DISASTER MANAGEMENT IN NEPAL: IN THEORY AND IN PRACTICE

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CONTENTS

SUMMARY

Nepal is home to numerous natural disaster risks, including earthquakes, floods, avalanches, landslides, droughts, famines, epidemics and cold waves. Understanding and assessing disaster management practice in Nepal is especially important in light of the April 2015 Gorkha earthquake. This project considers the degree to which disaster management policy in Nepal coincides with international best practice in disaster management, both in theory and in practice. This paper presents an overview of vulnerability in Nepal, international best practices related to disaster management, and existing policies and practices in Nepal. Results indicate that social vulnerability is higher in western Nepal and that many of Nepal's disaster management policies align closely with best practice in theory but not in practice.

INTRODUCTION

Purpose and Significance

Disasters are devastating worldwide but have especially severe consequences in developing countries. With accelerating population growth and climate change, more people in developing countries inhabit high-risk areas (Islam & Lim, 2015, p. 60). People in developing countries are more likely to die from disasters and less likely to have the resources to recover. From 1980 to 2012, 42 million life years were lost worldwide, with more than 80% of lost life years coming from low and middle income countries (UNISDR, 2015a, p. v). Asia, home to 60% of the world's population, had 85% of the world's disaster-related casualties in 2011 (Islam & Lim, 2015, p. 57). Understanding what makes disasters in Asia so devastating is essential in reducing disaster casualties and increasing resilience to natural disasters.

While empirical research about disaster management is abundant in developed countries, there is a noticeable dearth of academic research on developing countries, especially in terms of management planning. In Haiti, Indonesia, and, more recently, Nepal, large-scale natural disasters drew public attention to the ineptitudes of disaster management policies. One central question in disaster management literature concerns the transferability of management lessons across space and time. Can lessons from 9/11 and 3.11 inform contemporary policy and planning in the U.S. and Japan? Are the same lessons relevant in contemporary Mexico and China? Differences across social, political, and economic structures often determine if a disaster catalyzes positive change or undoes decades of development work, and many of the structures that keep natural events from becoming natural disasters in developed countries are lacking in the developing world.

This project asks: To what extent do the Government of Nepal's (GoN) disaster management policies align with international best practice in disaster management in theory and in practice? Though there are many tenets of best practice in disaster management, this project focuses on principles related to hazard mitigation and decentralization of disaster management policy and planning. Effective disaster management in Nepal is paramount in light of the April 2015 Gorkha earthquake, which claimed nearly 9,000 lives and caused more than 10 billion USD of physical damage. The devastation of the Gorkha earthquake indicates that GoN disaster management policies failed to identify and address fundamental vulnerabilities. In the years preceding the 2015 earthquake, GoN reports expressed intentions to make disaster management policies more proactive and locally driven. It is clear that competent local institutions are important to effective management. Even in highly centralized management situations, central governments eventually rely on local governments and institutions to communicate and share funds with disaster victims.

Though natural disasters are eerily common and frequently devastating in Nepal, there is limited academic research on social vulnerability and natural hazard risk in Nepal. Vulnerability expert Susan Cutter (2003) notes that little academic research compares social vulnerability across places (p. 243). Cutter et al. (2003) created a social vulnerability index for counties in the United States based on variables ranging from simple (percentage female population, percentage non-white population, etc.) to complex (value of commercial developments, density of medical services.) (p. 246). The study determined higher social vulnerability in counties in the southern half of the United States, due mostly to racial inequality and fast population growth (p. 255). This project creates a simplified social vulnerability index similar to Cutter et al.'s to demonstrate the dispersion of social vulnerability and the complexity of natural hazard risks in

ethnically and topographically diverse Nepal. Understanding social and environmental vulnerabilities is essential in developing effective disaster management policies. By mapping vulnerability and risk in Nepal, this project validates the need for locally driven management and planning and increased attention to highly vulnerable districts in far-western Nepal.

This project, unfortunately, suffers from limited data availability in Nepal. Many of the variables used in Cutter et al.'s study and other social vulnerability studies (see Flanagan et al., 2011) are not available for Nepal. Most of the data missing for this project relate to infrastructure. This project, therefore, primarily uses demographic variables to assess social vulnerability. Furthermore, what little data are available tend to be at a high level of aggregation. While Cutter et al. were able to use county-level data for the United States, this project uses district-level data for Nepal. Aggregating variables such as socioeconomic and minority status can skew results, as can the exclusion of potentially significant variables. Improving data collection and management should be a GoN policy in future disaster management planning.

This project also considers the GoN's Ministry of Home Affairs' biannual *Nepal Disaster Reports* from 2009, 2011 and 2013 as evidence of GoN planning and management priorities. Pre-2009 reports and the 2015 report are currently unavailable. Empirical research in Nepal would be necessary to better understand GoN disaster management priorities before the Gorkha earthquake. The 2009, 2011, and 2013 reports are indicative of growing pressure from international donors to develop grassroots capacity for disaster management. Though the GoN received criticism for its mismanagement of the 2015 Gorkha earthquake, many tenets of international best practice are visible in GoN disaster management policy.

A common theme in the GoN's biannual Disaster Reports from the 2000s is the need to prepare for the long-anticipated megaquake. The 2009 Disaster Report ominously eluded to the Gorkha earthquakes:

> Noting that no major earthquake has occurred … [in] the central Himalayan gap, over the past several centuries, seismologists...predict that any part of this segment could experience a major earthquake with a magnitude over 8 in the near future. (p. 109).

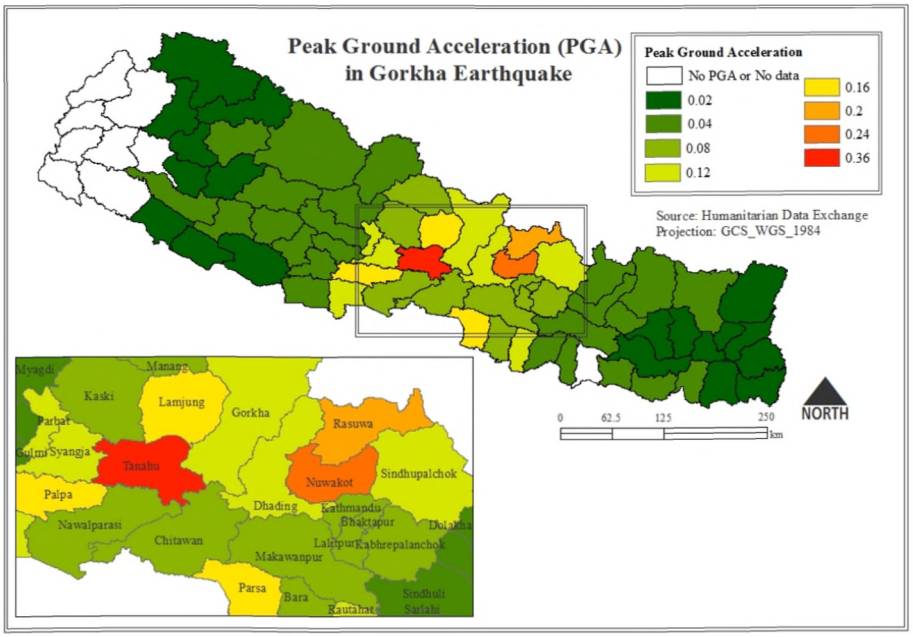
In addition to wreaking havoc on central Nepal, the Gorkha earthquake drew attention to the likelihood of a much larger earthquake in the near future. Seismologists hypothesize that the 2015 earthquake released only a fraction of the seismic pressure building along the fault line since the last major earthquake in 1344. Estimates place an impending 8.4M megaquake with an epicenter west of the 2015 earthquake (Hand & Pulla, 2015, p. 485). More than eighteen months after the Gorkha earthquakes, the GoN is yet to mobilize an effective nationwide recovery. Considering the high probability of a much larger earthquake, it is more imperative than ever that the GoN revisit its existing policies to reduce vulnerability.

The Gorkha Earthquake

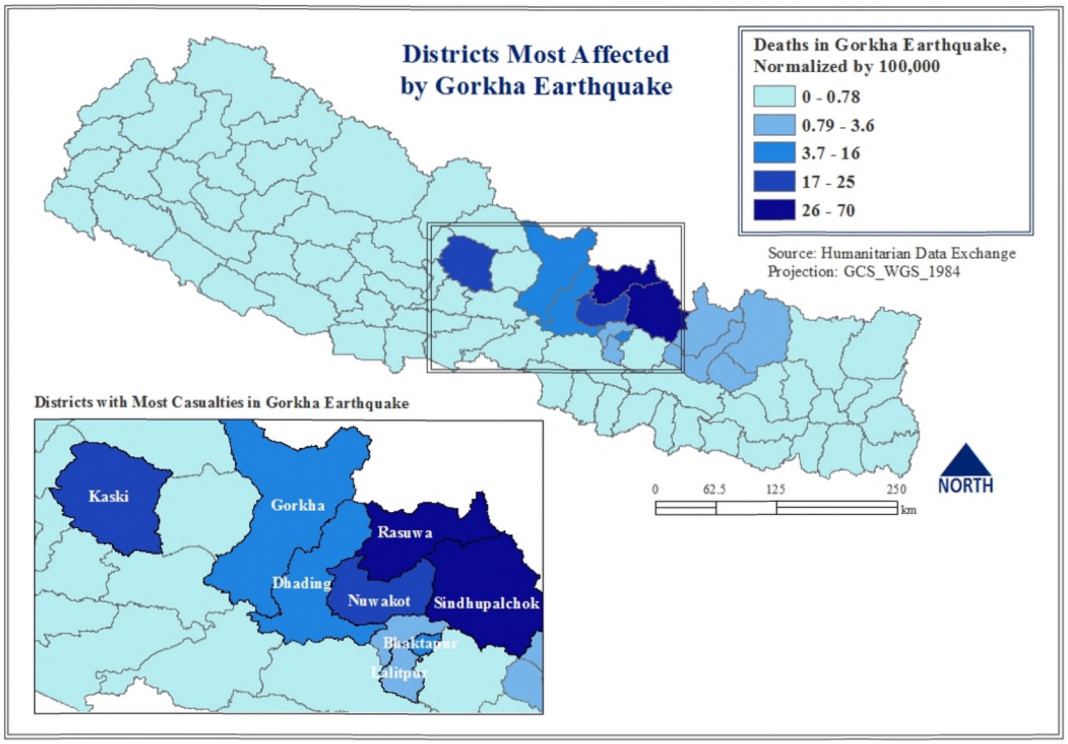
The Gorkha earthquake on April 25, 2015, with a moment magnitude scale of 7.8Mw, is the most destructive natural disaster in Nepal's modern history. The epicenter of the April 25, 2015 earthquake was in the eponymous Gorkha district. Though 80 km from Nepal's capital city, Kathmandu, the Gorkha earthquake caused severe damage to the densely populated capital city and the second largest city, Pokhara (Hand & Pulla, 2015, p. 485). The GoN's inefficiency in responding to the Gorkha earthquake can be explained partially by chaos in Kathmandu. Even 3 days after the earthquake, the Kathmandu airport struggled to accommodate the surge in traffic; within 4 days, rescue teams were yet to reach many districts surrounding the Kathmandu Valley (Sharma, 2015, p. 1819).

Gorkha Statistics[1]

8,891	Deaths
189,000	People displaced
605,000	Houses destroyed
288,000	Houses damaged



[1] (UN OCHA, 2017)



The above maps show Peak Ground Acceleration (PGA) and casualties in the Gorkha earthquake normalized by 100,000. PGA measures maximum ground acceleration during an earthquake, while the Mercalli or Richter scales measure the total energy released. Importantly, the above maps demonstrate that districts with higher PGA values did not necessarily have higher rates of casualties. Social vulnerability is a plausible explanation for the incongruity between PGA and casualty rates. Districts with higher normalized rates of casualties but lower PGA may have less seismically resistant structures or more vulnerable populations.

It is unclear if the casualties occurred as a result of the physical or social elements of the Gorkha earthquakes. Physical elements entail actual ground movement, subsequent landslides, and structural collapses; while social elements include access to emergency services, shelter camps, and financial resources. Researchers debate whether disasters can and should be separated from their effects (Dombrowsky, 1998, p. 20). To assess policy and management, it is

important to separate damage in terms of direct and secondary effects; policy interventions can do little to prevent unpredictable, extreme events like earthquakes from occurring but can be instrumental in determining the extent of secondary effects. As such, a deeper examination of the breakdown of casualties related to disasters in Nepal could shed more light on the efficacy of Nepal's disaster management policies.

In many cases, effective management before and after a disaster saves lives and reduces damage. In January and February 2010, Haiti and Chile, respectively, experienced large-scale earthquakes.[2] Though Chilean earthquake released 500 times more energy than the Haitian earthquake, effective policies and strong management significantly reduced the devastation of the Chilean earthquake (Useem et al., 2015, p. 93). Chile's strong building codes prevented thousands of casualties and insulated the government and private citizens from financial losses. Widespread private insurance coverage meant that the private sector absorbed much of the financial shock from the earthquake, allowing Chile's government to spend more on public reconstruction. The Chilean recovery from the Maule earthquake depended largely on what Useem et al. (2015) call "a mutually reinforcing combination of able national leadership and strong institutional practices" (p. 109). The leadership and institutions that made Chile's recovery possible may not exist in Nepal today but can be aspirational for future policy changes.

Definition of Terms

This project uses many terms commonly seen in disaster management literature, including "vulnerability," "risk" and "disaster." There is no singular definition of what qualifies as a disaster, and definitions vary across disciplines. Researchers squabble as to whether the

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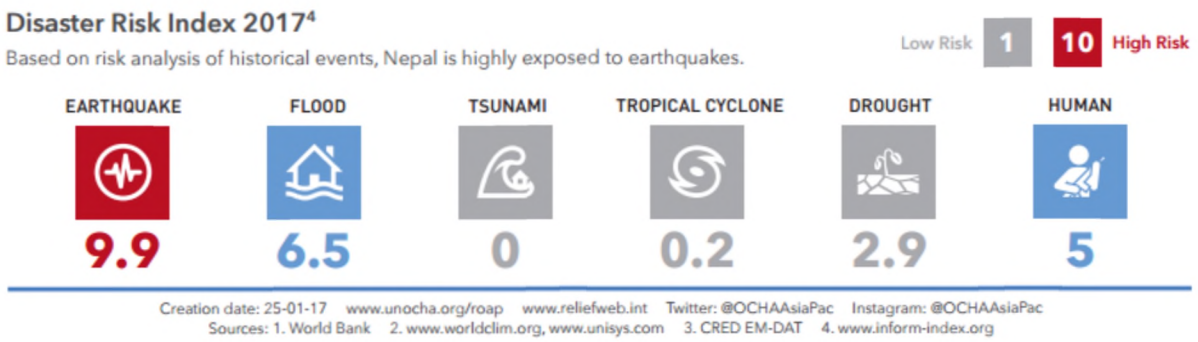
[2] The January 2010 Haitian earthquake had a Richter Scale magnitude of 7.0Mw; the February 2010 Chilean earthquake, known as the Maule earthquake, measured 8.8Mw.

term "disaster" refers to a natural event, the effects of a natural event, the social implications of an event, or all of the above. Regardless of the definition used, it is essential to consider the social component of disasters. As Lowell Carr (1932) explained, "...so long as the city resists the earth-shocks, so long as the levees hold, there is no disaster. It is the collapse of the cultural protections that constitutes the disaster proper" (p. 211). Most sociological definitions of disaster are similar, defining disasters as the extreme, sudden onset events that disrupt everyday life.

Enrico L. Quarantelli (2008), a leader and early founder in the field of disaster sociology, identifies six characteristics of disasters: 1) everyday community social functions and social institutions are suddenly interrupted, 2) many organizations cease operating or operate in a reduced manner, 3) local officials are unable to complete their usual work tasks, 4) most aid comes from distant areas, 5) nonlocal mass media outlets cover the crisis, and 6) high-ranking government officials and organizations become involved (p. 874). The Gorkha earthquake in Nepal certainly meets all of the above characteristics. Most other events in Nepal, such as smaller earthquakes, floods, and landslides, do not garner the attention of international organizations and the central government and would therefore not fit Quarantelli's (2008) definition of disaster.

Less catastrophic natural events, such as the 1988 Udaypur earthquake and the 2008 Koshi floods, significantly disrupted everyday community functions and encouraged nationwide policy changes. These events are therefore still defined as "disasters" for this study. The below infographic from the UN OCHA 2017 Nepal Country Profile highlights earthquakes and floods as the largest natural disaster risks in Nepal (UN OCHA, 2017). Based on the definitions used in

this project, the "human" disasters, a reference to the People's War from 1996-2006, are not considered disasters.



Quarantelli (2001) also breaks the term "disaster" into five categories: natural, technological, famine, epidemic, and conflict (p. 335). Some research includes all five categories as a definition of disaster. Researchers debate how to define famines, epidemics, and droughts (FEDs) within the field. Quarantelli (2001) argues to consider FEDs as "chronic stress settings rather than crisis operations" (p. 334). This project ascribes to Quarantelli's definition of disasters and focuses primarily on earthquakes, floods and landslides, though FEDs, avalanches, and cold waves are also common in Nepal. It is challenging to compare sudden onset disasters, like earthquakes and floods, with slow-forming disasters like FEDs. Governments are more likely to have advance information about slow-forming disasters, which can alter public response. Sudden onset disasters, on the other hand, require immediate, adaptive decision-making and often involve major reconstruction. In Nepal, floods and earthquakes have served as the main stimuli for policy innovation. Therefore, for this study, "disasters" are considered only to be sudden onset extreme weather events that require nonlocal responses.

Risk, vulnerability, hazard, and resilience are also complex terms in disaster management literature. Cutter et al. (2003) simply define vulnerability as "potential for loss" (p. 242). Cutter and Finch (2008) later expanded on this definition, explaining that vulnerability is "driven by

exposure, sensitivity and response and ... requires measurements of both environmental and social systems..." (p. 2301). This project uses Flanagan et al.'s (2011) definition of vulnerability as "the extent to which persons or things are likely to be affected" (p. 1). Various indices use different variables to define vulnerability. In general, vulnerability refers to social factors that influence a given community's potential for loss. Cutter et al.'s (2003) hazards-of-place model include indicators of gender, socioeconomic status, race/ethnicity, age, commercial development, employment, rural/urban, residential property, infrastructure, homeowner occupation, professional occupation, family structure, education, rate of population growth, medical services, dependence on social services, and special needs/disabled populations (p. 246). The data for many of these indicators are unavailable at the district-level in Nepal. This project, therefore, uses indicators similar to those in Flanagan et al.'s (2011) study, which breaks vulnerability into four categories: socioeconomic status, household composition/disability, minority status/language, and housing/transportation (p. 4). While vulnerability represents the social factors of disaster risk, "hazard" can be explained as the biophysical component of disaster risk. Disaster risk is typically considered a function of hazard and vulnerability. A simplified explanation of the relationship between risk, vulnerability, and hazard is: Risk = Hazard + Vulnerability (Islam & Lin, 2016, p. 62).

Methodology & Organization

This project is divided into two chapters. The first chapter is primarily descriptive and spatially presents biophysical and social vulnerability factors for Nepal. The second chapter examines concepts in international best practice for disaster management and existing policies in Nepal. These chapters are designed to provide a preliminary case study of vulnerability and policy in Nepal. The final section of this project explains conclusions and next steps for

research. This paper uses the term "GoN" to refer to any agencies officially related to the Government of Nepal. Due to lack of transparency related to government activities and the absence of empirical research for Nepal, it is often unclear which agencies and/or individuals are directly behind a given policy decision. A deeper empirical study would delve deeper into the nuances of GoN organizations and individual personalities involved in decision-making.

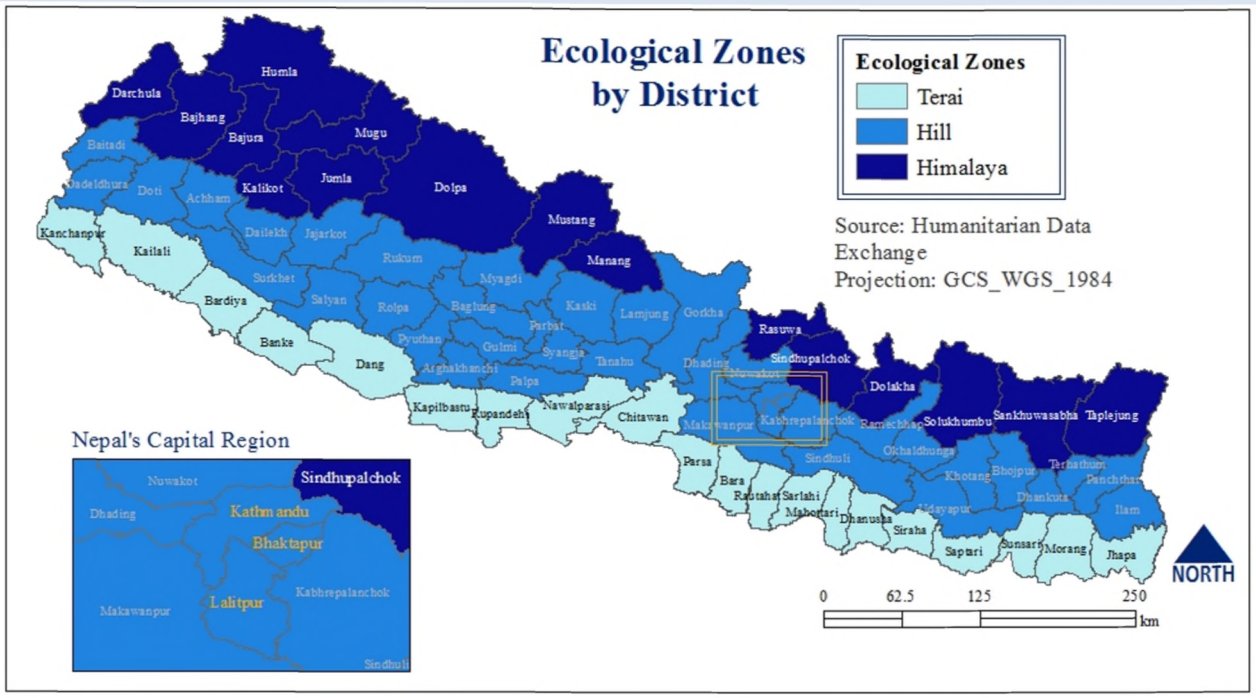
All maps and tables were created by the author using ArcMap 10. All maps are graduated color maps, using a Natural Breaks (Jenks) classification and display district-level boundaries for Nepal. Data sources for maps are available in the bibliography section. All maps are projected in GCS_WGS_1984; all scales measure distance in kilometers.

CHAPTER 1: VULNERABILITY IN NEPAL

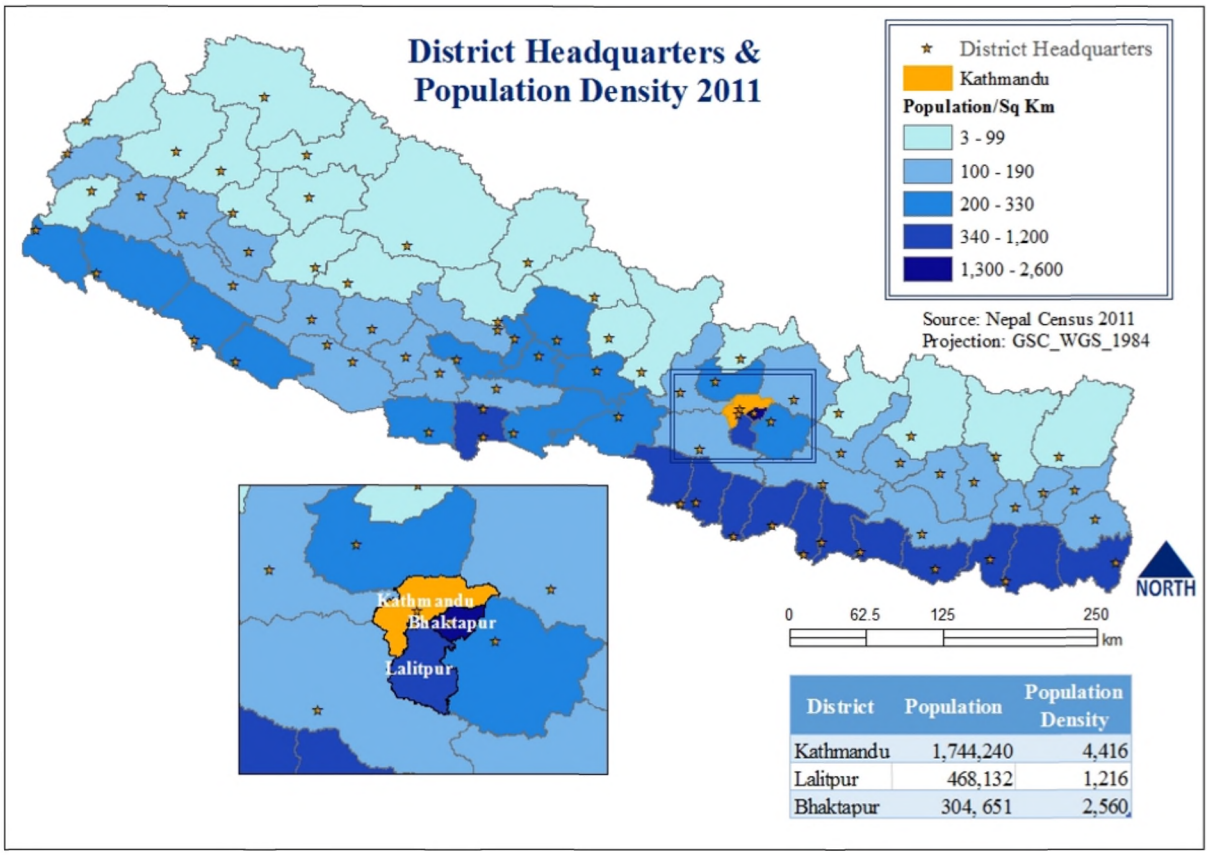
Social vulnerability is an important, often missing, component of effective disaster management policies. The Gorkha earthquake disproportionately affected vulnerable populations in Nepal. The UNDP (2016) estimates that 26% of damaged houses had female heads, 41% were *dalits* or indigenous communities, and 23% were senior citizens (p. 1). Though extensive research exists on social vulnerability affecting different castes, minorities and ethnic groups in India, such robust research is lacking for Nepal. The 2009 and 2011 Disaster Reports focus on natural hazard risks more than social vulnerability. Understanding the complex social and environmental factors that affect Nepal's vulnerability to natural hazards is essential in considering Nepal's disaster management priorities, policies, and opportunities.

The social vulnerability index presented in this chapter demonstrates the spatial variability of vulnerability throughout Nepal. Social vulnerability is inherently challenging to quantify and is often sacrificed to provide deeper analysis of biophysical vulnerability. Cutter et al. (2003) suggest that vulnerability indices should consider social vulnerability (age, race, health, income, etc.) as well as place vulnerability (urbanization, growth rates, etc.) (p. 243). The index presented in this chapter only includes social vulnerability, as much data related to place vulnerability were unavailable. A future project would benefit from incorporating the factors considered in Cutter et al.'s (2003) hazards-of-place model of vulnerability. Furthermore, an extension of this project would likely use VDC-level data. This project uses district-level data as VDC-level data was available for only a small number of variables.

BIOPHYSICAL VULNERABILITY



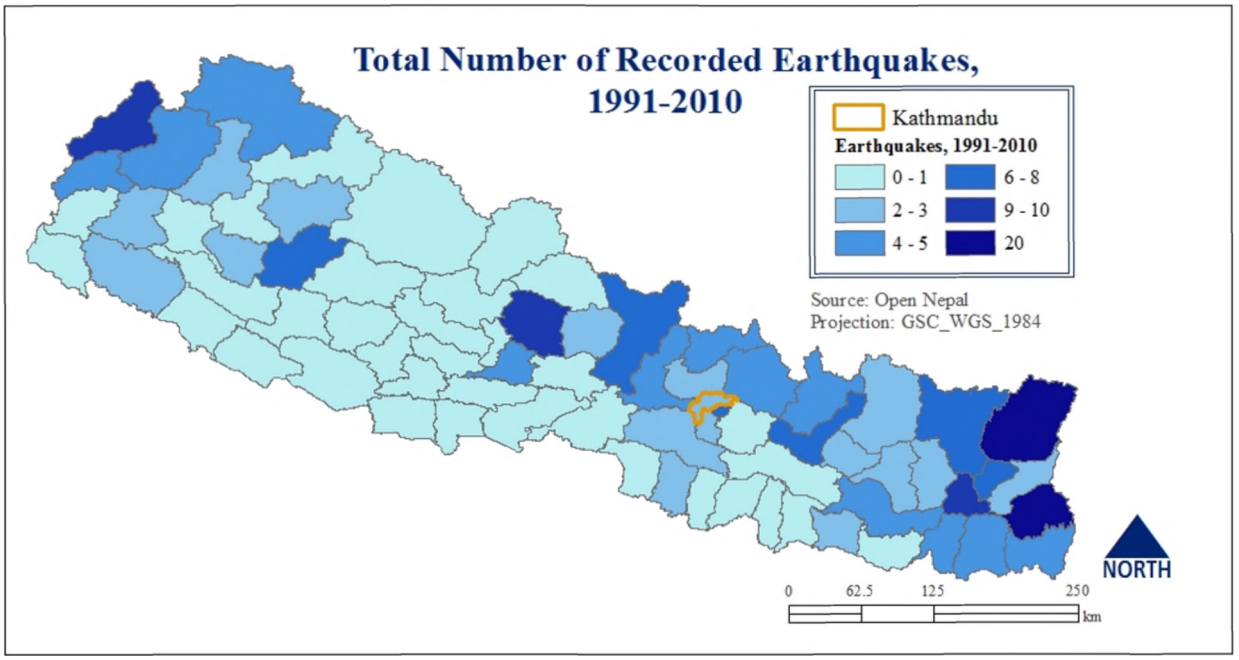
"Biophysical vulnerability" refers to the natural factors influencing a place's vulnerability. Nepal's varied topography exposes the population to a range of natural hazards and complicates the implementation of effective nationwide disaster management plans. A country slightly larger than the state of Arkansas, Nepal has three distinct ecological zones ranging from the subtropical southern Terai region to the cold mountainous Himalayan region in the north (see above map). Nepal's complex climate results in a range of natural hazards. The 2011 Disaster Report identifies floods, landslides, fires, epidemics, and droughts as "regular disasters," occurring throughout the country with some frequency; small earthquakes occur often, though occasional large earthquakes can be devastating (*Nepal Disaster Report,* 2011, p. 8). Avalanches and cold waves are also common in parts of Nepal. The below map demonstrates that the most densely populated districts in Nepal are those in the low lying, semi-tropical Terai region along the southern border with India.



District	Population	Population Density
Kathmandu	1,744,240	4,416
Lalitpur	468,132	1,216
Bhaktapur	304, 651	2,560

The following section demonstrates the spatial distribution of hazard risks in Nepal. Earthquakes, floods, fires, and landslides are well documented and therefore discussed in depth in this section. Though some risks, such as avalanches and floods, are more common in specific ecological zones, it is clear that each district faces more than one type of hazard risks. Based on the definition of disasters as sudden onset events, FEDs are not considered in this section, though maps of epidemics and droughts are provided in Appendix B. Maps of cold waves and avalanches are also included in Appendix B. These maps only consider the frequency of extreme events because available data do not provide strong evidence as to the severity of individual events. A future study with more robust data would account for variety in the severity of different extreme hazard events. During the time frame presented (1991-2010), the only major disaster event was the Koshi flood of 2008.

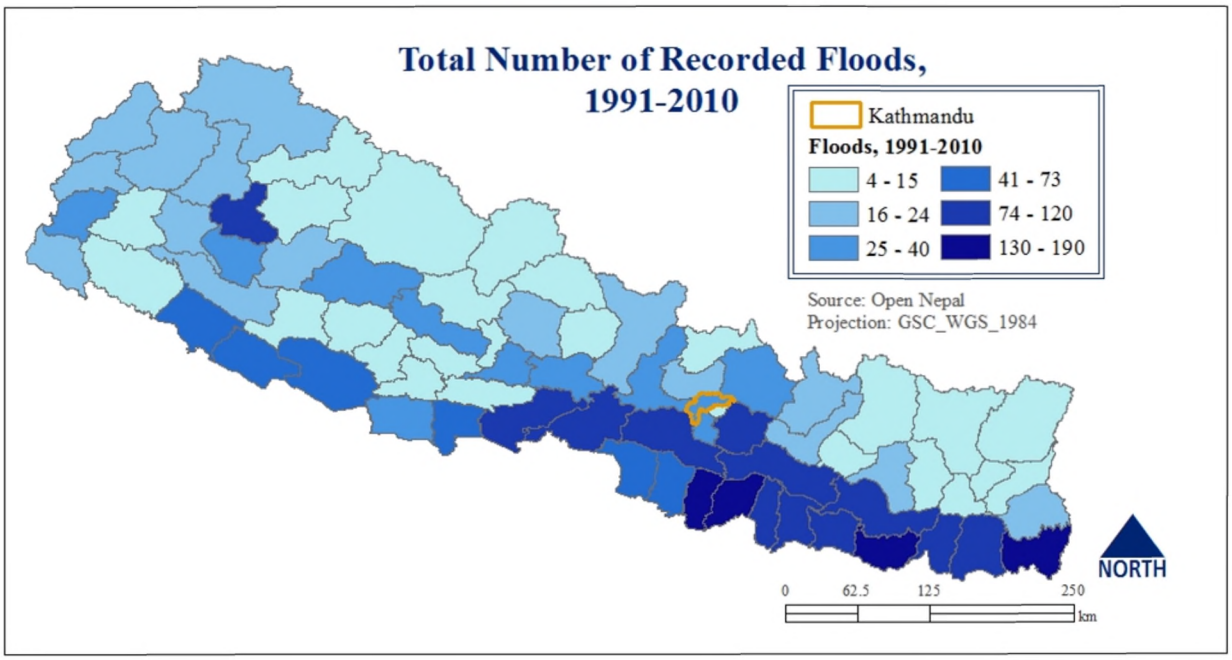
Earthquakes



Inherently unpredictable, earthquakes present a unique challenge to policy makers and planners in Nepal. The Seismic Hazard Mapping and Risk Assessment for Nepal identified 92 active faults throughout the country (*Nepal Disaster Report*, 2011, p. 5). Failure to plan for and mitigate earthquakes can have devastating social and economic consequences. The 1988 Udaypur earthquake, with a moment magnitude of 6.5Mw, killed 721 people, injured 6,553 people, and made 460,000 people homeless. The earthquake caused 78.5 million US dollars of damage to housing, 62.4 million dollars of damage to roads and bridges, and 32 million US dollars of damage to schools (*Nepal Disaster Report*, 2011, p. 73). The 2011 Disaster Report notes that the Udaypur earthquake brought to light the overall inadequacy of Nepal's current building practices, "this earthquake showed that the current building construction practice was not strong enough to resist even moderate earthquakes" (p. 79). Tragically, the Gorkha earthquake provided supplemental evidence to shortcomings in Nepal's building codes.

The earthquakes shown in the above map were mostly minor quakes, though eastern Nepal experienced a major earthquake in 2011. The Nepal-Sikkim earthquake on September 18, 2011 had a moment magnitude of 6.9Mw. The earthquake affected 7,746 families in 12 districts in eastern Nepal and damaged more than 6,000 buildings (Hada, 2014, p. 354). Even after the devastation of the Udaypur earthquake, the GoN was unable to implement strong building codes and management policies to prevent the 2011 earthquake from becoming a disaster.

Floods



This map demonstrates that no district in Nepal had fewer than 4 floods between 1991 and 2010, and that floods predominantly occur in the semi-tropical Terai region in southern Nepal. It is important to note that the characteristics and severity of floods vary throughout the country. Though more common in the Terai, floods in the Himalayan region can be particularly devastating. Glaciers in the high Himalayan region are melting at an increasing rate, causing an increase in glacial lake outburst floods (GLOF) (Moench & Dixit, 2004, p. 42). In 1985, the Dig

Tsho moraine dam collapsed, releasing freezing glacier melt and causing over 3 million US dollars of damage (ICIMOD, 2011, p. 4). The International Centre for Integrated Mountain Development (ICIMOD) conducted a major study of glacial lakes in the Nepal Himalayas in 2009. To reduce GLOF risks, ICIMOD (2011) recommended implementing early warning systems, investing in mitigation, and engaging communities in risk reduction (p. 84).

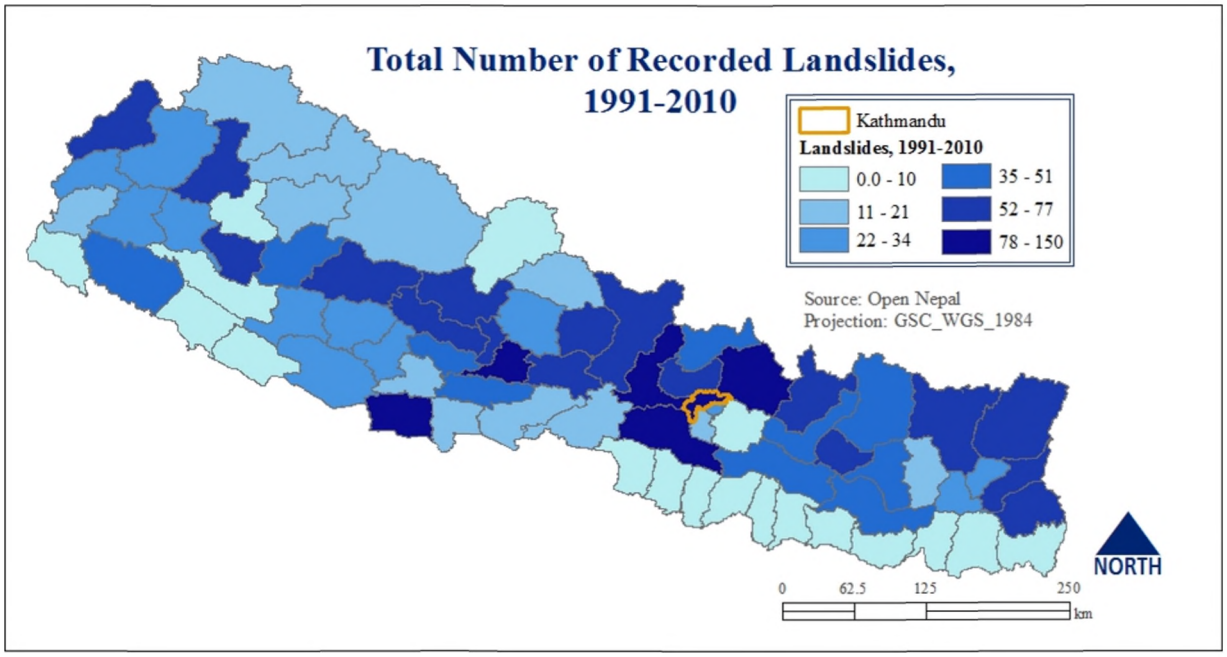
The two most severe floods between 1991-2010 were the 1993 flood in the Mahabharat Range and the 2008 Koshi flood. The 1993 flood affected over 8,000 families in Makawanpur and 3,000 families in Dhading (*Nepal Disaster Report*, 2011, p. 81). The 2011 Disaster Report claims there was "no preparedness at any level" and that poor communication with officials led to unfounded rumors (*Nepal Disaster Report*, 2011, p. 85). Still, the 2011 Report argues that the management of the 1993 flood was the best in Nepal's history, due largely to lessons learned from the 1988 Udaypur earthquake (*Nepal Disaster Report*, 2011, p. 86).

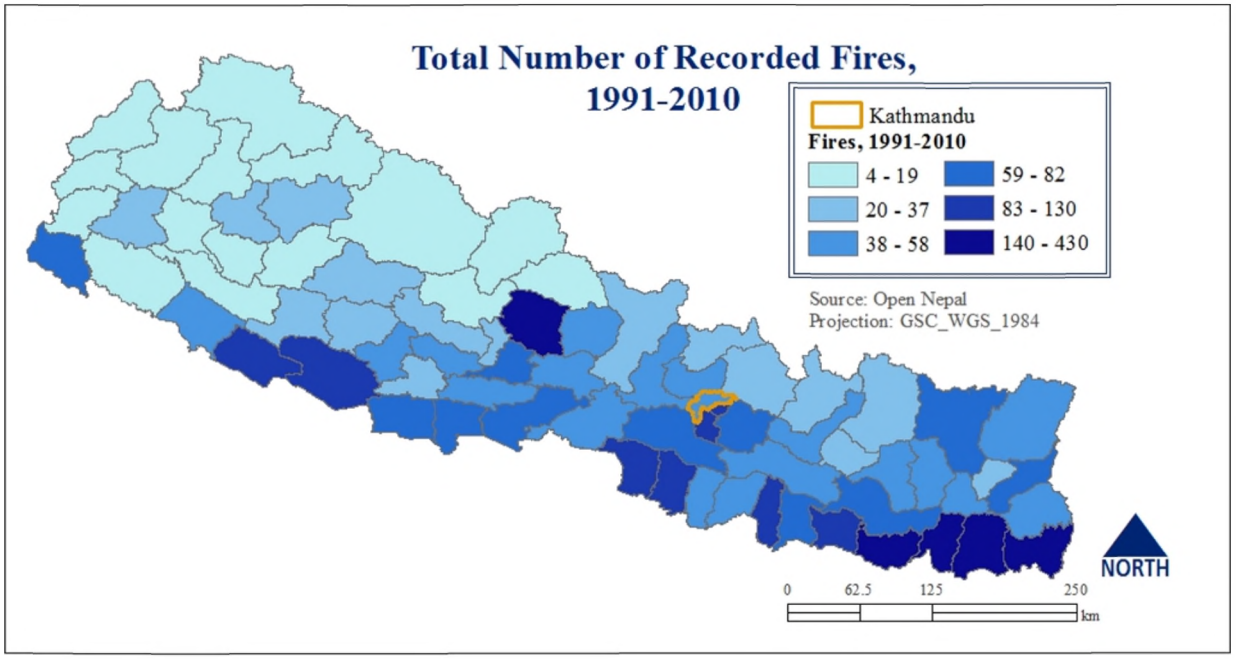
While the floods in Makawanpur and Dhading may be examples of successful management, the Koshi flood of 2008 is a clear example of mismanagement. The Koshi Flood of 2008 caused 56 casualties, 55 of which were from illnesses contracted in displacement camps (*Nepal Disaster Report*, 2011, p. 92). That only one casualty occurred during the actual flooding in Koshi is an obvious indication of mismanagement. The GoN failed to provide clean, safe camps with adequate resources, leading to all but one of the casualties in the Koshi flood. In addition to casualties, the Koshi flood damaged almost 300km of road, 6 bridges, and 67 culverts (*Nepal Disaster Report*, 2011, p. 93). The east-west highway, one of Nepal's most important transport routes, was impassable 3 months, causing major disruptions to national and international trade. The Flood also caused major damage to phone lines for 2 days (*Nepal*

Disaster Report, 2011, p. 97). These infrastructural failures indicate a troubling lack of preparedness.

Landslides & Fires

Landslides, fires, cold waves and avalanches, however common and devastating, are less likely to meet Quarantelli's (2008) criteria for defining disasters. Unlike the Gorkha earthquake, these "regular disasters" do not receive as much attention from international media outlets, aid organizations, or the central government. Furthermore, landslides, avalanches, fires and cold waves are less likely to motivate major policy change, as their effects are generally more spatially limited than earthquakes and floods. The below maps indicate that landslides and avalanches are generally more frequent in the northern Himalayan region, while fires and cold waves are more frequent in the Terai in the south. Both landslides and fires occur at relatively high frequencies; between 1970 and 2015, landslides constituted 23% of all disasters in Nepal (UN OCHA, 2017).





Like social vulnerability, natural hazard risks vary throughout Nepal. Frequent, small-scale natural disasters such as fires, droughts, cold waves, and avalanches cause severe damage to livelihoods and infrastructure, not to mention human casualties. Occasional, large-scale disasters, like the 1988 Udaypur earthquake and the 2008 Koshi flood, are often transformative for citizens and government officials. These major disaster events sparked the development and implementation of new policies to improve disaster management, most notably the National Calamity Relief Act (NCRA) and Local Self-Governance Act (LSGA). A much longer study would include important biophysical vulnerability factors, such as slope, access to water, etc., to assess natural hazard risk more thoroughly. A complete hazard vulnerability index, coupled with the social vulnerability index presented in the next section, would paint a much clearer picture of risk and vulnerability in Nepal.

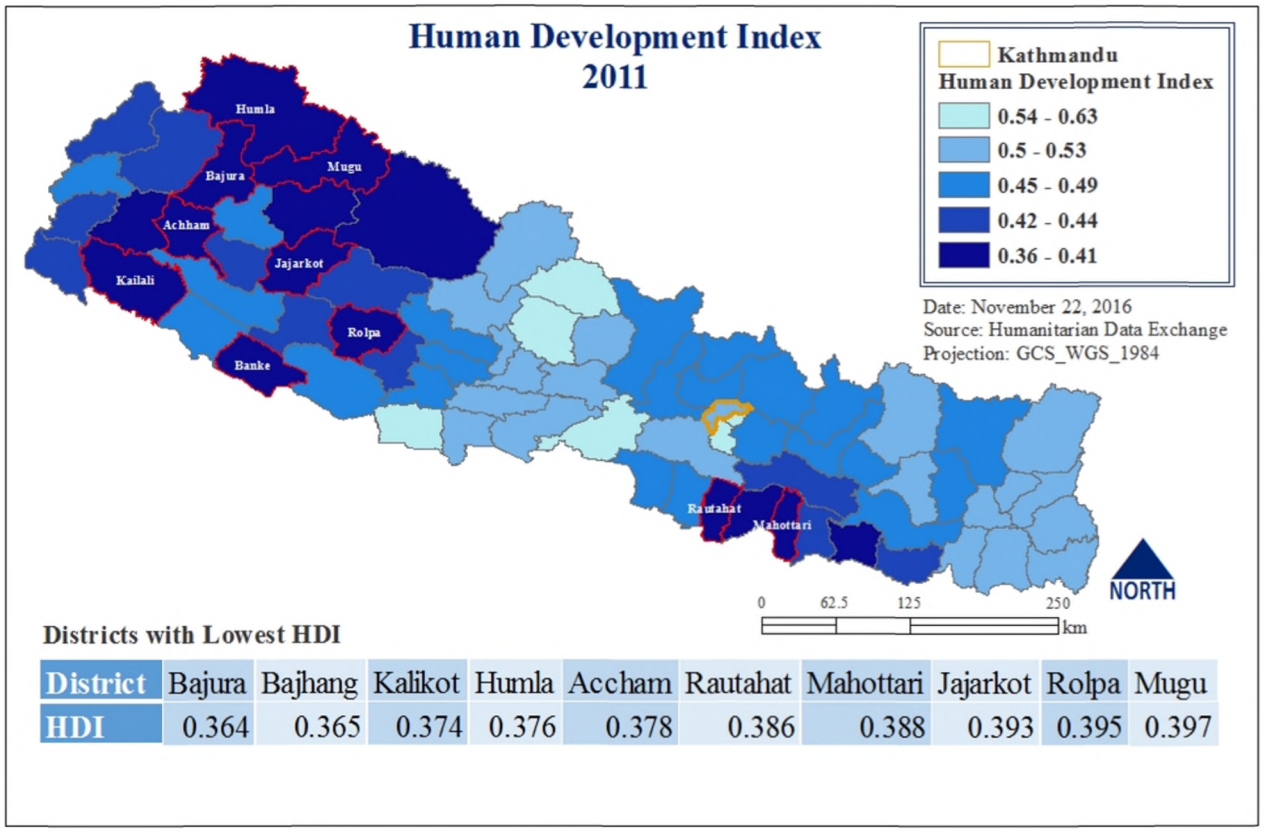
SOCIAL VULNERABILITY

This section presents a map of the final Social Vulnerability Index, in addition to socioeconomic and minority status. Maps for other variables can be found in Appendix C. Variables for this index were included based on availability. An expansion of this study would provide a more nuanced look at some of the variables presented here, especially socioeconomic and minority status. Both variables are complex and important in understanding social vulnerability. Due to limited data availability, this project presents simplified variables for both socioeconomic and minority status.

This index uses eight variables to assess social vulnerability in Nepal representing: socioeconomic status, minority status, gender ratio, homeownership rates, absenteeism, average household size, disabled populations, and dependency ratio. Each variable was downloaded in Excel and joined to a district-level shapefile of Nepal's 75 districts. Resultant shapefiles were rasterized (ArcToolbox > Conversion Tools > Feature to Raster). A model was created in ModelBuilder using Site Analysis Tools in ArcToolbox. Rasterized files for the eight variables were reclassified so that a high value of each variable corresponded to higher vulnerability. The minority status variable was reclassified to be categorical, such that 0=not minority, 1=minority. A weighted overlay was created in ModelBuilder; all variables were weighted equally (Spatial Analyst Tools > Weighted Overlay > Equal Influence). Finally, a conditional function was used to identify districts with the greatest vulnerability (Spatial Analyst Tools > Conditional > Con, SQL: socvul=6 OR socvul=7).

Social Vulnerability Index Variables				
Variable	**Description**	**Calculation**	**Effect on Vulnerability**	**Source**
hdi	Socioeconomic status Human Development Index HDI (life expectancy, education, per capita income)	N/A	High HDI = Low Vulnerability	HDI
min	Minority Status whether or not majority population in district is national ethnic majority	0=Majority ethnic group is Brahmin or Chhetri 1=Major ethnic group is national minority	High Minority Population = High Vulnerability	Nepal, National Planning Commission Secretariat. *Population Monograph of Nepal: Volume II (Social Demography).* Central Bureau of Statistics, 2014. Web. 30 November 2016.
sex	Female Population % of the population that is female	(female pop)/(total pop)	High Female Pop = High Vulnerability	DistricWise Population 2011_V1
home	Homeownership % of homes that are owner-occupied (as opposed to rented, institutional or other)	(owned)/(total)	High Homeownership = Low Vulnerability	Nepal Household and Population Data at District Level, Hhld_Table1
absent	Absentee Population % of population absent from household	(absent population)/total pop	High absenteeism = High Vulnerability	Nepal Household and Population Data at District Level, Hhld_Table11
hh	Household Size average household size	N/A	High average HH size = High vulnerability	Nepal Household and Population Data at District Level, Indv_Table12
disab	Disabled Population % of the population with disabilities (physical, blindness, deafness, deaf-blind, speech problem, mental disability, intellectual disability, multiple disabilities)	(total pop-pop without disabilities)/total pop	High disabled population = High Vulnerability	Nepal Household and Population Data at District Level, IndTab24
age	Dependency Ratio Ratio of dependent population to working age population	(population over age 60)/(population under age 15 normalized by 100)	High Dependency Ratio = High Vulnerability	Nepal, National Planning Commission Secretariat, 2014, p. 108

Socioeconomic Status

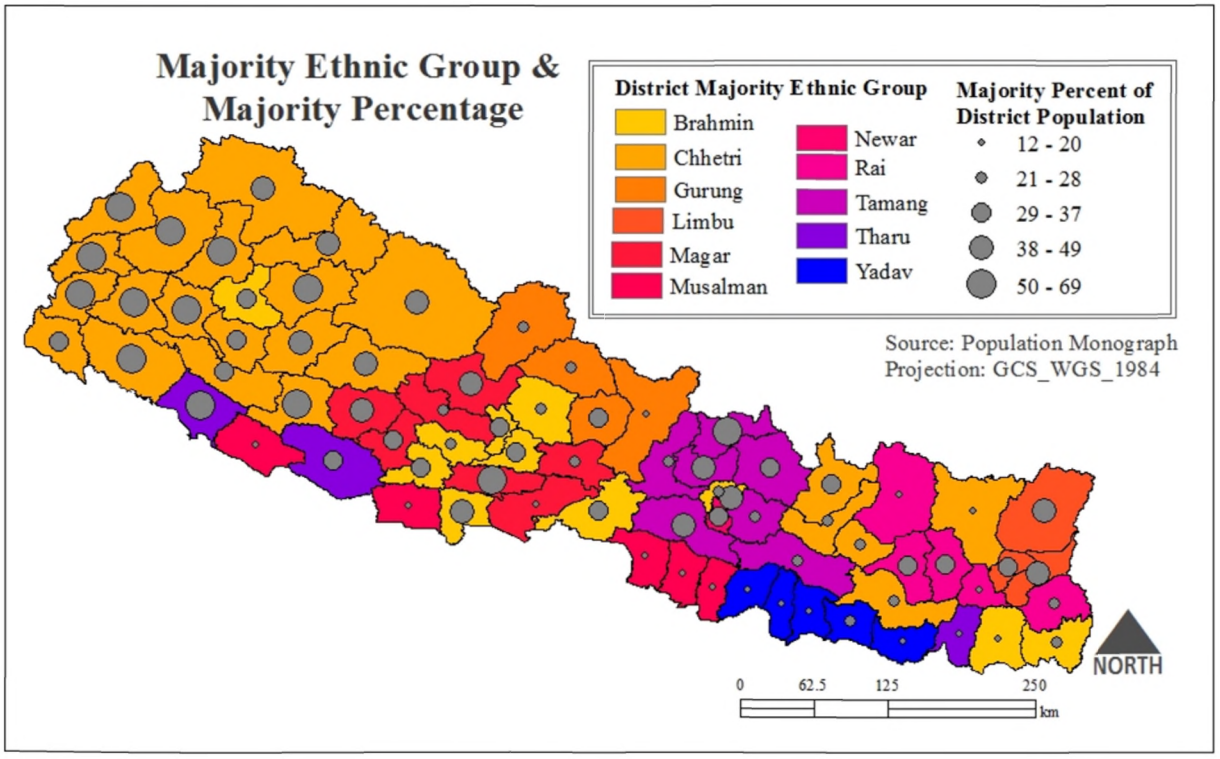


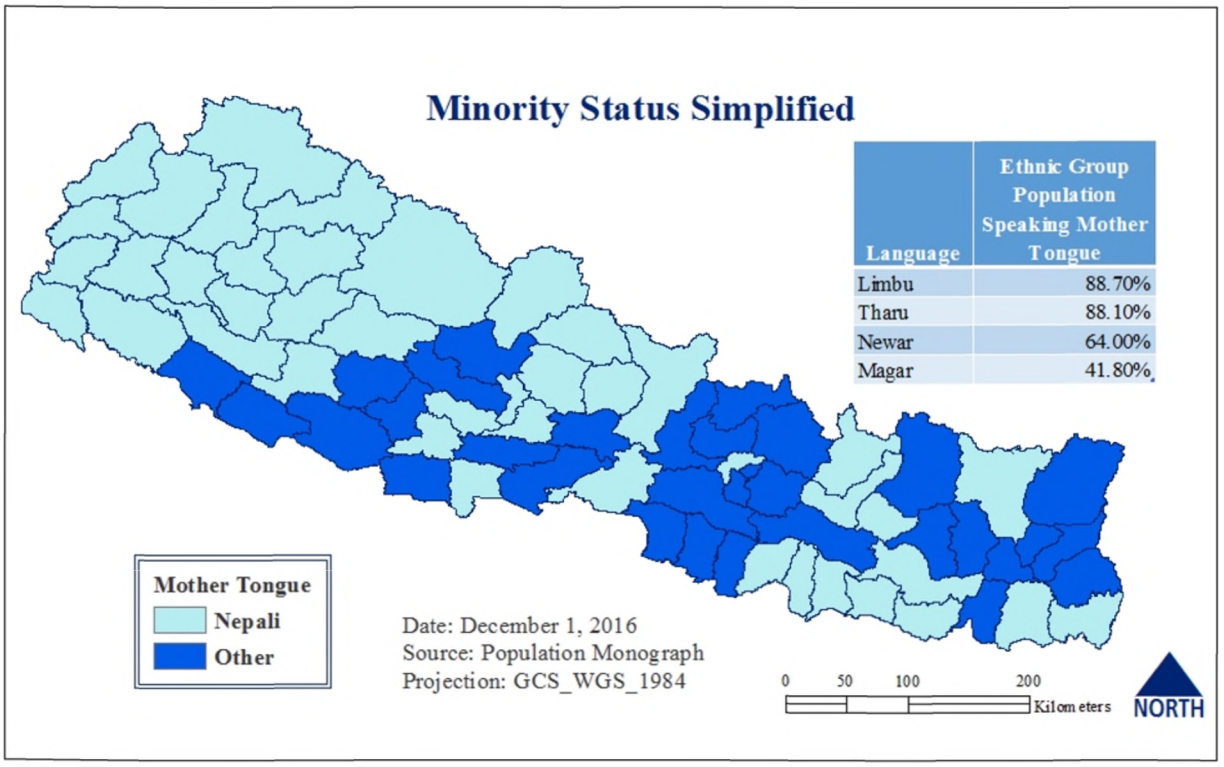
Districts with Lowest HDI

District	Bajura	Bajhang	Kalikot	Humla	Accham	Rautahat	Mahottari	Jajarkot	Rolpa	Mugu
HDI	0.364	0.365	0.374	0.376	0.378	0.386	0.388	0.393	0.395	0.397

This map of the HDI by district indicates that western Nepal tends to be less developed than central and eastern Nepal. The HDI measures life expectancy, education, and per capita income and is therefore a useful composite variable to represent socioeconomic status. Many of the lowest scoring districts are also Nepal's most remote. Some of the districts with the lowest HDI are also some of the most densely populated. Rautahat, Sarlahi, Mahottari, and Siraha are located in the densely populated terai region bordering India. The tropical climate and low terrain make these regions highly susceptible to tropical diseases like malaria and flooding during the monsoon season.

Minority Status





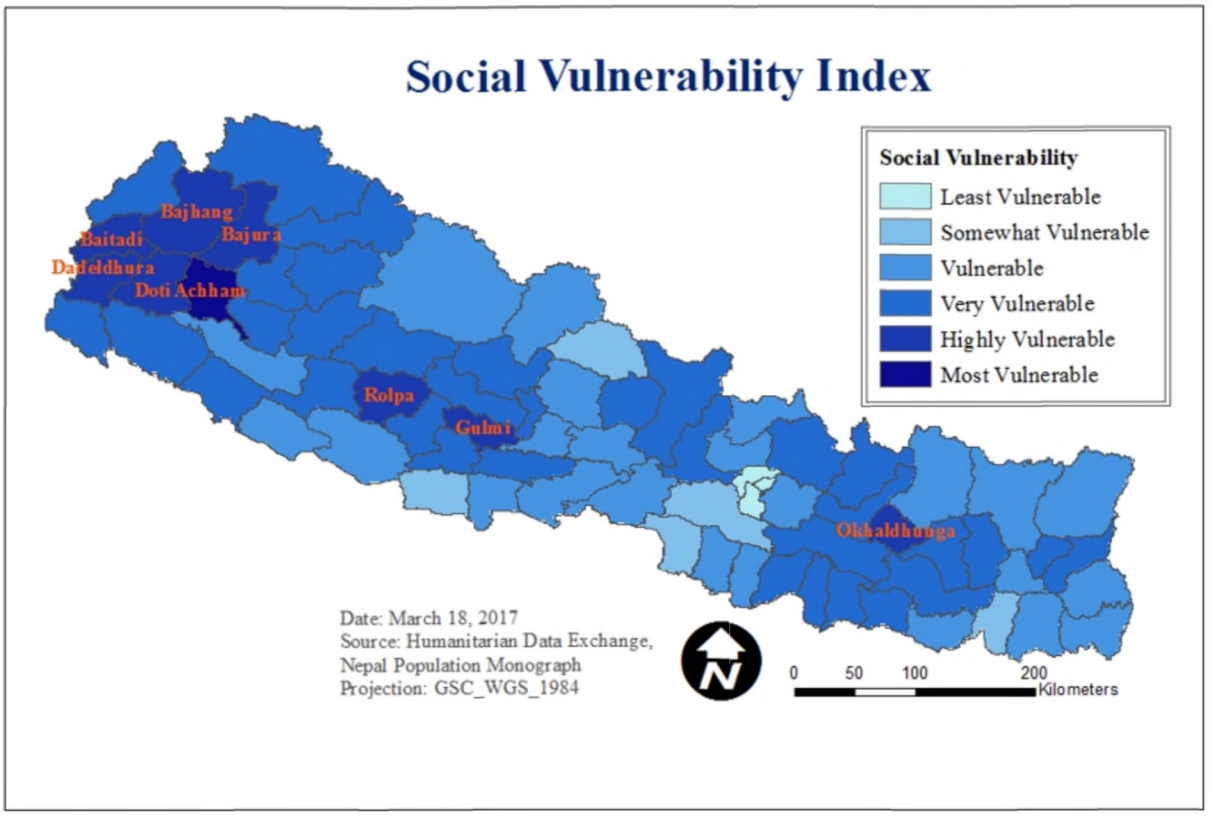
Minority status and language are important indicators of social vulnerability in Nepal. A caste-based society, Nepal has many marginalized groups who have been excluded from political process for decades. Minorities face unique risks in emergency situations because they tend to have less access to relief materials, often published in the national language (Flanagan et al., 2011, p. 6). Nepal has 123 different languages, and only 44.64% of Nepal's 27 million people speak the national language, Nepali, as their first language (Nepal National Planning..., 2014, p. 55). Brahmin and Chhetri constitute what is commonly known as the higher castes in South Asia. The minority status map shows that the remote western regions are mostly dominated by majority ethnic groups, while the densely populated Terai, in addition to eastern and central Nepal, have large minority populations. This map demonstrates that districts in Nepal are highly diverse; in many districts, the majority group makes up less than 30% of the district population (see Appendix D).

Nepali is most common in the hill region of Nepal and significantly less common in Terai and high Himalayan regions (Nepal National Planning..., 2014, p. 55). Language competence is challenging to depict geospatially, especially since many people in Nepal speak more than one language; according to the 2011 Census, 41% of the population was at least bilingual (Nepal National Planning Commission Secretariat, 2014, p. 51). While many people in the Terai and mountain regions might have some knowledge of Nepali, the 2011 Census does not provide sufficiently detailed data to determine if the population can understand complex reconstruction documents and forms in Nepali.

Cutter et al (2003) argue that race and ethnicity can influence social vulnerability in a number of ways. Minority groups tend to lack access to resources and often face political marginalization (Cutter et al., 2003, p. 253). Exclusion from political processes is a prominent

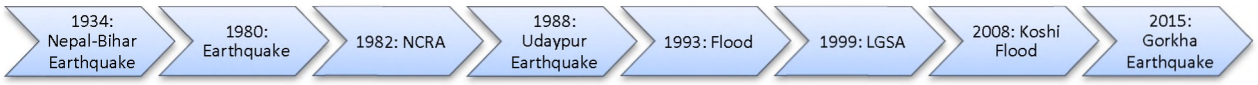
consideration in caste-based Nepal. Askvik et al (2010) argue, "members of lower castes have been excluded from political representation and economic opportunities…Today caste discrimination is officially illegal but it has not disappeared" (p. 420). This project uses a simplified depiction of caste and ethnic groups to depict minority status. The simplified map identifies whether or not the major ethnic group in each district are native speakers of Nepali. A future project would include deeper research into methods for quantifying minority status in highly diverse societies. Given Nepal's linguistic and ethnic diversity, this simplified binary metric omits some factors influencing social vulnerability.

Social Vulnerability Index



This social vulnerability index indicates higher vulnerability in western Nepal. These results are particularly worrisome, as geologists anticipate that Nepal's next megaquake will likely be in western Nepal (Hand & Pulla, 2015, p. 485). The index also demonstrates surprising pockets of vulnerability in the hill region in Ropla, Gulmi and Okhaldhunga. An expansion of this project would use ward- or VDC-level data instead of district-level data. The notably low vulnerability the Kathmandu Valley region indicates that this index suffered from aggregating data to the district level. Kathmandu, Bhaktapur, and Lalitpur likely have communities with varying degrees of vulnerability, but the inequality in those districts skewed the index results. Again, a future study using disaggregated data would more accurately demonstrate social vulnerability across the country.

CHAPTER 2: DISASTER MANAGEMENT IN NEPAL



This chapter delves into the evolution, content, and enforcement of Nepal's disaster risk reduction and management policies, primarily the 1982 National Calamity Relief Act (NCRA) and the 1999 Local Self-Governance Act (LSGA), and the extent to which these polices align with international best practice in disaster management. The 2009 Disaster Report calls the GoN's disaster planning strategies "reactive...with rescue and relief as its key objective" and response to disasters "top heavy" (p. 152). Nepal's existing disaster management policies exemplify two key components of disaster management best practice: mitigation and decentralization. The Natural Calamity Relief Act (NCRA) theoretically justifies increased emphasis on mitigation and risk reduction, while the Local Self-Governance Act (LSGA) justifies decentralized leadership in recovery and reconstruction. Though both concepts have legal backing, it is evident that neither the NCRA nor the LSGA has been operationalized effectively. The frameworks and fundamental ideas of the NCRA and LSGA are strong, but it is clear that both policies require revision to be effective during Nepal's next disaster.

In the past, major disasters have sparked policy innovations in Nepal. The Udaypur earthquake of 1988, for instance, motivated the GoN to establish stronger building codes (Kreimer & Preece, 1991, p. 132). The 1974 Deurali landslide in Pokhara laid the groundwork for the creation of the National Calamity Relief Act (*Nepal Disaster Report*, 2011, p. 8). It is still too early to determine the long-term policy implications of the Gorkha earthquake. Nevertheless, it is certain that the Gorkha Earthquake, the largest modern disaster in Nepal, will have some effect on disaster management policy in Nepal. By analyzing the state of Nepal's

existing disaster management policies, this project hopes to identify areas of improvement for policy revisions following the Gorkha Earthquake.

Defining best practice is a challenge in any discipline. What criteria determine best practice? How can best practices be measured? Who sets such criteria? Should development practitioners or academics define what constitutes best practice? Where does authority in best practice come from? This project argues that best practice comes both from academic and practical sources. Empirical academic literature provides critical insight into what does and does not constitute a best practice. "Gray literature," such as UN guides and publications, are also instrumental in shaping what constitutes best practice. International public agencies have significant clout in determining disaster management policy in developing countries like Nepal. In theory, empirical research informs UN guides and publications on best practices; as such, the practices outlined in the two bodies of work should coincide. This chapter considers sources related to mitigation and decentralization in disaster management. Academic sources were selected based on certain criteria. Only sources published 1) within the last 10 years, 2) in peer-reviewed journal articles, and 3) related to developing countries were considered relevant for this literature review. Practitioner publications come from the World Bank and United Nations International Strategy for Disaster Reduction (UNISDR).

Best practice also stems from case studies. One particularly useful case study is Michael Useem, Howard Kunreuther, and Erwan Michel-Kerjann's 2015 book *Leadership Dispatches: Chile's Extraordinary Comeback from Disaster*. Useem et al.'s book catalogues the Chilean government's innovative management strategies which were responsible for Chile's swift and effective recovery from the 2010 Maule Earthquake. Though this text does not address disaster management in developing countries, its importance in the field of disaster management merits

inclusion in this project. Other academic case studies come exclusively from developing countries, mostly from the Asia-Pacific region. Case studies were collected using the following databases: Web of Science, Applied Social Sciences Index and Abstracts, and Social Science Research Network.

Each disaster is unique, and lessons learned from the management of one incidence may not always be applicable to other cases. For a number of reasons, it is ill advised to apply the principles and policies that facilitated Chile's speedy recovery to Nepal. The Chilean government benefitted from strong local institutions, a predominant culture of individual responsibility and preparedness, and robust national copper reserves. At the time of the 2015 earthquake, the GoN was still reeling from a decade of internal conflict, which impeded local elections and slowed development. Nonetheless, cases of deft disaster management can provide a roadmap for policy making in Nepal. The policies in place and any gaps in implementation before the Gorkha Earthquake were shaped by Nepal's tumultuous civil war and ongoing political instability.

The People's War

Before exploring Nepal's disaster management policies, it is important to understand the politics behind said policies. Nepal's current political climate, much like its topography and demography, is complex. After a decade of conflict, the Maoist insurgency or the "People's War" in Nepal came to a close in 2006, with more than 13,000 lives lost and at least 392 billion Nepali Rupees of public property damage (Shakya, 2009, p. 2). In August 2016, Pushpa Kamal Dahal's election as Prime Minister marked the 25th leadership change in 26 years ("The Cost of," 2016). For decades, Nepal has struggled for democracy and independence from its neighboring

superpowers, China and India. More than 10 years after the conclusion of the Maoist insurgency, Nepal's political climate is still in transition.

At the time of the Gorkha Earthquake, Nepal was still a relatively young democracy, recovering from a decade of civil war and centuries of political oppression. Anand Swaroop Verma and Guatam Navlakha (2007) claim that "the struggle of the Nepalese people against the monarchy is as old as the kingdom itself" (p. 1839). Throughout the 20th century, popular uprisings in Nepal struggled to eliminate an oppressive feudal system. In 1950, the Indian government undermined the Nepalese effort to overthrow the Rana autocracy by helping the king regain power (Verma, 2007, p. 1839). In 1961, King Mahendra sparked a royal coup to end Nepal's first democratic government, replacing the Nepali Congress with the "partyless" Panchayat system. From 1961 to 1990, "the king wielded absolute power, governing through a largely rubber-stamp government and national assembly whose members were not permitted to identify themselves with any party or ideology" (Khadka, 1991, 694).

On February 13, 1996, after decades of frustration with Nepal's feudal and autocratic regimes, the Communist Party of Nepal-Maoist (CNP-Maoist) started the People's War by attacking a police post in western Nepal.[3] The guiding goals of the People's War were to abolish the monarchy, establish a democracy, and elect an assembly to draft a new constitution (Do, 2010, p. 736). A peace treaty concluded the War in 2006, and a former CNP-Maoist leader won the 2008 assembly elections to become Prime Minister in 2008. Since the 2006 peace treaty, Nepal has experienced numerous national leadership turnovers and significant political

[3] For more information on the People's War, see Prashant Jha's Battles of the New Republic or Aditya Adhikari's The Bullet and the Ballot Box.

polarization. Though the People's War altered Nepal's national political climate, it did not spark institutional change and capacity building at the local level.

The transition to democracy has been far from smooth. Nepal has "diverse regional interests, ethnic groups and hitherto neglected castes swathe process of democratization as an opportunity to put forward their demands. In the transition to democracy, numerous games of tug-of-war and horse-trading between political parties occurred" (Askvik et al., 2010, p. 420). It is hard to overstate the importance of effective leadership in disaster recovery. Useem et al. (2015) attribute a large degree of Chile's successful recovery to the leadership and management of President Sebastian Piñera:

> Much of Chile's readiness for the massive 2010 earthquake and its recovery from the event stemmed from strategic decisions taken by its country leaders before and after the disaster. Their decisions entailed choices that were neither mandated nor preordained. Others in the same offices might have behaved differently and reached very different choices (p. 756).

This argument highlights two pivotal considerations in comparing the GoN's management policies and priorities to those of other administrations. First of all, the Piñera administration's decisions were largely shaped by its predecessors' decisions. Fortunately, these decisions generally reduced vulnerability and risk in Chile. Alternatively, in Nepal, the decisions of previous administrations did not ready the country for their transformative disasters. The GoN's decisions and leadership choices in response to the Gorkha Earthquake are drastically limited by the ineffective policies and oversights of its predecessors.

MITIGATION

Mitigation is a widely accepted component of best practice but is rarely operationalized effectively. Politicians face numerous obstacles in implementing mitigation projects. The benefits of mitigation spending are less obvious to constituents and often less immediate than investment in infrastructure, education, health services, etc. The time period immediately following a major disaster can be ideal to implement mitigation projects, as the public is more likely to support investment when a disaster is in recent memory. Mitigation is often broken into two categories, structural and non-structural mitigation. Structural mitigation refers to physical measures, such as retrofitting houses to increase seismic resistance; non-structural mitigation refers to measures excluding physical construction and engineering, such as policy interventions like awareness campaigns, trainings, and education. This project focuses primarily on non-structural mitigation activities and opportunities in Nepal.

The UNISDR (2010) argues that both structural and non-structural mitigation are more cost-effectiveness than post-disaster spending, yet governments often face political opposition when trying to implement mitigation measures (p. 32). Behavioral economists have explained the difficulty of implementing proactive, long-term disaster management policies to mitigate risks. People living in high risk areas often fail to implement risk reduction measures because they know the government will provide relief in the event of a disaster (Kunreuther, 2006, p. 208). This phenomenon, known as "natural disaster syndrome," is both inequitable and inefficient (Kunreuther, 2008, p. 912). Vulnerable people lack the incentives and resources to finance mitigation measures and become dependent on public generosity to recover from a disaster. Policies to reduce disaster risk, therefore, need to make mitigation measures affordable and appealing to vulnerable populations.

Robust evidence suggests that non-structural mitigation can be an affordable way to reduce risk (O'Brien, 2006; Dahal & Dahal, 2017, Shreve & Kelman 2014, Ganderton, 2005). For many developing countries, including Nepal, non-structural mitigation can mean the development and enforcement of stronger building codes. There are numerous cases of weak building codes leading to high casualty rates during disasters in developing countries. Pantelic (1991) argues it was the "inadequate implementation of building codes, rather than their absence" that caused the deadly structural collapses during the 1988 earthquake in Armenia (p. 90). After the devastating 1985 Mexico City earthquake, the Government of Mexico prioritized the immediate implementation of strict building codes. Within 14 months of the earthquake, the Popular Housing Reconstruction (RHP) agency rebuilt 45,100 dwellings, averaging more than 3,000 dwellings per month (Kreimer, 1991, p. 53). The Government of Mexico requested assistance from the World Bank to research new building codes and zoning measures to reduce earthquake vulnerability. Within five weeks of the earthquake, Mexico City implemented its new Emergency Building Codes in place (Pantelic, 1991, p. 90). The cases of Armenia and Mexico demonstrate that non-structural mitigation through designing and enforcing stringent building codes can lead to structural mitigation in the construction of safer buildings. Non-structural mitigation is generally a cost-effective way to reduce damage from natural disasters.

Mitigation in Nepal

The Natural Calamity Relief Act (NCRA) represented an important step in organizing disaster management policy in Nepal. Comprehensive disaster management first entered Nepal's political agenda in the 1970s after the devastating 1934 earthquake and a major landslide in Pokhara in 1974 (*Nepal Disaster Report*, 2011, p. 5). These events drew attention to the lack of coordination across disaster response agencies, and the international community pressured the

GoN to focus more on comprehensive disaster management (*Nepal Disaster Report*, 2011, p. 8). The stated goal of the NCRA was to make disaster management more organized and comprehensive. Prior to the 1982 earthquake, post-disaster activities operated on an ad-hoc basis, primarily through social work institutions (*Nepal Disaster Report*, 2011, p. 8). The NCRA established a structure to coordinate response work and designated roles for local institutions in disaster response. In theory, institutions can operationalize the NCRA both before and during a natural disaster (*Nepal Disaster Report*, 2009, p. 154). In many ways, the NCRA is inadequate; the Act prioritizes rescue and relief over mitigation and makes no provisions for research and development to find long-term solutions (*Nepal Disaster Report*, 2009, p. 161). These oversights dampen the importance and value of the NCRA.

The NCRA has received significant criticism. The 2011 Disaster Report claims, "there has been a general consensus that the country requires a new act to incorporate the whole spectrum of disaster risk management starting from risk reduction, mitigation to preparedness, response and reconstruction and rehabilitation" (p. 8). Though designed to improve mitigation, the NCRA emphasizes relief and preparedness but is ineffective and outdated (Moench & Dixit, 2004, p. 43). One reason for the failure to implement the NCRA is the absence of local institutions. As of 2009, many of the NCRA subcommittees were not operating, and no local relief committees had been established (*Nepal Disaster Report*, 2009, p. 161). The lack of local institutions in Nepal is further discussed and analyzed in the next section on decentralization and the LSGA. The 2011 Report also claims that the NCRA was not designed to manage medium- or large-scale disasters like the 1988 Udaypur earthquake or the 1993 South-central flood (p. 19). The likelihood of another earthquake much larger than the 2015 Gorkha earthquakes demonstrates the need to implement policies capable of a managing a large-scale disaster.

In addition to the NCRA, the GoN has enacted policies to address disaster risk reduction. One noticeable shortcoming in policy during the Gorkha earthquake was the weakness and lack of enforcement for Nepal's various building codes. The Udaypur earthquake in 1988 was a watershed moment for building codes in Nepal, as Alcira Kreimer and Martha Preece (1991) of the World Bank note:

> Before 1988, there was no building code for low-cost and non-engineered building construction, and no appropriate zoning and land-use policies and regulations. Not even basic construction techniques, much less earthquake-resistant features, were always part of building practices. Most construction was done in the informal sector, so no training programs on seismic-resistant construction were available. Rural families commonly build on their own dwellings with the help of unskilled artisans (p. 132).

Though existing national building code policies do provide guidelines for earthquake-resistant construction, adherence to building codes is far from standard. The 2009 Disaster Report calls overall compliance to building codes "poor" and notes that "building codes are rarely adhered to except perhaps in a few public buildings" (p. 119). The high rates of casualties and structural damage caused by the Gorkha earthquake further validate a major reexamination of Nepal's building codes and their enforcement.

Based on established best practice guidelines discussed in this chapter, the NCRA aligns with best practice in theory but not in practice. By promoting policy interventions to mitigate risk, the NCRA presents an opportunity for increased disaster preparedness at all levels of government. The absence and relative weakness of local institutions makes it difficult to operationalize local community organizations designated in the NCRA. Building codes, like the NCRA, align with best practice in theory but not in practice. The GoN's approved building codes include parameters for increasing seismic resistance, but the implementation of codes is inconsistent. The Gorkha earthquake has presented the GoN with a unique opportunity to

harness national and international resources to make major policy changes for disaster management in Nepal. The resulting public focus on disaster risk reduction can help the GoN implement better building codes and finance mitigation projects.

DECENTRALIZATION

Decentralization in disaster management is a cornerstone of UN best practice guidelines. Decentralization is a tricky term in disaster management literature; it covers a spectrum from the engagement of community stakeholders to complete community ownership of management decisions. Regardless of the degree of local ownership, both major aid organizations and researchers agree that a top-down approach to disaster management is ineffective and inequitable. The argument for local involvement in reconstruction is multi-faceted. Involving local communities develops local capacity, promotes efficiency and builds long-term resilience. The UNISDR (2010) outlines four ways in which local institutions are ideally situated to respond to disasters; unlike national or regional institutions, local institutions have 1) familiarity with local social, economic, environmental, and political systems, 2) accountability to constituents, 3) involvement in and familiarity with local development planning, and 4) proximity to affected communities (p. 11). The UNISDR also distinguishes between "government" and "governance." The term "governance" implies that informal institutions often play pivotal roles in decision-making processes (UNISDR, 2010, p. 1). This distinction is particularly important in Nepal, where local government is often nonexistent but local governance can be influential. The UNISDR (2006) also notes the importance of combining local knowledge with technology to improve risk reduction strategies (p. 23).

Other major UN publications address the importance of decentralized management of disaster recovery and planning processes. One of the most influential UN policies related to best

practice in disaster management is the Hyogo Framework for Action (HFA), which set UN disaster risk reduction priorities for 2005-2015 at the Second UN World Conference on Disaster Risk Reduction in Kobe, Japan in 2005. The HFA identifies strong local governance and emphasis on proactive management as key components of effective disaster management (UNISDR, 2007, p. 5). The HFA's successor, the Sendai Framework for Disaster Risk Reduction, echoes many of the principles of best practice outlined in the HFA. The Sendai Framework validates the argument for decentralized planning and management, stating that plans should consider specific local risks (UNISDR, 2015b, p. 10). The Sendai Framework also calls for the expansion of disaster risk governance, another tenet largely supported in theoretical and empirical academic research (UNISDR, 2015b, p. 14).

Substantial academic research supports the idea of local governance in disaster management (Escaleras & Register, 2012; Krishnadas, 2008; Useem et al., 2015). Local or decentralized management of relief and recovery has been successful in numerous past disasters. Following the Maule Earthquake in Chile, President Piñera employed a system of "tiered leadership," which expedited reconstruction and engaged local people. Piñera's Minster of Planning, Felipe Kast, gave significant autonomy to local officials:

> Upon taking office, he [Kast] believed that the government should target those most in need-as judged by those in Santiago. But in time he came to rely increasingly on the judgment of local mayors whose priorities and perceptions he appreciated would vary significantly, town by town…Some in the national government were leery that public funds might be improperly diverted for political purposes, but Kast found that mayors proved not less committed to overcoming the suffering, and granting them autonomy to engineer it had the effect of building their trust and customizing their work (p. 491).

Though a cornerstone of best practice literature, local governance is rarely employed in management scenarios.

Decentralization in Nepal

The Local Self-Governance Act (LSGA) is Nepal's attempt to comply with best practice by empowering local institutions. The practical failures of the LSGA are understandable considering Nepal's recent political history. After the dissolution of the highly centralized Panchayat system, a new system of local governance emerged in the 1990s, which allocated local governing power to village development committee (VDC) and district development committee (DDC). Coalition governments and a decentralization commission emerged in the mid-1990s and pushed for the creation of the LSGA in 1999 (Asia Foundation, 2012, p. 5). Though local elections were held in 1992 and 1998, the intensity of the Maoist conflict led the government to refrain from holding local elections again in 2002.

As its name suggests, the LSGA's goal is to empower local institutions for self-government. In many ways, the LSGA represents a continuation of the principles espoused in the NCRA, though it took 19 years to identify local responsibilities in the LSGA after the 1982 NCRA. The LSGA was created based on the assumption that

> …local people and local bodies are the most appropriate points of entry to meet development needs at the district, municipal, and village levels...empowering these institutions is expected to enhance local leadership and its capability to make appropriate decisions about matters affecting the day-to-day needs of local people (*Nepal Disaster Report*, 2009, p. 156).

The theories behind the LSGA are very much in line with accepted best practice in creating "tremendous opportunities" for local development of disaster risk reduction plans and programs (*Nepal Disaster Report*, 2011, p. 12). Unfortunately, nearly two decades without local elections precluded the development of such local plans.

The absence of local institutions is a fundamental obstacle to effective disaster management in Nepal. The Asia Foundation (2012) concisely summarized the obstacles of Nepal's highly centralized government structure:

> …Nepali citizens rely on a range of informal arrangements to fill the void created by a weak state. Clearly, states rarely function the way they are meant to and often the government, for various reasons, even breaches its own procedures. This, for instance, is most visible in the untimely transfers of government officials and ad hoc fund allocations, particularly, at the local level. In other instances, because of unfunded mandates and lack of human resources many functions of the government are never executed. Beyond inability to rule by law and capacity issues, individual interests and incentives also produce behaviors and practices that are not described in formal documents (p. x).

The aforementioned "untimely transfers" of ad hoc funding have been painfully evident in the GoN's response to Gorkha earthquakes. More than one year after the earthquake, the GoN was yet to fund the reconstruction of a single home ("The Cost of…," 2016). Theoretically, the NCRA allows the central government to share relief funds with local institutions via regional and district governments. The 2009 Disaster Report, however, notes that "local-level funding is not operational yet" (p. 156). In fact, as of 2009, many of the NCRA's subcommittees were "dormant, and no local disaster relief committees [had] been formed" (*Nepal Disaster Report*, 2009, p. 161). The absence of such local institutions has been apparent throughout the Gorkha earthquake recovery process, especially in terms of recovery financing.

The UNISDR (2010), however, notes that unofficial, informal organizations often play pivotal roles in disaster management (p. 1). The presence of informal local institutions, such as women's community groups or cooperatives, could present the GoN with an opportunity to share resources with rural areas devastated by the Gorkha Earthquake. Identifying and collaborating with effective informal institutions could help the GoN more effectively support locally driven recovery. Regardless of opportunities related to informal local leadership, the GoN should prioritize building strong local institutions to reduce natural hazard risk. Empowering local ownership of disaster preparation, relief and recovery processes is essential in aligning with best practice.

CONCLUSIONS & NEXT STEPS

Recommendations

This project determined that Nepal's disaster management policies theoretically align with certain international best practices; yet, for a number of reasons, the theoretical foundations for effective disaster management have not led to the implementation of best practices. As such, this project has determined that Nepal's policies are aligned with best practice in theory but not yet in practice. Due to time and data constraints, this project is unable to explain why a policy implementation gap exists in Nepal. Despite the limitations of this project, a few useful policy recommendations can be drawn from the findings.

1) Align policy implementations with an understanding of vulnerability. Chapter 1 demonstrated that social vulnerability is complex and spatially varied throughout Nepal. Unique factors shape vulnerability in each zone, district, VDC, and ward in Nepal. An understanding of which factors exacerbate vulnerability should guide policy decisions. Integrating vulnerability into policy decisions should lead to locally-determined, less generic policies. Districts with high rates of feminization may need different policy treatments than districts with low rates of homeownership. A detailed study of vulnerability in Nepal would help shape more effective policies nationwide based on local needs.
2) Invest in non-structural mitigation. Chapter 2 highlighted the value of policy implementations like building codes in reducing vulnerability and increasing resilience. Though GoN policies set a precedent for strong building codes, it is clear from the Disaster Reports that these codes have not been standardized and implemented nationwide. Strong building codes reduce risk and exposure and

educate communities on risk. There are, of course, many obstacles to standardizing and implementing strong building codes in Nepal. Available building materials and hazard-specific risks vary geographically, and skilled labor is not widely available. Designing and implementing building codes that effectively reduce vulnerability will require community input and feedback. Policies should be designed with local capacities for building code implementation and monitoring in mind. For building codes to be implemented effectively, each district needs people trained to assess the safety of structures.

3) Invest in building social and institutional capital at local levels. As demonstrated in Chapter 2, strong local institutions can be instrumental in building resilience and creating effective disaster response. The LSGA gives communities influential powers to develop and maintain local organizations to manage disaster recovery. The GoN should prioritize determining why local institutions have not been formed and promoting the creation of strong institutions at all levels of government.

These recommendations come from a simplified understanding of obstacles to effective policy design and implementation in Nepal. Designing and implementing new policies require further research into the causes of vulnerability and reasons for the implementation gap established in this project.

Next Steps

An important takeaway from this project is the challenge of researching and understanding vulnerability, risk, and policy implementation in Nepal with existing data. Like many studies of developing countries, this project suffers from missing and incomplete data. This project has identified several potential areas of study that would benefit from further

investigation. Potential future research questions include: To what extent does an understanding of social vulnerability shape decision-making processes at local, regional, and national levels? Why do the formal and informal organizations mandated by the LSGA not exist? What is the role of informal organizations in shaping disaster management decisions in Nepal? To what extent are informal organizations aware of the parameters outlined by the LSGA and NCRA? What incentives are available to encourage investment in mitigation? These questions could be answered through an empirical case study of local governance decisions in Nepal.

A future study would benefit from access to better data. This project focused on social vulnerability instead of biophysical vulnerability due to data availability. An integrated model considering both social and biophysical vulnerability would paint a much clearer picture of vulnerability in Nepal. A future vulnerability index would hopefully be able to use data a lower level of aggregation, ideally at the VDC or ward level. This project also had to rely on secondary sources to understand disaster management policies and practices because detailed primary data were unavailable. An expansion of this study would compare Nepal's actual policies to case studies of high-risk districts to determine the extent of implementation failure. Case studies can be selected based on the vulnerability index, ideally using a mixture of highly vulnerable, moderately vulnerable, and minimally vulnerable VDCs to determine the relationship between policy implementation and vulnerability.

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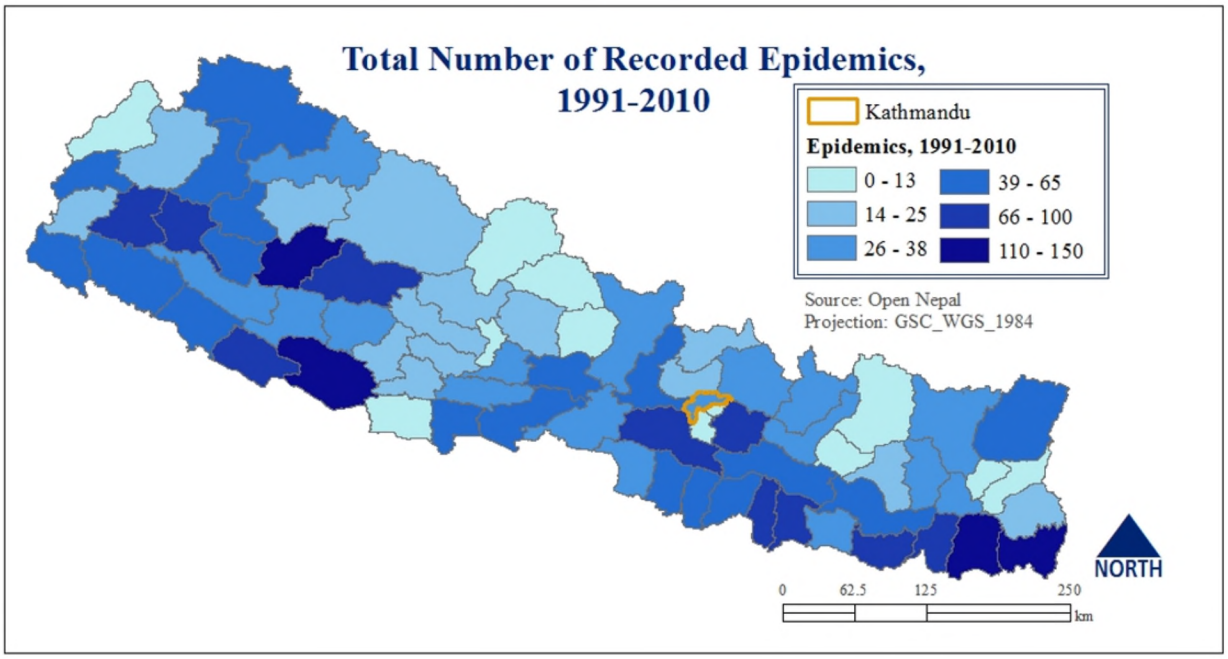
Geospatial Data Sources

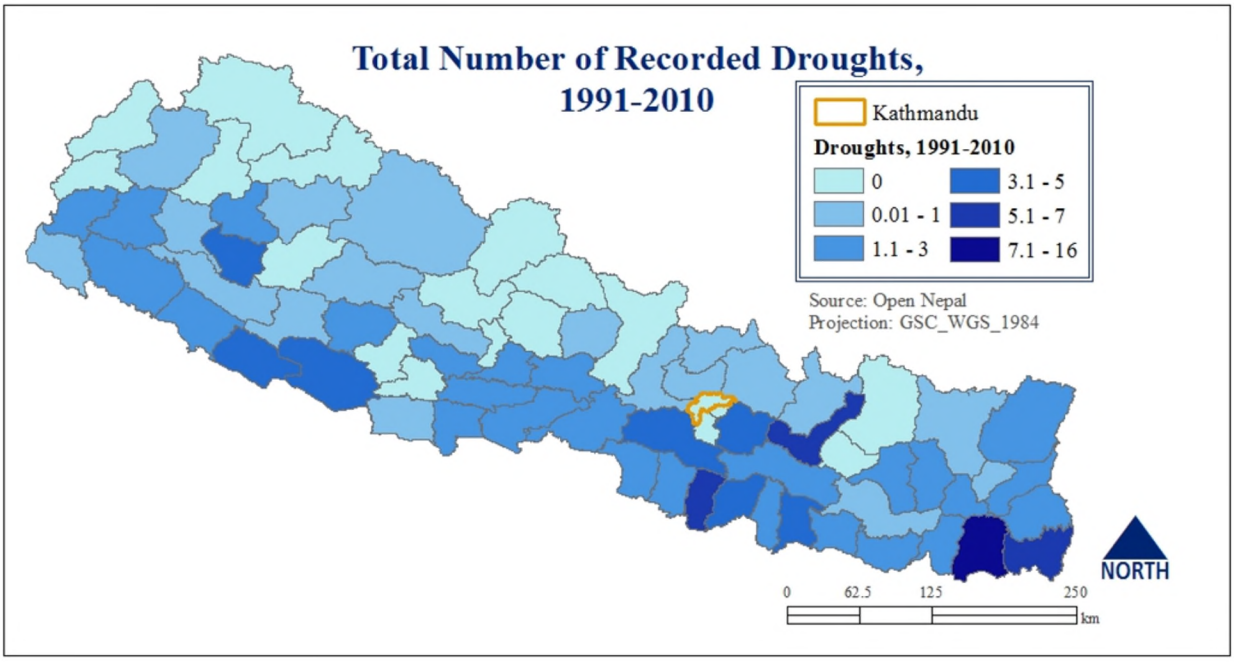
Data	Type	Source	Hyperlink
Administrative Boundaries by District	Shapefile	OCHA Nepal	District
2011 Human Development Index	Excel Database	Open Nepal	HDI
Gorkha Earthquake PGA	Excel Database	OCHA Cass	Gorkha
Gorkha Earthquake Casualties	Excel Database	Code for Nepal	Gorkha Casualties
Historical Disaster Data	Excel Database	Open Nepal	1991-2010
District Headquarters	Shapefile	OCHA Nepal	Headquarters

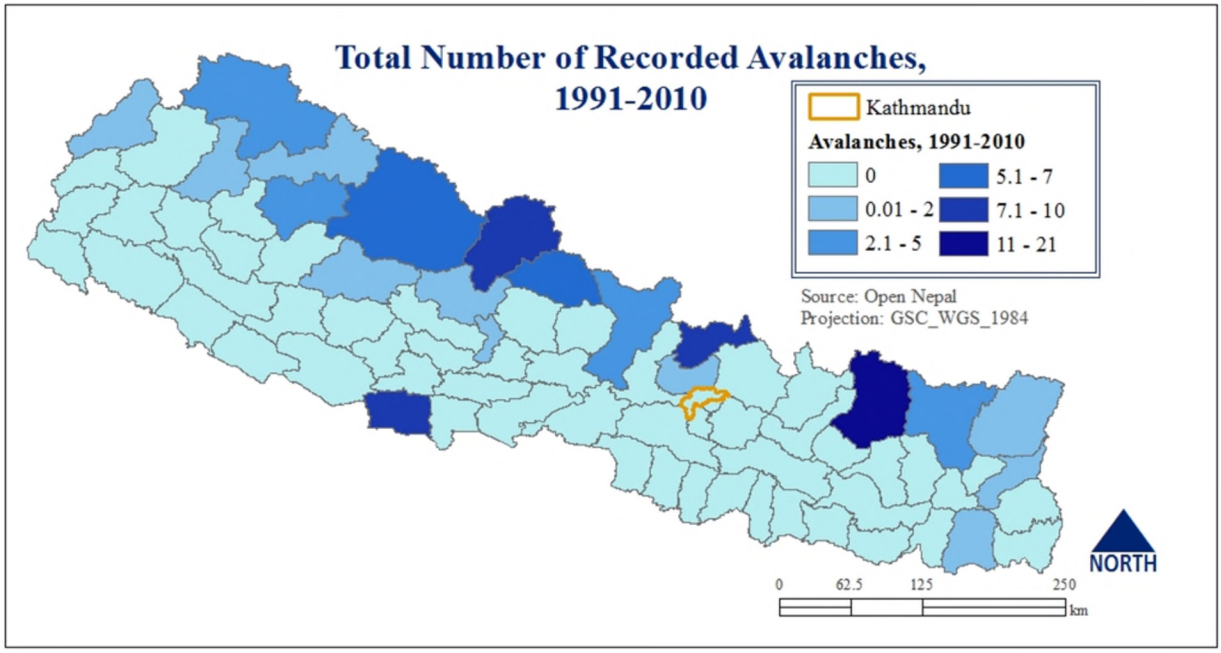
APPENDIX

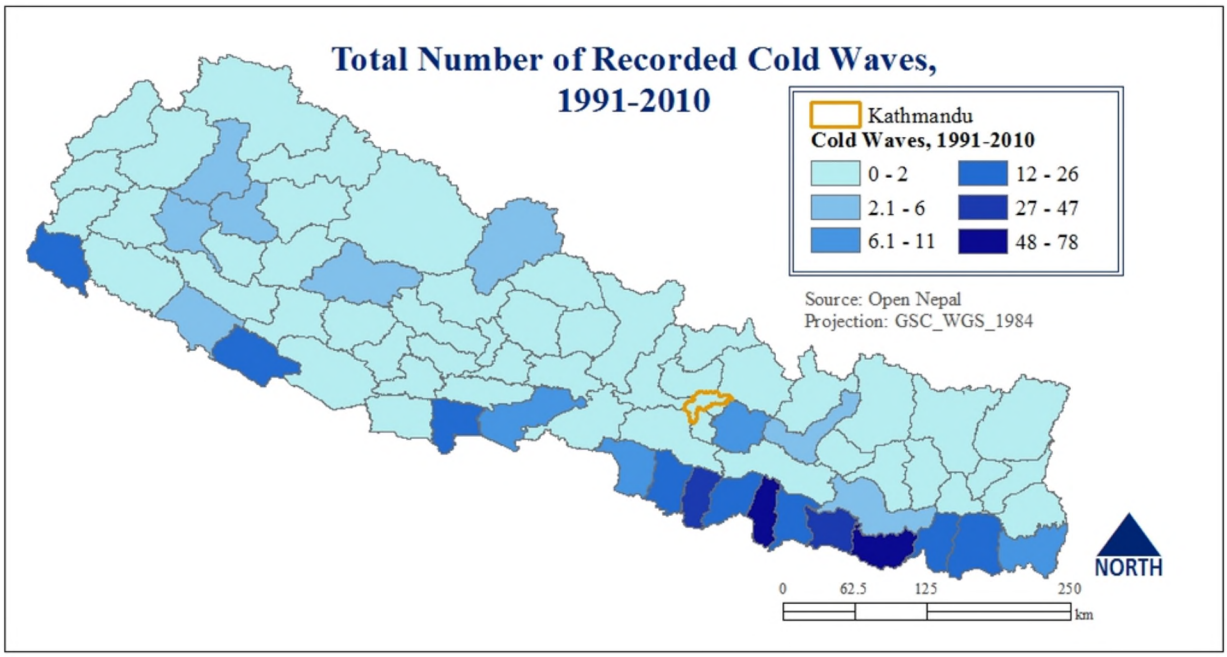
APPENDIX A: SOCIAL VULNERABILITY INDEX MODEL

APPENDIX B: BIOPHYSICAL VULNERABILITY SUPPLEMENTAL MAPS

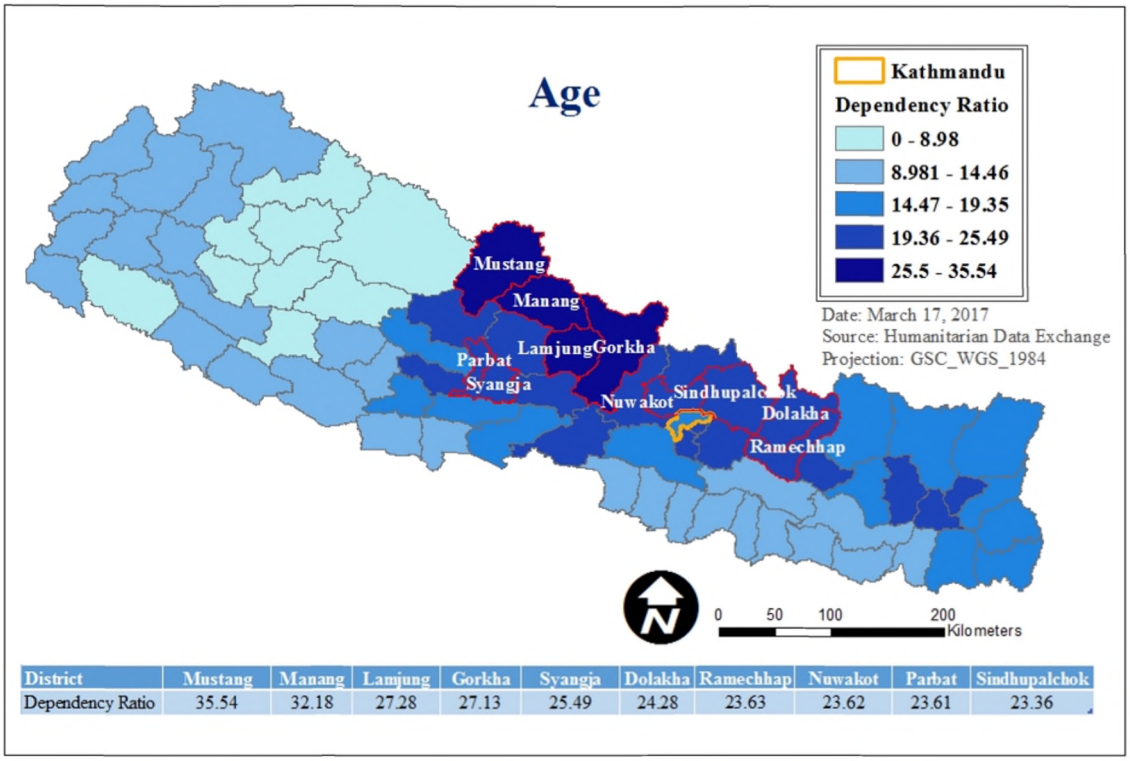




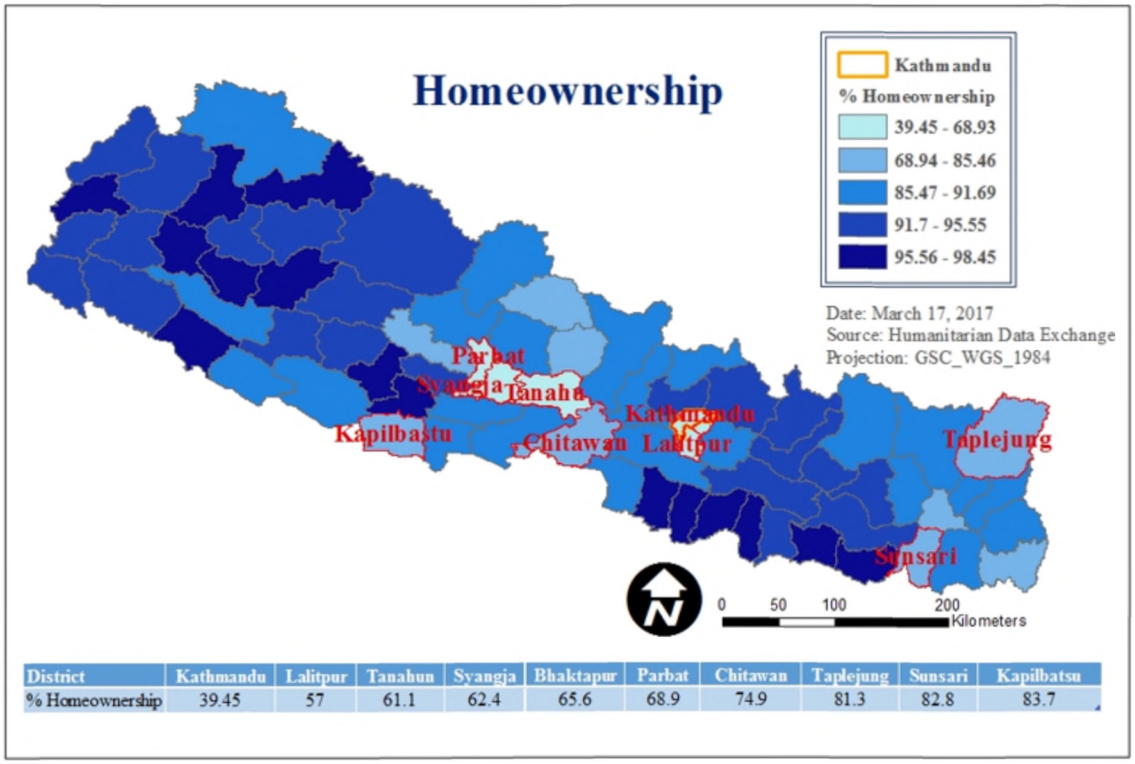

Total Number of Recorded Avalanches,
1991-2010
Kathmandu
Avalanches, 1991-2010
0
0.01 - 2
2.1 - 5
5.1 - 7
7.1 - 10
11 - 21
Source: Open Nepal
Projection: GSC_WGS_1984
NORTH
0
62.5
125
250
km


Total Number of Recorded Cold Waves,
1991-2010
Kathmandu
Cold Waves, 1991-2010
0 - 2
2.1 - 6
6.1 - 11
12 - 26
27 - 47
48 - 78
Source: Open Nepal
Projection: GSC_WGS_1984
NORTH
0
62.5
125
250
km

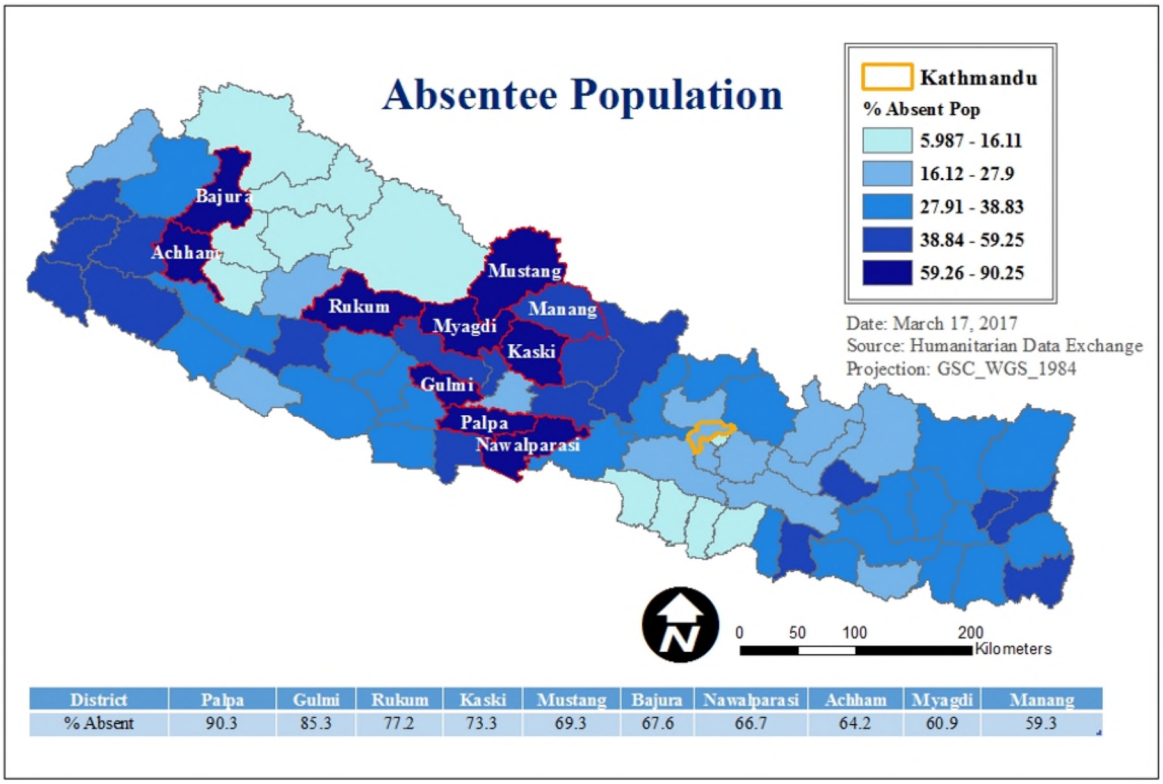
APPENDIX C: SOCIAL VULNERABILITY INDEX SUPPLEMENTAL MAPS



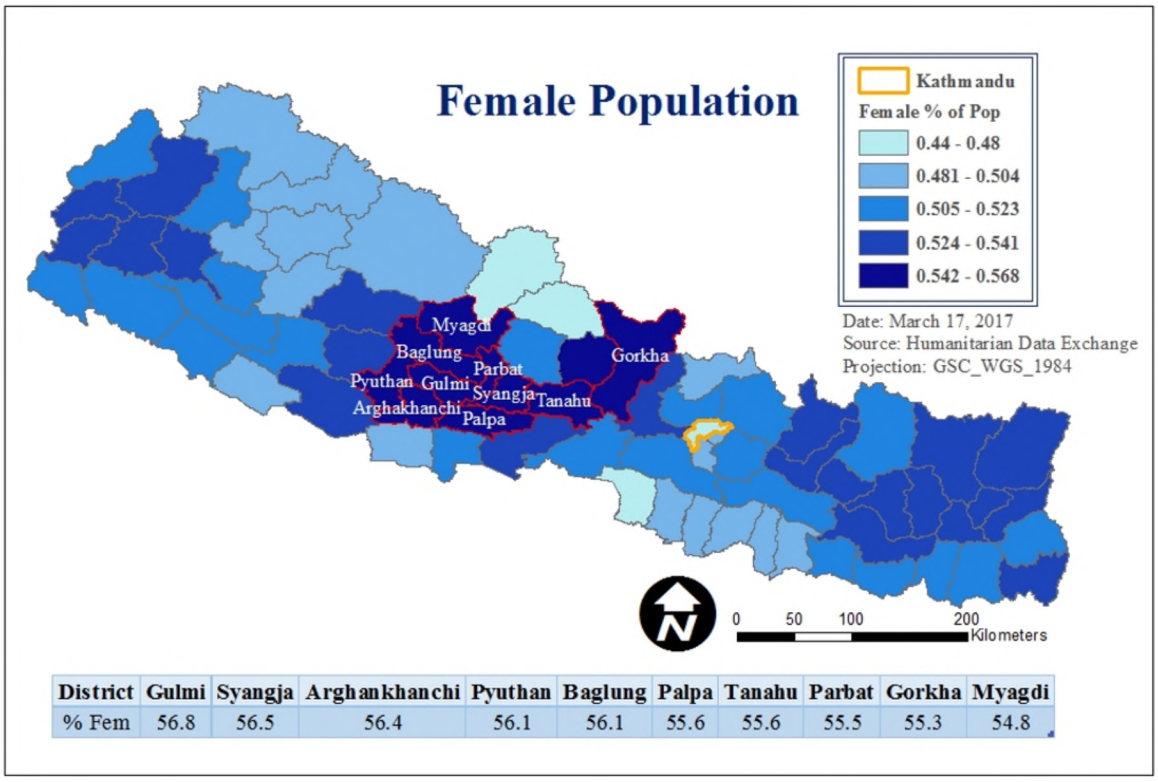
District	Mustang	Manang	Lamjung	Gorkha	Syangja	Dolakha	Ramechhap	Nuwakot	Parbat	Sindhupalchok
Dependency Ratio	35.54	32.18	27.28	27.13	25.49	24.28	23.63	23.62	23.61	23.36



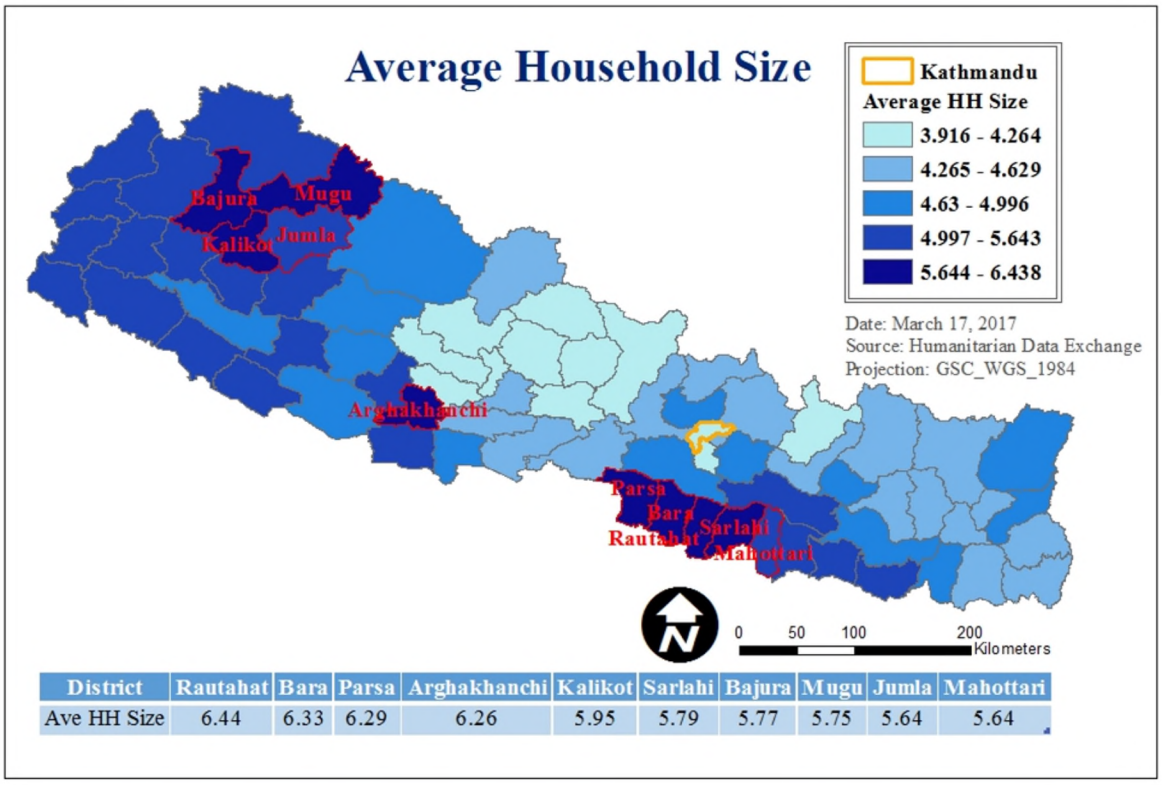
District	Kathmandu	Lalitpur	Tanahun	Syangja	Bhaktapur	Parbat	Chitawan	Taplejung	Sunsari	Kapilbatsu
% Homeownership	39.45	57	61.1	62.4	65.6	68.9	74.9	81.3	82.8	83.7



District	Palpa	Gulmi	Rukum	Kaski	Mustang	Bajura	Nawalparasi	Achham	Myagdi	Manang
% Absent	90.3	85.3	77.2	73.3	69.3	67.6	66.7	64.2	60.9	59.3



District	Gulmi	Syangja	Arghankhanchi	Pyuthan	Baglung	Palpa	Tanahu	Parbat	Gorkha	Myagdi
% Fem	56.8	56.5	56.4	56.1	56.1	55.6	55.6	55.5	55.3	54.8



District	Rautahat	Bara	Parsa	Arghakhanchi	Kalikot	Sarlahi	Bajura	Mugu	Jumla	Mahottari
Ave HH Size	6.44	6.33	6.29	6.26	5.95	5.79	5.77	5.75	5.64	5.64

APPENDIX D: CASTE & ETHNICITY

The following data comes from: Nepal, National Planning Commission Secretariat. *Population Monograph of Nepal: Volume II (Social Demography)*. Central Bureau of Statistics, 2014. Web. 30 November 2016. <http://cbs.gov.np/image/data/Population/Population%20Monograph%20of%20Nepal%202014/Population%20Monograph%20V02.pdf>.

District	Ethnic/Caste Majority	Majority/District Population
Jhapa	Brahmin	23.7
Morang	Brahmin	13.1
Kathmandu	Brahmin	23.5
Chitawan	Brahmin	28.6
Syangja	Brahmin	30.9
Kaski	Brahmin	27.8
Parbat	Brahmin	35.7
Gulmi	Brahmin	25.2
Rupandehi	Brahmin	44.4
Arghakhanchi	Brahmin	32.8
Kalikot	Brahmin	28.8
Sankhuwasabha	Chhetri	18.3
Okhaldhunga	Chhetri	22.8
Udayapur	Chhetri	21.5
Ramechhap	Chhetri	26.9
Dolakha	Chhetri	33.4
Rukum	Chhetri	45.0
Salyan	Chhetri	57.0
Surkhet	Chhetri	31.6
Dailekh	Chhetri	34.9
Jajarkot	Chhetri	38.0
Dolpa	Chhetri	38.0
Jumla	Chhetri	61.2
Mugu	Chhetri	48.9
Humla	Chhetri	38.7
Bajura	Chhetri	57.8
Bajhang	Chhetri	66.5
Achham	Chhetri	55.5
Doti	Chhetri	57.7
Kailali	Chhetri	55.5

Kanchanpur	Chhetri	28.9
Dadeldhura	Chhetri	53.6
Baitadi	Chhetri	52.2
Darchula	Chhetri	64.5
Gorkha	Gurung	19.7
Lamjung	Gurung	31.3
Manang	Gurung	21.4
Mustang	Gurung	21.4
Taplejung	Limbu	41.4
Panchthar	Limbu	41.9
Terhathum	Limbu	35.8
Tanahu	Magar	26.9
Myagdi	Magar	39.5
Baglung	Magar	28.0
Palpa	Magar	52.3
Nawalparasi	Magar	17.5
Pyuthan	Magar	32.6
Rolpa	Magar	43.2
Rautahat	Musalman	19.7
Bara	Musalman	13.1
Parsa	Musalman	14.5
Kapilbastu	Musalman	18.2
Banke	Musalman	19.0
Lalitpur	Newar	33.3
Bhaktapur	Newar	45.6
Ilam	Rai	23.8
Dhankuta	Rai	20.3
Bhojpur	Rai	32.0
Solukhumbu	Rai	19.6
Khotang	Rai	36.6
Sindhuli	Tamang	26.9
Sindhupalchok	Tamang	34.2
Kabhrepalanchok	Tamang	24.0
Nuwakot	Tamang	42.8
Rasuwa	Tamang	68.8
Dhading	Tamang	22.1
Makawanpur	Tamang	47.8
Sunsari	Tharu	12.0

Dang	Tharu	29.5
Bardiya	Tharu	53.0
Saptari	Yadav	15.8
Siraha	Yadav	24.4
Dhanusha	Yadav	17.5
Mahottari	Yadav	15.1
Sarlahi	Yadav	15.5