing" (Benjaminsen and Bryceson 2012, p. 335) or "conservation fad" (Lund et al. 2017, p. 124) that reproduce historically grown and existing inequalities (see also Myers et al. (2018)). Here, a political ecology perspective on human security is not only mutually beneficial in conceptual terms but a necessary step towards transforming unequal conditions and (ultimately) improving the lives of affected communities.

Third, solution-oriented perspectives, considering social cohesion as a crucial system function in strengthening the resilience of SES to upcoming changes and future crises is beneficial and necessary. Later thoughts and meanings during the elaboration phase of this thesis

suggest, that such an approach widens the scope of problem-oriented analyses of conflict sensitivity and vulnerability by providing entry points for reflexive governance to expand its full potential.

Fourth, on a more methodological note, interdisciplinary research is needed and highly beneficial to cover cross-sectoral and cross-scale interconnections that together make up the complexities of global change. Additionally, taking a transdisciplinary perspective is particularly relevant for solution-oriented research that aims to co-create knowledge for strengthening social cohesion and thus enhancing the resilience of present and future societies.

Fifth, and last, in times of COVID-19 and generally in times of crisis, strengthening local value chains and local value production while engaging with global civil society through supportive networking campaigns provides a glimpse of what Goffman (2020, p. 48) calls "a new kind of glocalization" in which people value the local while strengthening global awareness. Therefore, I join Wernli et al. (2020) in calling for appreciating the benefits of a globally connected world, while avoiding the systemic risks that arise from globalization processes. Building on these conclusions, I can draw the following policy recommendations.

8.2.2 Policy Recommendations

Formulating policy recommendations is rocky terrain, as they always have to be tied and tailored to the specific context that the policy is addressing. Therefore, the following recommendations are to some extent formulated rather cautiously, and the applicability should be reviewed and specified individually for each case. Furthermore, these recommendations are written for decision-makers, which include not just governmental policy-makers but also other formal and informal institutional decision-makers, be it donor agencies, civil society organizations, private enterprises, or financial investors. Lastly, policy recommendations have to be tailored to the policy level (local to global) they are addressing. Therefore, the following recommendations speak to different policy levels and differentiate roles and responsibilities on local to global governance scales.

To strengthen reflexivity within institutions on local to regional scales in southwestern Amazonia, the following prerequisites need to be fulfilled: (1) the clarification of responsibilities between governance institutions (and their financing); (2) the awareness raising for existing power structures and opening spaces for enhanced local participation; (3) the breaking of corruptive cycles while developing economically, ecologically and socially sustainable livelihood opportunities; and (4) taking the continuous reproduction of illegal activities into account while clarifying responsibilities, raising awareness, and breaking corruptive cycles.

During the preparation and implementation of new measures, local decision-makers should apply a conflict-sensitive approach. This implies analyzing the local context and incorporating local knowledge holders in the design process of the measure. This may avoid the creation of greed and grievances that may become a source of conflict. Additional sensitivity towards existing conflict dynamics and evaluating how the proposed measure affects these is advisable to anticipate unintended impacts. This goes beyond the do-no-harm principle in safeguarding against, for example, violations of human rights and land rights, but it means conducting a comprehensive analysis of the potential conflict aggravating impacts of the proposed measure.

While earlier chapters of this thesis stopped with this problem-oriented call for conflict sensitivity, later chapters re-framed the approach into a more solution-oriented formulation of recommendations. This is reflected in the call for local decision-makers to strengthen social cohesion to increase the coping abilities of local communities in the face of multiple social-ecological crises. The SCCM and the related framework provide a first step in understanding the role of social cohesion in land use change dynamics. In the second step, the Tipping Multiverse Framework serves as a useful tool for decision-makers to understand the complexities of SES on regional scales. The joint analysis of interactions and potential cascading effects as proposed through the framework promotes a better understanding of human-nature interac-

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tions and critical linkages that may serve to indicate early warning indicators for cascading tipping dynamics. Hence, the Framework can be applied for monitoring or intervention purposes or information for policy-makers to better understand interconnections that are relevant to promote resilient SES.

Such knowledge is also highly relevant to be fed in the international debate on the implementation of protection measures, such as the Global Biodiversity Framework that aims at protecting 30% of the planet's surface for safeguarding biodiversity and the climate (CBD 2022). Such large-scale measures need to consider the local contexts and ensure that the local population keeps or gains access to sustainable resource use to prevent or mitigate conflicts and thus empower people to protect PAs even under increasing market and developmental pressure. Within this debate, international bodies can take a pioneering role in not only calling for and framing conflict-sensitive design of appropriate measures but to acknowledge local knowledge holders and including them in the international debate. These local knowledge holders should also be included as leaders of national and local implementation of such measures. The addition of context-specific knowledge can serve as an entry point to strengthen social cohesion by maintaining or giving people the possibilities for sustainable livelihoods and thus building up local resilience to future disturbances and shocks.

To take a normative turn, the categorization of processes into life-sustaining and detrimental pathways can provide orientation towards windows of opportunity for transformation towards sustainability on local regional governance scales. Data generation for the quantification of drivers, indicators, and related feedbacks, is necessary to facilitate the determination of the interval in which a critical value for drastic shifts within the system is anticipated. Such data would facilitate the identification of cascading dynamics within the regional SES and could guide early identification of crossing 'detrimental tipping points' or of windows of opportunity for crossing 'life-sustaining tipping points'. Such data is increasingly relevant at local to regional levels to develop adequate governance options and collection of such data should thus be strongly encouraged and facilitated.

This brings me to a general recommendation for national research policies, not exclusively but currently particularly relevant in Germany. As research has identified the discrepancy between knowledge and action as a second-order knowledge problem (Berg 2019), it becomes increasingly clear that the limiting factor is not the availability of knowledge about what is happening, but knowledge about how we address these challenges. This knowledge-action gap is hindering the achievement of the goals formulated in international policy documents such as the Paris Agreement or the SDGs. In addition, the multitude of interdependencies described above only become visible with detailed knowledge of the local situation. Therefore, context-specific, cross-scale, cross-sectorial, inter-, and transdisciplinary applied research should be funded to generate knowledge that can specify and provide supporting data for the rather general recommendations given here. Such research should be encouraged instead of sacrificed for its long-term design that builds on relations to local knowledge holders and is oriented towards sustainable instead of fast impact.

Lastly, and relevant for actors on national and international scales, massive investment in the underfunded state and non-state institutions in southwestern Amazonia and a parallel strengthening of collaboration on and across scales to enhance environmental regulation and public security in the Amazon are promising approaches that could counteract the current detrimental development.

8.3 Outlook for Future Research

The research presented in this thesis provides a starting point for a better understanding of how governance shapes pathways towards cooperative or conflictive social-ecological tipping points. Much more research is needed, to back up the sketched dynamics with data on tipping

points in the southwestern Amazon SES. In particular, more research is needed to understand how interlinkages and feedback loops between local social dynamics and land system changes contribute to life-sustaining or detrimental impacts on present and future societies. Accordingly, a deepening of the Social Cohesion Conceptual Model is needed, providing information on the drivers of conflict and organized crime in the southwestern Amazon, and the reflexive capacity of the respective institutions regarding their impacts on SES feedback loops. This implies the validation of the SCCM and the mainly virtual field research (due to the COVID-19 pandemic). Such research can provide detailed information on the impacts of potential agents and drivers of change that moderate and influence the feedback processes in the southwestern Amazonian SES. In particular, more research is needed to understand the role institutions play in allowing or even promoting the transformation of disruptive developments into strengthened social-ecological resilience of local communities.

For future studies, it is also promising to analyze the impact of international and national non-governmental organizations on resource governance and conflict drivers. Additionally, the impact of the international mix of hard and soft law, coined by Pickering et al. (2019) as the 'Crème Brûlée' approach, which, according to the authors has the potential to encourage flexible responses and thus strengthen reflexivity within institutions, is an interesting approach for further research. Building on this approach, the impact of such a mixed hard and soft law approach on human agency and social cohesion on the local level are interesting questions to investigate, as the local level is the one where these measures prove "to be well-cooked" or ending up as "deflated souffle" when failing to provide "a robust yet flexible legal framework for cooperation" (Pickering et al. 2019, p. 27).

The expected results of this research will point towards feedback loops and potential tipping dynamics and hence provide input for the evaluation of criteria for reflexive institutions, spaces of democratic deliberation, and early warning indicators necessary to create reflexive measures for sustainable future societies in the southwestern Amazon. As a next step to move beyond human-centered connotations of the SCCM, it would be interesting to include non-human agency and its impact on social cohesion within this framework, changing the perspective towards 'social-ecological cohesion'. Looking beyond the southwestern Amazon, a task for further research is to apply the SCCM within the proposed framework, ameliorate its structure where necessary and, in the best case, produce comparative analyses of social cohesion in different regions and strengthen social cohesion research within the SES research community.

8.4 Final Remarks

Lastly, to hold myself accountable, I aim to disseminate the results of this thesis to a wider interested audience that reaches beyond the academic realm. I believe in a researcher's obligation to communicate the conducted research understandably, to contribute to a general comprehension of complexities among an interested audience, and to make a range of people interested in the highly relevant but often not mentioned details of scientific discovery. Therefore, I will summarize the findings of my research in easy-to-digest blog entries in Spanish and/or Portuguese to communicate the research to the people who supported and contributed to this research by being available for interviews and discussions. Additionally, I will also translate these blog entries into English and/or German, to make more people aware of the challenges that people in the southwestern Amazon are facing and that are often overlooked in the general discussion over 'the fate of the Amazon Rainforest'.

I see this as my small contribution to the life-sustaining pathway I wish for the present and future societies in the southwestern Amazon and globally. I further wish for the global community to further grow its cooperation potential and overcome the dividing barriers that are currently in place through power imbalances and structural violence. One does not need

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to put it in the drastic formulation of UN Secretary-General Antonio Guterres at the Petersberg Climate Dialogue in Berlin on July 18, 2022, who said "We have a choice. Collective action or collective suicide" (The Guardian 2022). But what comes out of these words is not just the expression of urgency with which the global climate and biodiversity crisis must be addressed. This expression of freedom of choice inevitably raises a responsibility that the Global North has to be held accountable: to bear responsibility for colonial continuities that have been reproducing dependencies and inequalities and that manifest themselves not least in the challenges that the southwestern Amazon is facing today. In this spirit, I would like to say: I want us to stand up to our "common but differentiated responsibilities" (UN 1992b, p. 2). And then I want us to act.

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A | ETHICAL STATEMENT

Project description with special attention to any work, experiments, or problems that raise relevant ethical questions about science and research

Objectives of PRODIGY Work Package 3

In WP3, we aim to understand how interlinkages and feedback loops between local social dynamics and land system changes contribute to life-sustaining or harmful impacts on present and future societies in the MAP region. This region is located in the Southwestern Amazon and includes the following subnational entities: Madre de Dios, Peru; Acre, Brazil; Pando, Bolivia. Social cohesion remains the function at risk. Societies' capabilities to govern multiple transformation processes depend on the reflexivity of formal and/or informal institutions, allowing for access to natural resources, land, water, markets, capital/credits, social services, knowledge, and income opportunities. Accordingly, we need to deepen our understanding of the developed social cohesion model, the drivers of conflict and organized crime, and the reflexive capacity of the respective institutions regarding their impacts on SES-feedback loops. In detail, we aim to (T1) investigate the impact of potential agents and drivers of change in the social-ecological system of the MAP region that moderate and influence these process feedbacks; (T2) evaluate criteria for reflexive institutions and spaces of democratic deliberation necessary for the realization of the PRODIGY- Sustainability Scenario; (T3) offer a methodological toolbox (digital & non-digital) for science-based communal planning in co-production processes of sustainable livelihoods/futures; (T4) disseminate PRODIGY (WP3)-results to other tropical regions in dialogue with further GlobalTip-projects; (T5) Sustain the relevance of scientific results for other tropical regions by making our toolbox available to planning processes in comparable contexts.

Methods

PRODIGY established a common basis for engaging in transdisciplinary research and co-producing knowledge at the interface of society, the scientific community, and nature. During the initiation phase of PRODIGY, stakeholder workshops were held to jointly elaborate the objectives of the research. Co-creation of knowledge continued after funding for the project was secured. In addition to the co-creation processes, semi-structured interviews are conducted to gain an overview of stakeholders' opinions and views. Due to the pandemic, those processes were partially transferred to the virtual space for the past two years. In 2022 we aim at validating our results with regional and local stakeholders and relevant decision makers ready to become integrated into ongoing local, regional, national, and global learning processes including participatory action research in the MAP region, adequate for contexts of rapid change, high diversity, and social inequality. To investigate the impact of potential agents and drivers of change in SES (T1) we intend to validate the mainly virtual field research of phase 1 through semi-structured interviews and focus group discussions. Additionally, we need to validate our framework concerning feedback loops and potential tipping dynamics. In consultation with the WP2 household survey, we will assess the following agents and drivers of change: rural youth, young indigenous peoples, bioeconomy coalitions, fair trade networks,

migration, digitalization, agribusiness, conflict, and organized crime factions using narrative interviews and focus group discussions. To evaluate the criteria for reflexive institutions and spaces of democratic deliberation (T2), we will further develop and test the indicators for reflexive institutions; and co-produce intergenerational spaces of democratic deliberation to validate and adjust the PRODIGY- Sustainability Scenario together with WP5; to co-produce a methodological tool-box for science-based communal planning (T3) we intend to use participatory methodologies of knowledge co-production to operationalize the results of WP3, WP4, and WP5 for science-based communal planning in co-production processes of sustainable futures. To disseminate PRODIGY-results (T4) in global forums we will contribute to the relevant working groups and chapters in dialogue with other GlobalTip-projects; only after evaluating internally T1-T4, we will be able to estimate the relevance of scientific results for other tropical regions (T5) and adjust our toolbox of co-produced results for planning processes in comparable contexts. For all our activities, we cooperate with local academic partners, practitioners, and a local network of civil society actors. In addition, an exchange of ideas and methods will continuously take place with former participants of the PRODIGY postgraduate course, which was started by the project in 2020 as a reaction to the pandemic and the impossibility to travel to the research region.

Ethical Considerations

We are aware that each kind of stakeholder interaction raises ethical questions about how science and research are conducted. Therefore, we take care that we:

- ask open-ended questions that invite the participant(s) to share as much as they see fit. In semi-structured interviews, leading questions are designed in a way that prevents the attempt to fish for certain responses, but rather in a way that questions encourage the interviewee to respond freely and openly.
- ensure transparency and honesty during stakeholder interaction. Before formally beginning the interview/stakeholder interaction, a thorough explanation of the interview's / activities and purpose is given in a manner that is accessible to the interviewee. The participant(s) are encouraged to ask questions so that they fully understand the course of the interview/activity and feel comfortable providing the information they will be asked for. The specific use for this information is explained and consent to use what the interviewee shares is requested. It is disclosed that the interview will be recorded, but also assured that the recording will only be used by the researcher as a reminder of their conversation and will not be shared with anyone else. We ask the interviewees if they agree to us recording the conversation and we respect that decision. This further ensures that the interviewee feels as comfortable as possible. We respect the interviewee's decision to stop the interview whenever she/he wants.
- respectfully approach a person, considering that interaction might differ for different people in different communities. When approaching for a conversation we ensure that the interviewee feels comfortable and listened to wholeheartedly. If something is unclear, clarification is requested so that misunderstandings are greatly reduced.
- remember that the participant is the primary focus. The participant(s) should feel comfortable speaking whatever comes to their mind. If the interviewee expresses discomfort or is unwilling to answer a question, this wish is fully respected, as this goes against protecting the interviewee's wellbeing.
- clarify the aims of the research activity at the end of the activity to remind the participant(s) of the purpose of their conversation, as well as what the information obtained will be used for.

- continue to ensure the privacy of the participants in write-ups and further research endeavors, unless the release of certain statements for verbatim quotation is requested individually from the respective participants.
- distribute the knowledge gained through the research project to people in the research region in a format that they can access, including non-technical language, and they can use for their objectives, e.g., policy design.

Short description of the project in non-technical language

PRODIGY is a scientific cooperation project between Germany, Brazil, Bolivia, and Peru. The principal interest of the project is to understand whether a higher diversity within systems spanning from the soil and health to economic and social aspects enhances their resilience in the Southwestern Amazon basin. (The previously described Objectives and Methods only relate to the social sciences part of PRODIGY). Thus, PRODIGY addresses the constantly transforming dynamics between nature and society in the tri-national MAP region. The project aims at describing the interdependencies by revealing the respective tipping points of the system's imminent functions. These tipping points are the moments when the systems change to a different state, often threatening human well-being on a mid to long-term scale. Jointly with local stakeholders, PRODIGY contributes to the development of sustainable options for future decisions, which avoid the crossing of tipping points and safeguard livelihoods in a world that is changing fast. Additionally, PRODIGY is concerned with guiding young scientists towards transdisciplinary perspectives. As a research project, PRODIGY combines existing local and academic know-how with the production of new data within various academic fields, aiming at understanding the advantages of bio-, socio-economic and cultural diversity.

B | SAMPLE GUIDELINE FOR SEMI-STRUCTURED INTERVIEWS

Note: **Bold** questions will be asked; bullet point questions describe the expected information in the answer and will only be asked if not mentioned in the answer.*

A. *Warming Question*

1. **Tell me what you are doing in your position as XXX in this organization/institution/community.**
 - a. What is your role? What are your tasks?
 - b. For how long have you been doing this work?
 - c. What did you do before?
 - d. Why did you choose to do this work?
 - e. With whom do you work together?

B. *Specific questions to authorities/leaders/higher levels.*¹

2. **How long has this institution/organization been operative? What is its main function?**
 - a. Who has authorization power over this institution?
 - b. To whom is this institution exercising authority?
 - c. What do you think are the interest of this institution?
 - d. What was the motivation to create this institution? By whom?
 - e. With which institution is this one collaborating?
 - f. Where do you see challenges/problems in your work for this institution?
3. **Which are the most important laws and regulations that shape access to land and natural resources at the state level?**
 - a. How did these regulations change in the past years?
 - b. To which degree do you think these regulations are implemented?
 - c. Who is involved in the implementation? Are parallel structures/overlapping competencies existent?
 - d. Which different land categories exist in Madre de Dios?
4. **More concrete: What is the legal fundament for the National Reserve Tambopata, its buffer zone, and its surroundings?**
 - a. Which governmental (federal, state, municipal) entity is in charge of the conservation areas?

¹ A different guideline with target-group specific questions was used for interviews with farmers, miners, and other people in the communities.

- b. Who is managing the reserve on the ground and what are the management goals?
 - c. To what degree is the area conserved and the management goals implemented/achieved?
 - d. Who has access to the National Reserve?
 - e. When have the conservation areas been declared and what was the process?
 - f. Who was involved in the decision process?
 - g. What was on the land before (original or restored landscapes)? Have displacements taken place? (living and/or working on the land) Where are these people now and what do they do for a living?
 - h. Are there extractive mineral/logging etc. activities active? Have there been activities before the declaration of the national reserve?
 - i. Who was involved in the drafting of the management plan?
- 5. Who takes decisions on (adapt to the interviewee: land management/mining concessions (illegal mining) /agricultural practices) in the region?**
- a. Which institution has which competencies?
 - b. What do you think, which actors/institutions/persons play an important role in shaping decision processes?
 - c. Did these structures change in the past years?
 - d. Do you think collaboration among institutions is functioning well?
 - e. Do you think some institutions do not function well?
 - f. What would need to be changed?
- 6. What has changed in (adapt to the interviewee: land management/mining concessions (illegal mining) /agricultural practices) in the region?**
- a. Are there new actors around? Since when? What has changed through these new actors?
 - b. What do you think are the reasons for this change?
 - c. Do you think these changes are rather positive or negative?
- 7. Would you like to add anything that you find important but we have not covered yet?**

C | CURRICULUM VITAE

REBECCA FROESE | CURRICULUM VITAE

SUMMARY

Enthusiastic and ambitious researcher at the interface of human geography, peace and conflict studies, and political sciences with a background in natural sciences | Multi-annual expertise in interdisciplinary qualitative empirical (field) research in Latin America | Engaged in excellent research, teaching and science communication

SCIENTIFIC CAREER

POSTDOCTORAL RESEARCHER

Center for Interdisciplinary Sustainability Research & Institute of Political Sciences
Project SUNrise Lab - Sustainable University Landscape Münster - Living Labs as Drivers of Transformation towards Sustainable Universities | Funded by the German Ministry for Education and Research (BMBF)

since 01/2023

Münster, DEU

RESEARCHER AND PHD CANDIDATE

Research Group Landuse Conflicts, University of Koblenz-Landau
Thesis Title: A Social-Ecological Perspective on Conflicts and Social Cohesion in Southwestern Amazonia | Project PRODIGY - Soil Biodiversity Governing Tipping Points in the Amazon | Funded by the German Ministry for Education and Research (BMBF) | Completion Date: 16/01/2023

05/2019 - 12/2022

Landau, DEU

RESEARCHER

Peace Academy Rhineland-Palatinate, University of Koblenz-Landau
Research and publications in the area of climate change, land use and conflicts | Conceptualization and elaboration of applications for third-party funds | Public relations, science communication

04/2018 - 12/2022

Landau, DEU

ASSOCIATED RESEARCHER

Research Group Climate Change and Security, University of Hamburg

since 01/2018

Hamburg, DEU

EDUCATION

M.SC. INTEGRATED CLIMATE SYSTEM SCIENCES

Cluster of Excellence CliSAP, University of Hamburg
Thesis: Towards an integrated approach of climate-proofing development cooperation | Final Grade: 1.3

10/2014-12/2016

Hamburg, DEU

B.SC. GEOSCIENCES

University of Bremen & University of Victoria
Thesis: The impact of gas hydrate formation on mineral authigenesis and geochemical hydrate-water and core-water properties | Final Grade: 1.6

10/2010-09/2013

Bremen, DEU & Victoria, CAN

UNIVERSITY ENTRANCE QUALIFICATION (ABITUR)

Gymnasium an der Willmsstraße

08/2002-07/2009

Delmenhorst, DEU

SUPERVISION

SECOND ADVISOR

Master Thesis, Franziska Uhlen, Philipps-Universität Marburg
Title: "Resource Curse Never Again? Environmental Peacebuilding and Gold Mining in Burkina Faso"

09/2021-05/2022

TEACHING

SCIENCES PO, CENTRE FOR INTERNATIONAL STUDIES (CERI)

Espace Mondial / Weltpolitik - Internationale Beziehungen global gedacht
3 Seminars à 2 hours per week | Teaching Language: German

09/2022-12/2022

Nancy, FRA

UNIVERSITY OF KOBLENZ-LANDAU, INSTITUTE FOR ENVIRONMENTAL SCIENCES

Tipping Points in the Southwestern Amazon
6 month research-based course, co-taught with the PRODIGY research team |
Teaching languages: Spanish, Portuguese, English

09/2020-03/2021

online

SCHOLARSHIPS | THIRD PARTY FUNDING

2 SCHOLARSHIPS FOR FIELD RESEARCH

MIN Graduate School International, University of Hamburg (funded through DAAD PROMOS)

2018/19

SCHOLARSHIP OF THE GERMAN-FRENCH YOUTH ORGANIZATION (DFJW)

One-month project in France about „Climate awareness in France in the context of the COP 21 in Paris“

2015

GRANTEE OF THE CLAUSSEN SIMON STIFTUNG

Scholarship for M.Sc. Studies

2014-2016

GRANTEE OF THE STUDIENSTIFTUNG DES DEUTSCHEN VOLKES

Scholarship for B.Sc. and M.Sc. Studies

2011-2016

MEMBERSHIPS

EARTH SYSTEM GOVERNANCE NETWORK

SCIENTIFIC REVIEW ACTIVITIES

CLIMATE AND DEVELOPMENT

INTERNATIONAL ENVIRONMENTAL AGREEMENTS: POLITICS, LAW AND ECONOMICS

PLOS CLIMATE

OTHER WORKING EXPERIENCE

INDEPENDENT CONSULTANT

Freelance

Acquisition of projects in international development cooperation (EU, GIZ, IDB) in the areas of governance, climate change, sustainable urban development

Since 01/2018

home-based

CONSULTANT

GFA Consulting Group, Project “Climate Strategy and Action Plan” in Serbia
EuropeAid/135966/DH/SER/RS

10/2017-12/2017

Belgrade, SRB

CONSULTANT

GFA Consulting Group, Latin America Department

Acquisition and project management in the area of climate change, sustainable urban development and governance

01/2017-12/2017

Hamburg, DEU

SKILLS

SOFTWARE Experienced: Office 365 | MAXQDA | \LaTeX | WordPress | TYPO3

Familiar: Matlab | Python | ArcGIS | QGIS

LANGUAGES Native: German | Proficient: English, Spanish, Brazilian Portuguese | Beginner: French

