Training Rivers, Training People: Interrogating the Making of Disasters and the Politics of Response in Nepal's Lower Karnali River Basin

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Abstract

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Training Rivers, Training People: Interrogating the making of disasters and the politics of response in Nepal's lower Karnali River Basin

Thesis directed by Professor of Geography, Dr. Emily T. Yeh

This thesis employs a political ecological approach to examine the discursive, material, and ontological production of floods as disasters along Nepal's lower Karnali River and the politics that surround various attempts to mitigate them. Specifically, I examine the uneven ways in which residents of Rajapur Island participate in, benefit from, and are excluded from three development interventions that have been initiated by organizations with the purported goals of structurally controlling the Karnali River and supporting communities in coping with climate-induced disasters though networks of human infrastructure. These include: 1) the Rajapur Irrigation Project, a large-scale infrastructure project that has attempted to 'modernize' a traditional farmer-managed irrigation system to 'exclude floods,' 2) the government-funded Karnali River Training Project, a recent endeavor of the Nepal government to embank 43 kilometers of Rajapur's vulnerable riverbanks, and 3) a community-based early warning system that relays live river-level data downstream to over 52,000 Nepalis and 400,000 Indians.

Informed by five months of qualitative fieldwork, I argue throughout these articles that floods have not always been the disasters that they are today in Rajapur, but *became* so as policy, law, and infrastructure amplified the destructive effects of inundation, restructured local ways of living with the river, and unevenly distributed risk onto certain bodies. In excavating the social and political roots of disaster, my objective is neither to deny the biophysical reality of inundation nor to discount the devastating effects of floods. Rather, I argue that reducing the complexity of disaster and severing floods from their entangled causality does not serve the interests of impacted peoples. Instead, it acts to further mask and exacerbate underlying patterns of vulnerability. Ultimately, this thesis reveals specific ways in which interventions to 'fix' disaster can further marginalize the very communities they claim to serve through the assumptions they make about causality, vulnerability, and people's capacities to secure themselves. I conclude that it is only when a crisis is understood first through the politics of its production and the reasons behind people's uneven vulnerability are explicitly confronted that attempts to untangle and dismantle disaster can also work to achieve greater social justice.

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List of Abbreviations

ADB	Asian Development Bank
CBEWS	Community-Based Early Warning System
DHM	Nepal Department of Hydrology and Meteorology
DOI	Nepal Department of Irrigation
DRR	Disaster Risk Reduction
DWIDM	Nepal Department of Water Induced Disaster Management
DWIDP	Nepal Department of Water Induced Disaster Prevention
EWS	Early Warning System
FMIS	Farmer Managed Irrigation System
GON	Government of Nepal
IFRC	International Federation of Red Cross and Red Crescent Societies
INGO	International Non-Governmental Organization
KRTP	Karnali River Training Project
NGO	Non-Governmental Organization
PA	Practical Action
RIP	Rajapur Irrigation Project
STS	Science and Technology Studies
UNISDR	United Nations International Strategy for Disaster Reduction
VDC	Village Development Committee

Glossary of Terms

aguwa	indigenous engineer in the farmer-managed irrigation systems of Rajapur responsible for overseeing the design and construction of traditional infrastructure to divert water into irrigation canals and regulate their flows
badghar	village leaders, who in the traditional *Tharu* governance structure were chosen by consensus annually and served the community by mobilizing collective labor, overseeing the construction of communal infrastructure, and mediating local disputes; these individuals continue to play a role in local governance on Rajapur Island alongside the formal, state-recognized Village Development Committees instituted by the Government of Nepal
bandh whua	traditional brushwood dam constructed by farmers on irrigation canals to divert water from the river and regulate flows along subsidiary channels
Bhaura Tappa	the original *Tharu* name for Rajapur Island, meaning "bee island"
Budhi Kulo	the name of the main canal of the largest farmer-managed irrigation canal system on Rajapur Island hand dug by *Tharu* farmers over 100 years ago
chaudhary	representative for each sub-branch of the farmer-managed irrigation system, elected every four years from among the village leaders or *badghar*s within that branch; in addition to coordinating with the system's other *chaudhary*s at meetings, these individuals are responsible for mobilizing labor and resources for maintaining the irrigation system's main intake and the sub-branch for which they are responsible
chokidar	individual in the *Tharu* governance structure responsible for disseminating information throughout the village and acting as a local messenger
desawar	annual or biannual ritual practice and period of collective labor that involves all members of a farmer-managed irrigation system traveling to the canal's main intake and camping along its banks until all necessary sediment is removed and repairs are made to the system's infrastructure
duriya puja	ritual performed annually at an irrigation canal's intake to appease the *Tharu*s' water god in order to ensure adequate flows for the growing season and to offer protection to the farmers laboring in the canals
gurwa	*Tharu* religious leader who performs all rituals required by *Tharu* cosmology to ensure adequate flows for a particular farmer-managed irrigation system and who is asked to perform this duty for his entire life

kamaiya	a form of temporary bondage in *Tharu* society that was traditionally short-term and arranged between neighbors and relatives; historically this served as a social safety net ensuring that indebted families were sheltered and fed as they paid off their debt through manual labor; this system was later appropriated by wealthy elites and became a violent form of enslavement; individuals bonded through this system were also called "*kamaiya*s"
kulo	an irrigation canal, often hand-dug and managed directly by farmers to channel water from the river into their fields
kulo pani	the name for a committee of *chaudhary*s who collectively manage the irrigation system by mobilizing farmer labor within each sub-branch and coordinating annual work trips to maintain the system's intake canal
mantra	a religious incantation or prayer either chanted or sung during a ritual
mukta kamaiya	the group of individuals who were originally bonded through the *kamaiya* labor system, but who were emancipated in Nepal in 2000
pachuwa	the apprentice of the *aguwa* who studies indigenous engineering technologies for diverting the river and regulating flows within the farmer-managed irrigation system; this individual usually takes over the *aguwa*'s duties when he is too old or sick to continue overseeing construction
Rana	a dynasty of Prime Ministers that ruled the Kingdom of Nepal from 1856 until 1951
Sonaha	a semi-nomadic indigenous group of the *Tarai* that historically lived along the Karnali River fishing and collecting gold; this population later was displaced to the Mahakali River and continues to exist here in small numbers as well as in Bardiya and Kailali Districts along the Karnali River
sukumbasi	literally individuals without property rights to the land that they occupy; many landless individuals, however, are also the victims of political, social and economic marginalization and have limited access to resources or rights to participate in local decision-making
Tarai	a lowland, flood-prone region in southern Nepal and northern India that lies between the foothills of the Himalayas and the Indo-Gangetic Plain
Tharu	a semi-nomadic ethnic group, indigenous to the *Tarai* that primarily relied on cattle grazing and shifting cultivation for their livelihoods and that currently occupy Nepal's southern districts and certain areas of north India
tigoria	a three-legged wooden tripod structure used as a construction technology by *Tharu* farmers to assemble temporary dams in their irrigation canal

I. Introduction

1. Disaster, Entanglement, and the Politics of Intervention

The island of Rajapur is a place made and remade by the fluid movements of the Karnali River. Straddling the Nepal-India border and the divide between Nepal's Bardiya and Kailali Districts, Rajapur is situated just beneath the Chisapani gorge where the Karnali River plunges out of the Himalayan foothills to form a sweeping inland delta. Here, the river fans into a complex network of waterways that wander across the northern edge of the Indo-Gangetic Plain, known in Nepal as the *Tarai*. Although Rajapur sits on both political and geographical boundaries, it is a landscape that refuses to be contained or defined by sharp lines. Even the banks of the river are unstable, changed through seasonal inundation that plays a significant role in shaping this fluid landscape. As monsoonal rains wash sediment out of the hills, the Karnali's riverbed frequently fills, displacing water with earth. This causes the river to spill over its banks and carve new paths across the floodplain. It is through this process of sand and water constantly being swept across the landscape by the river that the island of Rajapur was made and continues to be remade: a place built of soil carried by floods from the mountains.

Many of Rajapur's inhabitants have lived with inundation for generations as they fished the Karnali's waters, collected gold from its sandbars, and farmed the island's interior. While floods have always been destructive, periodically carving away large swaths of the island and taking people's crops, homes, and livestock with them, they were far more complex than disasters. Cyclical inundation, which carries both rich humus and gold out of the mountains, has sustained local livelihoods for centuries and is the reason, in fact, why the *Sonaha*s and *Tharu*s first settled Rajapur to begin with. Thus, rather than resisting the Karnali's floods, the *Tharu* and

Sonaha people practiced a semi-nomadic lifestyle that enabled them to shift with, and continue to benefit from, the Karnali's vagrant path. It was not until Rajapur was claimed and divided as private property in the early twentieth century and its original residents became not only 'fixed' to the landscape, but also pushed onto the island's most vulnerable margins, that floods became the chronic disasters that they are today. This violent history of dispossession and marginalization over the past century remains embedded in the landscape, fundamentally shaping local exposure to floods. Yet, as I will argue below, this is also a narrative of disaster that is not revealed by, but rather concealed through, many attempts to 'fix' flooding in Rajapur.

I chose the lower Karnali Basin for my field site not only because of Rajapur's history of inundation, but because of the many interventions initiated by international non-governmental organizations (INGO) and government institutions to arm and protect what Nepal considered to be some of its most vulnerable people. What I set out to understand here was how floods were being managed as disasters within the emergent effects of climate change and the extent to which government and INGO-initiated projects aligned with or displaced local adaptive strategies. Yet, as I began to interrogate the various 'solutions' to flooding in Rajapur, I came to realize that I had assumed that floods naturally *were* disasters and that people simply had different strategies for coping with them. It was only after an initial summer of fieldwork as I struggled to make sense of contradictions in my data regarding local people's expectations of, doubts about, desires for, and frustrations with external 'solutions' to inundation in Rajapur that I realized my research had begun with the wrong questions. Floods had not always been the same disasters that they are today in the lower Karnali Basin. Rather, they had *become* so as the destructive effects of inundation were gradually amplified by policy, law, and infrastructure developments that also redistributed risk unevenly onto certain bodies.

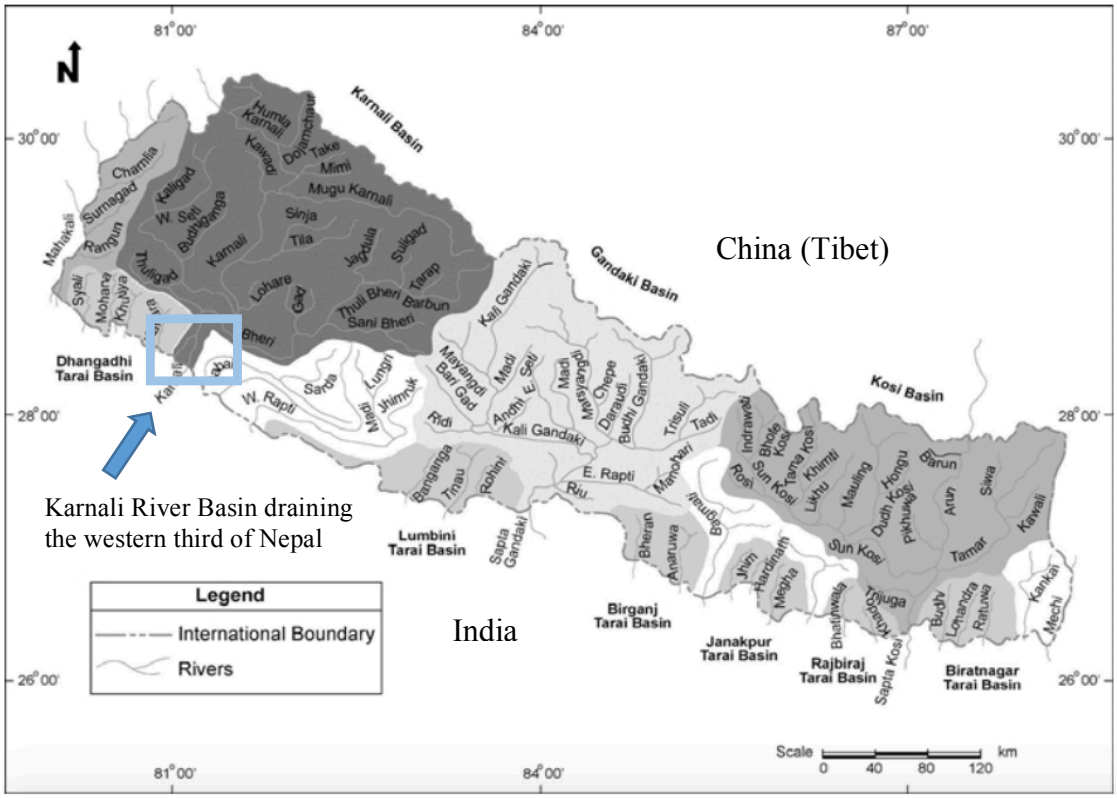

Figure 1. River basins of Nepal, including Karnali River Basin in the western region (adapted from Dixit, 2003, p. 160).

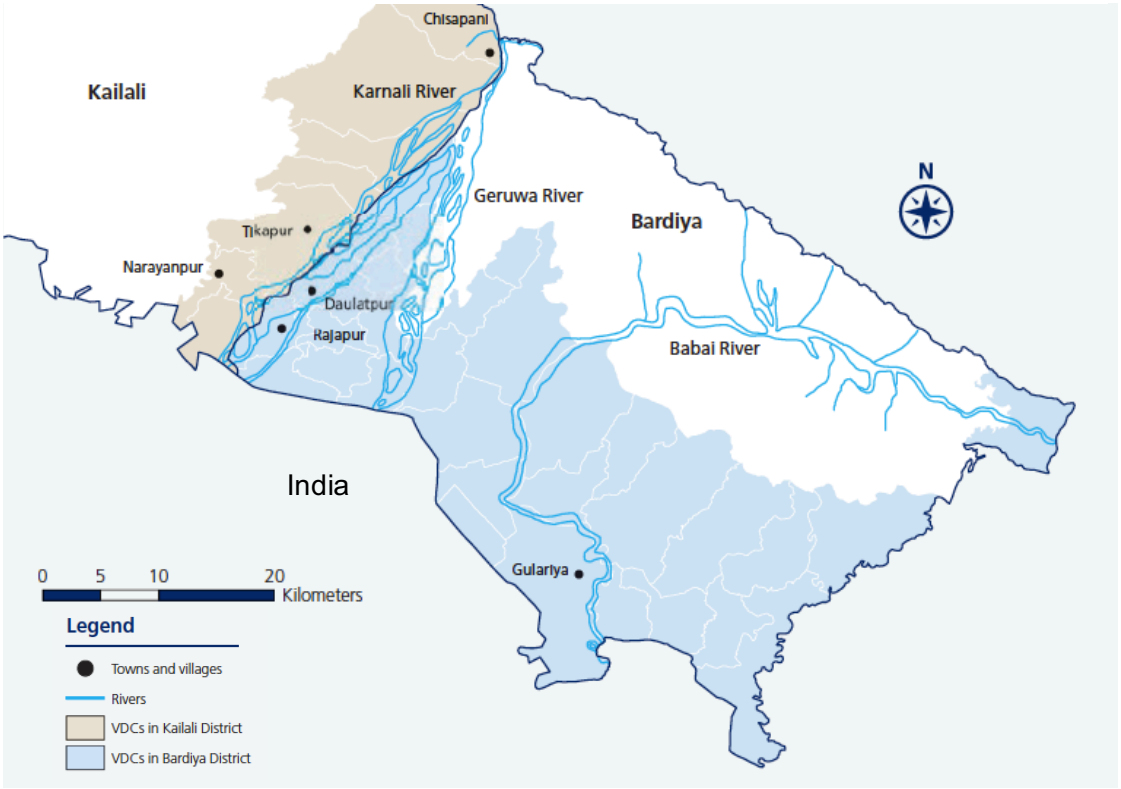

Figure 2. A map illustrating the lower Karnali River and the island of Rajapur—the triangular landmass extending from Chisapani to the Nepal-India border as indicated in Figure 1 above (Zurich, 2015, p. 7).

When I returned to Rajapur the following year, I began my work by asking different questions: Who defines what counts as a catastrophe? If floods *are* considered to be disasters in Rajapur, then disasters for whom? How have inundation events come to be understood and experienced in this way? It is with such questions, I realized, that a situated accounting of disasters and those who suffer from them must begin. This approach took me deeper into the heart of Rajapur where *Tharu* farmers still practice their religious, social, and customary rituals of maintenance along their irrigation canals and the *Sonaha*s go daily to collect gold on the Karnali's shoals and fish its currents. From these peoples, I began to understand a radically different way of relating to inundation and the river's agency that did not rely on the language of disaster.

Figure 3. Sandbars constantly shift as the Karnali River carries massive loads of sediment out of the mountains and deposits them onto the floodplains. Rajapur Island is located on the far right riverbank.

It was also through listening to *Tharu* farmers and the *Sonaha*s tell me stories of their current economic struggles and collective histories of dispossession that I came to understand the

contemporary making of disasters in Rajapur through the political dimensions of vulnerability. Through progressive waves of marginalization as Rajapur was settled and developed, nearly 70,000 dispossessed and landless people were pushed onto the island's most flood-prone edges, lining the Karnali's riverbanks and squatting in other waterlogged places to which nobody else had laid claim. Personal accounts of this history returned over and over again as I traversed the island by motorbike, visiting a chain of villages along both banks of the river where people lived whose ancestors had been tricked into bondage or whose land had been confiscated from them when Rajapur was settled by Kathmandu elite and settlers from the hills (Guneratne, 2002).

Yet, the more I came to understand how people had become vulnerable in Rajapur, the clearer it became that despite the many 'solutions' inundating the island and its people, none of the non-governmental organizations (NGO) or government agencies working to mitigate disaster there were repeating the story of disaster that I was hearing from Rajapur's most vulnerable people. Instead, their explanations for the devastation of inundation primarily orbited around natural hazards and apolitical narratives of a changing climate, stressing the fact that floods and droughts will only become more frequent and devastating with an increasingly shorter and more intensified monsoon (Khatiwada et al., 2016; Matthew, 2012; National Research Council, 2012; Shah & Giordano, 2013). While this is a reality that Rajapur's residents already know intimately, it is only part of their story and experience with disaster. Narratives of hazards exacerbated by global environmental change do not fully explain the dynamic nature of flooding, nor do they account for uneven exposure within the Karnali's riverine communities.

Disasters, I argue, cannot be blamed on nature alone, for they already lay nascent in a given landscape (Wisner & Luce, 1993), "prefigured" by social, economic, and political conditions that structure vulnerability unevenly (Hewitt, 1983b). As Ribot (2014), reminds us,

"vulnerability is, by definition, the social precarity found on the ground when hazards arrive [...] It does not fall from the sky" (p. 667). Yet, by shifting attention away from the reasons *why* certain people are more vulnerable than others before disaster even strikes (Ribot, 2014), the current discourse of climate change elides the ways in which floods are not only climate-*induced,* but also socially and politically *produced* through development, infrastructure, and policies that serve certain people at the expense of others (Cannon, 2000; Cannon & Müller-Mahn, 2010; O'Brien et al., 2006; Wisner et al., 1994). Thus, climate change is utilized as an apolitical narrative that explains disaster and justifies intervention in the lower Karnali in a way that strips floods from their structural roots and masks the nuances of their entangled causality.

Figure 4. Communities of landless and dispossessed families continue to occupy flood-prone and waterlogged land adjacent to the Karnali River and Rajapur's largest irrigation canal, the *Budhi Kulo*.

As I expose through my analysis below of three different interventions to protect residents from flooding in the lower Karnali Basin, it is precisely those peoples who are the

direct victims of historical dispossession and contemporary processes of marginalization who now live most at risk to floods that for them have become chronic disasters. Tragically, these are also the individuals who are most often displaced or go unserved by the very structures erected and the interventions extended to provide the rest of Rajapur with protection. While it may not be surprising that, "disasters produce more marginal people" (Wisner & Luce, 1993, p. 130), what this thesis contributes to the fields of political ecology, critical development studies, and the broader literature on disasters is an analysis of the specific ways in which '*solutions'* to disaster can actually work to further marginalize the very communities they claim to serve through the assumptions they make about causality, vulnerability, and people's capacities to secure themselves. Thus, rather than focusing on floods as biophysical events and attempting to better predict and contain them as hazards, I argue in the three articles that follow why it is critical for both scholars and practitioners of development to investigate the entangled web of broader social and political processes that enables inundation to become a disaster to begin with. Without this understanding of how disasters are born, attempts to prevent them can only achieve very little.

2. Theoretical Framework and Overview of Arguments

In the three articles below, I employ a political ecological approach to examine the discursive, material, and ontological production of disasters in the lower Karnali River Basin and the politics of participation that surround the enactment of flood 'solutions' there. In particular, I examine three different projects that have been initiated with the purported objectives to structurally control the Karnali River and to support communities in coping with climate-induced disasters though networks of human infrastructure. These include: 1) the Rajapur Irrigation Project (RIP), a large-scale government initiated infrastructure project that has attempted to

'modernize' the traditional farmer managed irrigation system (FMIS) in order to exclude internal inundation on the island, 2) the government-funded Karnali River Training Project (KRTP), a more recent endeavor of the Department of Water Induced Disaster Management (DWIDM) to embank 43 kilometers of Rajapur's most vulnerable riverbanks, and 3) a widely-celebrated community-based early warning system (CBEWS) initiated by the INGO Practical Action (PA) that relays live river-level data downstream to over 52,000 Nepalis and 400,000 Indians.

Informed by literature in critical development studies, political ecology, and science and technology studies (STS), I examine each of these projects to analyze the material consequences of ignoring—whether intentionally or not—the uneven landscape of vulnerability that underlies all disasters as well as any attempt to mitigate them. In doing so, my objective is not to deny the biophysical reality of inundation nor the material impacts that floods have on people's lives, but rather to confront the politics through which such hazards manifest as disasters at a particular time and place (Cannon & Müller-Mahn, 2010; O'Brien et al., 2006; Wisner et al., 2004). As I argue in the articles that follow, floods are not inherently disasters, but *become* so as policy and infrastructure restructure ways of living with the river and people are disciplined through interventions to understand floods and their own vulnerability in specific ways.

In the first article, I examine the RIP, a large-scale infrastructure project initiated by Nepal's Department of Irrigation (DOI) in the early 1990s with funding from the Asian Development Bank (ADB), as an encounter between two distinct ontologies or "ways of worlding" that interact and clash through the design, construction, and displacement of infrastructure (Blaser, 2013). I compare the physical structures, knowledge practices, and maintenance rituals embedded in the *Tharu* FMIS with those of the highly engineered RIP that replaced it. In doing so, I aim to illustrate how contrasting visions of what a flood *is* and distinct

understandings of the Karnali River's agency directly shape the physical infrastructure and social practices enacted along Rajapur's waterways. The *Tharu* people depended upon the Karnali for their livelihoods and moved to accommodate the river's frequent vacillations to benefit from the fertility it delivered. However, the recent imposition of structural solutions to control floods in Rajapur relies on a discourse and set of knowledge practices that severs floods from their productive functions and ties inundation events to the narrow category of disaster. In this way, I argue that the specific ways in which floods are defined and understood (what a flood *is*) directly shape normative responses to inundation in the material world (what a solution *should be*).[1]

Furthermore, through a situated accounting of Rajapur's transformation with the RIP, I document the social and material consequences that occur as 'modern' irrigation infrastructure designed to 'exclude' floods from Rajapur's canals begins to realign the ways in which people interact with the Karnali River and its waters. In particular, I illustrate how *Tharu* farmers struggle to control the *re-design* of infrastructure within their system and how the replacement of their flexible structures for mediating flows with permanent concrete structures has produced a cascade of new disasters that residents still live with almost two decades later. Consequently, I argue that interventions like the RIP that attempt to suppress a river's agency by tying floods to the narrow category of disaster and erecting infrastructure to contain or eliminate them, displace far more than inundation. They can also, for example, replace existing ways of living with rivers and relating to the world through the economies of maintenance that they impose. In this way, I conclude that ontological encounters in development and struggles over design do not end with a project's construction, but continue as people resist the ways in which infrastructure reconfigures their daily lives by reasserting their own 'ways of worlding' into its cracks and fissures.

[1] See Goldman et al. (2015) for a detailed analysis of this process through the discourse and enactment of droughts.

Shifting from struggles over the design of infrastructure to the politics of its *position*, in the second article I analyze the KRTP, a ten-year project initiated in 2014 that involves embanking over 40 kilometers of Rajapur's most flood-prone riverbanks. This is a response to inundation that has, in many ways, been discursively and materially fixed as 'the only solution' to flooding in Rajapur. This has occurred as local political elites' interests in large-scale infrastructure and the kickbacks it brings have aligned with policies that have made alternative ways of coping with floods impossible for many of Rajapur's residents. In this context, people do not participate in debates over whether or not embankments should be erected within their communities to begin with, but simply over the specifics of the structures' location and alignment. Actively being built and negotiated on the ground, the KRTP provides a compelling case to interrogate who wins and loses as structural 'solutions' to floods are erected within communities to serve some residents at the expense of others. Fundamentally, I argue that what is at stake in local struggles over *where* infrastructure gets built and who gets to control it, is *who* is ultimately protected, displaced, or further marginalized by a 'solution' to flooding that has largely already been determined.

While Rajapur residents are able to (re)align infrastructure through protest and political struggle, they do so unevenly. People of privilege are often able to successfully negotiate with engineers to relocate embankments to protect their property, while historically marginalized residents are most likely to become physically displaced or abandoned in 'sacrifice zones' between the structure and the river (Mishra, 2008c). As such, I argue that the KRTP has had the effect not of securing, but of further exacerbating the existing vulnerability of Rajapur's most marginalized people. This is a process of dispossession that begins during implementation as embankments secure and demand sacrifices from individuals unevenly. However, even those

who ‘win’ protection do not benefit equally, as embankments induce a whole set of material ‘side effects’ like waterlogging and sand casting that enact their own violence upon those people who live directly along their arms.

In the third and final article, I use critiques of resilience and community-based responses to disaster to deconstruct and confront the implicit assumptions and material effects of PA’s CBEWS in the lower Karnali Basin. In particular, I analyze the politics of *participation* in CBEWS and the responsibilities that ‘beneficiaries’ of these systems are asked to take on in order to mitigate their risk of disaster. In this way, I reveal the dangers of interventions that assume, even implicitly, that by giving people greater responsibility for their own security, they inherently build resilience and reduce local vulnerability. Rather, I contend that as CBEWS increasingly mobilize discourses of resilience and make this their objective, even ‘successful’ interventions can enact a subtle form of violence on marginalized people by training them to not only become self-securing subjects of a future full of disasters, but also to bear the burden of disseminating their own early warnings in the absence of a responsible state.

Using specific examples from PA’s intervention in Rajapur, I argue that there are inherent risks that come with the participatory logic of all CBEWS, including the ways in which they can naturalize vulnerability, individualize responsibility for self-securitization, and provide an excuse for a government’s continued neglect of its most marginalized citizens. Yet even as I use PA’s CBEWS to expose the dangers of resilience, I also highlight the multiple ways that PA combats the burden it puts on communities by investing in and holding the Government of Nepal (GON) accountable to its citizens. In this way, I argue that PA sets an example for how INGOs can better mitigate disaster not only by supporting vulnerable people with information to be

shared through their own networks, but also by facilitating a discourse of rights and responsibilities between governments and their citizens.

Through a situated accounting of the material effects of these three different interventions in Rajapur, I interrogate the ways in which local people participate in and benefit unevenly from 'solutions' implemented by various institutions to 'protect,' 'secure,' and 'save' their lives. In particular, I attempt to document who gains protection and who is displaced by embankments, who controls the shape of irrigation infrastructure and the locations in which it gets built, who bears the cost of its maintenance and at what price, and who is able to secure themselves with an early warning or is left with the burden of dissemination. More importantly than what these interventions *claim* to do for communities, I expose the material effects of their enactment. Informed by this evidence from the ground, I argue that in the interest of mitigating disaster, interventions can actually end up exacerbating, entrenching, or silencing patterns of uneven exposure by overlooking contemporary patterns of vulnerability. With both roots in the past and consequences in the present, vulnerability matters not only in the production of disasters, but also in their mitigation. Therefore, I conclude that it is only by recognizing the entangled nature of floods and understanding disasters first through the politics of their production that interventions, like those in Rajapur, can even begin to relieve the vulnerability of those who suffer most.

3. Research Methodology

This research is based upon an analysis of qualitative data collected during five months of fieldwork conducted in July 2015 and from August to December of 2016 in communities of Nepal's lower Karnali River Basin. During field data collection, I triangulated information through a mixed methods approach, involving 200 semi-structured interviews with local

residents and key informants, 25 focus groups in communities, and extended participant observation of NGO and government activities at local, regional, and national scales of operation. Furthermore, I utilized discourse analysis of policy documents and reports as an additional method for assessing the ways in which different visions and articulations of disaster, flood risk, and resilience are framed by intervening institutions. While all focus groups were held in communities directly impacted by flood mitigation interventions, I conducted interviews with local residents as well as with key informants in government agencies, international and national NGOs, donor institutions, consulting firms, and district and local level government. National and district-level interviews were generally conducted in English, while interviews and focus groups in Rajapur and surrounding areas were conducted in Tharu and occasionally Nepali with the assistance of two local research assistants and translators.

My broader structure for data collection involved a telescoping approach, in which I began conducting interviews at national-level offices, and then worked down to the district, village, and household levels, before zooming back out through each. This enabled me to access interlocutors with varying degrees of power over interventions and policies affecting my fieldsite and also provided opportunities for follow-up in later phases of research. As many informants were selected for their specialized knowledge of a particular intervention, I relied primarily on chain or snowball sampling, whereby one informant would recommend another who had additional insights to offer my research project. This method was particularly useful when interviewing project coordinators of government and INGO interventions at the national level who often connected me with field staff at regional and local levels of operation. Furthermore, since my research was concerned with the material effects of intervention and the uneven distribution of benefits *within* communities, I devoted a significant amount of time to holding

informal focus groups and conducting interviews with Rajapur's most marginalized people. As I became familiar with Rajapur's historically dispossessed, landless, and bonded communities, my interlocutors began suggesting other villages that I should visit, delineating their own situated geography of who was most vulnerable on the island and directing my investigation accordingly.

Figure 5. Focus group with women who now live at the foot of an embankment actively being constructed on the island of Rajapur as part of the Karnali River Training Project.

In both interviews and focus groups, I used a list of questions that I had prepared to guide conversations [see Appendix 1]. Rather than formally structuring interviews and focus groups, this document provided a map to ensure that my research assistants and I were covering the essential content. This approach enabled more organic interactions, which also allowed my interlocutors to have greater agency and control over the topics discussed. After all, I was interested in how people thought about floods and their impacts, explained causality, understood their own vulnerability, and reflected on their participation in various projects. Thus, in order to

access this information, it was essential to ask open-ended questions that allowed people to tell stories and reason through their experience. Many people explained their relationship to the river through stories that required walking to see evidence embedded in the landscape. Consequently, interviews and focus groups often became multi-sited, beginning in a tea shop or in the yard of someone's home and then moving to the edge of the river to examine crops damaged in a recent flood or to a place where an embankment had recently been erected on private land. In this way, data collection on the ground was almost always organic: informed by frequent assessments of my data and its gaps, but largely shaped by the time and insights people were willing to give me.

In addition to these interviews and focus groups, I also relied on participant observation in order to more intimately understand the politics of an intervention's implementation. While I spent time in government offices and joined several engineers on field visits to construction sites, most of my extended engagement and participation in project activities occurred with an NGO and INGOs. During July 2015, I spent one month at PA's regional office in Nepalgunj and the field office of its local implementing partner based in Rajapur. Over the course of these weeks, I joined field staff as they led trainings on disaster preparedness, organized street performances and mock drills to educate communities on how to respond to an early warning, and delivered updated contact information to the gauge reader at Chisapani responsible for relaying river level data downstream. Through participating in these activities, I came to understand how NGOs interact with and involve local residents in their interventions. I then was able to return to the same villages to capture participants' own perspectives on the project, including both the intervention's limits and achievements.

In terms of analysis, only interviews conducted at the national level were audio-recorded, so most of my data did not require transcription. In the field, interviews and focus groups were

recorded manually and then later scanned into PDF documents for analysis. All interview transcripts and scanned field notes were then systematically analyzed using a thematic and descriptive coding structure developed iteratively throughout data collection and analysis to reflect core themes in my theoretical framework [see Appendix 2]. In applying this coding structure to my data, I paid particular attention to the ways in which floods and disasters were discursively framed and solutions were positioned by different interlocutors. I also created a set of codes to trace the interactions of knowledge practices in the design and implementation of interventions and to account for the range of ways in which residents participated in, were excluded from, or became marginalized by these 'solutions.' These themes are woven throughout the arguments, content, and analysis of the articles presented here.

II. Interlude

Figure 6. Layered dams on an irrigation canal intake, with gabion and concrete structures built by engineers as part of the Rajapur Irrigation Project and later reinforced using traditional *Tharu* technologies.

I stood on the bank of an irrigation canal in southwestern Nepal, confronted by an oddly shaped structure. It appeared to be a dam, or perhaps three. What was obvious was that it was layered and made from multiple materials including concrete, wire, stone, and wood. A hulking body of gabion cages several meters wide and filled with cobbles stretched across the canal. A man with several dozen goats used it as a bridge as I stood there pondering its shape. By now it was rusting, the stones discolored beneath it. I could see several places where the current had torn away the fragile wire, and the round river rocks had begun to roll downstream. Directly against its sagging cages, and just visible beneath a skin of clouded water, was a much sturdier concrete slab. This extended in a perfectly straight line across the channel. I could not tell which was built first, or if they had been made together. The strangest layer, however, was what appeared to be a beaver dam, a series of snagged branches that arched in an S-shaped wave across the water a few meters upstream. It appeared to be assembled from thousands of branches and sticks, wedged on an angle against the current and supported by a line of wooden tripods.

What is this? I asked myself, as I struggled to make sense of the three entangled dams. *Is it part 'modern'? Part 'indigenous'? Who were its engineers?* I concluded initially that the infrastructure before me must be 'hybrid,' a tri-part structure shaped by multiple knowledge

practices and marrying diverse materials, systems of construction, and maintenance practices. However, it was not possible, without knowing its history, to understand how its layers were embedded in uneven histories, to see the politics of knowledge and participation that shaped how it came into being, those whose ontologies gave it form. It was not even obvious which layers were made first, who designed its original shape, or in what order its form was assembled. In the end, I was left wondering, *which layer was protecting which?*

Over the course of my fieldwork, as I came to understand the politics of this structure through the history of the *Tharu*s' irrigation system, it became clearer that the three dams that I had seen on the irrigation canal was not 'hybrid' at all. While its shape was fluid, and in many ways still being built, it was not co-produced by its multiple engineers, at least not in the sense of being made through a fair and distributed process of power and negotiation. Rather, it was assembled over time through a process of accretion as interacting knowledge practices and their associated enactments contributed layers. A story of knowledge and power was sedimented in its shape, but one I could not initially see.

III. The Imposition of Infrastructure: Ontological Displacement through the Remaking and Maintenance of Rajapur's *Kulo*s

1. Introduction: Ontological Struggles in a Fluid Landscape

The island of Rajapur, or *Bhaura Tappa* to the *Tharu* people, is a fan-shaped land mass located in the lower Karnali River Basin, straddling the borders of southwestern Nepal and north India, as well as Nepal's Bardiya and Kailali districts. Besides these political boundaries, Rajapur sits in a geographical transition zone, positioned just beneath the Chisapani gorge where the Karnali River plunges out of the hills, draining the western third of Nepal. Here, the river slows and splits into two main arms, which wrap around Rajapur Island, converging again just below the Nepal-India border. These branches further divide into braided channels that crisscross the *Tarai*, depositing rich soils onto its alluvial floodplains. The island itself, which stretches 20 km lengthwise, is the initial body of sediment dropped as the Karnali River loses its momentum. As its 100-ton annual load of suspended matter settles (Yadav, 2016), its channels fill, and the river displaces itself. As a result, Rajapur's very shape is plastic (Sturgeon, 2005), constantly being remade as the river swings back and forth across the floodplain, pulling the island with it.

Beyond the ways in which sediment, water, and topography converge to make the fluid landscape of the lower Karnali Basin (Moench et al., 2003), human actions also affect how water flows across its floodplains. Over time, different peoples have settled here, developing unique strategies for living within the river's braided channels. The migratory *Sonaha*s were first, following the Karnali's currents in search of fish and gold washed down from the Himalayas. Without modifying the riverine environment to deter floods, the *Sonaha*s instead adapted to seasonal inundation by constructing elevated riverbank shelters and becoming adept boatmen. Later, the *Tharu*s migrated from the eastern *Tarai* and devised ways to channel and domesticate

the Karnali's flows for farming. Developing a complex system of canals and temporary irrigation infrastructure riddling the island's interior, the *Tharu*s put the river to use. Yet they did so in such a way that their control was never complete, recognizing that in order to benefit from the rejuvenating aspects of inundation they would have to work *with* the Karnali River, accepting occasional destruction and negotiating with its waters through physical and religious practice.

It has only been in the last 25 years that the agency of the landscape began to be suppressed, beginning with the Rajapur Irrigation Project (RIP), a $16.6 million infrastructure project implemented by Nepal's Department of Irrigation (DOI) from 1992-2001 to rehabilitate and protect the island's farmer-managed irrigation system (FMIS) from floods. As the logic of engineers, government technocrats, and Kathmandu hydrologists came to shape infrastructure along Rajapur Island's irrigation canals, situated understandings of the landscape's complex hydrology and plastic dynamics were slowly displaced. Instead of cooperative coexistence, intervention increasingly came to be a practice of training the river, controlling its floods, and channeling its currents on paths that were straight and predictable. This drastic shift in how people relate to the river has had both material and social consequences.

This paper examines the RIP as a political encounter between two ontologies or "ways of worlding" (Blaser, 2013, p. 551): 1) *Tharu* traditions of living with the Karnali River and directing its flows through a FMIS and 2) government engineers' institutional practices of structurally training Himalayan waterways. This is not to say that either of these groups are homogenous in their world views or will forever practice the same ways of living with rivers and building infrastructure upon them. Rather, what I focus on here are a particular set of competing practices and material enactments that converged on Rajapur Island through the RIP at one particular historical moment. In doing so, I compare the physical infrastructure and maintenance

practices embedded in the *Tharu* FMIS with those of the RIP that partially replaced it. My objective is to illustrate how contrasting visions of what a flood *is* and distinct understandings of the river's agency directly shaped the physical infrastructure and social practices enacted along the island's canals, or what the *Tharu*s refer to as *kulo*s. In the end, concrete assumptions about reality remain embedded in infrastructure throughout its material life (Carse, 2012), even if the ontologies that shape them, and those who hold them, later shift. As a result, the structures of the RIP, although many have since fallen into disrepair, still extend their ontological influence over the communities that deal with their maintenance and material consequences.

My use of ontology here is specific. Rather than referring to that which is real in a singular and bounded sense, I use ontology to reference an ongoing and dynamic process of enactment, whereby the world is produced through daily practice (Latour, 1987; Law, 2004; Mol, 1999). My approach follows the material semiotics tradition in science and technology studies (STS), which suggests that rather than reality being permanent and fixed, it must be maintained and constantly *re*-enacted through the collective practices and labor of communities. In facing the radical notion that space does not exist on its own but must be *made*, reality itself becomes precarious: a far less stable space, but one that holds the possibility of a new way of examining the political arrangements and "patterning of practices" that shape the complexly entangled world in which we live (Law, 2010, p. 180). Matter, after all, as Karen Barad (2007) reminds us, "comes to matter through the iterative intra-activity of the world in its becoming" (p. 152). In other words, the physical objects that structure and give shape to our world are continually produced through our daily intra-actions with other human and non-human forces. These material-discursive practices are both what hold together and reinforce the realties in which we live, yet are themselves never fully fixed (Barad, 2007, p. 170). Recognizing the world

as in an endless process of formation, Barad (2007) asserts that fundamentally human agency lies in the ability we have to participate in this dynamic process of the world's becoming through our own enactments and interventions (p. 206).

Here, Mario Blaser's (2013) understanding of ontology as *a* "way of worlding" (p. 551), provides a useful framework for confronting the ways in which projects of world making and their material enactments are also always multiple and contested (Mol, 2002). Individuals both inhabit and participate in enacting their own worlds; sometimes these are shared with others and sometimes they are not. Yet, as soon as we recognize that plural ways of worlding necessarily produce multiple realities (Goldman et al., 2016; Mol, 2002), one has to ask what happens when these different ontologies and their associated material enactments meet? How do they intersect, overlap, clash, and displace one another on the ground? Verran (2001; 2002), Blaser (2010; 2013; 2014), Mol (1999; 2002), and Law (2004), have taken on these questions through their own situated work on the politics of ontological encounters. What their collective work has shown is that what fundamentally underlies any ontological struggle are distinct assertions about what the world *is* and how it should be *made.*

Development interventions, then, particularly those like the RIP that impose physical infrastructure on populations, offer an ideal site to examine the conflict that occurs as multiple 'ways of worlding' interact within uneven fields of power. It is in the field of intervention, where distinct ontologies clash and confront one another, that ways of living in and seeing the world change. It is also here, to use the words of Mario Blaser (2013) that, "it is possible to discern how what is brought into existence by a certain worlding [here, the RIP] might interfere and conflict with what is brought into existence by another [the *Tharu*s' *kulo*s] (p. 553)." After all, as we will see in the Karnali Basin, what a flood *is* and at what point it becomes a disaster are not

self-evident facts, but rather are ontological questions guided by how one understands and relates to the river. Floods are different things to different people. To an engineer a flood is a calculated volume of discharge that at a certain point exceeds the capacity of a channel to contain it. To a *Tharu* farmer, floods are both the promise of water and nutrients for crops as well as the risk of destruction. These differences matter, particularly as they become translated into 'solutions' and people struggle over *whose* understanding of what a flood is will shape the intervention.

Power dynamics and colonial histories both shape and are what is at stake in such an ontological encounter (Verran, 2002). After all, while ontologies are multiple (Mol, 2002), they are not all equally valued. As a result, it becomes important to account for the ways in which certain logics and knowledge practices are privileged over others in the design of infrastructure. This is particularly relevant when studying development interventions, where what counts as 'knowledge' (Haraway, 1988), and who is seen as possessing a valid understanding of reality (Ingold & Kurttila, 2000; Yeh, 2016), determines who gets to enforce a particular making of the world. In the case of the RIP, *Tharu* knowledge practices and 'ways of worlding' became marginalized as infrastructure was designed that embodied engineers' belief that humans maintain the capacity to fully control nature even while exploiting it. Thus, the enactment of infrastructure through intervention can, in effect, work to impose one ontology on another by physically structuring new ways of living and being in a place. This paper is about accounting for *those* material effects in the RIP and using them as an entry point to ask deeper questions about the politics underlying ontological encounters in development. In particular, I argue that the ontological consequences of intervention occur not only during implementation as engineers, contractors, and machines directly interact with people and impose structures on their world, but extend into a project's aftermath as people negotiate how to go on living in an altered place.

Through this situated case of one island's material and social transformation through intervention, I document the fallout that occurs when one way of seeing the world and thereby enacting reality (here, the RIP), is imposed upon an entangled social-natural system that operates within a radically different one (the *Tharu* FMIS). Informed by five months of qualitative research in Nepal that involved 25 informal focus groups with residents and 200 interviews across national, regional, and local scales, I trace the material effects of the RIP as a "political ontological project" (Blaser, 2013). Specifically, I investigate how the concrete dams, weirs, and canals of the RIP interact differently with the Karnali's fluid landscape than the *Tharu*s' traditional brushwood structures and analyze the ways in which the shape and position of both kinds of infrastructure indirectly configure local human and non-human relations. In the process, I argue that situated struggles over the design of the RIP, as well as local efforts to modify and maintain it, reveal the uneven politics underlying ontological conflicts in development.

I begin this article by examining the ways in which *Tharu* farmers have learned to live with the unpredictable Karnali River, developing ways to domesticate its flows without denying it agency. In describing the material, social, and religious maintenance that make this relationship possible, I illustrate how *Tharu*s' situated knowledge and ways of worlding are reciprocally produced through their embodied practice along the river and its *kulo*s. I also show how the *Tharu*s' traditional irrigation dams come to embody their ontological assumptions, or situated understandings of what the world *is* and how it should be maintained, at the basic level of design. By arguing that all reality is produced through such material enactments, I preview the conflict that arises when infrastructure embodying certain assumptions about the world is imposed upon the *Tharu* system, which operates under another set of relations and ways of being in the world. This will position me to introduce the RIP within the context of what Blaser (2013)

has called "ontological conflict," or the encounter that occurs when distinct ways of worlding interact and clash. Since in development interventions, these political and ontological negotiations are often lived out through competing claims about the physical shape infrastructure should take and where it should be positioned, I pay particular attention to whose knowledge practices and logics are privileged and marginalized in the design and implementation of the RIP. I argue that ultimately the RIP's infrastructure was designed according to a very different understanding of the river and its relations than the system on which it was imposed.

I then trace the significant social and material consequences that have occurred as farmers' situated understandings of the Karnali River and their relationship with it have been increasingly displaced and confronted by the technocratic logic of engineers and their 'modern flood solutions.' In this way, my analysis contributes to the emergent body of social science literature on infrastructure (Anand, 2011; 2015; Barnes, 2017; 2014; Carse, 2012; 2014; Carse & Lewis, 2017; Furlong, 2010; Graham & Thrift, 2007; Mitchell, 2002; 2014), by illuminating the ways in which material structures, like the weirs and embankments used to control the flow of water, do more than simply reshape hydrological landscapes. In the process of its planning, enactment, and maintenance, infrastructure not only disciplines subjects through practices of maintenance as Barnes (2017) asserts, but also, I argue, reconfigures and builds new material, social, and ontological worlds. By approaching infrastructure as a technology that not only mediates how individuals relate to the world (Furlong, 2010; Larkin 2013), but also how they (re)enact it, I illustrate how the imposition of physical structures on Rajapur's irrigation canals reconfigures more than the movements of water and sediment. The material demands of using and maintaining these structures also constrains and restructures peoples' ways of being in and reproducing their world. Furthermore, I unpack the temporal dimensions of this displacement by

examining several ways in which infrastructure previously erected continues to impose certain ways of interacting with the material world that matter in people's daily lives.

While I highlight the ways in which the infrastructure of the RIP comes to enforce a particular social and material reality on the Karnali River through new economies of maintenance, I also examine local acts of resistance. These include the multiple ways in which *Tharu* farmers have modified, jerry-rigged, and reclaimed infrastructure in the aftermath of intervention. I argue that since all infrastructure requires maintenance, just as reality needs to be continuously *re*-enacted, this opens up a space for ontological politics to continue in the aftermath of intervention. Despite the fact that 15 years that have passed since the RIP ended, its material and ontological effects are still unfolding, as both the physical hydrology of Rajapur's *kulo*s change and peoples' ways of worlding and maintaining these waterways are gradually undone and reconfigured through infrastructure. As a result, I conclude not with a final answer of what this encounter has meant for the people and place of the lower Karnali River. Rather, I end with four interpretations of what the RIP continues to mean to residents who have been affected by the project differently. As I show, locally situated ontologies continue to persist, even as they change and are rearticulated in dialogue with the logics and projects imposed upon them.

2. Fluid Ontologies of the Karnali and *Tharu* Ways of Living with the River

Although the *Tharu*s were not the first peoples to occupy Rajapur Island, they consider themselves to be indigenous to the *Tarai* (Guneratne, 2002). For centuries they moved semi-nomadically with their cattle through the jungles that southern Nepal and northern India share today, stitching together a mosaic of young forests and fields in their wake. Though little is written about their history (Cox, 1990; Gill, 2016; Guneratne, 2002; Ojha, 1983; Rankin, 1999;

Skar, 1999), oral histories[2] claim that the *Tharu* were pushed into western Nepal as their land in the Dang Valley was captured by settlers, eventually reaching Rajapur Island seven generations ago. As their villages and fields expanded across the island, a few hundred *Tharu*s with help from Indian laborers hand dug an irrigation ditch they named the *Budhi Kulo*. This was a small canal that originally channeled just a few springs into their fields. However, it eventually grew to become one of the largest FMIS in Asia (Howarth & Lal, 2002). Over time, demand for irrigation pushed farmers to bring new water sources into their system, until the canals eventually stretched the entire length of the island, containing an intricate capillary system of *kulo*s. Yet this expansion did not occur by human industriousness alone.

In 1964, one of the most devastating floods in collective memory engulfed Rajapur. Breaching the head of the island, the swollen Karnali River invaded what at the time was only a rudimentary canal system and found an easy path along the *Budhi Kulo*. Scouring its canal all the way to India, the 1964 flood greatly expanded and radically changed the system's hydrology, requiring over a year of repairs (Howarth & Lal, 2002). As a result, the *Budhi Kulo* essentially became a third branch of the Karnali River, channeling water from Chisapani to India through the heart of the island. Consequently, farmers had a perennial source of freshwater and nutritious silt for their fields, but those who lived in Rajapur's interior were now at the mercy of floods. Adapting with the fluid landscape in which they lived, the *Tharu*s embraced the river on which their livelihoods now depended by developing a complex system of labor and cooperation to

[2] Oral histories were collected from several individuals who were direct descendants of the first *Tharu* families that settled Rajapur Island. These narratives were also cross-referenced with interviews conducted with individuals from the *Sonaha*s community who were present in Rajapur prior to its settlement by *Tharu* cattle herders and swidden farmers. While the history I provide here is certainly limited by the memory and perspectives of the individuals with whom I was able to speak, I was careful to include the voices and perspectives of multiple groups who claim to be indigenous to the *Tarai* and who have an extended history of living on the Karnali River and its islands.

govern and maintain its flows. In this way, the *Tharu*s' relationship with the Karnali, was from the very beginning and by necessity, based on humility and compromise.

While the *Budhi Kulo* has been described as one of Nepal's oldest and most complex FMIS, the reality is that it is little more than 100-years-old. This is not to say that what the *Tharu*s built on Rajapur Island was not rooted in much older traditions that they had practiced in other places, and on other rivers, across the *Tarai.* However, the FMIS that the DOI encountered with their first irrigation project in Rajapur in the 1990s, was certainly not 'traditional' in the sense that it had been built into the Karnali landscape since the beginning of time. Rather, the *Tharu* system here had evolved continuously over the course of a century, as a semi-nomadic people settled into a place and learned to live within the braids of its waterways. Through their practices, the river's power became a force that could be directed and put to work, so long as this was done with structures designed to bend, and even break, with changes in its flow. Thus, when I refer to the '*Tharu* irrigation system,' what I mean is the place-specific system of governing water that existed prior to the RIP, that was based in traditions that predated *Tharu* history on Rajapur Island, but that also evolved more recently after the *Budhi Kulo* became directly connected to and entangled with the Karnali's fluid hydrology.

In the *Tharu* system of irrigation on Rajapur Island, the *Budhi Kulo* was one of six original systems that came to source their water directly from the Karnali River. Though all function similarly in terms of governance, in this paper I focus on the *Budhi Kulo*, which is by far the largest of the systems and was affected most extensively by the RIP. The *Budhi Kulo* is also unique because its intake is situated at the head of Rajapur Island, drawing water from the center of the Karnali River at the very place it splits. This water is then channeled through a gravity-fed system of canals that serves over 5,000 farmers and irrigates 10,400 hectares across

the island (Yadav, 2016). While the system continues to be governed by largely the same structure today, there are certain practices and aspects of maintenance that have dramatically changed as a result of the RIP. What follows is a description of the system that farmers practiced prior to intervention. Many of the changes that I discuss in the design and management of the *Tharu*s' FMIS as the DOI's 'rehabilitated' the Rajapur irrigation system have been documented extensively in other parts of Nepal by Elinor Ostrom (1990; 1992; Ostrom et al., 2011) and Prachanda Pradhan (1989; 2012a; 2012b). My analysis of the *Budhi Kulo*'s infrastructural remaking, however, goes beyond Ostrom and Pradhan's analyses of the politics of a system's governance structure to also examine the particular ways in which people's relations with the *kulo*s have been changed.

Each of the *Budhi Kulo*'s eleven original sub-branches had a representative called a *chaudhary* (serving between 300-2,400 hectares), who was elected every four years from among the village leaders or *badghar*s within that branch (Gill, 2016). In addition to coordinating with one another and the island's other five systems through formal *kulo pani* committee meetings, these eleven men were responsible for mobilizing labor and resources twice a year, prior to paddy and wheat seasons, for the maintenance of the *Budhi Kulo*'s intake. Each household benefiting from the system, was required to send one member to the intake to participate in collective labor until all repairs were complete. This involved traveling from across the island by oxcart and camping at the head of the island for several weeks or even a month depending on the situation and current needs. Referred to as *desawar*, this practice of collective labor enabled sediment delivered by the past monsoon to be removed from the *Budhi Kulo*'s intake canal and allowed the farmers to realign its mouth with whichever branch of the Karnali River had the most water. This required a tremendous amount of manual labor: hand digging a new canal each

year and rebuilding a two-kilometer-long rock and brushwood dam on the river to direct sufficient water into the *Budhi Kulo*. Yet this also enabled flexibility in the system, recognizing that as the hydrology around them changed and the river shifted in new directions, the farmers too would have to adjust their system and its intake.

Besides providing opportunities for farmers to physically realign themselves with the river, *desawar* also reinforced local social and religious relations. Described nostalgically by farmers as "a big party," *desawar* brought together men from every household in the system, reinforcing social bonds as people labored, slept, cooked, and bathed together for weeks on the banks of the river. Furthermore, *desawar* provided an opportunity to reinstate *Tharu*-Karnali relations through religious rituals. Just before labor in the canals began, the *Budhi Kulo*'s *gurwa*, a religious leader sponsored by the *chaudhary*s for the entirety of his life, would perform a ritual called *duriya* ('silt' in *Tharu*) *puja* to appease the *Tharu*s' water god. This practice, still performed annually at the system's intake, involves the recitation of a mantra, the sacrifice of several animals, and an offering of *rakshi,* the *Tharu*s' potent rice liquor. As the *Budhi Kulo*'s *gurwa* explained, the ritual serves two purposes: first, it calls on the water god to ensure adequate flows for the growing season, and second, it offers protection to the farmers who labor in the canals. This illustrates how *Tharu* farmers relate to and negotiate with the water in their canals. Most revealing, is that during the *mantra* the *gurwa* recites a list of all the actors, both human and non-human, responsible for bringing water to their *kulo*s. In this way, rituals serve to reinforce the *Tharu*s' local interdependence and relationship with their god to secure ideal flows. Conducted in coordination with the spring snowmelt, once the puja is completed, the river swells as if by divine intervention to fill the *kulo*s just in time for rice planting (Gill, 2016).

Like the manual labor that goes into maintaining the physical infrastructure of the canals,

the ritual serves as its own type of spiritual maintenance. After all, without these periodic supplications and offerings that reinstate reciprocal commitments between *Tharu* farmers and their gods, the spiritual or cosmological relations that enable the *Tharu* irrigation system to function would also begin to crumble. The *Budhi Kulo*'s *gurwa*, for example, asserted that when he was forced to flee Rajapur due to violence during the Maoist conflict, farmers did not worship at the intake for nearly ten years. He continued to explain that during this time, the farmers struggled to access sufficient water as a direct effect of the system's essential religious maintenance being neglected in his absence. Also, the fact that every canal system has its own *gurwa* who is asked to perform these rituals for the entirety of his life, underscores the ways in which *Tharu*s see the security of their world tied to a deep understanding of the specific social-natural-cosmological entanglements of that particular place. *Chaudhary*s praise and formally honor their *gurwa*s, who with decades of practice, master the rituals that enact their commitment to the water god and weave together the necessary set of relations that ensure sufficient water.

With the religious maintenance of *desawar* complete, the farmers could enter into the *kulo*s to begin their practices of excavation and repair. During the weeks that this process took place, the day-to-day labor and construction of infrastructure was traditionally overseen by the *aguwa* and his apprentice, the *pachuwa*. These were essentially the system's indigenous engineers who possessed extensive knowledge of building structures, like stone and brushwood dams, to manipulate the river and direct its flow into the irrigation canals. While highly respected for the technical skills *aguwa*s developed over a lifetime of labor in the *kulo*s, it is important to acknowledge that since all farmers were included in construction during *desawar*, knowledge of how to build the *kulo*s*'* infrastructure was held collectively. The reproduction of these skills was also ensured within sub-branches as *chaudhary*s frequently organized small teams of farmers to

repair structures on tertiary canals employing the techniques they learned during *desawar*.

This decentralized system of maintenance illustrates how the situated knowledge of the *Tharu*s, particularly when it comes to manipulating local hydrology, functioned not as a fixed body of facts that could be mastered outside of practice (Haraway, 1988; Lowe, 2006). Rather it was a *skill* obtained, a *way of living* (Ingold, 2000; Ingold & Kurttila, 2000; Yeh, 2016), perfected over decades of assembling and reassembling infrastructure and participating in rituals along their *kulo*s. Maintenance here works as a mechanism for social—and ontological—reproduction (Barnes, 2017; Graham & Thrift, 2007). Thus, the *Tharu* knowledge I describe here is not 'indigenous' or 'traditional' in the sense that these terms have often been used to tie non-scientific and 'othered' knowledge practices to a remote past (Agrawal, 1995; Dove, 2002). Rather, *Tharu* ways of living with the river are very much alive, grounded in the place-based practices of their ancestors and reinforced through frequent acts of maintenance, but also changing with the dynamic Karnali landscape.

Tradition here is not a thing, but rather a way of living. To use the words of Ingold and Kurttila (2000), when regarded as a process, tradition becomes, "continuous without taking any fixed form. Change is simply what we see if we sample a continuous process at a number of fixed points separated by time" (p. 192). In this way, a *Tharu* ontology not only emerges *from,* but is also reinforced *by*, embodied ways of inhabiting and reproducing the world (Ingold & Kurttila, 2000, p. 184). *Tharu*s' use of their situated knowledge through the construction and maintenance of infrastructure on the *kulo*s *is* their ontological practice. This is a reciprocal relationship: how farmers understand the world, and thereby come to know it through religious and physical labor, directly shapes their enactments in the world (Blaser, 2013).

This relationship becomes clearer when we examine *Tharu* irrigation infrastructure and

the ontological assumptions inscribed in the design of their brushwood dams or *bandh whua*s. Ranging in size and shape depending on their position in the system, *bandh whua*s essentially functioned as temporary dams that enabled farmers to direct and regulate discharge along the canals. While those built at the *Budhi Kulo*'s main intake might extend for more than a kilometer into the river's current, within the system's sub-canals, the dams were much smaller, used simply to raise and lower water levels as demand changed within individual irrigation canals. Farmers manipulated these structures throughout the year, partially dismantling them to relieve pressure so the *kulo*s could flow freely when water was not needed and by adding branches when additional discharge was required. The fluid ways in which these structures were modified, also meant that they could easily be moved to accommodate changing patterns in the rivers, their flows, and sediment loads.

Figure 7. A series of farmer-built *bandh whua*s on a secondary irrigation canal in Rajapur. These structures are deconstructed and (re)assembled as necessary to direct the precise volume of water needed by farmers in smaller branch canals.

Tharu engineering was consistent in its goal: *bandh whua*s allowed farmers to direct the Karnali River into their *kulo*s and regulate their flows through highly flexible structures that both

accommodated and respected the river's agency. This approach is evident in the basic blueprint of their structures. No matter the shape, all *bandh whua*s were built by assembling a series of wooden or bamboo tripods that the *Tharu* referred to as *tigoria.* These three-legged structures were fixed in the current, with two legs positioned upstream and the third leg sharpened to a point so that the full force of the current drove it into the riverbed. In this way, the *Tharu*s harnessed the power of the river to strengthen their infrastructure. At the same time, the porous nature of their structures allowed sediment and non-human species like macro-invertebrates and fish to travel through the system, maintaining reciprocal relations with all who used the *kulo*s.

Figure 8. A *Tharu* farmer demonstrates, using grass and scraps of bamboo how *tigoria*, the three-legged structures used to construct *bandh whua*s in Rajapur's irrigation canals are structured to harness the river.

Larger dams were made by assembling several *tigoria* in a long chain across the river or a major *kulo* and then wedging thousands of sticks into the riverbed. Unlike the 'modern' river training projects later built through the RIP, *Tharu* engineers built their largest *bandh whua*s in wave-like shapes across the river or that slanted downstream at a 60-degree angle. This design,

farmers insisted, works better than the straight lines and hard 90-degree angles of engineers because, in the words of one *aguwa, Tharu* engineering "compromises with the river." These are not just casual assertions, but claims supported by stories of embankments built in the *Tharu* style that outlived those designed by formally-trained engineers by decades.[3] While conflicts over knowledge practices and ways of worlding on the Karnali is something I return to below, here I want to stress the ontological assumptions embedded in *Tharu* infrastructure.

For the *Tharu*s, the river had agency—even intentionality—that could be harnessed by humans through religious supplications and carefully designed structures so long as the river's power was still acknowledged and accommodated. Furthermore, the *Tharu* approach to working *with* the Karnali involved accepting some level of destruction and sacrifice of structures during monsoon in return for silt-rich waters to nurture their crops. As there was no way to prevent major floods from entering the *Budhi Kulo* and flooding the island from within, inundation periodically caused tremendous devastation. This required an immense amount of labor as farmers had to reconstruct every structure on the system in the wake of major floods (Zhang, 2003). Yet, to some extent this arrangement was by design: when the *bandh whua*s failed, they did so in a way that limited damage to the crops and homes around them. Ultimately, the *Tharu*s' compromise with the river acknowledged that floods were more than disasters, they were also valuable both in flushing any sediment that had accumulated in the system and in delivering beneficial silt to farmers' fields (Pradhan, 2012a). Thus, the *Tharu*s lived in a reciprocal

[3] In addition to the *Tharu* farmers whom I interviewed along Rajapur's *kulo*s, I also encountered several Nepali scholars and intellectuals based at NGOs in Kathmandu who advocate a similar approach to living with and developing Nepal's riverways. In an interview with the president of the Institute for Social and Environmental Transition-Nepal, Ajaya Dixit asserted, "If you look at these [irrigation] canals, the canals are all built straight, but rivers are never straight. Rivers are always [meandering], but how come these engineers always build these straight canals? Why not build curvatures in their canals? […] There is a mindset that it has to be straight…"

relationship with the waters of the lower Karnali, building and rebuilding a world, and an ontology, based on compromise and negotiation.[4]

3. An Invitation for Intervention and the Opening of an Ontological Encounter

While the *Tharu*s' *kulo*s functioned effectively for decades, they were not without their limits—a fact that the devastating 1983 flood made particularly acute when the irrigation system was completely gutted by the largest flood in recorded history and most homes on the island were leveled. Even for farmers who deeply understood the value of floods and the need to accommodate the river in their system, this event was by all accounts a disaster. When the waters receded, an emergency *desawar* was organized. More than 10,000 farmers labored for four months, camping along the *kulo*s and cutting over 2,000 trees to rebuild the hundreds of *bandh whua*s essential to the system. Overwhelmed by the scale of destruction, and uncertain whether their system would continue to be sustainable, the *chaudhary*s began sending delegations to Kathmandu in hopes that the government might be able to provide them with material assistance or a long-term solution as they struggled with the limits of their system.

In 1992, the DOI finally mobilized $16.6 million from the Asian Development Bank (ADB) to support the farmers through the RIP (Zhang, 2003). As this was an intervention

[4] In arguing against command-and-control infrastructure that attempts to suppress floods and control rivers, Mishra (2001) cites a passage from the *Mahabharata* where the ocean speaks with his wives, the rivers. "'Rivers! I notice that during floods you get filled to the brim and uproot big trees and carry them with their roots and branches to me but the cane is not seen in your flow. The cane is a thin and very insignificant plant. It has no strength of its own and grows all along your banks. Still, you are not able to bring it to me. Do you avoid the plant or has it done some good to you?' […] Ganga replies, 'O Lord of rivers, the big trees, because of their arrogance, do not bow before the might of our flow. Because of this [confrontation to] nature, they get destroyed and have to leave their places but the cane is not like them. The cane bows before the swift currents and when the river subsides, it regains its place. The cane understands the times and behaves accordingly; it is always in our grip and never misbehaves with us. There are no traces of arrogance in it and that is the reason why it hasn't gone to leave its place" (Mishra, 2001, p. 2,756). This call for humility before the agency of nature reflects the *Tharu* approach to living with, and erecting structures, along the Karnali River that is very different from DOI engineers who build walls and dams with concrete.

designed to respond to farmers' requests for assistance, and not imposed by the government on unwilling or disinterested residents, it facilitated an interesting point of ontological contact between *Tharu* farmers and government engineers who understood rivers and approached floods in radically different ways. This was also the first major development project on the island, and accordingly marked a novel encounter between the central government and residents of the Karnali who had never been materially served by it before. That is not to say that the farmers of Rajapur had hitherto been isolated from the influence of Kathmandu. On the contrary, the central government's policies and priorities had politically and economically marginalized the *Tharu*s for decades, particularly after the government's large-scale malaria eradication program swept the *Tarai* in the 1950s, opening its jungles to a massive wave of migration from the hills (Guneratne, 2002). With additional land grants that had been made by *Rana* royalty to high caste elites, *Tharu*s were rapidly dispossessed of land and political power even as they have maintained a local ethnic majority, around 80% today (Gill, 2016; Guneratne, 2002; Ojha, 1983). What the RIP marked, then, was not a first political encounter between the *Tharu* people and Kathmandu, but rather the first time a project had been initiated by the central government to directly benefit *them*. As a result, the intervention was launched in 1992 full of expectations. This was further reinforced by the fact that the RIP was framed by the ADB to be transformative in its participatory approach (Howarth & Lal, 2002; Zhang, 2003), radically changing the DOI's institutional approach from one that was notoriously top-down and heavy-handed to one that actively engaged residents throughout implementation. While this trend to decentralize authority to beneficiaries and include them as partners in interventions was a neoliberal trend occurring throughout the irrigation sector in the 1990s (Pradhan, 2012b), the RIP was by far the largest project of this nature the ADB had yet attempted (Howarth & Lal, 2002). Yet the extent to which

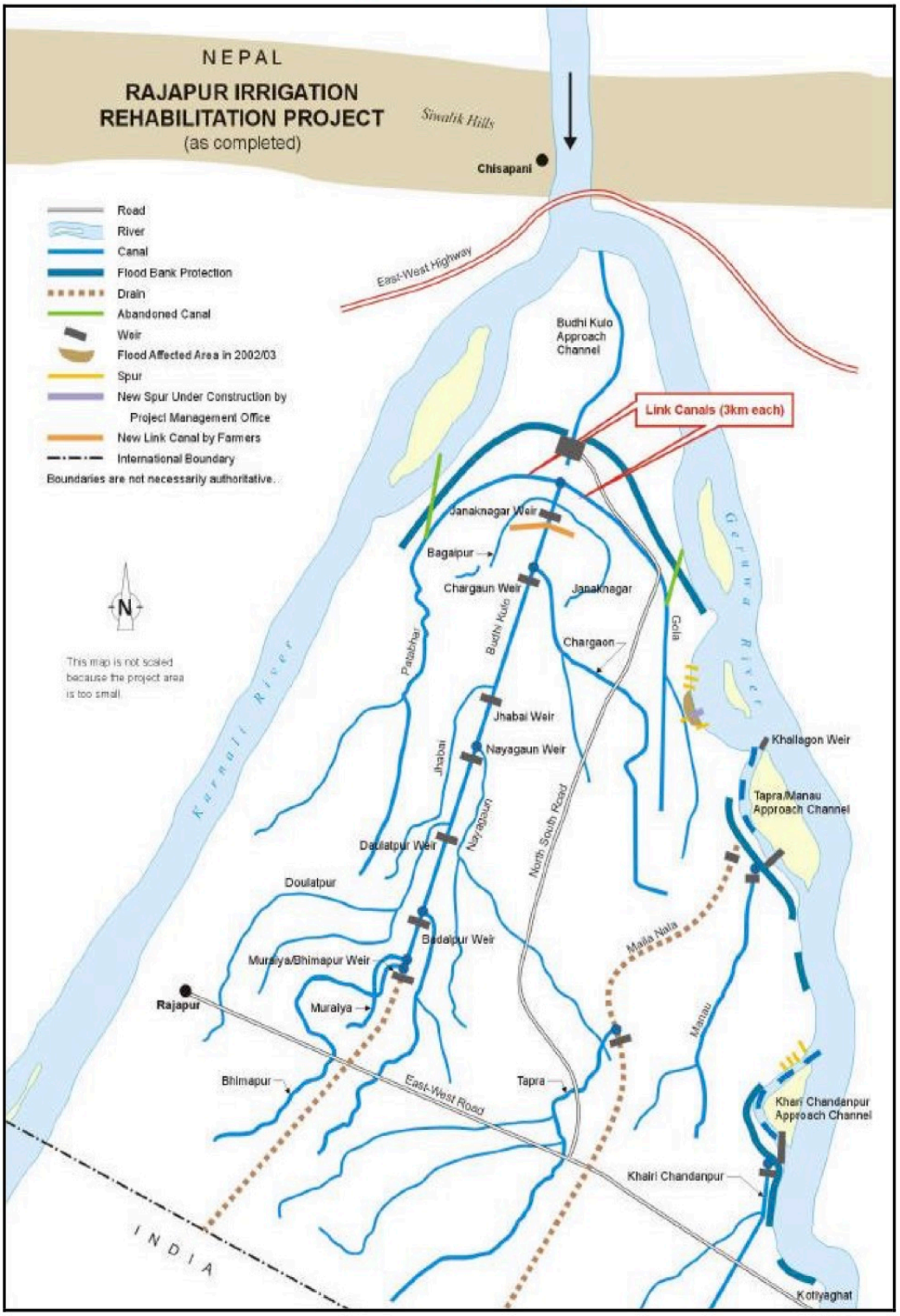

Figure 9. Map of the Department of Irrigation's Rajapur Irrigation Project as included in the Asian Development Bank's Project Completion Report published in 2001 (Yadav, 2016, p. 10).

their theoretical objectives of participation materialized in practice, depends upon who one asks.

While those employed by the formal intervention claimed it to be farmer-driven and participatory (Howarth & Lal, 2002; Zhang, 2003), residents described their involvement in the RIP as constrained to consultation on the difficulties they were facing with floods. During a formal survey of the system in 1992, the system's *chaudhary*s and *aguwa*s were invited along. At the time, they felt like they were participating in a vision for the new system. However, when the farmers' insights later failed to fit the inputs of hydraulic calculations, the engineers devised a solution based on their own knowledge practices in the distant offices of Kathmandu. When they came back to build a system that would combine all six of the island's intakes into one, the farmers were furious (Gill, 2016). Since the ADB had stipulated beneficiary participation in design be a condition of loan, for the first time in its institutional history, the DOI could not simply override the farmers' objections. Negotiations delayed the design phase for over two years, as nearly 60 meetings were conducted between frustrated farmers and engineers (Howarth & Lal, 2002; Yadav, 2016; Zhang, 2003). In the end, only two systems were combined into the *Budhi Kulo* before the island's canals were gutted and 'modernized.' While farmers did have some influence over design, they did not contribute creatively, but rather by either 'rubber stamping' engineers' plans, or struggling to veto the worst of the DOI's impositions.

Within the canals, the engineers' visions maintained full control. In the course of the ten years (1992-2002) that the project was under construction, 18 kilometers of river and canal were embanked and some 300 *Tharu bandh whua*s were stripped from the *kulo*s and replaced with concrete weirs and intakes (Yadav, 2016). The new structures were, according to the experts who had come from the DOI to diagnose the 'problem' in the *Tharu*s' system, "essentially better

engineered versions of the indigenous structures which they replace" (Howarth & Lal, 2002, p. 116). 'Better' here means concrete, as the engineers had determined that permanent structures would be the only way to suppress the effects of floods, dramatically reduce labor, and prevent residents from having to resort to 'deforestation' to make their annual repairs. Engineers, who saw floods only through the narrow lens of disaster, insisted that these inundation events would have to be completely "excluded" from the system through a permanent concrete intake and 500-meter embankment to allow only a fixed volume of water ($85m^3/s$) to enter the *Budhi Kulo* (Zhang, 2003).

Figure 10. Concrete intake for the *Budhi Kulo* built at the northern reaches of the island's farmer-managed irrigation system as part of the Rajapur Irrigation Project.

As Howarth and Lal (2002) reported after the intervention, "farmers did not accept the rationale behind the proposed methods of flood control" (p. 122). While engineers and their contractors 'fixed' the *Tharu* system, pinning dynamic *bandh whua*s permanently into place with concrete, farmers attempted to influence how the new structures were shaped and where they

were placed. They knew from their experience with historical patterns of the river shifting and fluctuating in flow that where their structures were situated now was not necessarily where they would need to be in the future. Yet most farmers were frustrated that their suggestions seemed to have no impact on the location of the structures that ultimately were built. At the same time, the technical knowledge that went into 'modernizing' the system, remained inaccessible to the farmers being served. In the end, what the intervention delivered was not shaped by farmers' situated knowledge practices and *Tharu* understandings of dynamic Himalayan hydrology, but rather by engineers' technocratic calculations and scientific expertise.

This ontological mismatch or disconnect between ways of worlding that occurred during the physical implementation of the RIP, has had significant material impacts that are distributed unevenly on the shoulders of those very people the project was supposed to serve. This illustrates what I call the double production of disaster in that as floods were framed by the government and its engineers through the narrow lens of disaster, the solution that the DOI enacted had the effect of producing a whole series of new hydrologic nightmares. This process occurred as assumptions implicit in engineered solutions regarding nature and its need to be controlled, contradicted and suppressed the entangled reality upon which the farmers' irrigation system was built and depended. Engineers knew floods as crisis, a certain volume of discharge to be contained through command-and-control infrastructure. This perspective was mediated by certain knowledge practices: the very specific set of variables that their calculations collected, processed, and assembled. In this way, engineers' assumptions about what floods became inscribed in the dimensions of weirs and the openings of canals (Carse, 2012), while bracketing out the entangled nature of sediment, rain, topography and hydrology also at play in the Karnali's fluid landscape.

As we see along the *Budhi Kulo*, all that was excluded from the design and thus the enactment of a solution to floods, including situated knowledge practices and *Tharu* understandings of dynamic Himalayan hydrology, has had significant material, social, and ontological consequences. While it is important to acknowledge that all knowledge is partial (Haraway, 1988), what is at stake here is the fact that those whose knowledge practices shaped the 'solution' to floods on the *Budhi Kulo* became elevated above and ultimately excluded the situated insights of those who lived with and depended on the system. Infrastructure, after all, is not a neutral enactment of reality (Carse & Lewis, 2017), but an imposition of whatever ontology structures its design. On the Karnali, this has led not to an immediate or total displacement of *Tharu* ways of living, but rather to a gradual process of ontological marginalization that occurred not only during implementation, but also in the decades that followed as the material structures left behind reshaped not only the physical, but also the social landscape (see also Li, 2015).

4. The Effects of Intervention: Ongoing Material and Ontological Displacement

Ultimately the RIP achieved what it intended: to prevent major floods from entering the *Budhi Kulo* and to reduce farmers' manual labor on the *kulo*s. Thus, when engineers returned to the Rajapur to evaluate their project, they saw only success. Yet, if they had spent more time walking the *kulo*s and talking to farmers along the system, a very different reality would have emerged. The physical displacement of the *Tharu*s' *bandh whua*s, and with them the social relations on which their system had been built, gave rise to a whole suite of unanticipated changes to the hydrology and morphology of the *Budhi Kulo.* This was a slow creeping process precipitated by the enactment of permanent infrastructure on the canals, but with effects that did not materialize, in some cases, for several decades. Yet, as new management problems emerged,

such as rapid sedimentation and water scarcity, that farmers had not faced in their original system, changes in maintenance strategies were required that slowly eroded the very place-based knowledge practices that reproduce and maintain *Tharu* ontologies. Thus, the full effects of development were not felt or even known at the moment of intervention, but became evident over time. In this way, ontological meetings happen not only in an instant, but gradually as the reverberations of interventions continue to be felt and exert their influence in communities.

As 85 percent of the *Tharu*s' porous brushwood structures were remade in concrete by the RIP, sediment, which used to be a valuable fertilizer for *Tharu* farmers quickly became a 'modern' problem: clogging the *kulo*s and rendering dysfunctional much of the infrastructure built to make the farmers' lives easier. Within the *Tharu* system, sediment had never been an issue; the natural flow of the *kulo*s constantly swept particles through the crevices of the *bandh whua*s and any additional sand was flushed downstream by seasonal inundation and the occasional failure of these "disposable dams" (Gyawali, 2004). This was a natural process of excavation that the river performed for the *Tharu*s. However, as the RIP focused strictly on the absolute exclusion of floods and did not see sediment in the system, it failed to account for the ways in which the structures it imposed would radically transform the *kulo*s' hydrology and exacerbate rates of siltation. Once the *bandh whua*s were replaced with concrete and reinforced gabion, however, any debris that naturally entered the system became trapped behind fixed structures and rapidly accumulated in the canals.

As a result, the Karnali's high silt load quickly choked the *Budhi Kulo* until the entire hydrologic system had slowed and widened. In some places the *Budhi Kulo* is now over 100 meters wide (Howarth & Lal, 2002), and farmers describe over two meters of sediment accumulating in the canal bottom in the 15 years since the intervention. As sand has displaced

water over time, the *Budhi Kulo* has responded to the structures that attempt to tame it in violent ways. In addition to carving away private land as it spread across the landscape, overflows and sand casting have become routine. While farmers frequently organize local teams to construct emergency embankments with thousands of empty cement bags (ironically one of the DOI's few contributions to maintenance), hundreds of acres have had to be abandoned. Thus, one of the greatest tragedies is that the command-and-control infrastructure built on the *Budhi Kulo* to end floods also prevented the fine, nutrient-rich silt carried by floods from reaching farmers' fields, while greatly exacerbating the risk of localized sand casting. This has induced its own form of flooding as abrasive sand and pebbles wash onto farmers' fields and suffocate their crops.

Figure 11. Children fishing at a sand-choked structure on one of the *Budhi Kulo* system's canals.

Sediment dynamics have, in turn, affected water availability and the distribution of discharge within the system, producing scarcity in ways that never previously existed. While practices of adding and removing sticks to brushwood dams were used in the old system to

Figure 12. Farmers labor to construct an emergency structure to hold back the rising waters of the *Budhi Kulo* which threatens to overflow its banks and carry sand into their fields.

Figure 13. Laborers take a break from filling sandbags to reinforce the emergency structure illustrated above. They are using the half meter of sand that was washed into their rice paddies where the *Budhi Kulo* breached its banks since this debris will have to be scraped from the the fields if the farmers have any hope of reclaiming soil fertility. As the bed of the *Budhi Kulo* rises due to rapid sedimentation, cases like this of destructive sand casting occur more frequently along the island's irrigation canals.

carefully manage flows, the concrete structures that replaced these organic dams offered no capacity for adjustment. The openings of the new intakes were supposedly sized according to engineers' calculations that accounted for discharge, land size in irrigation, and crop requirements. Yet, the material ways in which sediment might interact with a concrete wall seemed not to have been anticipated, and certainly not communicated to farmers. As a result, within a year of construction two sub-branches were forced to abandon their intakes and dig new openings. While some *kulo*s continued to have plenty of water, at times even more than they needed, farmers in the system's southern branches were forced to ration water.

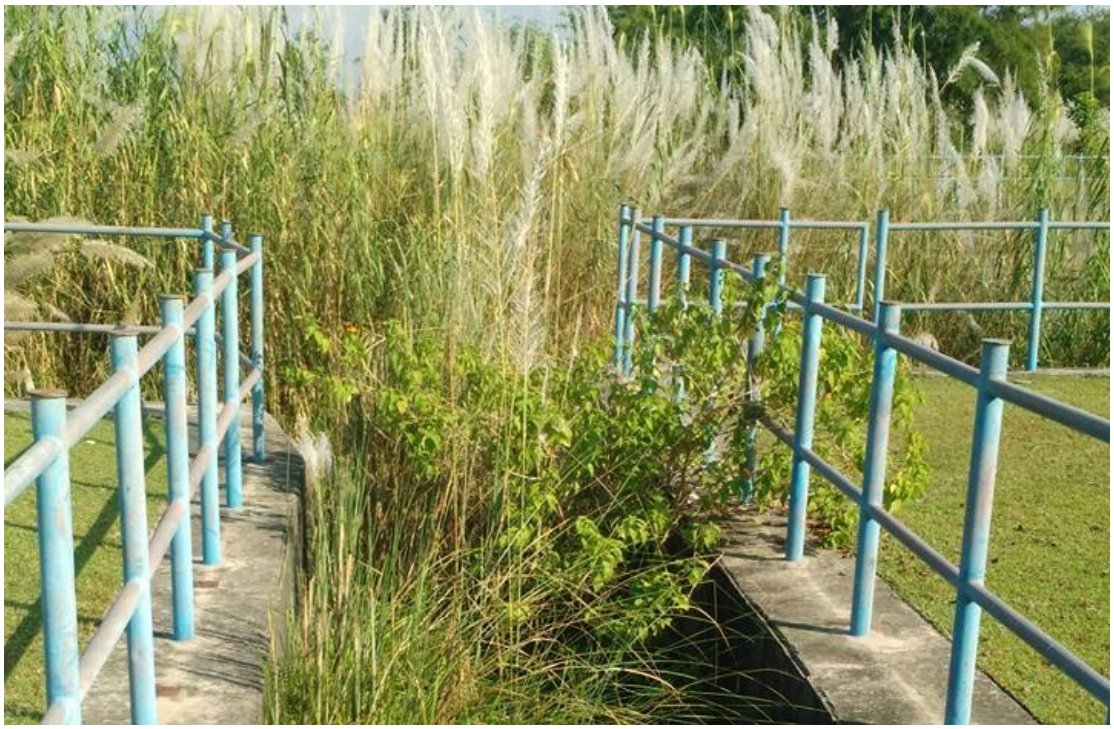

Figure 14. Example of one of the intakes to a secondary branch canal that was built in concrete as part of the RIP, but was abandoned within the first year of use due to rapid sedimentation.

As water scarcity has become a very real emergency, ensuring adequate flows has required a major mechanization of maintenance and a rapid shift toward a cash economy. This has meant that the RIP not only restructured the hydrology and morphology of the *kulo*s, but also the social and economic practices that maintain them. While *bandh whua*s had been built with

free materials and collective labor, after the intervention, the tremendous volume of sand that clogged the canals eventually became too great to be removed by hand. Farmers struggled with hand tools for over a decade after the equipment left by the DOI was destroyed by the Maoists, but they could not keep up with rapid rates of sedimentation. In 2013, the farmers finally gained access to a DOI excavator. Facing a crisis in their canals, farmers abandoned *desawar* immediately and invested their effort into paying for a machine to remove the meters of sand that had accumulated in the system.

As a result, the *chaudhary*s' traditional role of mobilizing collective labor and local resources for maintenance has been replaced with a duty to periodically collect cash from farmers in the system to rent an excavator to haul sand away. In this way, they became "petty contractors" (Gill, 2016; Howarth & Lal, 2002). Over time, demand for this service became so high that the *kulo pani* committee decided to pay a driver full time with the cash they pooled from farmers. This has been the case for the past four years. Thus, while the RIP may have been successful at reducing farmers' manual labor, it did not do so by displacing the need for maintenance completely, but by shifting it into a mechanized form. Indeed, several farmers feel that the cost of maintenance has only increased and that they were misled by engineers during implementation. The intervention, and the requirements of its infrastructure, simply translated what had been a labor burden into an economic strain, forcing residents to accumulate greater volumes of cash through wage labor and the intensification of their crops. The material demands of the RIP's 'modern' infrastructure converged with broader shifts toward a global, cash-based economy to pull farmers more swiftly into its circulation.

In interviews and focus groups, farmers described contributing 250 to 300 Nepali rupees per *bigha* (approximately 3 USD for each 0.677 hectare) of land for maintenance annually.

Seventy to eighty percent of this cash is used to excavate the main intake, meaning additional resources must be mobilized within each of the system's branches for localized sediment removal. In many canals, the cost of renting the DOI-provided excavator even at the discounted rate of 1,200 Nepali rupees per hour (four times the local daily wage) in addition to fuel and the driver's wage is so prohibitive, that farmers have gone back to removing sand by hand. At the end of the day, the amount of labor that farmers were saved by the intervention is questionable. What is clear, however, is that the nature of maintenance has profoundly changed, as farmers now invest in their *kulo*s and relate to one another not through shared labor, but cash.

Figure 15. Excavated sand piled along a branch canal of the *Budhi Kulo.*

This change has dramatically shifted the network of relations (Law, 2004), that undergird and sustain the *Tharu* irrigation system. Ensuring water in the canals now depends upon a system of cash, wage labor, remittances, machines, fuel, drivers, and local leaders with the political and social capital to coordinate these actors. The embodied practices now required of farmers to

secure their access to irrigation water are wage labor and the provision of cash via remittances, severing their direct connection to the *kulo*s. Thus, farmers' relationships with the Karnali's waters are now mediated by cash more frequently than labor and ritual offerings. Even the *gurwa* and *aguwa*, traditionally compensated through honor and in kind gifts, are now paid a wage. The *gurwa* still chants his mantras and makes offerings to the water god at the intake, but as *desawar* was abandoned years ago, Rajapur's thousands of farmers are no longer present. The *gurwa* enacts his ritual on the riverbank with only the *chaudhary*s and excavator driver beside him. Farmers, if they gather at all, do so to shovel sand when they can no longer afford a machine.

Thus, while collective labor and religious ritual are still practiced, their purpose within the new system is increasingly marginal. As less collective labor occurs on the irrigation canals, the core function of the *gurwa*'s rituals has become increasingly uncertain. As mentioned before, the *duriya puja* was not only performed to ensure adequate water in the *kulo*s, but also to protect farmers while repairing *bandh whua*s. When asked about how changes in the system had affected his practice, the *gurwa* insisted that the ritual still had the same effect. Now instead of securing farmers, the negotiations he makes with the water god, work to protect the excavator and its driver. Concrete and gabion structures, rather than *bandh whua*s, are solicited to provide sufficient flows. To the *gurwa*, at least, these details do not matter so long as the ritual is enacted. A god is still at work in the *kulo*s regardless if the world around it has changed.

Rajapur's *aguwa*s are facing a similar crisis. As *bandh whua*s have disappeared from the *kulo*s and maintenance has shifted to the mechanized excavation of sediment, the relevance of the *aguwa*s' situated knowledge is eroding. As I interviewed *chaudhary*s across the island, I found only one who still had a dedicated *aguwa*. Interestingly, his sub-system still had more than 50% of its traditional *bandh whua*s, as the RIP had not been able to replace all its structures

before the Maoist conflict grew too intense in the early 2000s and those involved with the project fled the island. In other systems, however, the new infrastructure has directly displaced the *aguwa'*s wisdom, and in doing so, increasingly undercuts the *Tharu*s' architectural skills and practices of collective engineering more broadly.

This *aguwa* was adamant that his skills will continue to be needed as all structures, even those that claim to be 'permanent,' erode and must be maintained. Yet the fact remains that the labor required by the irrigation system today is not what it used to be. While *bandh whua*s had to be rebuilt and adjusted several times a year, maintenance of the RIP is less about building things than coping with the burden of sediment. When asked if there were any methods within the *Tharu* system for addressing this issue, the *aguwa* was at a loss. There was no solution for sediment in the traditional system, because it simply did not exist there. His wisdom gained through embodied practice in the dynamics of the *Tharu* world had nothing to contribute to a problem created through the enactment of another reality. "This is a modern problem," he finally explained, "and so it will require a modern solution." Although the *aguwa* is very much a product of the *Tharu*s' 'old system,' he is careful not to romanticize it either. In a certain world it worked, but today it is no longer possible. He cites that fact that most of Rajapur Island is now incorporated into Bardiya National Park's buffer zone, which means cutting wood for *bandh whua*s would require a bureaucratic process to get permission from the state. Like many farmers, he is hopeful that the DOI will return to Rajapur to fix the sediment problem that they created.

This is how what I refer to as ontological marginalization often happens: not through a direct displacement, where ontologies are confronted directly and people are forced to abandon their ways of living, but rather through a gradual process of rendering certain practices and ways of worlding irrelevant or impossible. As a result, certain ontologies that are marginalized through

development interventions, for example, and their associated infrastructure are, "allowed to wither away in common, day-to-day, sociomaterial practices" (Mol, 2002, p. 6). As acts of maintenance change, so do the realities they sustain and the subjects produced in the process (Barnes, 2017; Graham & Thrift, 2007). Through their effort to make the RIP's infrastructure work, farmers practice becoming subjects not of a *Tharu* cosmological order, but of a 'modern,' developed Nepal. This ontological shift on Rajapur Island begs the question, not only *what* reality is being maintained through infrastructure (Barnes, 2017; Graham & Thrift, 2007), but *whose* and with what consequences (Carse & Lewis, 2017)?

While the *aguwa* and *gurwa* continue to assert that their situated knowledge and roles remain relevant even within the current system, it is unclear how this will change over time and what the ontological consequences will be. The *aguwa* and the *gurwa* who I met were both in their seventies, and while the *aguwa* had an apprentice, the *gurwa* lamented that he was the third generation in his family to serve the *Budhi Kulo*, and yet none of his sons, who spend most of the year working on construction sites in Dubai, are interested in learning the traditions. Already, the structures imposed by the RIP have begun to alter local relationships with the river and discipline farmers into subjects of the 'modern.' Infrastructure aligns with broader political and economic trends. A new generation is emerging that depends more on cash than ritual, machines more than labor, and that is increasingly dreaming the same dreams as engineers who see solutions in bigger concrete walls. The *aguwa,* on the other hand, was more confident that the knowledge practices he represents are not at risk of being lost for lack of practice. While farmers no longer build massive *bandh whua*s together, he sees these skills as embedded more deeply in *Tharu* ways of being and inhabiting the Karnali landscape. He reminds me about the young boys and

girls who still build miniature *bandh whua*s to catch fish on the smallest of canals. Even children know these things, he says. It is not a 'knowledge' that must be preserved.

Figure 16. *Tharu* children practice their fishing skills above one of the remaining *bandh whuas* in Rajapur.

There is no denying that as maintenance has become increasingly mechanized, less collective, and cash-based, the relationship between *Tharu* farmers and their *kulo*s is changing. This shift is occurring as the structures and practices of maintenance that reinforced the old *Budhi Kulo* system (*tigoria, bandh whuas, desawar*) disappear and are replaced with concrete weirs, excavators, and wage labor-migration particularly among the poorest farmers who otherwise have limited access to cash. As is often the case with development, the full effects of the RIP were not anticipated by anyone. Farmers who participated in delegations to Kathmandu and who were responsible in part for mobilizing the intervention to begin with did not anticipate the ways in which the knowledge practices and structural designs of engineers would come to slowly displace not only their *kulo*s' physical infrastructure, but with it their knowledge and

lifeways. Neither did they expect that they would essentially have no role in the design or position of the structures built on their system. While the DOI and the ADB imagined this intervention to be progressive in its level of local participation by implementing farmer consultations and actively embedding residents in long-term management, they overlooked the ways in which their ontological approach to managing floods clashed with and displaced the one on which the system had been built. In addition to exacerbating material disasters, this literally reshaped not only the *kulo*s, but people and their relationship with the Karnali River's waters.

If, as Ingold and Kurttila (2000) claim, ways of living *in* a place and those very places are reciprocally produced, then what will this mean for the Karnali Basin, Rajapur Island, and the *Tharu* people? I provide Ingold and Kurttila's (2000) reflection on one possibility here,

> People belong to the localities and environs in which they have grown up, just as much as the latter belong to them. To break the bond between persons and place […] would be to cast tradition adrift from its generative source of meaning, leaving it as the vestige of an ancestral form of life long since overtaken by its representation as an object of memory. The effect of such displacement would be to rupture the continuity of tradition and to cut people off from their past (p.194).

If it is truly the time spent laboring together in the *kulo*s that ultimately structure *Tharu* ontologies of relationality, if it is in physically building structures that compromise with the river that *Tharu*s come to understand non-human agency, then as their relations with the *kulo*s become mediated by machines, cash, and concrete, how will they also change? Can a god still live in the water if people stop participating in the rituals that reinforce those relations? I ask these questions not to suggest that *Tharu* worlds should not change, or that it would even be possible, let alone desirable, for a singular ontology to persist throughout time. Rather, what I am interested in is the ontological tension of intervention and the politics of this encounter. How might we account for the specific ways in which human-non-human relations are being realigned along the Karnali and who and what is implicitly structuring this transformation? After all, what

seems to be fundamentally at stake is an intimate relationship to place, one that may enable alternative logics and ways of living to continue to exist alongside, and ever in dialogue with, other practices of inhabiting the world (Gibson-Graham, 2006).

The RIP certainty seems to have re-patterned ways of living with the river and inhabiting Rajapur Island through its infrastructure and new economies of maintenance. Yet there is also evidence if one looks closely, that *Tharu* farmers have not passively accepted this displacement, but may in fact be reclaiming their relations with the *kulo*s through the very infrastructure that has failed them. After all, when the engineers left the island and took their technical expertise with them, *Tharu* farmers had to go on living, finding ways to function within a system shaped by structures they had no role in designing. Although concrete infrastructure limited their agency in material ways and directly reshaped and mediated their relationship with the river and *kulo*s, they still engaged in active practices of inhabiting the landscape (Ingold & Kurttila, 2000). Ontological displacement, to whatever extent it has occurred, is certainly not complete. It is to farmers' actions in this constrained space, in the wake of intervention, that I now turn.

5. In the Aftermath of Intervention: Inhabiting a Dysfunctional System

Despite the countless ways in which *Tharu* farmers' situated knowledge was excluded and displaced during the design and implementation of the RIP, residents have responded to the dysfunction they were left with in multiple ways. As James Ferguson (2009) and Tania Li (2014) remind us, even the most hegemonic development interventions never provide smooth 'solutions' and often fail to contain the world in which they are imposed. Sometimes people are disciplined into subjects that come to inhabit a vastly different world, but other times people respond to infrastructure and the ontological assumptions embedded within it with outright

refusal: *our world will not be structured in this way.* Infrastructure is always riddled with fissures. Its permanence as "a fixed and stable emplacement" is, after all, a myth (Graham & Thrift, 2007, p.10). Thus, it is in the spaces where these structures leak, metaphorically and literally, that people find ways to resist their marginalization and the ways in which infrastructure works to structure their lives.

This suggests that the ontological encounters in development, like the RIP, are not only about displacement and marginalization, but sometimes become spaces where "different ways of worlding sustain themselves even as they interact, interfere, and mingle with each other" (Blaser, 2013, p. 552). This, I argue, is exactly what is occurring in the lower Karnali Basin: an uneven encounter of intra-acting (Barad, 2007) and partially overlapping worlds (de La Cadena, 2015; Strathern, 2004), enacted through intervention, embedded in infrastructure, and visible through its material effects. Yet on the *kulo*s of Rajapur Island, struggles over design do not end with construction, but continue long into the aftermath of a project, as people reassert their alternative 'ways of worlding' through small acts of reclamation in the cracks and fractures of intervention.

While I have shown how infrastructure continues to structure and discipline new ontological subjects even after intervening institutions pull out, structures do not last forever. They must be reinforced (Barnes, 2017; Furlong, 2010; Graham & Thrift, 2007). Otherwise, "the political projects, promises, and aspirations that they carried dissipate'' (Carse, 2014, p. 219). Reality, after all, is dynamic and constantly being (re)enacted (Law, 2004; Mol, 2002). Thus, those who control the design and implementation of a project matters, but maintenance also provides a space were ontological negotiations can continue to live on in the aftermath of intervention. People marginalized during a project's formal design and implementation, occupy the site of intervention and inhabit it differently once the intervening institution leaves. This

opens up a space for reclamation, particularly when residents are formally given responsibility for maintenance, as was the case with the RIP. This is where *Tharu* farmers regain some of their power: they can choose *what* to maintain and *how* (Carse & Lewis, 2017), even if their agency remains circumscribed by the structure (Li, 2017). Through political acts of maintenance, they may choose to reassert an alternative ontology and refuse the structure imposed upon them, or in ongoing dialogue with Kathmandu, continue to call the government back to serve them.

In particularly sand-clogged *kulo*s, for example, *Tharu* farmers have attempted to modify concrete structures to ensure sufficient water for their paddies. Acts of maintenance, after all, do not necessarily equate with exact restoration, but open up an emancipatory possibility for improvisation and innovation through "the cannibalization and recycling of materials" (Graham & Thrift, 2007, p. 6). When two intakes on the *Budhi Kulo* went defunct within a year of construction, the farmers dug an entire new canal within a few months. Repurposing the spillway of a nearby concrete weir, farmers jerry-rigged this structure with brushwood and cobble extensions to reclaim their share of discharge. Deeper in the system, farmers frustrated with their access to water particularly during the droughts of 2005 and 2006, went to war with concrete structures that had "become too permanent." Where canal mouths were particularly choked with sand, farmers enlarged their openings with sledge hammers and chisels. This enabled access to a greater volume of water when needed, but also meant that when flows were sufficient they could clog the structures with sod, bamboo, and grasses to redirect water elsewhere. Through simple modifications and ''mediating technologies'' (Furlong, 2010), farmers have made the infrastructure more malleable in order to regain some control over the water flowing through it.

As sedimentation rates have increased in the system and 'permanent' structures built during the RIP have lived out their functional lives, indigenous architecture is reemerging. For

Figure 17. Concrete structure with scars where farmers used hammers and chisels to expand its opening.

Figure 18. This *Tharu*-style *bandh whua* was built as an extension on top of a concrete intake in order to repurpose existing infrastructure that had been built during the Rajapur Irrigation Project. This hybrid *bandh whua*-concrete structure is being used to direct water into a newly dug canal that was built by farmers to replace one of the concrete intakes that had to be abandoned due to sedimentation.

the first time since the RIP, over 745 farmers in the Kairichandanpur system, adjacent to the *Budhi Kulo*, gathered for three days to build a *bandh whua* to replace and reinforce the fragile and eroding structure on their main intake. As more and more structures age, rust, and begin to fail, "everyone may need to go back to the old system," one resident pondered. Several *bandh whua*s have even been constructed just upstream of concrete intakes that no longer provide sufficient water or on top of dams that are no longer high enough to direct water into sub-canals.

Figure 19. Here it is possible to see the wave-like structure of the *Tharu* dam used to reinforce the compromised concrete and gabion dams further downstream at the Kairichandanpur intake.

Carefully positioned in relation to the very concrete structures that displaced them decades ago, these *bandh whua*s are enabling the farmers to regain some control over their system. These farmer acts of reclamation produce what appears at first glance to be complicated 'hybrid' structures: dams cobbled together from many sources (i.e. stone, wood, wire, concrete), designed by multiple engineers, and built with diverse knowledge practices. While there is a certain multiplicity to their dimensions, the composite structures that guide water along

Rajapur's *kulo*s today did not emerge out of even social, political and economic relations. Rather there is a complex story of knowledge and power that remains sedimented in their layers, even as they continue to be remade, changing shape as old pieces erode and new extensions are added.

6. Conclusion: Multiple Ends, Still in the Making

What then, do these structures represent, beyond their material form? What do their entangled layers reveal about struggles over power in the aftermath of intervention? Consider these four interpretations.

1

At the most basic level, the jerry-rigged intakes and modified weirs suggest a desperate coping. People have material needs, and thus no option but to make do and to live within the structure because their livelihoods depend on the water that flows through its canals. The small modifications they make are acts of salvage to rescue a system that is otherwise failing them. This is what it means to live on the margins, occupying the cracks of 'modernity' in the aftermath of intervention.

2

Building 'hybrid' structures that embody both tradition and modernity, *Tharu* farmers and their *aguwas* engage in creative practices of resilience. Not only are they (re)enacting aspects of the infrastructure imposed upon them, but they are inventing novel ways to merge the best of modern engineering materials and technologies with their own place-based practices. This *is Tharu* tradition: not fixed but fluid, creatively picking up new tools and materials through constant interaction with other practices of making the world.

3

Through acts of maintenance, farmers are reasserting their control over the system, destroying intakes that failed to supply them with sufficient water, refusing to use the infrastructure in the way it was intended. They have hijacked weirs and made them work for different purposes. They have dug new canals, abandoned others. These actions can be understood as political resistance, a refusal to bend to the structure imposed upon them, to live within its limits.

4

As farmers rebuild *bandh whua*s once again, on top of, propped against, next to, and entangled with the concrete structures imposed upon them, they are regaining more than control over the *kulo*s. They are also reclaiming an ontology, based on a relationship with the river and its flows through their system. Collective labor is being practiced once again, and with it, old ways of living with the river continue to be maintained.

All of these readings, or ways of interpreting what has happened on the *Budhi Kulo* are true. This is how multiple realities exist: in part, but not completely (Haraway, 1988). In interviews with farmers I heard all of these analyses, sometimes from the same person, offered in a single breath. For weeks, I struggled to make sense of the contradictions. How could the RIP lead to all of these things: acts of coping and salvage, resilience, political resistance, reclamation? But almost everyone I spoke to seemed to straddle multiple realities as they articulated narratives of blame, feelings of anger, frustration, abandonment, doubt, nostalgia for the old system, hope in a technocratic fix, their plans to hold the government accountable, and expectations of a future intervention. Entangled in complex emotions, *Tharu* farmers on Rajapur Island live with contradiction. Perhaps this is what the effects of an ontological encounter, still

unfolding, feel like. Almost everyone saw some value in the RIP for lessening the burden of manual labor, even if they now face other hardships daily. Interestingly, no one advocated going back to the system that existed before the RIP. There was no way to shake the consequences of the intervention and to retreat to a romanticized past without problems. At the same time, the farmers also acknowledged that they could not continue to live with the current system.

Many residents have concluded that the only solution is calling the government back to fix the problems it created. Most still want concrete, just in a different shape and in a different place on their *kulo*s. They want structures with gates, infrastructure *they* can control and flush. Several *chaudhary*s, particularly those in higher positions of local authority and with closer connections to Kathmandu, have been organizing delegations for several years to the Ministry of Irrigation. Their political labor may finally be reaching fruition, as just two weeks before I arrived in Rajapur, several consultants working for the ADB had met with the farmers of the *Budhi Kulo*. The feasibility of a second intervention, projected at a cost of $33.8 million, is currently being reviewed (Yadav, 2016).

There is much uncertainty, however, if the funding goes through, regarding what this will mean—materially, socially, ontologically—for Rajapur's farmers and its *kulo*s. Will it finally provide justice as the government is held accountable for the monster they made of the *Budhi Kulo*? Will participation look any different? Might a second intervention realign residents' political relationship with the state, as a sense of rights and entitlements is cultivated? Or will this more likely be a tragic case of history repeating itself: another top-down 'solution' that ends in a final and full displacement of *Tharu* ways of living?

I ask myself these questions as I walk along one of the sand-choked *kulo*s that has suffered most since the RIP with the local *chaudhary*. He is telling me a story that I have heard

several times before: how a barrage at Chisapani, with complex siphons and miles of underground canals could deliver endless, sediment-free water to their system. I hold back my surprise, for it would seem that the dreams of engineers have become his own. Meanwhile, the volume of sand around us is so great that we have been forced to abandon our motorbikes to proceed on foot. Struck by the profound irony, I interrupt him for a moment to ask about the great dunes of sand that seem to be endlessly sliding back into the canal. *There is nowhere left to pile it,* he explains. Such is the hegemony of technocratic 'solutions,' as staring a different reality directly in the face, one still insists on humanity's capacity to engineer its way out of disaster.

Figure 20. Heaps of sand line the banks of the *Budhi Kulo*'s branch canals, overwhelming farmers who have nowhere left to haul it. Due to the amount of sand dumped on adjacent roadways, several can no longer be used.

This contradiction is more complex than mere seduction. The promises of modernity steal some individuals, particularly those who stand to benefit most by aligning themselves with a certain future. "Developed things in themselves are good," I am told at one point. But

development and "developed things," do not serve everyone equally in the end and not all *chaudhary*s, and certainly not all farmers, have the same faith in a technocratic fix. Doubt creeps up the *kulo*s. Expectations range. Some assume they will have more say the second time and that their vision will have to be embedded in the design and position of the solution. Others want nothing to do with the government that created this mess in the first place. *We are better off on our own*, they insist. There is not one, but many ways of imagining the future of the *Budhi Kulo*. Where in the end does this conflict in vision leave us? Attempting to occupy multiple realities, while accounting for the tension between them. A resolution perhaps is still in the making.

Throughout this article, I have sought to uncover the temporal dimensions of ontological displacement that can occur when one situated understanding of what the world *is* and how it should be remade is imposed upon another through development interventions. By tracing the long-term effects of the RIP's imposition on the world of *Tharu* farmers in the lower Karnali Bsin, I have revealed how a form of ontological marginalization has occurred not by immediately forcing *Tharu* farmers to abandon their traditions and ways of living, but rather through a gradual process of displacement as certain practices and ways of worlding have become irrelevant or are no longer possible within the new system of mediating irrigation waters.

In this way, my work on irrigation development in Rajapur informs the growing body of critical literature on infrastructure, by drawing attention to the deeper politics of ontological displacement that can occur through the imposition of physical structures like concrete weirs and dams. While some scholars have made clear that infrastructure is never a neutral manifestation of reality (Carse & Lewis, 2017; Furlong, 2010; Larkin 2013), until this article there have been few empirical analyses of what precisely is at stake in the imposition of structures that assume, enact, and assert a particular reality upon others' worlds. In particular, I have argued that only by

approaching infrastructure as a material enactment of reality that is embedded with and shaped by certain assumptions about the world is it possible to understand and more fully account for the deeper ontological politics both at play and at stake in development interventions.

While the imposition of infrastructure does not always lead to the marginalization of other ontologies, some change and rearticulation necessarily occurs. This is a negotiation that does not happen only at the moment of intervention, but occurs gradually as structures shaped by different understandings of reality continue to be felt and exert their influence over communities long after a project has ended. As I have shown above, the ways in which *Tharu* worlds are changed by the RIP in the lower Karnali River Basin is not immediate nor complete, but occurs through a subtle re-patterning of social, cultural, and economic practices. At the same time, local ontologies persist, even as they are reformed in relation to the logics and projects that surround and that are imposed upon them. This is how new material, social, and ontological worlds, still nascent and entangled with old ways of living, are made, questioned, contested, and reasserted.

In the *kulo*s of Rajapur Island, this messy encounter of contradicting ontologies is exposed in the fissures of infrastructure: where old dams—partially broken, eroded, propped, and abandoned—form complicated layers with those more recently erected. Farmers here are disciplined by the physicality of concrete structures to relate to water, land, and each other through new economies of maintenance required by the form of the infrastructure itself. At the same time, even the most 'permanent' structures in the *Tharu*s' *kulo*s require reinforcement. Thus, even as concrete structures shape local practices and ways of relating to the water, they have to be accepted and maintained by the people who use and depend upon them. The erosion of infrastructure over time provides a chance for refusal, as local people can resist the ways in which interventions have come to structure their worlds by choosing to maintain or abandon the

structures. As infrastructure ages, the people who are left with the responsibility of maintenance also gain the agency, albeit one that is constrained, to decide if and to what extent they will remake their world in the same way. Thus, rather than framing development interventions only as top-down impositions that restructure local relations, I have also argued that opportunities for resistance are preserved in the cracks and fissures of even the most dominating structures.

In the end, I would argue that such an ontological lens on development and the politics of intervention enables one to understand and make sense of the entangled and contradicting realities that have emerged along Rajapur's *kulos*. After all, this approach to tracing the long-term effects of interventions as ongoing negotiations of multiple ontologies does not force one to conclude whether an 'indigenous' or a 'modern' world is 'winning.' Rather than falling back onto such simple binaries, when we understand the world as constituted by active practices and ways of living then it becomes impossible to offer a final conclusion to any ontological encounter. Reflecting the complexity that one is confronted with while studying the material effects of development on the ground, when we enter the realm of ontological politics our own analyses do not offer closure. Rather, they open up a way for others to continue tracing the uneven ways in which people persist in the midst of contradiction as the worlds they inhabit are shaped by multiple and overlapping enactments that both they and others make.

IV. Interlude

Figure 21. A partially-completed embankment of the Karnali River Training Project. The remains of a water pump are still visible in the foreground where a community of bonded laborers lived until they were displaced by chronic waterlogging associated with the structure.

As I walked along a raw embankment still under construction in the village of Anantapur, I stumbled upon a string of houses situated precariously on the edge of water ponded at the structure's base. There I met Rishu,[5] a 75-year old man who had spent his life as a bonded laborer and whose home was completely destroyed by an older embankment that breached during a major flood in 2014. He received no assistance with recovery. When the central government began building an even larger embankment next to his home, he joined his four previously bonded and landless neighbors in protest. However, as these were the only households facing displacement in Anantapur, they were immediately silenced by the rest of the

[5] To protect the privacy of the individuals described here, I use pseudonyms for people throughout this piece.

community, who supported the intervention. As the most marginal members of society, Rishu and his neighbors were forced to shoulder the burden of life along the embankment.

As the monsoon's rains puddled along the structure, Rishu's house slowly sank underwater. He shows me the water pump from the yard of his old home as evidence, now a rusted pipe piercing a green pond of chest-deep water. With no option but to abandon his home, he managed to scrape together his savings and borrow from relatives to purchase enough land to build a house away from the river. Several other families were also forced to relocate. In this way, Rishu and his neighbors were also displaced by the embankment, not by its construction, but by being forced to live intimately with its side effects.

These days, Rishu comes to visit his neighbor who still lives by the river just to sit by his old home, now swallowed by water at the foot of the embankment. "I was born here," exclaimed. "I love this place. I never wanted to leave here." He was born into bondage in Anantapur and spent his life working for others in the community. When he was freed 16 years ago, he did not want to leave the island and migrate with the thousands of other families to government camps across the district. "I wanted to stay close," he explained. "There was no other option." And so he settled on the floodplain at the edge of the village he had spent his life as a slave.

Life had been precarious since. Floods struck every monsoon; to protect their property, he and his neighbors would tie the logs of their homes to a tree with rope so that at least they could recover the most essential—and expensive—materials to rebuild. Eventually the GON gave them the title for the scraps of land that they had settled. Rishu's presence then, in this vulnerable place on the riverbank is complicated: staying here was his decision, in part, but leaving for him was also an impossible choice. He moved only when the rising water finally filled his home, forcing him out of the embankment's shadow.

Rishu laughed when I asked if he thought the embankment would solve Rajapur's 'problem with floods.' The rest of Anantapur has such faith that this structure will protect them, but Rishu is not so idealistic. He has felt its failures, lived with its side effects. The same thing will happen with the new embankment, he assured me. Bigger structures promise bigger breaches. For those who have never been secure, promises of protection are hard to believe in.

V. Struggles on the Edge of Disaster: The Politics of Position and Displacement along the Karnali's Riverbank

1. Introduction: River Training Wars on the Karnali River

The braided arms of western Nepal's Karnali River fan out into a wide inland delta as they crash out of the Himalayas, shifting their major and minor branches every few years. In 2008, the river's main channel wandered west around the head of Rajapur Island. While this change in local hydrology was nothing unusual, landowners and political leaders of Thikapur, a growing city on the Karnali River's west branch, had become tired of the transient nature of this alluvial system that subjected its residents to inundation each monsoon and aggressive bank carving during the years it flowed close to the city. Following the example of numerous river training projects downstream in India and on the Kosi River in eastern Nepal,[6] wealthy landowners of Thikapur leveraged their connections in Kathmandu to have the Department of Water Induced Disaster Management (DWIDM) 'armor' their side of the river with several kilometers of embankments in 2010 and 2011 as a means to prevent inundation, bank cutting, and associated land loss for the people of Thikapur and Kailali District. While this structural response to flooding reflects a trend in Nepal to prevent the country's most routine and costly hazard through infrastructure to contain a river's 'uncontrolled flow' and meanderings (Zurich, 2015), it was a new approach in the lower Karnali Basin.

Although this structure proved effective in its preservation of Thikapur, it did so by

[6] In South Asia, India has trained the most Himalayan rivers, greatly influencing its neighbors like Nepal. After 100 years of resistance to obstructing rivers during the British Raj, India began jacketing its rivers when it gained independence in 1947 and has constructed 33,630 km of embankments since (Dixit, 2009). While India was well aware of the limits and profound failures of this infrastructure in other parts of the world, river training was seen as the epitome of the modern and demonstrated humankind's capacity to control nature. Nehru wanted to do something *tangible* for his people, while simultaneously civilizing them through the extension of roads, railroads, and irrigation canals (Dixit, 2003; Mishra, 1997). Embankments would not only embody, but also *enable* this development.

structurally turning the river toward the island of Rajapur, a triangular landmass across the channel home to nearly 100,000 people (Gill, 2016). Almost immediately, the river began whittling away Rajapur Island's most vulnerable edges. Typically, when a river is 'trained' both sides of a channel are embanked with a symmetrical pair of concrete or gabion structures to contain the river's floodplain to the space between the two embankments (Shrestha et al., 2012).[7] When built on only one side of the river, however, as was the case in Thikapur, embankments and their associated spurs work to structurally displace the river by forcing its current away from the shore being protected and towards the other, unprotected bank. This can dramatically exacerbate the rapid erosion and inundation of the opposite bank, thus protecting one side of the river at the expense of the other (Mishra, 1999).[8]

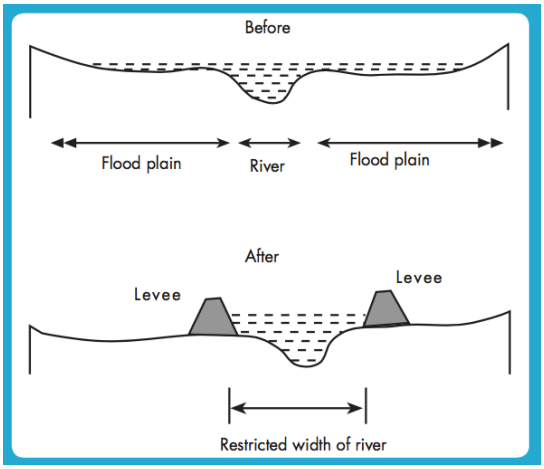

Figure 22.

This diagram illustrates the extent of a river's floodplain before and after it is structurally 'trained' with a pair of parallel embankments.

(Shrestha et al., 2012, p. 68)

[7] This engineering technique is called "jacketing," as it literally puts the river into a straightjacket by channeling its current on a linear path and dramatically circumscribing the floodplain to the space between the two embankments (Shrestha et al., 2012). As the river is collared, abutments called "repelling spurs" are constructed at 90-degree angles to the river to interrupt its current and increase siltation in the stagnant space between them. As sediment drops in these staggered pools, the river naturally displaces itself away from the bank (Julien, 2002). This strategic manipulation of discharge allows engineers to to take command of a river's flow and force its current away from vulnerable land by harnessing natural processes of sedimentation that normally cause rivers to meander.

[8] See Mishra (1999) for another case of an inter-district river training war whereby the government of West Bengal embanked the left bank of the Mahananda River without notifying villages across the channel. As embankments were built on one side of the river, they inflicted violence on Purnea district which suffered intense inundation as a side effect. As expected, the recommended response was building larger embankments across the river.

The full extent of this violence, however, was only felt in Rajapur several years later during a massive flood that struck the region in August of 2014. As a swollen Karnali River tore out of the Himalayas and struck the floodplain, the brunt of its floodwaters bounced off Thikapur's embankment and slammed directly into the opposite bank, striking the unprotected side of Rajapur Island. As a result, more than 2,000 hectares of the island were lost to the river, and over 14,500 homes were destroyed or damaged in Bardiya District, thereby impacting over 80,800 people (Zurich, 2015). While these statistics also include floods on other rivers in the district, people living on the edges of Rajapur were some of the most impacted, stranded on their rooftops for days until the waters receded. The far fewer effects felt across the river in Kailali District had to do, at least in part, with the embankments that spared Thikapur from significant damage. Thus, while flooding had always been part of life on an island embraced by a river that constantly changed its course,[9] the 2014 'disaster' on the Karnali was produced not by nature alone, but by the river's entanglement with human-built infrastructure (Wisner et al., 2004).

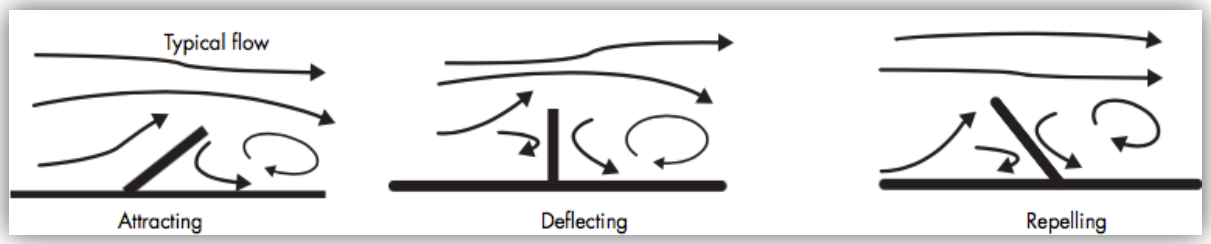

Figure 23. Illustration of how spurs can be aligned with the current to deflect the river away from one bank and toward the other. (Shrestha et al., 2012, p. 62)

Since DWIDM is notorious for executing projects in a piecemeal fashion with little upstream-downstream or left-right bank coordination (Zurich, 2015), it is difficult to claim that

[9] Most rivers in Nepal naturally wander as they enter the floodplains of the *Tarai.* This is a natural process as the flattening topography causes them to drop their incredible sediment loads until the displace themselves laterally. The Kosi River in eastern Nepal is most infamous for its roving nature. Between 1723 and 1948, it shifted 160 km westward, leaving 15 abandoned channels like footprints across the landscape (Dixit, 2003; Mishra, 2008a).

the destruction Kailali's embankments enacted on the island of Rajapur was an intentional act of infrastructural violence. However, what is certain is that when DWIDM later established a local office on Rajapur Island in the aftermath of the 2014 flood and broke ground that year on the $115 million Karnali River Training Project (KRTP) to 'armor' Rajapur Island with over 40 kilometers of embankments, it was already deeply implicated in an ongoing infrastructural war across district boundaries. Negotiations over a master plan for developing the lower Karnali had been taking place for years with political leaders from flood-prone communities on both sides of the river vying for the Nepali government's investment. Kailali's powerful elite had always been closer to government officials in Kathmandu than Bardiya's, enabling them to slide their project up the government's list of priorities so that embankments were built in Thikapur first.

Figure 24. Embankment built as part of the Karnali River Training Project on the east branch of the Karnali River (also known as the Geruwa River). Here it is possible to see how embankments work to exacerbate sedimentation between spurs and deflect the river away from the 'protected' bank.

Once private property began to dissolve in Rajapur, however, there was no longer a debate around the type or design of a solution necessary to prevent floods or bank carving, let alone the nature of the 'problem' to begin with. Rajapur's political leaders and landed elite immediately began organizing delegations to DWIDM demanding their own embankments as a response to those in Kailali.[10] The 2014 flood simply justified an adjacent technocratic 'fix' to 'correct' the river's path and prevent another 'disaster,' ironically created by the enactment of almost identical structures across the river. Most revealing is that while DWIDM presented the KRTP as a *natural* solution to Rajapur's floods, the island's elites celebrated the intervention as a *political* success. After all, the KRTP and the delegations that preceded it seem to have been motivated more by an interest in proving that Rajapur could *be developed* and compete with Kailali through its infrastructure than by an effort to secure its most vulnerable residents.

The river training war that continues to play out through infrastructure in the lower Karnali Basin provides a compelling case to examine how floods become structurally produced as disasters (Cannon, 2000; White, 1945; Wisner et al., 2004), and to study the temporal dimensions of 'who wins and who loses' as certain command-and-control 'solutions' are mobilized and enacted in a specific place (Peet et al., 2011; Robbins, 2011). In this paper, I use a political ecological lens to examine how people are differentially positioned and struggle to realign themselves—geographically, socially, and politically—in relation to embankments as a solution to flooding becomes 'fixed.' Political ecology is an approach to research that emerged in the 1970s and 1980s as scholars (i.e. Blaikie, 1985; Blaikie & Brookfield, 1987; Watts, 1983) began to question and critique apolitical explanations for environmental 'problems' that elide the more complex and entangled effects of social, political, and economic processes that produce

[10] In 2013, 38 political leaders from across Rajapur Island collected 500 Nepali rupees from each flood-prone household to cover travel and lodging in Kathmandu while they begged and bargained with government officials.

and shape vulnerability (Forsyth, 2003; Robbins, 2011). In my analysis, I follow Peet et al. (2011) who assert that any political ecological investigation of disaster needs to, "attend not only to the very real political fault-lines across which vulnerability is distributed, but also draw attention to the ways any characterization of such outcomes as 'natural' is itself a dangerous form of representation, which erases the very political nature of environmental crises" (p. 36).

In addition to both destabilizing the idea that floods are inherently 'natural disasters' in Rajapur and revealing the ways in which people participate unevenly in the implementation of structural solutions, this article informs studies on the political ecology of vulnerability by contributing an analysis of the ways in which people benefit unevenly from 'solutions' to disaster not only as they are erected, but over the course of time. While I trace how embankments divide and serve communities along existing fault lines of inequality as they are erected, often displacing the poorest and most marginalized members of society, I argue that certain individuals who initially seem to 'win' protection are not necessarily 'winners' in the long-term. Who 'wins and loses' changes as embankments begin to exacerbate a whole series of small, but chronic 'everyday disasters' in their wake (van Voorst et al., 2015). In this way, I highlight the temporal dimensions of protection within the context of disaster mitigation by arguing that what it means to 'win' and 'lose' from structural solutions to flooding changes over time as structures are allowed to stand and gradually fail certain people more than others.

In the Karnali Basin, this process of unevenly distributing risk and protection begins initially in the act of construction through a politics of positioning that depends not only upon *where* infrastructure is physically built and who gets to control it, but *who* is protected, displaced, or made more vulnerable in the process of planning and implementation. While people are able to negotiate these relations and alter their alignment with embankments through protest and

political struggle, they do so unevenly. Informed by five months of qualitative research conducted in Nepal in July 2015 and August through December 2016, this paper accounts for the social, political, and material effects of the KRTP and traces the processes of dispossession that occur both during construction and extend long into the aftermath of the intervention. Working closely with a local research assistant, I conducted 25 focus groups with residents directly affected by embankments and 200 interviews across national, regional and local scales with those involved in implementation.

I begin with a brief history of Rajapur Island to contextualize the place as well as its patterns of settlement and historical dispossession that "prefigure disaster" (Hewitt, 1983b, p. 27). This will enable me to illustrate the uneven nature of vulnerability, or "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner et al., 2004, p. 11), and the geography of risk on Rajapur Island that existed prior to, underlies, and is reinforced through the construction of the KRTP. I also show how specific policies enforced on the island have helped to make floods disasters by exacerbating the precarity of specific groups and thereby positioning them to be struck harder by the localized effects of inundation (Peet et al., 2011; Robbins, 2011). In doing so, I discuss how these policies structurally enabled embankments to become 'the only solution' to inundation by rendering impossible alternative ways of living with the river. From this, I move into the dynamics of implementation by tracing local protests over the placement of embankments and examining who wins and loses in the enactment of such solutions. This includes who has the capacity to influence the position of infrastructure, who is displaced by or loses land to embankments, who gains protection, and who is squeezed onto an increasingly marginal strip of land where new disasters gradually emerge in the aftermath of construction. In

doing so, I will argue that local struggles over the position of infrastructure are not only shaped by, but also further entrench geographies of marginalization and dispossession in Rajapur.

2. Patterns of Dispossession and the Hegemony of Structural Intervention

The way in which floods on Rajapur Island have *become* disasters and command-and-control infrastructure their 'only solution,' depends upon a process of gradual dispossession that begins not with Kailali's embankments, but rather one that has occurred alongside the development of Rajapur Island. The institutionalization of private property, the enclosure of forests as national parks and buffer areas, and government resettlement of bonded laborers have each contributed to shaping local vulnerabilities. Over time, the nature of floods and peoples' relationships to them have changed as the island's most precarious residents increasingly face disasters exacerbated by development patterns and infrastructure, at the same time that they have been structurally dispossessed of alternative ways of living with the river. In this section, I trace the ways in which vulnerability on Rajapur Island is dynamic, "generated by social, economic and political processes that influence how hazards affect people in varying ways and with differing intensities" (Wisner et al., 2004, p. 7; Peet et al., 2011). Specifically, I illustrate how what otherwise appear as disparate policies in Rajapur's history like land reform, forest enclosure, and resettlement converge to fundamentally alter the conditions of 'normal life' for precarious bodies in a way that "prefigures disaster" by situating them within a place of greater risk (Hewitt, 1983b, p. 27). Fundamentally, disasters are not produced by people's random exposure to natural hazards, but by the ways in which such hazards crash into existing patterns of social vulnerability and the material landscape that humans erect through infrastructure and development (Wisner et al., 2004).

Prior to the establishment of the DWIDM in 2000,[11] with a mandate to "prevent, manage and mitigate the problems of water induced disasters," floods in Nepal were not defined so narrowly. Rather than disasters, they were understood as complex phenomenon that caused occasional devastation, but that also had productive and generative qualities. This was the case in Rajapur, an island formed by sedimentation and sculpted over the centuries by the Karnali River's continuous vacillations. After all, the island was literally *made* by floods and its fertility depended on the freedom of the river to wander its floodplain, consuming and giving birth to new islands of rich alluvial silt between its braided channels (Thompson & Gyawali, 2006).

The first inhabitants of Rajapur Island recognized the productive value of floods. For the indigenous *Sonaha*s, who historically lived on the Karnali's edge fishing and collecting gold, monsoonal flooding and associated bank carving were not disasters, but natural processes essential to their livelihoods as the river's swollen waters carried gold particles out of the hills. The *Tharu*, a semi-nomadic people, who migrated to Rajapur several centuries ago by clearing pathways through the dense jungle for their grazing cattle and swidden farming, also relied on the Karnali for irrigation and floods to renew the fertility of their fields. Over time, both groups developed creative strategies to take advantage of inundation. In a region sparsely populated and without the constraints of private land ownership, the migratory patterns of the *Sonaha*s allowed

[11] After functioning as a technical center coordinated jointly by the governments of Nepal and Japan from 1991, the Department of Water Induced Disaster Prevention (DWIDP) was established in 2000 and merged with the DOI's River Training Division: an institutional marriage that continues to shape its technocratic approach to floods. Infrastructure used to structurally tame waterways either for irrigation or flood prevention became less about serving people, than about civilizing them, increasing productivity, and folding their labor and crops into cash-based economies (Sneddon, 2015). In 2015, DWIDP was renamed the humbler Department of Water Induced Disaster *Management*. DWIDM continues to function as a powerful state "hydrocracy" (Molle et al., 2009), populated almost exclusively by civil engineers who, Nepali water scholar Dipak Gyawali claimed in an interview, "are trained to think only in concrete […] to essentially be colonial bosses, to manage contracts and get their kick backs." Rather than thinking creatively about ways to manage floods, DWIDM sees solutions only in gabion and concrete walls.

them to shift their stilted homes and places of livelihood with the river. Bank carving did not dispossess them; when islands washed away, they moved to new ones.

While the *Tharu*s lived further inland, they too depended on inundation to wash rich silt into their paddies during the monsoon.[12] When the Karnali cut vast swaths out of the island, people did not despair. They knew that as the river ate one part of the island, it delivered soil to another. "In the past, land was never lost forever," one farmer explained, "it always returned." He remembered a man who had lost all his land to the river, only to get it back again when the Karnali shifted a decade later. People understood the relationship between the land and river as a give and take, an exchange that continued over time and on which the island's fertility and their livelihoods were based. Loss was rarely permanent; people either shifted their fields or waited for its floods to sweep soil back to them.

It was not until the island's land was claimed, divided, and institutionalized as private property that floods gradually began to spell disaster for the *Sonaha*s and *Tharu*s who were forced to settle definitively and became tied to specific places on the island. Both the *Sonaha* and *Tharu*s were largely immune to mosquito-borne diseases, a fact that protected their people from encroachment for centuries (Guneratne, 2002; Skar, 1999). However, by the early 20th century the *Rana* rulers further extended their political reach over rural Nepal by granting titles to vast tracks of the *Tarai* to Kathmandu-based elites, who would visit their estates to collect taxes and

[12] Farmers across Nepal's *Tarai* and India's the Gangetic Plain have historically depended on seasonal inundation to both irrigate and fertilize their fields. In 1930, Willcocks documented the practices of farmers living along the Damodar River in West Bengal who built one-meter-high bundhs, or small embankments, along river and would intentionally breach these structures during monsoon to allow the top level of river water thick with silt and full of fish eggs to flow into their paddies and hand-dug ponds which would act as storage devices for times of drought later in the year. The fish would hatch in their paddies and eat mosquito larvae. Sadly, the British recognized the brilliance of these local adaptive strategies only after they destroyed them by embanking the river. They had mistaken the 40-50 breaches made by farmers along the channel as natural failures and so in 1855 plugged the gaps and reinforced the structure as a 'flood-protection' rather than a flood-*enabling* device (Mishra, 1997; 2001).

extract agricultural wealth. Moreover, after Nepal's malaria eradication programs of the 1950s and the Land Reform Act of 1964, people from the densely populated hills began to occupy the plains in large numbers (Guneratne, 2002; Rankin, 1999). These *Pahari*s captured land from the *Sonaha* and *Tharu* covertly and formally registered much of the island in their names.

Figure 25. *Tharu* women and men fishing in the Karnali River's currents.

Not being farmers who invested labor into the soil, the *Sonaha*s were most easily displaced. Most became landless or *sukumbasi.* Initially, this did not matter as they continued to live on the riverbank owned by the central government. However, as the banks eroded and river shifted, the *Sonaha*s could no longer back away from the river as the rest of the island was owned. In this way, the institutionalization of private property *made* bank carving a disaster as people were pinned to a landscape that remained fluid around them. With time, many *Tharu*s also found themselves doubly dispossessed: not only tricked into giving away their land, but forced into debt and later bondage through the *kamaiya* labor system. This form of temporary bondage, traditionally short term and arranged between neighbors and relatives, had primarily

served as a social safety net in *Tharu* society to ensure that indebted families were fed and sheltered as the adults paid off their debt through manual labor (Rankin, 1999). However, as the *kamaiya* system was appropriated by powerful elite and absentee landlords. *Tharu*s essentially became slaves laboring on the very soil they had cleared; debt became perennial, bondage multi-generational.

Although little is written on Rajapur's history (Kocanda & Puhakka, 2012), oral sources[13] describe the island as having had one of the largest populations of *kamaiya* in the country, with 200-500 powerful landlords (only a few of whom were *Tharu*) that each 'owned' a small village of laborers. When the *kamaiya* were freed in 2000, the land they farmed remained owned by their landlords, resulting in 15,000 to 20,000 households immediately becoming homeless. As the government was consumed by a violent Civil War (1996-2006) with the Maoists, the *mukta* (freed) *kamaiya* were forced to build temporary shelters on whatever land they could find on the roadsides and riverbanks. Controlled by Kathmandu and seen as nothing more than 'wasteland,' these flood-prone, water-logged, and otherwise marginal spaces became the land legally granted to each *mukta kamaiya* family registered with the government, a process that began in 2001, but remains incomplete 16 years later. Many households were also never counted, having fled to India during the war for temporary employment. Along with the *Sonaha*s, these undocumented *mukta kamaiya* make up the majority of the *sukumbasi* people squatting on the riverbank today.

As thousands of Rajapur's most vulnerable people were exiled to the Karnali's edge, floods swiftly became disasters. Residents' daily struggle to live with floods became truly impossible in the early 2000s when community forests across the island were designated a part of Bardiya National Park's buffer zone. Through this enclosure of communal land, cutting trees

[13] Interviews and focus groups were conducted with elder members of *mukta kamaiya* communities as well as with individuals engaged in advocacy work on behalf of the *mukta kamaiya* at the national level through local NGOs.

and even gathering driftwood from the river became illegal. As these forests had provided an essential source of renewable construction materials, the cost of wood became prohibitive for the construction of traditional, two-story homes. Frequent reconstruction pushed many *Sonaha*s and *Tharu*s into debt. Each year the Karnali flooded, people took out loans at interest rates of 18-24 percent and men were forced to migrate for wage labor just to pay these bills. This illustrates how vulnerability deepens through "patterns of frequent stress" (Wisner et al., 2004, p. 5), as a series of chronic disasters erode people's capacity to secure themselves.

Today, Rajapur is still dominated by *Tharu*s who comprise 80% of the population (Gill, 2016), many of whom continue to labor as poorly paid sharecroppers for absentee landlords. No more than 150 *Sonaha* families remain. While there is little reliable data on *sukumbasi* and *mukta kamaiya* populations, one activist and founder of a local NGO estimates that there are 70,000-75,000 such people on the island today. Ninety-five percent continue to live in precarious, flood-prone places on the margins of the very communities they worked in as slaves. In this way, layered processes of social, political, and material dispossession that distribute vulnerability unevenly explain (Harvey, 2003; Peet et al., 2011, Wisner et al., 2004), in part, how residents of Rajapur Island slowly came to experience floods as disasters and how large scale infrastructure became the hegemonic solution to flooding in the Karnali Basin. Through changes in land tenure, both the *Sonaha*s and the *Tharu*s were structurally dispossessed and forced to inhabit the vulnerable edges of the island. As being stationary became mandatory, 'fixing' otherwise semi-nomadic peoples to a single location, their old ways of living with the river were displaced. People found themselves inhabiting a place in which they had always lived, but no longer with any ways to secure themselves. In this context, development in the name of protection became not only justified, but necessary.

Figure 26. *Tharu* families without sufficient land to feed their families often work as wage laborers harvesting paddy and other crops by hand for wealthy landowners. Many of these individuals were once bonded *kamaiya*s who sometimes work for the same individuals who once held them in bondage.

In the Karnali Basin, this has meant securing the people of Rajapur by reinforcing boundaries—literally and metaphorically—between the river and the land through the KRTP. All along the Karnali River, DWIDM is erecting a 40 kilometer wall of four-meter high, five-meter-wide embankment reinforced with gabion cages packed with a half meter of stone. The riverbed is also being lined with a gabion carpet or "launching apron" (Shrestha et al., 2012), that extends 15 meters out into the water to prevent the current from scouring under and collapsing the structures. To armor the island against bank carving, 130 spurs are being built onto the smooth face of the structures like arms reaching out into the current to deflect it back toward Kailali.

As in much of the world, the Karnali's floods are framed as *natural* disasters independent of, rather than entangled with, their surroundings, that can both be predicted and contained through scientific calculations and large-scale infrastructure (Dixit, 2003; Hewitt, 1983a;

Wachinger et al., 2013; Watts, 1983; White, 1945; Wisner et al., 2004).[14] This reflects a broader process whereby large-scale technical interventions like dams, levees, dykes and embankments become manufactured as the *natural* solution to water crises by rendering both the causes and the solutions apolitical (Peet et al., 2011; Robbins, 2011). In its KRTP master plan, for example, DWIDM characterizes the Karnali River as "highly aggressive in nature" and requiring "extensive and integrated river training and management work […] to minimize yearly flood disaster." Engineers do not speak of the disastrous effects of embankments across the river, nor that those most impacted by the 2014 disaster were Rajapur's most marginal and previously dispossessed populations. DWIDM produces a singular solution so that it appears "there is no alternative" (Mehta, 2001). Yet this naturalization of crisis strips both the definition of the problem and the positioning of its solution from the politics of knowledge and power that go into them (Allouche et al., 2011; Bakker 2011; 2012; Cohen, 2012; Cook & Bakker, 2012; Harris & Alatout, 2010; Mukhtarov & Gerlak, 2013; Swyngedouw, 1999). Moreover, critics' concerns are silenced and resistance to otherwise controversial forms of development like embankments is curtailed while "maintaining a form of hegemonic thought control" (Zeitoun & Warner, 2006, p. 448). Who, after all, can resist a solution that has 'nothing to do with politics'?

The irony, however, is that as embankments attempt to contain disaster by suppressing the effects of floods and erosion, they have the effect of producing new "hydro-hazardscapes" and exacerbating existing hydrologic risks that are both socially and politically produced (Mustafa, 2013; see also: Alley, 2014; Alley et al., 2014; Dixit, 2009; Gyawali & Dixit, 2001; Mustafa & Wrathall, 2011, Wisner et al., 2004). While most of Nepal's embankments have yet to

[14] Some of the earliest river training occurred in China on the Yellow River (Huang He), also known as "the sorrow of China" which was embanked in the 7th century BC and on the Yangtze River in the first century BC. The Nile River in Egypt was embanked in 12th century. River training works on the Mississippi River were completed in 1727 (Mishra, 1997).

live out their full technical life, the long-term side effects of this development path are most obvious downstream in places like Bihar. As flood 'protection' infrastructure was extended across India's Gangetic plains in the 1950s, for example, 2.5 times more land was actually taken *out* of production through waterlogging, sand casting, and breaches than land brought under irrigation, leaving local residents poorer and more vulnerable (Gyawali, 2011).[15]

Figure 27. This embankment was built during the first year of the Rajapur Irrigation Project to deflect the Karnali River back toward Thikapur, directly across the river and from where this canoe ferry is coming.

Why then do embankments continue to be built and reinforced through a cyclical process of intervention despite over seventy years of overwhelming evidence beginning with the work of Gilbert White (1945; 1961; 1964; 1974) that these structures do not end, but rather exacerbate floods and produce new disasters?[16] In the case of infrastructure on the lower Karnali River,

[15] In 1954, when the National Programme for Flood Management launched, Bihar had 2.5 million hectares of flood-prone land. By 1971, it had doubled to 4.3 million and by 1994 it had reached 6.8 million hectares (Mishra, 1997).

[16] For example, as India developed its plan to embank the Kosi River in 1954, two engineers went to China to study river training techniques used on the Yellow River. There they learned that in its history the embankments had

dismantling the embankments in Thikapur after the 2014 flood might have been a logical response given the extent of devastation. However, to suggest this would have been to appear 'anti-development,' a cardinal sin in a place like Bardiya where people have been chronically deprived of development and material investment by the state (Gyawali, 2013). Furthermore, Rajapur's political elite most likely recognized that in courting infrastructural solutions, they were positioning themselves to get a significant cut of the final budget for their patronage. On river training projects in India, after all, it is not uncommon for 60% of project funds to be divided within the politician-engineer-contractor nexus (Dixit, 2009). Thus, embankments become a structural solution to floods that reinforces existing power structures (Wisner et al., 2004). In this way, the KRTP emerged as the *only* solution to floods in the lower Karnali not because it was inherently so, but because local leaders who drove public opinion and who negotiated in Kathmandu 'on the rest of the island's behalf' insisted that the only way to respond to a disaster produced *by* infrastructure was *with* larger, more extensive structures.

This discursive hegemony of embankments in the lower Karnali Basin is certainly important and real, particularly as floods are increasingly narrated and framed as 'disasters' and this becomes "normalized and internalized" by Rajapur's residents (Peet et al., 2011, p. 40). However, it is also important to recognize the ways in which social, political, and economic policies like land privatization and the enclosure of community forests, described above, have aligned with infrastructure to *materially* make embankments seem the only solution. This has occurred as alternative ways of living with and adapting to inundation have been structurally

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breached 1,500 times and that in a major flood in 1933, 50 breaches killed 18,000 people and affected an additional 3.6 million. When the government responded by opening the embankments in 1938, the river breached in 200 places killing 890,000 people. Nonetheless, the engineers returned from their tour still recommending this approach. Two American engineers also commented on the Kosi scheme but neglected to mention that the 1912 flood on the Mississippi River wiped out 96 km of embankment by breaching in 300 places (Mishra, 1997; Wisner et al., 2004).

displaced and *made* no longer possible. For many residents of Rajapur, particularly marginal farmers who possess scraps of rapidly eroding land or *sukumbasi* people who can no longer access resources to rebuild, it is not so much that they are convinced by the promises of modern infrastructure, but rather that it is increasingly difficult to imagine any other solution.[17] As rivers are trained and forced on narrow paths, they no longer keep their promises to return the land they temporarily consume (Wisner et al., 2004). This means that if people want to preserve their property, they must armor it with infrastructure. Embankments become the only way to do this.

In this way, the pervasive conviction that *there is no alternative* to embankments is not only a matter of discursive hegemony manufactured by hydrocrats, engineers, and Rajapur's political elite (Zeitoun & Warner, 2006), but a material reality that has emerged as the island's most vulnerable people have been gradually dispossessed and pushed into precarious places. People have no choice but to place their faith in technology's capacity to secure them. As a result, their resistance to command-and-control infrastructure that contains floods and suppresses the river's agency is limited to a politics of its position. As one logic dominates and a solution is 'fixed,' certain actors are differentially empowered and disempowered (Peet et al., 2011).

"When the contractors come, we go to protest," a *Sonaha* woman confessed as she gazed out over the open water. "But we already know in the end we will have to agree, because we

[17] Ravaged by the 2014 flood, Tiuni village suffered such extreme losses that people no longer feel they can live without the government's infrastructure. Farmers explained that less than a decade ago the Karnali flowed over a kilometer away from their village. After the the river shifted to this side of the island and Thikapur armored its riverbanks, however, erosion has become overwhelming. In two years, Tiuni lost nearly 90 hectares of its community forest as the river cut closer to the village. While the local government tried to construct an embankment prior to the 2014 flood, the structure was not stabilized and the river easily breached its sack and rope reinforcement, plowing half a meter of sand and stone onto people's fields. As a result, over 30 hectares of land was lost to subsidence and at least five families became *sukumbasi* as the last of their property became part of the riverbed.

need the embankment." Ultimately, the KRTP serves only as a temporary solution to a gradual process of erosion that local people no longer feel they have any control over.

3. The Politics of Position

With the command-and-control approach to floods already determined in the Karnali Basin, people's agency and resistance to the KRTP is constrained to a struggle not over the implementation of embankments, but over their positions. While the KRTP is a formal response to resident delegations and requests for flood protection, its implementation still functions as a top-down solution imposed upon communities. Led directly by the central government in Kathmandu, the KRTP does not coordinate or share its plans with local government workers embedded in the island's Village Development Committees (VDC), let alone residents directly impacted by construction. Thus, while rumors percolate within villages and precede construction, the exact position and time is uncertain. Most residents only discover how embankments will affect them when surveyors or contractors show up with equipment in their fields.

This is particularly problematic because there is currently no government program or fund to compensate people whose land is consumed in the construction of embankments.[18] As a result, Rajapur residents are forced to provide their land for free, essentially under threat and pressure from DWIDM that if they do not consent to making this sacrifice, no protection will be offered at all. In this way, embankments have the effect of materially dispossessing the most vulnerable people even as they are supposedly built to 'protect' those very individuals. At the

[18] While India generally compensates individuals whose land is used in the construction of embankments, when river training was first launched in Bihar the government resisted compensating people, because it argued this would increase project costs so greatly that the necessary rate of return (typically a minimum of 10%) could not be met and they would not be able to justify the project (Mishra, 2008b). This speaks to the narrow logic that guides and justifies river training projects in India and Nepal as well as the unaccounted social costs that are bracketed out of cost-benefit-analyses and displaced onto the shoulders of local people.

same time, their space of contestation becomes limited to how residents are positioned *within* an already accepted solution. While villagers struggle to influence an embankment's specific location, local inequalities undergird who gets to have a say in this, as those with more wealth and influence have greater access to and influence over engineers and their supervisors, while those who are most marginal or negatively impacted are coerced into accepting the structures.

Figure 28. Excavator at an active construction site of the Karnali River Training Project.

While engineers are supposed to build and position embankments based on empirical formulas, in order to finish its projects, DWIDM ultimately has to cooperate with communities and at times be flexible with its calculations. According to India and Nepal's standard method for calculating the minimum distance between two embankments (Singh, 1980),[19] the Karnali River

[19] Lacey's formula assumes that the width of a natural channel at bankfull flow is proportional to the root of the discharge, and requires embankments to be built 1.5 to 3 times the Lacey's width (*L)* from the central line of the river (or 3-6 times *L* from one another). Not all engineers agree whether Lacey's formula should be exported to other geographies as it was developed on data collected from stable canals in the Bari Doab areas of west Punjab. As a result, this formula has several limitations including its failure to account for a river's sediment load and deposition rate (Shrestha et al., 2012), which can range from 10-30 cm a year on Himalayan rivers (Zurich, 2015).

technically requires a 1,500-meter-wide channel in order to contain a flood with a 50-year recurrence interval without breaching. The reality, however, is that even as engineers insist their structures are objectively designed and positioned, they are often dragged into compromises with local elites who want to secure their land and supporters. This is a process that often begins with protest as Rajapur's residents resist their physical displacement by embankments and local leaders intervene to negotiate an alternative alignment with DWIDM. During the first year of the KRTP, for example, protests erupted on almost every construction site. Yet these struggles never critiqued DWIDM's approach to training Himalayan rivers or managing floods more broadly, but were localized efforts to control the embankment's alignment. *Where would the site of construction be? Who would the embankment displace? Whose land and how much would be sacrificed beneath it?* These are questions of political ecology relevant to who wins and loses in the enactment of any development intervention (Peet et al., 2011; Robbins, 2011). Moreover, they are also political battles that individuals participate in and are excluded from unevenly.

When it comes to project implementation and the specific alignment of the KRTP, it is Rajapur's political leaders who hold the most sway. Directly connected to government ministers in Kathmandu, they have significant access to those who control the budget and project design, and can leverage their ability to influence local people to win bribes for providing 'security' to DWIDM field staff. After all, the violence that occurred in Rajapur during the Civil War between the Maoists and the central government is still raw and strains local relations. In fact, when the KRTP was launched in 2015, this was the first time that the central government had a physical presence in Rajapur since it was chased off the island in the early 2000s.[20] With local

[20] From 1992-2001, the DOI implemented the Rajapur Irrigation Project to rehabilitate and modernize the *Tharu*s' hand-dug irrigation system. I document the effects of this intervention in the first article of this thesis. During the Civil War, the DOI staff were taken hostage and the field office was gutted and burned.

protests still flaring around the 2015 constitution, which further marginalized many people of the *Tarai*, DWIDM engineers depend on local leaders from the Nepali Congress Party to serve as a buffer between them and the frustrated masses into which their embankments slam. In this way, engineers become the "pawns in the hand of politicians" (Mishra, 1997, p. 2213), who channel information and complaints between the village and their office. Local political leaders become far more powerful than both the VDC's government workers and *barghar*s*,* who are customary chiefs highly respected within villages, but whose power is not formally recognized by the state.

Within communities, most farmers—whether *Tharu* or *Pahari*— have less than one hectare of land (Dhakal et al., 2012), and are dominated by powerful politicians, most of whom are large landowners who continue to maintain their historical ties to Kathmandu. These marginal farmers are the individuals whom embankments are supposed to serve, but who often find themselves intimidated by engineers into giving up additional land for the construction of these structures. Some small landholders in alliance with strong local leaders are able to stand up to this coercion. However, since many land owners were directly involved in advocating for the embankments, they participate in protests more to control the structures' physical alignment and mitigate their personal losses than to protest an embankment's construction. Most ultimately consent to partial dispossession in order to save what little land that they have left. Few farmers have been able to pressure engineers into abandoning their design requirements and forcibly reclaiming their land through the enactment of infrastructure *in* the river that reasserts the boundary between land and water. Yet in the process of aligning themselves with embankments to become one of 'the protected,' marginal farmers often end up suppressing the struggles of the even further marginalized *mukta kamaiya* and *sukumbasi,* whose protests threaten to delay the

construction of protective infrastructure. Within each village, it is these populations who have the least capacity to resist their dispossession by embankments.

Figure 29. The waterlogged area on the left of this image is land that had been eroded by the Karnali River during the 2014 flood and that is being 'reclaimed' by constructing an embankment through the river.

While concessions do not come without a fight from engineers who struggle to defend the KRTP and its placement on the grounds of 'technical feasibility' (Mishra, 1997), DWIDM has been forced to construct 90% of its embankments wherever local leaders demand: often on the edge or even *in the river* to accommodate those who have already lost land and refuse to give up more. As engineers abandon their calculations, embankments are being used in ways that were never intended. They become weaponized in order to fight back the river and to struggle with it over land that has already been taken. Two years into the project, six hectares of farmland lost during the 2014 flood have been 'reclaimed' by building through the Karnali's waters. The irony, however, is that most of this land remains unusable—except perhaps as fish ponds—as it never fully drained. In this way, the KRTP has given marginal farmers lakes. Yet the fact remains that

even if embankments are realigned and the KRTP is built directly on the riverbank, the most vulnerable *mukta kamaiya* and *sukumbasi* are still often displaced. There are always winners and losers in the enactment of 'solutions' (Robbins, 2011), and unsurprisingly it is the middle class and wealthy landowners of Rajapur who benefit most from flood control (Wisner et al., 2004).

What these power relations reveal is that politics lie at the heart of the positioning of embankments along the Karnali River. Local struggles during implementation matter, however, because in the end how individuals are positioned in relation to both the embankment and the river determines who faces disaster most frequently, how inundation is experienced, and whether or not the structure relieves one's vulnerability or exacerbates it. Structural solutions to flooding do not serve all people equally and in fact, often shift the burden of displacement squarely onto the shoulders of the poorest and most vulnerable people in a locale. This injustice also extends far beyond construction as those who live most intimately with infrastructure also suffer the greatest from its failures, side effects, and disrepair, while rarely benefitting the most from its construction. Part of the violence of the KRTP, then, is the way it assumes even implicitly that disaster strikes all equally (Cannon, 2000). In reality, communities are fractured and uneven within (Peet et al., 2011), dynamics that often deepen with the enactment of infrastructure that both physically and metaphorically divides communities (Wisner et al., 2004).[21] Using the specific case of one community segregated by the KRTP, I argue that by refusing to account for historical patterns of vulnerability and the unequal distribution of power at the core of local

[21] Mishra (1999) describes the violence that erupts *within* communities as villages, and sometimes even extended families, are split by the enactment of embankments. As some people are abandoned between the river and the embankment, these individuals often have to manually breach the structures to prevent hundreds or even thousands of people from drowning. At the same time, those on the opposite side of the structure defend the embankment against damage that would compromise their protection. This is often a life-or-death situation for people living on *both* sides of the structure, even as certain individuals are positioned in places of greater risk.

exposure, the KRTP works not to relieve, but rather to further entrench the island's uneven topography of risk.

4. Intra-Community Struggles on the Edge of Disaster

Dalautpur is a village that sits on the west branch of the Karnali directly across the river from Thikapur. It is also home to one of the most powerful political leaders in Rajapur who represents the Nepali Congress Party for Bardiya's fourth constituency district. When DWIDM's engineers first came to survey a path for the embankment in 2014, they determined that it would need to run straight through the village, according to the necessary 1,500-meter distance from the embankment already constructed across the river in Kailali District. As the river channel narrows here significantly, maintaining the required distance would essentially involve abandoning an 800-meter swath of the island and village to flooding and aggressive bank cutting. The worst was that in this 'sacrifice zone' between the arms of the embankments were nearly 200 households of primarily subsistence *Tharu* farmers and *mukta kamaiya* families who would be abandoned.

These people living on Dalautpur's margins were shocked. For years they had supported local delegations advocating *for* the construction of embankments to protect their homes and land. Local political leaders had collected cash from them to finance trips to Kathmandu to meet with the DWIDM and vocalize concerns on their behalf. Yet when protection finally came many of the poorest villagers and those with the least amount of land found themselves delineated within a 'sacrifice zone,' structurally bracketed out of a place of security (Povinelli, 2011). Unsurprisingly, these groups immediately protested. The embankment, they demanded, must be built on the edge of the river. However, the engineers with their professed apolitical calculations and technical expertise could not justify this exclusion. An adjusted path closer to the river was

charted, but once again people resisted. They had already lost so much land to bank carving; to sacrifice what scraps they still had left to the embankment without compensation was too much to ask. Construction was delayed another season.

The path of the KRTP through Dalautpur became so contentious that the Minister of Irrigation, who is responsible for overseeing DWIDM, came to speak to the community himself during one of the surveying expeditions. Local political leaders implicated in the project and its position from the beginning were forced to make several trips to the KRTP office in Rajapur, negotiating between DWIDM and marginal landowners and the *mukta kamaiya* of Dalautpur who threatened to kill the contractors when they returned. The results of these political negotiations, however, were rarely conveyed to those directly affected by the decision. In Dalautpur, many *mukta kamaiya* and subsistence farmers had heard that construction would begin when monsoon ended, but no one knew exactly where the embankment would be built. Potential paths had been surveyed on both sides of them. They had no idea if they would be offered protection, stuck between the structure and the river, or simply displaced. All of the poorest residents lived on standby, uncertain what to expect, but prepared to rally whenever the excavators showed up on their land. Their thirst for information was palpable, as they had been intentionally excluded from the village's privileged channels of knowledge. During interviews, interlocutors began asking *me* what I had heard and seen up and down the river. I too knew little.

Eventually, I found Raj Kumar,[22] a man with more information and a local member of the Nepali Congress Party who was closely connected to the island's main party leader who now spends most of his time in Kathmandu. Over tea, he shared the details of the resolution that the community's most marginal farmers and *mukta kamiaya* people had been deprived of. With local

[22] To protect the privacy of the individuals described here, I use pseudonyms for people throughout this piece.

protests raging not only in Dalautpur, but in other communities up and down the Karnali, he had arranged an exclusive meeting for the leaders of every major political party on the island to discuss brokering a deal with DWIDM. They decided to challenge the grounds of the engineers' claims that embankments must be built 1,500-meters apart. Their plan was to cite the fact that the bridge that had recently been completed linking Bardiya and Kailali had embankments a mere 550 meters apart. If the government could build this bridge using the same logic and calculations as the KRTP then why could the embankments in Rajapur not also be constructed this distance from those in Thikapur? As this argument gained traction, *barghar*s and other land owners echoed it across the island.

After much negotiation, engineers ultimately caved to the pressure of local leaders and agreed to construct the embankment directly on the riverbank to avoid exposing any private land to further erosion. In Dalautpur, where 200 households would have been exposed to the river had DWIDM followed its design requirements, the most privileged as well as many marginal landowners were spared by the embankment's new alignment. "No one knows this yet," Raj Kumar told me as I took a sip of tea as if he just divulged a secret. When asked why the local *barghar*s and VDC staff had not yet been told, he laughed. "We don't have a *chokidar* to tell the people," he said using the *Tharu* word for 'messenger.' It is not the job of political leaders, who are constantly called upon to 'serve the people,' to disseminate information. Yet it is precisely this exclusion of others, including village *barghar*s and the local VDCs, from their networks of intelligence that allows local political leaders to preserve their power over people by deciding whom to protect and whom to exclude in their facilitation of solutions. "The problem has been solved," Raj Kumar assured me, "The people will see when the contractors come." In this way, people are made to live with uncertainty and depend on the grace of local elites to secure them.

When asked about the fate of Prem Nagar, a particularly vulnerable cluster of *sukumbasi* and *mukta kamaiya* homes perched on the riverbank on the outskirts of Dalautpur, Raj Kumar shrugged casually, "They have already been given land elsewhere by the government, they just don't want to leave." While it is true that those *mukta kamaiya* households that were registered with the government were supposedly being relocated, this does not address the 19 landless families that will have nowhere to go. Thus, political leaders had 'fixed' the 'flood problem' in Dalautpur by realigning the embankment to protect their landed constituents in a way that dispossessed only the *sukumbasi* and a few *mukta kamaiya* families living on the most vulnerable edges of Prem Nagar. A solution was reached by sacrificing those people otherwise seen by the larger community and political elites as "socially disposable" and with the least capacity to resist their physical displacement (Butler, 2004).

While these patterns of dispossession extend all along the KRTP in places where people live on the fringes of more privileged communities (Blaikie & Brookfield, 1987), most *mukta kamaiya* and *sukumbasi* communities have not attempted to coordinate their resistance. Instead, those who live in extreme marginality along the river struggle together in pockets of resistance against their more privileged neighbors. As it became obvious in Prem Nagar, for example, that the interests of the *mukta kamaiya* and *sukumbasi* were neither being represented by the *barghar*s of Dalautpur nor local politicians that had claimed to be negotiating with DWIDM on their behalf, these two groups bonded together in solidarity based on their common history of bondage and dispossession. As squatters on government land without a proper title, many *sukumbasi* had no 'right' to participate in local meetings let alone launch a protest. However, since the *mukta kamaiya* are a state-recognized disenfranchised population, they had the legal grounds to refuse displacement and the political leverage to confront the government on both

groups' behalf. When six *mukta kamaiya* families were promised safer land elsewhere, these households refused to vacate the riverbank until the other 19 *sukumbasi* families were also relocated. At the point of writing, it is still unclear what effect their refusal will have.

However, if the experiences of at least five other villages along the Karnali are any example, the resistance of the *sukambasi* in Prem Nagar is likely to be smothered by other farmers only slightly better off than them, yet also desperate to secure their rapidly eroding assets and who have been intimidated by engineers into believing that to protest at all is to risk losing the embankment completely.[23] Their anxiety is exacerbated by the general uncertainty of the KRTP's implementation. Construction begins and ends without warning and work is postponed in the wake of protest. Farmers are forced into an anxious waiting, doubting the power of their resistance and wondering if the government will ever return. While some farmers remain strong, "preparing their weapons for when construction starts again," others succumb to engineers' threats of abandonment and agree to relinquish their land for free. If people want protection, they must give and receive whatever they are told. Especially in villages where bank carving is particularly aggressive, the coercion that DWIDM uses to manipulate marginal farmers into giving up their land is reproduced and extended *within* communities through the suppression and dispossession of *mukta kamaiya* and *sukumbasi* people who are forced to shoulder the burden of displacement on behalf of the entire community. This reinforces the fact that even when such a problem is supposedly 'solved,' one must ask, *solved for whom*?

[23] In the village of Rajipur in the north of Rajapur Island, for example, where the KRTP was going to permanently displace 30 *mukta kamaiya* families, their protests were silenced first by contractors who threatened to abandon them to the encroaching river and later by furious landowners convinced that their resistance would delay the embankment's construction or end it altogether. Fearing isolated exposure, abandonment by the government, and contempt from the broader community, the *mukta kamaiya* families had a meeting and decided to submit a letter to DWIDM with all their signatures stating that they gave permission to build embankments on their land. This 'self-sacrifice' achieved through both coercion and consent reflects the complex ways in which marginal people are further dispossessed by the enactment of flood 'solutions' that secure only certain, privileged bodies within a broader community.

The case of Dalautpur and the uneven struggles over the position of embankments within it, illustrates how the burden of securitization comes to be borne by those with the least capacity to resist their marginalization and displacement. On Rajapur Island, it is the *mukta kamaiya* and *sukumbasi*—bodies historically dispossessed as the island was settled and developed—that are once again being sacrificed for the protection of others. This is a pattern repeated in villages all along the Karnali as the cries of the most vulnerable are drowned out by the rest of the community's desperation and demand for embankments. While dispossession begins at the time of an embankment's construction, it is also a process that extends long into the aftermath of intervention as the negative side effects of infrastructure are distributed unevenly and are felt most intimately by those who live closest to them (Dixit et al., 2007; Wisner et al., 2004). The irony, however, is that in the end it is marginal farmers who have only slightly more say than the *mukta kamaiya* and *sukumbasi* about where the embankments are initially placed, who end up becoming the next victims as chronic disasters emerge in the project's wake.

Thus, while the KRTP may provide basic short-term protection and mitigate some of the island's worst bank cutting for marginal farmers and the landed elite, it essentially "mortgages the future" of the majority of Rajapur's most vulnerable residents for a fragile and temporary security (Mishra, 1997, p. 2212; see also Wisner et al., 2004).[24] Furthermore, without a formal plan or fund to maintain its infrastructure (Dixit, 2009), DWIDM enacts a second act of violence as it abandons its structures with people who have no capacity to maintain them. The embankments are left to age on communities' margins, eventually becoming a greater risk than a

[24] In Bihar today, 80% of the budget allocated for river training works goes only to their repairs, which are now nearly equivalent to the cost of the initial project investments (Mishra, 1997; 1999).

source of protection as ruptures become more frequent. “Even with embankments,” a woman reflects staring up at the structure behind her home, “life here is not secure.”

5. Conclusion: When Embankments Breach

While embankments attempt to contain disaster and suppress the agency of waterways by erecting a material wall between the land and the river, they always fail to do so completely (Mishra, 2008c; 2012; Mishra & Kumar, 2004; White, 1945; Wisner et al., 2004).[25] Rivers are meant to move, the floodplain to be filled and later to drain. Indeed, rivers endlessly exceed engineers’ structural attempts to contain them as they undo and redo their braids, consume entire islands, form new ones, and forge new paths across the floodplain. In this way, floods in places like Rajapur are not crises *by nature* (Peet et al., 2011; Robbins, 2011; Wisner et al., 2004), but *become so* through the (mis)application of river training technologies that exacerbate the effects of flooding and expose already marginalized communities to even greater risk by artificially severing their relationship with the river (Gyawali, 2003). Furthermore, as floods are framed through the narrow lens of ‘disaster’ and are managed as such, their regenerative qualities are discursively erased and materially displaced (Gyawali, 2011). Instead of a self-reproducing fertility provided by inundation that deposits silt on the floodplain, farmers come to depend on synthetic fertilizers.

[25] One example is the 1953 embankment of the Kosi River with 125 km of river training works on each side of the river (Mishra, 1999; 2008a; Thompson & Gyawali, 2006). Consequently, 380 villages and 988,000,000 people from both India and Nepal were trapped *between* the embankments (Mishra, 2008b). Beyond dispossession through displacement, as the embankments aged they began to produce a whole suite of disasters. In 2008, a major breach occurred on the Kosi, affecting over 2,500 villages and destroying over 322,000 houses (Dixit, 2009). While this event received considerable media attention, everyone ignored that it had actually been the eighth major breach (Mishra, 2008a; 2008b). The older disasters were simply ignored as the state continued to extend its structures.

As Rajapur erects walls all along its edges in order to contain floods, it changes more than local hydrology, but also severs people—both physically and metaphorically—from their relationship with the river. Although the KRTP is only a quarter finished, many smaller disasters are already unfolding as the KRTP interrupts natural processes and prevents people from accessing the river they depend. This produces a whole suite of negative 'side effects' that enact their own erosive and quotidian violence on those who live along their bases (Wisner et al., 2004). Since embankments are designed to create an impermeable barrier between the land and river in order to *prevent* floods, they also restrict drainage. During monsoon, water puddles along the structure and stands stagnant for months ruining crops and molding the bases of people's thatch homes. Rather than suffering from the Karnali's occasional inundation, people now have to *live* with floods, elevating their beds on bricks in order to sleep and subsisting on dry food on days it is impossible to cook.

Like the rain which can no longer drain, people too cannot access the river, as embankments have become a wall of scree that people have to climb up and down. Elderly people in particular have a hard time getting over the structure and women complain that they now have to carry water to their livestock because the embankment blocks their cattle's path to the river. Little 'disasters' produced by infrastructure make life harder: rocks roll into their yards, rain washes sand into their fields, mosquitos breed in waterlogged areas, and they no longer can feel a breeze off the river. In this way, embankments enact multiple barriers, not all of which are desired. As fluid movements of water, people, and animals between the land and the river are restricted in the name of preventing one 'disaster,' many others are created. These become catastrophes of the everyday as embankments continue to be built and extended, dispossessing those who are most marginal based on a fragile illusion that flood control is ever fully possible.

Figure 30. Embankments prevent drainage, creating massive waterlogged areas like this pond in the foreground particularly during the months of monsoon.

In the meantime, those farmers who were supposedly 'beneficiaries' of the KRTP continue to pay taxes on land at the bottom of the river, under new embankments, and for 'reclaimed fields' that are now nothing but fish ponds. They hold onto the hope that the river will move again and that they will be able to reclaim the land they have lost not only to the river but under the island's embankments. In this way, even those who initially 'win' protection from infrastructural enactments do so unevenly and are not guaranteed this status forever; the security that is extended to them is precarious and is often quickly eroded by the material ways in which the agency of nature, and its flows of sediment and water, slams into human-made walls. Importantly, it is the poorest landowners and subsistence farmers, who are often positioned discursively by political elites to be the beneficiaries of embankments—for whom the structures were erected to begin with and realigned to secure—who actually end up suffering the most as they are forced to live with negative side effects such as chronic waterlogging and sandcasting.

Figure 31. A partially-completed embankment built to 'protect' this community was not only built on their land, but has also created everyday challenges for them including waterlogging in their fields, erosion of stone and sand that washes into their yards, and difficulties in accessing the road and river.

Thus, the 'winners' and 'losers' of structural solutions to disaster are not only determined at the time of construction as people struggle to control where an embankment is built and who gets displaced, but also as the side effects of infrastructure emerge slowly in the wake of intervention. Ultimately, until the Karnali River is given back some of its power, "the victims will continue to live, not with floods, but [with] the politics of it" (Mishra, 2001, p. 2761), as infrastructure wielded by Rajapur's elite takes one dimension of nature and creates disaster by attempting to sever the river from its surroundings. This is a violent redistribution of vulnerability that begins with political struggles at the time of construction, but that later takes on a life of its own as biophysical processes become entangled with and exacerbated by the materiality of rock and gabion walls. As embankments alter the material landscape through the barriers they erect, inducing new and more chronic disasters like waterlogging, those who initially 'win' flood protection from the river often become victims of other forms of crises. In

this way, vulnerability is redistributed not only at the time of an embankment's construction and through the political struggles that precede it, but also by nature's own response to infrastructure.

Scholars of political ecology have already shown that disasters are social (Oliver-Smith et al., 2017; White, 1946), that vulnerability is uneven (Cannon, 2000; Wisner et al., 2004), and that environmental management is always political (Peet et al., 2011; Robbins, 2011). What this article contributes to this body of literature is a reconceptualization of vulnerability as a fluid condition that changes over time and that can actually be exacerbated by the very structures erected purported to alleviate people's suffering. Furthermore, the ways in which the precarity of certain individuals is induced by structural 'solutions' to disaster occurs not only as risk is socially and politically redistributed during intervention, but also by the material effects of infrastructure that reshape human-nonhuman relations and gradually induce new disasters in their wake. In my analysis of local struggles to control the position of the KRTP and mitigate the effects of dispossession, I have argued that those who 'win' protection from embankments at the moment of intervention are not necessarily guaranteed security in the long-term. For this reason, I encourage scholars studying the political ecology of disasters to pay closer attention to the temporal dimensions of vulnerability and how it can be induced not only by politics of a solution's position, but also by the material ways in which infrastructure reconfigures people's relationship with and access to resources, like the river, that surround them.

With time, all embankments and the divides they embody either slowly disintegrate or violently breach. Less than two years after construction, stretches of the KRTP never reinforced were already eroding and washing abrasive sand into adjacent fields. Weakened on the backside by runoff during monsoon, there were also places where the river's current had already undercut its gabion apron, causing entire spurs to slump into the river. In the end, the more tightly a river

is trained, the higher its chances of premature breaching as water and sediment become consolidated in the narrow space between two embankments (Dixit, 2003). In Rajapur where structures are being built half the required distance from each other, another socially-produced disaster feels imminent, particularly since DWIDM does not account for how sedimentation will impact its infrastructure when designing and positioning embankments (Mishra, 2004).

Figure 32. A temporary embankment built to protect an active construction site upriver slumps into the Karnali River as monsoonal floods undercut the structure. While gabion structures are stronger than these sandbag and rope spurs a similar process can occur as the wire rusts and weakens.

If as Dixit (2009) so bluntly states, "embankments are of two types: those that have already breached and those that will breach" (p. 77), then the question becomes *when* and who will suffer the consequences? Considering Dixit's predication and the tragedies that have been unfolding along India's embankments for over sixty years,[26] I imagine Rajapur's final disaster.

[26] In Bihar, people have been driven to cut embankments themselves to allow their land to drain and to prevent thousands of people from drowning. In other places, farmers have been forced to abandon their waterlogged land

Eventually, so much sediment will have settled in the jacketed river that the Karnali will rise high above the surrounding land (Wisner et al. 2004). The island's 'armored' core will ironically become an inverted bowl in the middle of the river. Then, one day the flood everyone has been attempting to prevent will finally come, dislodging a massive load of rocks and boulders that it will plow directly into Rajapur's ring of protective infrastructure. When this river of underwater matter slams into the physical wall of island's embankments, the structures will no longer be able to contain the Karnali River. The direct pressure of so much water on their shoulders will be too much to bear. At this point, a whole series of violent breaches will occur, as Rajapur's 'life ring' collapses in on itself and the whole river that had for decades been contained will spill into the island's core. As the dividing walls between the people, land, and river comes crashing down, the Karnali will take back all of Rajapur, and this place once renowned for its fertility will be swept to the sea as another island is created elsewhere. On this new land further downstream people will once again build a relationship with the river. There, they too will have the chance to struggle over and to choose whether to enact another structural solution that attempts to tame and contain the Karnali or to craft a different way of living with the river and its agency.

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completely while the government responded by declaring 90,000 hectares a bird sanctuary (Mishra, 1997; 1999; see also Mishra, 2008c).

VI. Interlude

Figure 33. Prabati Gurung, a gauge reader employed by Nepal's Department of Hydrology & Meteorology, observes the Karnali River's water level at the Chisapani gauge station.

Throughout the early hours of August 15, 2014, a swollen Karnali River tore through the Chisapani gorge in southwestern Nepal. Nearly 500 millimeters of rain had fallen over the previous 24 hours, leading to flash flooding upstream in the saturated Sivalik hills (Zurich, 2015). As the gauge reader responsible for reporting precipitation and river level data to Nepal's Department of Hydrology and Meteorology (DHM) every two hours and alerting downstream

communities in the event of a major flood as part her role in an INGO-initiated early warning system, Prabati Gurung knew that she would get no rest overnight as the river continued to rise. With two of her neighbors, Gurung camped out at the gauge, located on a narrow dirt road that hangs from the side of the canyon nearly a mile above the village of Chisapani. From the path, Gurung had to descend a precipitous staircase to measure the water level on the gauge's black and white bands running up the canyon wall. Although there is a handrail now and the steps are reinforced with concrete, it is still Nepal's most dangerous gauge station. The risk of slipping hung over Gurung all night, as she climbed up and down the steps in the slicing rain while the river's turbulent body swelled beneath her.

By 1:00 am, the Karnali reached ten meters, triggering an anticipatory alert in the basin's early warning system. At that point, Gurung was already in constant contact with DHM, the district office responsible for coordinating emergency response, as well as with villages downstream who had been calling her since the rains had begun. Gurung's phone battery was draining quickly as she was making and receiving nearly 100 calls per hour. Since Chisapani had lost electricity earlier in the night, Gurung had to borrow her neighbors' phones to continue providing updates. Also with insufficient power backup, the gauge's radar system, which had been disseminating river level data automatically to DHM every 15 minutes, finally failed at 2:00 am. From then onward, Gurung's reports by telephone were the only source of information.

When the Karnali River exceeded eleven meters at 3:00 am, Gurung was supposed to alert downstream villages to begin evacuations. It was also at this hour, however, that the hill above the road finally gave way to the massive weight of water in its soil and an ensuing landslide cut Gurung and her neighbors off from Chisapani. As all of their phones' batteries were dead after hours of extremely high use, they were forced to relay information across the debris

flow by shouting to people on the other side who then ran to telephone downstream villages using the village landline. By 6:00 am, the river had crested at 16.1 meters, exceeding the top of gauge, which had been designed based on the largest previous flood in 1981, by over a meter.

In the end, the miracle of this story is that despite Gurung's own precarious situation and the many obstacles impeding her capacity to act, that night she successfully managed to warn over 52,000 people who otherwise would have still been sleeping when the flood struck them. This commitment and willingness to risk her own life in order to save the lives of countless others, has made Gurung a local legend, "the heroine of the Karnali" for thousands of downstream people. When I met Gurung one year after the 2014 flood, she assured me that the boundless appreciation she receives from people downstream makes her personal sacrifices worth it. However, as much as Gurung's generosity is a testament to human selflessness, I could not help but leave our conversation wondering if this is what it means to be resilient: a woman who has been made responsible for the lives of countless others, even as her own precarity seems to go unnoticed not only by those depend on her, but by those institutions that continue to make greater demands of her?

VII. The Politics of Participation in Community-Based Early Warning Systems: Building Resilience or Precarity through Local Roles in Dissemination?

1. Introduction: When Disaster Falls, Who is Made Responsible?

On the island of Rajapur, embraced by two flood-prone arms of Nepal's Karnali River, farmers keep an eye skyward as they labor in their paddies. Clouds have gathered and the air smells like rain in the heart of the monsoon. Only 20 kilometers upstream the Karnali River crashes through a narrow gorge after plummeting 10,000 vertical feet out of the Himalayas. Here, on the edge of Nepal's Bardiya and Kailali Districts, the river sweeps below the tiny town of Chisapani before splitting as it enters the alluvial floodplains of the *Tarai.* As the gauge reader at Chisapani, Prabati Gurung is contracted by Nepal's Department of Hydrology and Meteorology (DHM) to collect and report live precipitation and river level data to their national headquarters three times daily throughout the year. During the four months of monsoon, when Nepal receives 80% of its annual precipitation (Kansakar et al. 2004), however, Gurung is expected to monitor the river day and night, every two hours. While this routine may seem mundane, the burden of Gurung's work is made considerably heavier as she is also responsible for relaying this information to over 52,000 Nepalis between Chisapani and the Nepal-India border, who rely on Gurung's reports of the river's rising waters.

Since 2010, this network of mostly rural farmers has been enrolled in a community-based early warning system (CBEWS) initiated by the international non-governmental organization (INGO) Practical Action (PA) to advise 'at-risk' villages across the Karnali River's vast floodplain when they are in danger of inundation (Smith et al., 2017). Filling a gap where the Government of Nepal (GON) previously had no mechanism for disseminating live river level data directly to its citizens, PA initiated its first CBEWS in Nepal in 2002. After successfully

linking communities along the East Rapti-Narayani River to share information on upstream river conditions that would enable action prior to floods, PA expanded its intervention into the Karnali Basin in 2010 (Mercy Corps & Practical Action, 2010; Practical Action, 2008). Using low-tech gauges like the black and white lines that Gurung reads on the canyon wall and a decentralized communication chain for relaying data, PA's CBEWS has been able to provide a two to three-hour lead times for 74 flood-prone villages along the Karnali River that previously received no forecasts or early warnings directly from their government (Zurich, 2015). Now, in PA's system, if the river exceeds a threshold of 10 meters, Gurung initiates a series of graduated warnings and updates by calling downstream communities who share the message locally via hand-held sirens and megaphones so that people can secure their valuables and evacuate to flood shelters.

This community-based approach to disaster mitigation reflects a global trend in which INGOs are investing in "people-centered" early warning systems (EWS) (UNISDR, 2005; 2015), particularly in countries like Nepal where government-formulated forecasts and early warnings are not disseminated to the public and rarely reach the most vulnerable people. Following the Hyogo Framework for Action, which asserts that 'at-risk' communities should not be passive recipients of information, but rather active participants empowered to both disseminate and respond to disaster information (UNISDR, 2005), most CBEWS are monitored and managed directly by beneficiaries. In many of these communities, especially in places like Nepal where the government has not been proactive in extending services to it citizens, people are used to securing themselves out of necessity. However, as INGO initiators of CBEWS increasingly mobilize discourses of resilience and celebrate people becoming 'empowered' to take responsibility for their own protection, many of the world's most marginalized communities are being made to volunteer their own labor to provide services within their communities and to

neighboring villages that their own governments have failed to extend to them. While INGOs often describe this process as building local resilience to climate change and the disasters that it will induce, I challenge such claims by interrogating the ways in which the participatory logic of CBEWS can also build precarity and enable the continued marginalization of vulnerable people who are asked through such interventions to rely not on their governments, but rather to become more responsible for themselves.

Although not all CBEWS are positioned in response to climate change, many INGOs leverage resilience in their frameworks for CBEWS that attempt to build the capacity of communities to anticipate and secure themselves prior to disaster. Resilience, in this context, is understood as, "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR, 2009, p. 24). While resilience emerged as a descriptive term in the early 1970s as an alternative way to understand ecological systems (Armitage et al., 2012; Carpenter et al. 2001; Davidson, 2010; Folke, 2006; Gunderson & Holling, 2002), its broader application in society gained traction in the 1990s as humanitarian and development practitioners found this framework useful for interventions that 'empowered' people to be proactive rather than reactive in facing an uncertain future (Brand & Jax, 2007; Brown, 2014). In particular, the United Nations' use of the concept in its global initiatives to integrate climate adaptation and disaster risk reduction (DRR) into development has enabled resilience to become one of the most pervasive justifications for intervention in vulnerable populations today. Since it is so ubiquitous, however, resilience has become an idea seemingly beyond critique, rarely questioned or critically examined by those who actively use and apply it.

Through a critical analysis of PA's CBEWS in the Karnali Basin, this paper challenges both the implicit assumptions and material effects of community-based interventions that mobilize resilience as their stated objective. Informed by the work of political ecologists who expose the social, political, and economic roots of disaster (Cannon, 2000; Cannon & Müller-Mahn, 2010; O'Brien et al., 2006; Wisner, 2001; 2003; Wisner et al., 2004) and scholars who interrogate the discursive objectives and material effects of resilience (Evans & Reid, 2013; 2014; Grove 2013; 2014; Reid, 2012; 2013; 2014), I raise important questions about the politics of participation for both academics and development practitioners involved in the design and implementation of CBEWS across the 'developing' world. In particular, I use PA's CBEWS as a case study to confront some of the ways in which attempts to mitigate disaster by 'empowering' people to secure themselves in the absence of a responsive state can have the effect of eliding and even reproducing underlying patterns of vulnerability. This can occur, I argue, if participatory interventions do not balance the demands they make of communities with an equal effort to hold governments accountable for protecting their most vulnerable citizens.

In the first section of this article, I introduce two important critiques of resilience and its extension through participatory interventions informed by critical literature on resilience as a neoliberal approach to governing risk and the political ecology of disasters. In particular, I discuss the ways in which INGO-initiated community-based efforts to mitigate disaster can unintentionally ignore or obscure social, political, and economic dimensions of vulnerability. Using PA's CBEWS as an example, I reveal how many interventions, at least in their implementation, depend upon apolitical narratives of causality that stress the role of climate change in exacerbating disasters, rather than facing the ways in which situated histories of political and economic dispossession preconfigure local exposure. This naturalization of

disasters and peoples' exposure to them can lead to the assumption that resilience may be built and disasters mitigated simply by enhancing participatory data collection and dissemination. Contrary to this expectation, I argue that in order to fundamentally mitigate disaster, interventions must confront the structural roots of vulnerability that determine not only who lives in danger, but also who is capable of receiving and responding to an early warning.

Next, I use critiques of resilience as a neoliberal approach for governing risk to analyze the expectations and material effects of interventions that mobilize participants using this logic. I discuss how resilience discursively locates responsibility for security on the individual and artificially bounded communities in a way that shifts the weight of adaptation to climate-induced disasters from the shoulders of government to vulnerable populations (MacKinnon & Derickson, 2012). In this way, I argue that the aspirations of empowerment and local ownership implicitly embedded in CBEWS are not *necessarily* progressive, but can actually reproduce local precarity by deepening the responsibilities of gauge readers and extending the burden of dissemination onto community volunteers. My goal in this section is not to claim that these socially regressive effects of resilience occur in every intervention nor are they necessarily permanent, but rather to point to some of the inherent risks that come with the participatory logic of CBEWS that should be considered in both the design and evaluation of these systems.

Informed by these critiques of resilience and participatory responses to disaster, I turn to PA's attempt to build resilience in the lower Karnali Basin in order to interrogate the ways in which people participate in and benefit from the CBEWS unevenly. While there are material ways in which PA has improved the lives of even the most marginalized people, PA's CBEWS does not fully take into consideration the situated political history of Rajapur that leaves populations unequally vulnerable to disasters and unevenly capable of responding to an early

warning. Furthermore, through the discourse of resilience which celebrates people's capacity to take action on their own, this intervention shifts the burden of risk mitigation from the GON onto vulnerable bodies. This occurs as local residents are 'empowered' to not only secure themselves in the face of disaster, but also to take responsibility for the safety of their downstream neighbors in the absence of a responsive government. In this way, by analyzing PA's CBEWS material effects, I reveal the ways in which it produces both socially positive and regressive results that must be accounted for in the evaluation of a project's 'success.' After all, the CBEWS in the lower Karnali Basin enables people to secure themselves from disaster, but only through the labor of an underpaid gauge reader and a chain of volunteers who are asked to shoulder the state's responsibility for disseminating early warnings.

Besides critiquing the limits and adverse effects of this CBEWS, in the final section of this article I discuss how PA's national-level investments to mitigate the weight shifted onto participants' shoulders through the CBEWS have encouraged the state to take greater responsibility for more comprehensive forms of information sharing and services to its citizens. I argue that this effort can be read as an attempt by PA to combat the regressive effects of its intervention. For this reason, I argue that PA may provide a model for how other institutions can avoid placing excess burdens on the shoulders of those most vulnerable by working to not only 'empower' local people, but also the state to support its citizens who face chronic disaster. Thus, I contend that PA's work in Nepal both raises concerns about the negative effects that CBEWS can have when mobilized based on the discourse of resilience as well as highlights progressive ways that organizations can work collaboratively with the state to ensure protection more justly. Nevertheless, while the GON is now increasingly involved in DRR through a more comprehensive EWS developed in partnership with PA, its focus remains limited, attending only

to the apolitical dimensions of predicting hazards rather than the root causes of vulnerability that underlie them (Oliver-Smith et al., 2017). Ultimately, I conclude that in order to truly relieve vulnerability and protect people from disaster, intervening institutions like PA need to not only remind the state of its responsibility to produce and disseminate early warnings, but also of its obligation to redress political marginalization through structural change and social protection.

2. Critiques of Intervention: Disasters without Roots & the Production of Resilient Subjects

2.1. *Framing Vulnerability: Climate-Induced vs. Socially and Politically Produced Disasters*

Climate scientists have suggested that an increasingly unpredictable and more intense monsoon will exacerbate the effects of floods and droughts across the Himalayan region, striking the poorest and most vulnerable populations first (Khatiwada et al., 2016; Matthew, 2012; National Research Council, 2012; Shah & Giordano, 2013). Recognizing that immediate attention will be required to respond to the effects of climate change, many interventions working to mitigate disaster in the region mobilize a discourse of crisis that marries climate-*induced* disasters with scientific forecasts of severe ecological transition. While climate change will certainly intensify disasters that have already been occurring in the Karnali Basin, institutions rarely intervene with the objective of addressing the entangled social, political, and ecological roots of these events (Oliver-Smith et al., 2017). Rather, they aim to enable people to cope with 'natural' hazards now exacerbated by climate change.

This is not to say that intervening institutions like PA do not acknowledge the role of vulnerability—or "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner et al., 2004, p. 11)—at all in shaping disasters. In fact, most INGOs implementing CBEWS

conduct participatory vulnerability and capacity assessments prior to, and often intermittently throughout, their projects (IFRC, 2008). However, as vulnerability is simplified in assessments into a set of universal variables such as gender, age, reproductive status, and physical ability for the purposes of implementation, CBEWS focus primarily on *who* is vulnerable rather than *why*. As a result, interventions may maintain their apolitical framings of disaster that enable politically neutral responses, such as attempts to better predict and contain floods through improved modeling and dissemination technologies. To situate floods as the more complex socially and politically-*produced* disasters that they are, after all, might also require more complicated and politically charged responses (Ribot, 2014; Wisner, 2001; 2003). Since most INGOs operate under the graces of foreign nations, however, they must assess whether confronting the political dimensions of disaster in their work, particularly when the state has exacerbated the exposure of certain groups, could compromise their ability to operate in the future. Indeed, this may be why the political dimensions of vulnerability are factors more often recognized in literature than dealt with in practice (see IFRC, 2012; Mercy Corps & Practical Action, 2010; Pasteur, 2011).

In the case of PA's CBEWS, many field staff were hired directly from participating communities on the island of Rajapur. As a result, most individuals responsible for project implementation were intimately aware of historical patterns of dispossession that "prefigure disaster" in the basin and shape local exposure (Hewitt 1983b, p. 24). Some staff members are even the descendants of Rajapur's original *Tharu* inhabitants whose land was confiscated from them as political elites from Kathmandu and farmers from the Himalayan foothills began to settle the *Tarai* after the success of malaria eradication programs in the 1950s and 1960s (Guneratne, 2002). Supposedly, Rajapur's land was so fertile that it attracted hundreds of powerful landlords, who exploited the *Tharu*s' traditional *kamaiya* system of temporary bondage, by tricking people

into debt and forcing them to labor as slaves on their own land (Rankin, 1999). When nearly 20,000 families of bonded laborers were finally emancipated by the king in 2000, they were thrown onto Rajapur's streets. With most of the island claimed, these liberated '*mukta' kamaiya* were now homeless and forced to build shelters on whatever land they could find. While the GON eventually registered *mukta kamaiya* households and gave them land, they missed many people in their survey and even the titles that they granted were for the same precarious land people were already squatting on along the riverbanks. As a result, approximately 70,000 dispossessed and landless *sukumbasi* people continue to occupy Rajapur's most flood-prone margins, living in long linear villages along both branches of the Karnali River.

While this is a history that explains many patterns of local vulnerability and that most PA field staff had grown up knowing, this narrative of uneven exposure did not translate into the execution of the CBEWS where the *cause* of disaster was seen primarily as a biophysical phenomenon. On social vulnerability maps, people were marked vulnerable if they were, for example, elderly, pregnant, disabled, or lived in close proximity to the Karnali River (Mercy Corps & Practical Action, 2010, p. 34; see also Sugden, 2016). While the latter may serve as a proxy for having been historically dispossessed, the actual indicators used to document flood risk were severed from the context in which they are produced. In this way, vulnerability in Rajapur was accounted for not as an "economically and politically induced condition" (Cannon & Müller-Mahn 2010, p. 632) that "resides in the pre-hazard precarity of people" (Ribot, 2014, p. 696). Rather, it was presented only as a set of descriptive variables that reflect uneven exposure in a way that is unhinged from the politics of its production. In mapping risk and exposure in this way, PA distanced itself from the contentious dimensions of vulnerability like who is landless, without citizenship, or once was enslaved (Ribot, 2014). This tendency to neglect a historical

investigation of causality that might explain *why* certain populations have been made vulnerable is characteristic of interventions like CBEWS that attempt to build resilience by focusing instead on forward-looking, normative approaches that blame no one for the current situation.

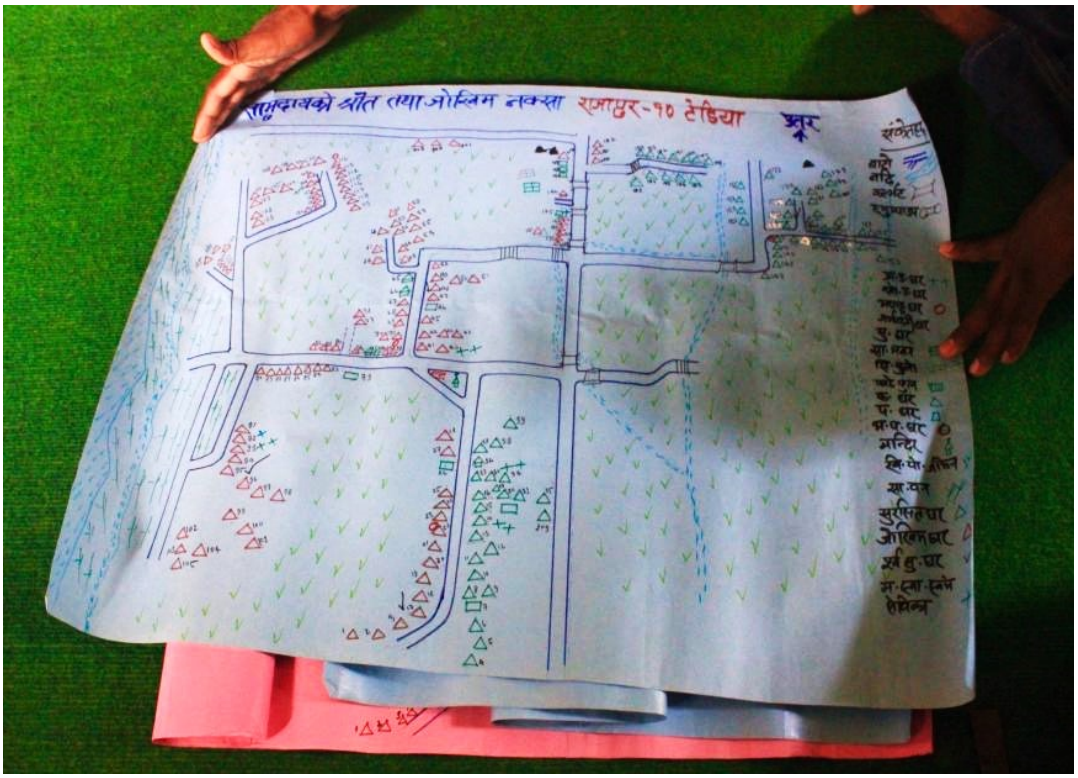

Figure 34. An example of a risk and vulnerability map made by PAfield staff in partnership with each of the 74 communities participating in their community-based early warning system.

With this approach, risk is presented not as something to be addressed by confronting the structural roots of vulnerability (Pupavac, 2005). Instead, participants are trained to take their precarity for granted as natural to their existence (Evans & Reid, 2014; Reid, 2013), rather than a politically-induced condition produced through one's socially regulated exposure to danger (Butler, 2010, p. 25). For example, in Mercy Corps and Practical Action's (2010) handbook for establishing CBEWS, discourses of 'empowerment' are mobilized rather than those of social justice. From the very beginning of an intervention, they claim, it is essential that communities, "not see themselves as victims" (Mercy Corps & Practical Action, 2010, p. 43). Although not

necessarily intentional, this naturalization of a population's current vulnerability discursively severs it from the social, political, and economic history that created it (Reid, 2013). In this way, discourses of empowerment can enact their own form of violence by asking people not to question or resist the structures that have made them precarious to begin with, but to become resilient within them instead (Evans & Reid, 2014). As a result, normative responses to climate-induced disasters, particularly interventions that focus strictly on the apolitical dimensions of disseminating early warnings without confronting the structural roots of exposure, ultimately prevent disaster only for those already in a position to be able to take preventative action.

2.2. *The Consequences of 'Empowerment' in the Production of Resilient Subjects*

In addition to evading the unequal abilities of individuals within communities to act upon information, the discourse of resilience embedded in CBEWS works to shift responsibility for securitization against climate-induced disasters from the shoulders of government onto the most precarious people. As resilience increasingly comes to justify the extension of CBEWS across much of the 'developing' world, communities are no longer promised security, but rather are 'empowered' to prepare for disaster and secure themselves (Evans & Reid, 2014). For example, the explicit goal of many CBEWS is to, "transform at-risk communities into prepared disaster-resilient communities" (Macherera & Chimbari, 2016, p. 6; see also United Nations, 2006). This process often involves developing individuals for an uncertain future by normalizing disaster and automating local responses (van Voorst et al., 2015), all while seeking to "embed security within people" rather than the state (Duffield, 2007, p. 127). In this way, rather than targeting the disaster itself and working to dismantle its root causes, development targets the victims. Trained to not only bear their normal state of precarity (Ribot, 2014), resilience asks vulnerable people to

continually "live out the catastrophic moment" in order to remerge as *better,* more adapted human beings (Evans & Reid, 2013, p. 85). Through the logic of resilience, disasters become not only threats to be secured from, but also opportunities for self improvement.

This ability to leverage the language of empowerment, while simultaneously dis-embedding people from broader social and political communities that might otherwise sustain them (Evans & Reid, 2014), illustrates the ideological fit of resilience, and any project that claims to build it, with neoliberalism (Walker & Cooper, 2011). As an approach to governance built on the free market and small government, neoliberalism is characterized by "deregulation, privatization, and withdrawal of the state from many areas of social provision" (Harvey, 2005, p. 3). Similarly, resilience provides a mechanism for decentralizing risk and its reduction to the individual or communities while relieving the state and other institutions from obligations to provide more robust forms of security (Grove, 2014; Li, 2010). Butler and Athanasiou (2013) have framed such a retraction of social protection as a violent "responsibilization," whereby the state slowly slides out of responsibility to its citizens by rolling back social welfare or denying any need for it. While many people in places like Nepal have never experienced the security of government safety nets, the possibility of experiencing more robust forms of social protection can be foreclosed by the resilience project (Evans & Reid, 2014). Under the dogma of resilience, after all, external assistance is not only framed as unnecessary, but even capable of 'eroding' individuals' adaptive capacity by creating a 'dangerous' sense of dependency (Duffield, 2012).

Thus, resilience can enable a government's social contract with its citizens to provide protection in times of crisis to be exchanged for a commitment to train them, often through informal partnerships with INGOs, to support their own lives in a space of violent abandonment. Survival then, is no longer the responsibility of the state but the burden of the poor who are

conditioned through repeated drills for the many crises they will face (Grove, 2014). In this way, resilience can train people to channel a sense of abandonment into 'positive action' as reflected in the words of one of PA's beneficiaries, "We community people must work together to help ourselves. Just like now, it will always be possible that external help might not come" (Practical Action, 2008, p. 15). In this way, communities are celebrated as cohesive, self-reproducing spaces where people secure one another through informal safety nets offered by one's extended family and neighbors (Duffield, 2010, p. 65). While it is true that the world's most precarious people do rely heavily on their local social networks for survival, this fact should not be romanticized. After all, this "village myth of self-sufficiency" (Li, 2010, p. 81-82) overlooks the ways certain lives are marginalized not only by broader structures of power, but also through their immediate social relations. Furthermore, while vulnerable people may support one another in times of crisis, there are material limits to group-based self-sufficiency when most of the population already lives on the edge of disaster.

3. Confronting The Material Effects of Intervention

Although PA has cultivated a relationship with DHM since it established its first CBEWS in Nepal in 2002, its early projects were designed to serve populations that had essentially been abandoned by their governments. As a result, these CBEWS were necessarily low-tech: designed to build a network of human infrastructure along the river so that people could relay information downstream with little more than mobile phones and megaphones. Once lead times were established between the gauge station in Chisapani and downstream villages, three graduated warning levels were agreed upon so that people could anticipate how they would be affected by inundation when they received a call from Gurung (Smith et al., 2017). PA also facilitated the

formation of community disaster management committees within each village and distributed loudspeakers and sirens for volunteers to disseminate warnings locally.

Figure 35. An example of a hand-operated siren used within villages to alert and mobilize residents when an early warning is received by the gauge reader in Chisapani.

In interviews and focus groups, most Rajapur residents expressed a deep appreciation for the myriad small ways in which the CBEWS was serving them. They explained that before PA's intervention, their old systems for predicting floods were largely limited to watching the sky for rain or observing the color of the water flushed from the hills. If it was thick and milky, they knew a cloudburst was rupturing upstream and that the river would be swelling swiftly.

Sometimes they studied the movements of birds, listened for the cries of livestock, or looked for ants marching in a tight line away from the river. While these methods speak to an intimacy with one's surroundings, they were not always reliable nor did they necessarily give individuals much notice before a flood. As a result, residents value the fact that every community now has a two to three-hour early warning (Smith et al., 2017). While many people still face ruined homes, crops, and grain and seed storage in the wake of inundation, community members stressed that they lost far less than they had in the past due to the EWS. It is for these small gains that organizations like PA continue to build CBEWSs, especially in places like Nepal where there has been very little government support extended to populations suffering from chronic disasters.

Nonetheless, while PA's intervention is deeply valued by participating communities, it still makes assumptions about peoples' capacities to respond to early warnings and extends the responsibility for dissemination onto vulnerable communities. Particularly as CBEWS align more closely with discourses of resilience and mobilize this as their goal, there are ways in which even carefully designed interventions can have material effects that redistribute risk on individuals or enable the state to justify the continued neglect of its most vulnerable citizens. As Ribot (2014) asserts, all interventions can be "damaging or emancipatory" depending on how they restructure rights (p. 685; see also Watts, 1991). Turning now to PA's intervention in the lower Karnali River Basin, I analyze which of these has been the effect of the CBEWS in participating communities. In the process, I use the critiques of resilience and community-based responses to disaster discussed in detail above to deconstruct the implicit assumptions of this CBEWS and highlight the dangers of any intervention that takes for granted that greater participation and local responsibility necessarily builds resilience and reduces vulnerability.

3.1. *The Limits of Intervention: Gaps between Access and the Capacity to Act*

While PA's CBEWS has been effective at translating river level data in ways that enable many people to evacuate and secure their most essential valuables (see Smith et al., 2017; Zurich, 2015), this intervention still serves residents unevenly and incompletely. Even with graduated sirens and elevated flood shelters, residents can salvage only what they can carry to higher ground in a few hours. Homes, crops, and most livestock must be surrendered to the river. This means that after major floods the poorest residents are left to rebuild shacks with whatever materials they can salvage. Furthermore, landless *sukumbasi* and *mukta kamaiya* families, who not only live closest to river but are also the farthest from the center of villages, cannot always hear the sirens sounded there. Many do not have easy access to life vests, which are kept in the main village, or have to travel several kilometers to the closest flood shelter. Unsurprisingly, the same factors that shape vulnerability and uneven exposure *within* communities also prevent the most marginal people from responding to an early warning regardless of its accuracy and clarity.

The community of Mujara, for example, is comprised of several hundred *sukumbasi* households who were once bonded laborers. Without access to land on Rajapur, the *sukumbasi* were forced to settle on a smaller island in the middle of the Karnali River. Here, they were never accounted for by the GON and thus never had access to government land allocations. While Mujara has been included in PA's CBEWS for the past several years, people living there are rarely able to secure themselves even with a three-hour warning. Evacuating the island's 850 people by boat across a swollen river is to risk death itself. As a result, residents often have no option but to wait out floods on their roofs after breaking the walls of their own homes to relieve pressure and prevent the structures from being swept away. As the river swallows the entire island, residents often wait days for the water to recede: soaked, unable to cook, and with

nothing to drink but water dipped from the Karnali. In this place of profound vulnerability, it is not uncommon for children and the elderly to die of exposure. A flood shelter was finally built for them last year, yet even this does nothing to protect their livestock, crops, and possessions which are frequently lost to floods.

Figure 36. Residents of Mujara travel by boat across the east branch of the Karnali River from Rajapur. During floods this is the only way to evacuate the island's population of 850 *sukumbasi* people.

The case of Mujara illustrates the limits of interventions that focus strictly on dissemination and assume that information alone builds resilience to disaster. Even if an early warning is perfectly conveyed to communities, not all recipients will be able to respond. While this is a reality recognized by INGOs and development organizations in their publications and guidelines (IFRC, 2008; 2012; Mercy Corps & Practical Action, 2010), the *reasons* that people fail to take action are often assumed to be issues of miscommunication, misunderstanding, or a lack of appreciation for the urgency of their situation. While these factors could be addressed by altering messaging or organizing more trainings, the truth is that people often fail to act due to a

fundamental lack of material resources or the social and political agency to secure themselves. This is a reality that cannot be altered by better information or communication alone.

Figure 37. Villagers enrolled in PA's CBEWS practice evacuations in preparation for monsoon.

In order to prevent disaster then, interventions have to pair early warnings with other material investments to secure vulnerable communities. This has to begin with not only documenting *who* is vulnerable and in *what* ways, but also by "tracing out the chains that cause and disable capacity" (Ribot, 2014, p. 679). For example, *how* have people come to be 'at-risk' in a particular place to begin with and *why* do they remain unable to escape disaster even with a warning? An approach to disaster mitigation beginning with such questions involves "disaggregating the structure of poverty" within a specific place, situating it historically, and accounting for processes of marginalization that extend into the present (Wisner & Luce, 1993, p. 127). While PA's work in the lower Karnali Basin has benefited many people in ways that should not be overlooked, it is also important to face its limits, as shown here, in order to

consider productive ways to move its work forward. Shifting now to the politics of dissemination, I examine the ways in which PA's CBEWS risks bracketing the responsibility for disaster prevention on already vulnerable bodies by simply re-enrolling people in their own networks of self-sufficiency.

3.2. *The Burden of Dissemination: Who is Responsible for Whom?*

When PA first established its CBEWS in the Karnali Basin in 2010, they asked Chisapani's gauge reader, Prabati Gurung, to share the river level data that she had been sending directly to DHM with downstream villages. Although her daily stipend provided by DHM was a modest 200 Nepali rupees (approximately 2 USD) and she was offered no additional compensation to support PA's CBEWS, she agreed to notify downstream residents of impending floods on top of her normal reporting duties. If there was a way for her to make the data that she was collecting more useful, then she was was happy to volunteer her time, labor, and resources. However, as the CBEWS was expanded over the years to include more communities between Chisapani and the Nepal-India border, Gurung gradually became directly responsible for the safety of 74 communities downstream by conveying river level data to them and fielding questions and concerns from any of the 52,000 residents who have her mobile phone number.

Thus, Gurung's job colleting and sharing information about floods on the Karnali River suddenly had an incredible emotional weight and social responsibility attached to it. As she was enlisted in the CBEWS, Gurung was no longer accountable only to DHM's scientists, but now had 52,000 people whose lives depended on her warnings. This was a responsibility that was supposed to be the GON's rather than hers to bear. However, as her failure to reach the gauge and efficiently disseminate data came to mean endangering the lives of thousands of people

downstream, Gurung's own precarity deepened as she was forced by the new expectations of her role in the CBEWS to take greater risks with her own life.

Gurung's willingness to shoulder this burden is even more profound considering her family's history. Gurung has been "reading the river" since she was a child, toddling behind her father who was the gauge reader at Chisapani for decades before her. In 1989, however, he slipped while descending to the river during a storm and died in the churning waters below. Her family struggled to pay for his cremation and survive financially after he passed, but despite his death while on the job, they received no support from DHM. Even so, the family did not abandon their post. When Gurung was appointed by DHM to replace her father, she was downgraded to a temporary position and the few benefits that had been extended to her father were retracted despite the fact that she continued to perform the same job. Initially, DHM paid her only ten Nepali rupees (0.1 USD) a day. After three years they added five rupees to her daily wage. Growing incrementally in this way, her income increased to the 200 rupees that she is paid today.[27] While she still insists that her relationship with DHM is positive, the real tragedy is that while Gurung monitors the most dangerous gauge station in Nepal, her situation is no more secure than her father's was decades ago. DHM still provides no insurance to its gauge readers nor compensation for injury,[28] even as they are asked to endanger themselves monitoring

[27] During interviews with DHM staff at national and regional-level offices, I was told that 200 Nepali rupees was a "fair" daily wage for gauge readers. As it was explained to me, even though gauge readers are required to report live river level and precipitation data to DHM's central office three times daily throughout the year, and every two hours during the four months of monsoon, the amount of time that they actually spend at the gauge(s) collecting this data is not equal to the amount of hours one would spend doing manual labor to earn the same income. It is through this logic that gauge readers like Gurung are considered by DHM to be "part time" employees and are paid accordingly.

[28] Officials at DHM explained that providing insurance or extending other forms of social security to gauge readers like Gurung is not possible when their own regional-level field staff remain uninsured. Many of these individuals are expected to wade into flooding rivers, or suspend themselves from cables over gorges in places like Chisapani, to manually collect discharge data during a river's peak flow. This illustrates how, fundamentally, vulnerability and precarity are relative states of existence, distributed unevenly onto the shoulders of many people who are asked to bear different burdens and who also have more or less protection in the process.

frequent and violent floods as well as shoulder the additional burden of disseminating this data to countless downstream communities.

Today 52,000 vulnerable Nepalis are being secured from disaster by the labor of this one dedicated woman who continues to risk her life for the benefit of others. As if this responsibility were not enough, in 2015, PA decided to extend its CBEWS across the border to serve an additional 400,000 Indians living on the floodplains of Uttar Pradesh. As these individuals were not receiving early warnings from their government either, PA saw an opportunity to assist them by informally relaying live river level data across the border from Nepal. DHM does not have the legal authority to share data directly with India. However, once Gurung shares river level data with members of Nepal's CBEWS, no one can prevent them from relaying the warnings across the border themselves. Thus, PA established an informal channel of communication to bypass the institutional, legal, and political barriers that prevent information from being formally disseminated within this trans-boundary river basin. In this way, PA's effort to mobilize communities to disseminate data and secure each other in the face of disaster does not have the effect of rolling *back* existing state support in either India or Nepal; it simply built a system where none had previously existed. The irony, however, is that PA's 'solution' to trans-boundary flooding now requires Gurung and the marginal Nepalis she serves to not only secure their own lives, but also take responsibility for their equally vulnerable downstream neighbors.

While this may be framed as a perfect case of 'community empowerment,' in doing so, it simultaneously provides an excuse for the state to continue neglecting its own duties of dissemination. In this way, I argue that CBEWS do not *inherently* benefit participating communities or build their resilience, but rather this depends on how they restructure rights and redistribute responsibility. In the case of PA's intervention in the lower Karnali Basin, just

extending the CBEWS downstream into India multiplied the number of individuals being served by nearly tenfold. While this growing population of beneficiaries could be framed strictly as an indicator of the system's success, fundamentally it is neither the government of Nepal nor India that have invested more time, finances, technology, or resources into their most vulnerable people. The burden of dissemination continued to rest squarely on Gurung and community volunteers in Nepal who have agreed to be responsible for relaying the warnings they receive on the Karnali's river level in Chisapani over the border to Indian villages further downriver.

Figure 38. One representative from an upstream Nepali community and one representative from a downstream Indian community are paired and exchange contact information so that they can share river level data in the event of an impending flood. This was part of an exposure visit coordinated by Practical Action in 2015 that involved taking volunteers from Nepal to visit Indian beneficiaries.

Ultimately, one has to question to what extent a system like this can be endlessly extended to serve more vulnerable populations when even now it depends upon a few bodies already spread dangerously thin. At this point, over 450,000 people depend directly on Gurung as a source of information. Should she slip, however, like her father did, then the whole system

fails. This is the danger of resilience and its discourse of endlessly replenished strength. Using the language of empowerment, resilience builds systems that require already marginalized bodies and communities to not only bear the precarity of their own situation, but to become more adapted, disaster-ready human beings (Evans & Reid, 2013; Grove 2013; 2014), who can take on new responsibilities like the dissemination of their own early warnings. For this reason, I argue that institutions like PA must confront the extent to which their efforts to mitigate disaster with CBEWS actually offers security to communities or rather reproduces the precariousness of the very bodies they claim to save. In the Karnali Basin, at least, this is a question that has yet to be answered. This outcome will depend, in part, on how successful PA is at combating the negative effects and limits of its intervention by enrolling the GON more actively in disaster mitigation.

Ultimately, if PA takes its objective of building resilience seriously, then I would argue that a truly resilient Karnali will require more robust material investments in not only people like Gurung who hold the system together, but in all those bodies currently being 'empowered' to endlessly emerge from the debris of disaster. As PA itself has recognized,

> Community-based disaster mitigation should not be confused with unaided self-help, though many communities without access to resources are forced to rely on small makeshift mitigation measures at the local level which often prove to be totally inadequate against the magnitude of the hazards faced. It is all too easy to romanticize the virtues of traditional techniques and methods which in themselves may only reflect severe technological and economic constraints and an acute lack of resources (Maskrey, 1992, p. 4).

With this in mind, I now turn to specific actions that PA has taken to cultivate relationships with government agencies in Nepal and to hold them accountable to their mandates. No intervention, in the end, is without its limitations and unintended consequences. Yet, it is precisely because PA has worked so diligently at the national level to relieve the burden of dissemination and securitization that its CBEWS has extended within Karnali communities that makes it an ideal

case to not only expose the dangers of resilience, but also to discuss an alternative approach for conceptualizing responsibility.

3. Working Toward Protection through State Investment and Government Accountability

Rather than allowing the 'success' of their CBEWS to become an excuse for state inaction, PA has simultaneously pushed and supported DHM to take responsibility for supporting flood-prone communities like those in the lower Karnali Basin. While direct advocacy is not always feasible, PA has strategically partnered with the media to put pressure on government officials and hold them accountable to the public. For example, in June 2016, PA collaborated with a Kathmandu-based journalist to exert pressure on DHM to initiate an SMS-based EWS that would send text messages directly to individuals located in river basins where flooding was imminent. As PA had been developing a probabilistic flood forecasting model in partnership with DHM (Dugar et al., 2017; Smith et al., 2017), it hoped to put these forecasts to use through more comprehensive methods of dissemination. The journalist spent several days in the Karnali Basin, interviewing Gurung and local beneficiaries. With these stories, he returned to Kathmandu and arranged an interview at the Ministry of Information and Communications about the need to invest in better dissemination technologies. After the conversation was broadcast on television, a meeting was convened with key stakeholders. Just two weeks later, DHM, in partnership with a private cellular network provider, launched Nepal's first automated SMS-based EWS for eight major river basins in Nepal (Himalayan News Service, 2017). In its first season of operation, the system sent out over 1.5 million text messages to residents across Nepal.

Moreover, that same year Gurung, along with seven other gauge readers essential to Nepal's CBEWS, started to receive a 'bonus' of 3,000 Nepali rupees (approximately 30 USD)

per month given during the four months of monsoon (Sugden, 2016). These EWS management funds, established at the district level in 2016, would support gauge readers by financially compensating them for their constant labor throughout monsoon and the cost of making thousands of phone calls to notify downstream residents. Prior to this, gauge readers who also disseminated early warnings locally received no additional compensation than those who reported only to DHM and were paid only 200 rupees per day regardless if it was the dry season or monsoon. These material gains for gauge readers like Gurung were a direct response of the GON to an advocacy campaign initiated by PA at the national level (Sugden, 2016).

As PA has pushed DHM to better compensate gauge readers like Gurung and reach thousands of residents directly through its new SMS EWS, the burden of dissemination that its CBEWS previously extended onto taxed bodies like Gurung and community volunteers has been partially relieved. By sending warnings directly to residents by text message, there is now less risk of the CBEWS failing should Gurung be unable to reach everyone. In this way, PA's work to compensate for the socially regressive effects of its CBEWS by holding the DHM accountable to its mandate and supporting the development of a state-led EWS to increase the lead time, reach, and effectiveness of early warnings in Nepal is exemplary (Smith et al., 2017). Moreover, PA's ability to press the GON to better compensate its most essential gauge readers has provided better financial remuneration to precarious individuals like Gurung who take incredible risks to both collect and disseminate data on behalf of the GON and many of its vulnerable citizens. While this 12,000 Nepali rupee 'bonus' does nothing to lessen the physical demands or dangers of Gurung's job, it does at least cover the cost of dissemination that she previously paid for from her own meager salary. Furthermore, greater financial security may enable her to secure her own body as she can more easily afford better footwear and weather protection.

In addition, throughout its interventions, PA has continued to invite government officials to the Karnali Basin to see their CBEWS and meet participants, as part of their strategy of "bringing people of power to the ground." Although at times a slow and tedious process, it is this broader work "connecting DHM with communities," that I would argue is even more important than 'empowering' local people if the goal is to mitigate disaster in the Karnali Basin. After all, as articulated in the Senadi Framework for Disaster Risk Reduction, "each state has the primary responsibility to prevent and reduce disaster risk" (UNISDR, 2015, p. 13). In this way, PA provides a model for how INGOs can effectively invest not only in vulnerable people, but also in governments so that their community-based solutions to disasters do not erode or prevent the extension of state programs, but rather serve to complement and enable them (IFRC, 2012).

Nonetheless, DHM's current focus on predicting floods and disseminating forecasts still "locates risk in the hazard itself" (Ribot, 2014, p. 677), treating disasters as an objective phenomenon that can be anticipated and prevented through better calculation and dissemination (van Voorst et al., 2015). Even its financial investment in gauge readers is a cash bonus without social benefits that, one could argue, makes the readers responsible for better securing themselves through a rational use of their income. As a result, even as the GON has become more actively involved in DRR at the national level, it is primarily through apolitical technologies that shift attention away from the uneven landscape of vulnerability into which disasters slam and the early warnings that precede them land. This connects to concerns I raised earlier through the example of Mujara, regarding the ways in which any system that relies strictly on the dissemination of information does nothing to resolve the inequality of exposure. Thus, mitigating disaster in villages across Rajapur will require more than an EWS, even if it is led by the state. In the end, any solution to disaster in the Karnali Basin will have to confront people's

fundamental vulnerability and work toward greater social and political protection through policy and material investments to secure Nepal's most precarious people. This is not something that PA or any intervening institution for that matter can do alone, but that it can play a role in facilitating using the relationships it has already fostered in the government.

PA's success at inspiring DHM to both launch a government-led SMS EWS and to better compensate its gauge readers for disseminating early warnings still fails to address the root causes of disaster in the Karnali. Nonetheless, while the GON is currently taking on responsibility only through the apolitical realms of disaster prediction and dissemination, there is an opportunity here to begin to mobilize a discourse of rights and entitlements alongside resilience. If people of the lower Karnali Basin, for example, begin to develop a relationship with the state that positions it as an institution that exists to serve them, then even without the direct advocacy of INGOs, people may begin to confront and respond to the structural roots of their own vulnerability by forcing the state through a democratic process to redress the political dimensions of their marginalization.

4. Conclusion: Where Intervention Begins

Resilience, in the end, may not be the best framework to inspire interventions that address the structural roots of disaster. However, so long as this concept continues to mobilize CBEWS and inspire efforts at disaster risk reduction in frontline communities facing climate change, there is a need for intervening institutions to reframe the current narratives of 'empowerment' and 'responsibility' they leverage. Instead of prescribing a 'resilient life' for the most vulnerable that is "within the limits of their own powers of self-reliance" (Duffield, 2007, p. 68), development practitioners might consider what it would mean to 'empower' people if empowerment did not

refer to an individualized capacity to self secure, but rather to "the ability to influence the political economy that shapes entitlements" (Watts, 1991; Watts & Bohle, 1993, as cited in Ribot, 2014, p. 686). Security does not have to become the responsibility of vulnerable individuals alone, but instead can involve holding governments accountable to their citizens and designing social protections that support the most marginal in a world of more frequent crises.

In the end, institutions cannot assume that their CBEWS inherently build resilience or the capacities within communities that they might hope for or imagine. As I have shown through PA's work in the Karnali Basin, CBEWS can actually have the effect of building precarity and exacerbating vulnerability if those institutions initiating them are not careful and work to proactively anticipate, understand, and combat these effects. While INGOs like PA cannot single-handedly change the deeper political dimensions of vulnerability that constrain people's capacity to act even with a clear early warning, the causal roots of disaster have to be where any 'solution' begins. Certainly confronting the *why* behind vulnerability is always a socially and politically contentious process; however, as Ribot (2014) asserts, "this is our responsibility" (p. 698). To do anything less, particularly when intervening in communities that have been structurally marginalized and thereby *made* more vulnerable to disaster is to risk reproducing and deepening the violence of past actions that have put certain people in places of elevated danger.

If the goal is to build "people-centered EWS" (UNISDR, 2005; 2015), then those committed to this project will have to not only look forward and toward the skies, anticipating and mitigating the next disaster, but also backwards and to the ground where historical patterns of marginalization continue to structure people's uneven experience with, and capacity to resist, disaster. Current efforts to communicate early warnings may also have to change: beginning not with attempts to *reach* more people through new technologies that better disseminate information

about hazards looming on the horizon, but by listening first to people's stories about how they came to be in precarious positions to begin with. With a deeper and more situated accounting of the very human topography that structures risk to any disaster, interventions may become more meaningful and useful to the most vulnerable people, while also building greater social justice.

At the same time that the roots of vulnerability must be where any intervention begins, it is equally important for implementing institutions to question the criteria through which they evaluate their own projects. In the case of PA's CBEWS in the lower Karnali Basin, for example, if success were to be measured strictly by the number of bodies enrolled in the system then the staggering 452,000 people between Nepal and India currently participating would only be cause for celebration. However, if evaluation metrics were to dig deeper into the politics of dissemination and response, this number would become more complicated. When we consider not only who receives an early warning, but also who is ultimately capable of responding to it, then the 'success' of a CBEWS may look different. Access alone is not enough.

Furthermore, as I have shown through an analysis of the social and emotional weight that PA's CBEWS places on individuals like Prabati Gurung who bear the burden of relaying information, simply folding new communities into the CBEWS and extending its reach downstream does not necessarily build resilience to disaster. In fact, it can actually exacerbate the precarity of certain individuals already enrolled in the system. As a result, there is an urgent need to more deeply confront the politics of people's participation in CBEWS—including both their role in disseminating information and responding to it—and to more critically assess the material effects of these interventions. In the process, we may need to rethink not only the place from which interventions to build resilience begin, but also how we evaluate and improve our attempts to do so.

In the end, information can only do so much to secure people, regardless of from whom it comes or through which technology it is disseminated. Therefore, if INGOs who initiate CBEWS take their objective of mitigating disaster seriously, then they have to move beyond the mere provision of warnings and trainings within vulnerable communities to actually address the structural roots of disasters and the ways in which people already bear their impacts unevenly. Rather than starting with an assessment of what people have that they need to secure, interventions might begin by examining what the most marginalized people still *require*—materially, socially, and politically—in order to be able to respond to a flood, or an early warning, for that matter. Until these gaps are closed, vulnerable people will continue to face disasters, exacerbated by nature and a changing climate, but equally created by policies, projects, and political acts of dispossession that expose certain people to greater danger. Fundamentally, to ignore these processes without confrontation is to enable disasters to continue.

Precluding disaster, in this way, may require focusing less on technologies of predicting hazards in order to work with the state through a discourse of rights, social justice, and entitlements, to serve and secure the most vulnerable communities even in the absence of a crisis. This process will necessarily look different in each situation, just as disasters themselves are a phenomena constituted by a web of entangled social, political, and biophysical processes that cannot be explained, predicted, or prevented at a distance from the material realities that people face in a particular time and place.

VIII. Conclusion

"While one might think that calling our era the Anthropocene would turn attention from nature back to people, it oddly guides gazes back toward hazards. So, in the Anthropocene, the struggle is still to maintain attention on the social and political production and reproduction of risk."

—Jesse Ribot (2014, p. 696)

In the three articles above, I have traced the changing ways in which floods are understood and responded to along Nepal's lower Karnali River. In the process, I have argued that inundation in Rajapur has not always been a disaster, and even today is not for everyone, but rather has *become* so for certain people through the uneven effects of policy, infrastructure, and historical processes of dispossession. Consequently, farmers and fishermen who have lived on the banks of the Karnali River for generations have gradually been drawn into chronic states of crisis that have their roots in many places. Read together, these three articles expose the social and political production of disasters in Rajapur as floods are made into crises: *discursively*, through the mobilization of apolitical explanations of causality, *materially* through legislation and interventions that displace existing ways of living with the river and redistribute risk onto certain bodies, and *ontologically* as people are disciplined through interventions to understand floods and their own vulnerability in particular ways. In excavating the social and political roots of disaster in Rajapur, my objective has neither been to ignore the agency of nature in the making of devastating inundation events, nor to trivialize the material effects of floods as they become a chronic crisis in certain people's lives. Rather, I have argued that when it comes to the politics of intervention, reducing the complexity of disaster by focusing on causation as strictly 'natural' and severing floods from their entangled causality does not serve the interests of the most impacted peoples, nor does it work to redress their chronic suffering.

As I have shown in the lower Karnali Basin, apolitical explanations for floods are currently being used to justify both structural and non-structural 'solutions' that serve certain people often at the expense of the most marginal members of society. In Rajapur, for example, embankments are erected between people and the river to protect those who possess land and political leverage, while the *sukumbasi, mukta kamaiya*, and *Sonaha*s are often displaced or further dispossessed by the same infrastructure. Furthermore, while PA works to disseminate more accurate forecasts with longer lead times so that people can prepare for more frequent floods, their warnings primarily serve those residents who already have resources to secure and the capacity to respond. The most vulnerable people, on the other hand, often go unreached by early warnings, or even if told a disaster is approaching, are unable to do anything about it.

This failure to serve Rajapur's most marginalized people, I have argued, is a consequence of the fact that most intervening institutions do not acknowledge the role humans play in the making of disasters. Whether intentional or not, this lack of accounting for the uneven social, political, and economic landscapes into which disasters slam has meant that solutions to floods are being erected and extended in communities that already experience floods and suffer from disaster in radically uneven ways. Yet instead of acknowledging and redressing this inequality first, interventions build on top of these already asymmetrical topographies of vulnerability, thereby further marginalizing many of the very communities they claim to serve. Thus, as I have argued above, it is only when a crisis is understood first through the politics of its production and when the reasons behind people's uneven vulnerability are explicitly confronted that attempts to untangle and dismantle disaster can also work toward achieving greater social justice.

In the context of the lower Karnali Basin, where floods are both climate-induced *and* socially and politically produced, such an approach requires tracing out the "chains of causality

and the recursive relations" that have enabled inundation to become a disaster in a place and that continue to induce the precarity of certain lives (Ribot, 2014, p. 692). While I have attempted to do this through my own analysis of peoples' uneven experiences with inundation in Rajapur, it is even more important that institutions intervening in peoples' lives and erecting infrastructure on the landscape begin with a similarly more situated accounting of the vast array of natural, social, economic, political, and cultural factors that contribute to the making of disasters. At the same time, floods must be recognized as the complex phenomena they are, constituted by entangled social and natural processes that can never fully be unraveled from one another (Barad, 2007). Floods will always be more than disasters. Therefore, any 'solution' to 'fix' inundation must consider the multiple ways in which people relate to rivers and avoid completely severing peoples' complex relations with them. While the agency of nature continues to play a critical role in the making of disasters, and floods will remain events that humans can never fully tame, now more than ever our narratives of causality and reasons for response must include a more nuanced discourse of responsibility informed by our own human politics.

Climate change, after all, is not a *natural* crisis, but rather one that has been made through the entanglement of social, political, and biophysical processes (O'Brien et al., 2006). Yet, rather than inspiring more nuanced accountings of causality, the fallout of a warming planet is increasingly being used to occlude, rather than advance, human responsibility (Ribot, 2014). Many interventions, including some of those I have examined in Rajapur, focus on building resilience and supporting adaptation to climate change in front-line communities of the 'developing' world, rather than extending social protections and investing in the livelihoods of those people most impacted and yet least responsible for the crisis (Cannon & Müller-Mahn, 2010). As with any disaster, the politics of intervention are fraught. However, it is precisely

because climate change is so obviously a catastrophe with entangled causality that I would argue it also offers a profound opportunity for scholars and practitioners alike to reconsider our current approaches to mitigating disasters, framing causality, and managing their effects more broadly.

While the impacts of floods and climate change more broadly may warrant a response in places like the lower Karnali, I have challenged readers to rethink where interventions might begin. Rather than investing primarily in technocratic efforts to better predict and contain an uncertain future, we might consider how, "the precarity of life imposes an obligation upon us" (Butler, 2010, p. 2) not to respond to disaster by simply training vulnerable bodies to secure their own survival and erecting walls to protect the property of the most privileged, but rather through a "politics of care" extended to all precarious life (Butler, 2004; Butler & Athanasiou, 2013). As Butler (2010) so pointedly states, "simply put, life requires support," every life must be "propped" and "supported by what is outside itself" (p. 21). With the lack of a responsible government, the most vulnerable people in Rajapur have long been propping up themselves and each other on the margins of their own communities. This self-reliance is a form of resilience perhaps, but it is one that is exceedingly fragile and hardly worth celebrating for the increased burdens it places on those already disenfranchised.

As climate change deepens the disasters that marginalized peoples already suffer from in places like Rajapur, I can only hope that life in the precarious era of the Anthropocene will inspire interventions guided by the practices of care for which Butler (2010) calls. Rather than responding to disasters based only on their anticipation, containment, and control, our interventions must cultivate a greater sense of interdependence that extends beyond bounded communities to include all those implicated in the production of disaster. Many vulnerable lives demand more robust investments than those they are currently receiving. In other words, they

require support not exclusively in the form of trainings that 'empower' people to survive yet another crisis or infrastructure that holds back disaster for a decade or less, but rather in programs led by responsible governments that provide some basic level of material security and social protection.

In this way, climate change may provide a chance to do more than despair by enabling us to rethink to whom and for what we as human beings are responsible. While we are all implicated in this disaster, though certainly some more than others, in the end it is *how* we understand and respond to one another's vulnerability that will matter. Will our interventions to mitigate crisis secure only those bodies already privileged through protective infrastructure while those already vulnerable are abandoned to their own means of survival? Or will we take responsibility for the instability of a world that we have helped to create by ensuring the well-being of the most marginalized people not through a discourse of individualized resilience, but rather of a "collective continuance" (Whyte, 2013)? These are some of the most critical questions of our times, with answers that cannot, fundamentally, be severed from an ethical politics.

IX. References

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X. Appendices

Appendix 1. Sample Interview and Focus Group Discussion Questions

Demographic Data and Broader Contextualization	• Name, age, gender, ethnicity/caste (*jaat*), occupation, place of residence • Where were you born and how many years have you lived on Rajapur Island? • Do you or your household own property? If so, how much? • Do you belong to a users group or a cooperative of any kind?
Causality of Floods and their Impacts	• To what extent and in what ways do you depend on the Karnali River for your livelihood? • How would you describe floods in your community? • How do these events impact you and your community in positive (i.e. soil fertility, fisheries, access to gold) and/or negative (i.e. property loss, crop damage, sedimentation, etc.) ways? • What causes floods and their negative impacts? • Are there actions that can be taken to mitigate the negative impacts of floods or prevent them? • Why does the Karnali River so often shift channels? Does the river have agency or intentionality?
Local Perceptions of Change in Flood Dynamics	• How many floods have you experienced in your lifetime? When were they and what were they like? Which were the worst and why? • Did your (great)-grandparents ever tell stories about particularly large flood events and what happened? • Do you think recent floods are more or less devastating than floods in the past? Why do you think this is the case? • Have you noticed an increase or decrease in the timing, frequency or intensity of flood events in recent decades/years? If so, how would you describe the patterns you have witnessed? • Do these patterns correspond with any particular development projects upstream or downstream in the river basin? • Do these patterns correspond with any changes in temperature and/or shifts in the onset, timing, or extent of monsoon?
Local Access to and Use of Formal Climate and Weather Information	• Do you have access to formal weather forecasts or live river level data to prepare for floods? • How do you access this information [ID sources and technologies]? • Are there certain barriers (social, economic, practical) that prevent you from accessing this information? If so, what are they? • How do you use these forecasts and/or live river level data to make decisions and plan for flood events? • To what extent do you find this information reliable and trustworthy? Are there reasons you choose not to use this information even if it is accessible?

	• Are you formally enrolled in an early warning system of any type? If so, how? What has been the extent of your participation? • Do you have access to seasonal forecasts that enable you to adjust the crop varieties or your planting/harvesting schedule to avoid crop loss due to flooding? • What kind of information, and in what form, would be most useful for guiding your decision making process and for enabling you to be more prepared for climate-induced disasters?
Traditional Forecasting and Early Warning Systems	• Are there certain observable environmental indicators or other ways in which this community has traditionally predicted floods? If so, how? • Who are these predictions made by? Are they actively practiced today? • How was/is this information shared within the community prior to an event?
Local Adaptive Strategies and Indigenous Knowledge in Coping with Floods	• How do you prepare for the monsoon and/or flood events? What specific actions do you take to reduce you/your family's losses from these events? • Have you modified these actions after experiencing and witnessing the impacts of floods in the past? • How did your (great)-grandparents prepare for or mitigate the effects of floods? Where they the same or different than the actions you take today? • Do you know of any 'traditional' strategies that people used to use or still use to prepare for and/or recover from damages after floods? • How effective have these strategies been during recent events? • Are there any recent modifications to traditional prediction or coping strategies that have been developed locally to limit exposure and prevent losses? • What other actions, if any, would you take if you could to be more prepared for floods? • What limitations and challenges (financial resources, time, technical knowledge, etc.), if any, prevent you from taking these actions?
Irrigation Canals: Traditional Infrastructure and Modern Sedimentation Challenges	• What is the history of the *Budhi Kulo*? • How is the *Budhi Kulo* governed? • How has its physical nature changed over time? • What role have floods played in these changes? Are these events formally documented in any of the user group's written or oral records? • How has infrastructure development either upstream or downstream affected the *Budhi Kulo*? • How was the *Budhi Kulo* traditionally maintained? How is the *Budhi Kulo* maintained today? • What were the traditional control structures used to regulate flow? Are these techniques still used today? If so, where? • What were the effects of the Asian Development Banks's intervention to modernize the system in the 1990s? • What role does the government or any other institution currently play in supporting farmers along the *Budhi Kulo*?

Local Perceptions of and Participation in Structural Interventions	• What has been your experience with and participation in the Karnali River Training Project? • When were embankments first constructed in your community? • What were your perceptions and expectations at the time? • What was the process for consulting communities, planning the location, and compensating households for lost land? • How have you participated in the planning, construction and/or maintenance of the embankment? • What has been your experience since the embankment's construction? Have there been any negative side effects from the structure • Do you feel more secure/protected now? To what extent do you believe this intervention will solve your flooding challenges?
Local Perceptions of and Participation in NGO/Government Non-Structural Interventions	• What has your involvement been with NGO and/or government adaptation programs in this area? • Describe the goals and/or objectives of the program(s) as you understand it? • What was the process like when the NGO/government staff first came into your community? How did they interact with the local people? • How did the community respond to these activities? • In your opinion, have the intervention(s) been effective at mitigating flood risk/meeting their intended objectives? If so, why do you consider it effective? If not, why do you consider it ineffective? • What could be done to make them more useful or relevant to community needs?
Scientific and Expert Knowledge	• When was the first time you heard the term 'climate change'? How did you encounter it? How was it defined to you? • Have you ever heard the term 'resilience'? When and how did you first encounter it? How was it defined to you? • How useful have you and/or your community found scientific (forecasts, EWSs, information on climate change) and technical knowledge (e.g. engineering expertise, structural interventions) in preparing for and responding to flood events? In what ways has it helped/failed to help? • How effective have you found engineered solutions (embankments, barrages, dams, channels, etc.) in mitigating the effects of flooding?

Appendix 2. Descriptive and Thematic Coding Structure for Data Analysis

Discursive Framings of Floods and Disasters

DF_DISASTER_DEF: Discursive framing/definition of disasters generally
DF_DISASTER_CAUS: Discursive framing of causality of disasters
DF_DISASTER_SOL: Discursive framing of solution to disasters (how positioned, justified)

DF_FLOOD_DEF: Discursive framing/definition of flood
DF_FLOOD_CAUS: Discursive framing of causality, how floods explained
DF_FLOOD_SOL_STRUC: Discursive framing of structural solution
DF_FLOOD_SOL_NONSTRUC: Discursive framing of non-structural solution

AGENCY_RIVER: discussion of river's agency or intentionality in explaining floods/disasters
AGENCY_KULO: discussion of agency in the *kulo*s' (irrigation canals) in relation to floods

Locally-Initiated Flood Solutions and Coping Strategies

LAT_GOVASSIST: Local action taken to mitigate floods with government assistance
LAT_NGOASSIST: Local action taken to mitigate floods with NGO assistance
LAT_CBOASSIST: Local action taken with community based organization assistance
LAT_NOASSIST: Local action taken to mitigate floods without institutional assistance

Formally-Initiated Flood Solutions and Interventions

SOL_STRUC_KRTP: Structural flood solution/intervention, Karnali River Training Project
SOL_STRUC_RIP: Structural flood solution/intervention, Rajapur Irrigation Project
SOL_NONSTRUC_EWS: Non-structural flood solution/intervention, Early Warning System
SOL_NONSTRUC_OTHER: Other non-structural, training/awareness/education program

Local Participation in Flood Solutions or Interventions

LP_ID_PROB: Local participation in identification of problem
LP_ID_SOL: Local participation in identification of solution
LP_DES_SOL: Local participation in design of solution
LP_POS_SOL: Local participation in positioning of solution
LP_IMP_SOL: Local participation in implementation of solution
LP_MANG_SOL: Local participation in management/maintenance of solution
LP_TRAIN: Local participation through training, awareness, education programs

Sources and Forms of Interacting Knowledge Practices

KNOW_SCI_ENG: Scientific-engineering knowledge and professional expertise
KNOW_SCI_CLIM: Scientific-climate knowledge and professional expertise

KNOW_LOC: Local/place-based/traditional knowledge

GOV_DOI: Government (Department of Irrigation)
GOV_DWIDM: Government (Department of Water Induced Disaster Management)
GOV_VDC: Government (Village Development Committee/Local Government)
NGO_(name): Non-governmental organization (specified name of organization)
ENG_PC: Engineers and/or private consultants
CBO_FMIS: community-based organization related to farmer managed irrigation system
LOC_THARU: Local resident, *Tharu*
LOC_SONAHA: Local resident, *Sonaha*
LOC_OTHER: Local resident, (specify other group)

Interactions and Politics of Knowledge Practices

KNOW_COEXIST: coexistence of knowledge practices but without interaction and/or conflict
KNOW_DISP: Displacement of one form of knowledge practice
KNOW_ABAND: Abandonment of knowledge practice
KNOW_CONTEST: Conflict/contestation over or between knowledge practices
KNOW_APPROP: Appropriation of local knowledge or knowledge practice
KNOW_RESIST: Resistance to other form of knowledge practice
KNOW_COMPARE: One knowledge practice discursively compared/valued against another
KNOW_HYBRID: Hybridization of knowledge practices

Impacts and Limitations of Flood Solutions/ Interventions as Identified by Local People

SOL_EFFECT_PROTECT_LIFE: Leads to the protection of life (i.e. through evacuations)
SOL_EFFECT_PROTECT_PROP: Leads to the protection of property, crops, etc.
SOL_EFFECT_RESILIENCE: Builds resilience/capacity of people to respond to disaster
SOL_EFFECT_ ABANDON: Leads to abandonment of vulnerable populations
SOL_EFFECT_EXTENRESP: Extends responsibility onto marginal populations
SOL_EFFECT_UNEVENVULN: Further marginalizes certain population

CP_RIP: Conditions prior to Rajapur Irrigation Project
CS_RIP: Conditions after Rajapur Irrigation project
LIMIT_RIP: Limits/constraints of Rajapur Irrigation project

CP_KRTP: Conditions prior to Karnali River Training Project
CS_KRTP: Conditions after Karnali River Training Project
LIMIT_KRTP: Limits/constraints of Karnali River Training Project

CP_CBEWS: Conditions prior to Practical Action's community-based early warning system
CS_CBEWS: Conditions since Practical Action's community-based early warning system
LIMIT_CBEWS: Limits/constraints of Practical Action's early warning system