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Local Peoples Risk Perception of Natural Hazards in the Seti River Valley, Nepal

GEO 511 Master's Thesis

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Photo Title Page: Local Inhabitants of the Seti River Valley. Source: Isabelle Henzmann

Abstract

Climate change is a global phenomenon with manifold impacts throughout the world. With already noticeable impacts on the local population, the high-mountain environment of the Himalayas is particularly sensitive to the ongoing changes. Thus, there is an urgent call for climate change action on a global, regional and local scale. Due to a vast variety of challenges that address different disciplines, climate change and its adaptation have to be tackled with a holistic, multidisciplinary approach. The integration of local people's risk perceptions plays a vital role for the acceptance and success of climate change action in the long term. The present study was conducted in the Seti River Valley in the Western Hills of Nepal, a remote high-mountain area of the Himalayas which lies within the boundaries of the Annapurna Conservation Area. The inhabitants of the Valley live exposed to a bundle of natural hazards, due to steep valley slopes, weak geological structure, the occurrence of intense monsoon rainfalls and the decreasing glacier and snow cover in the Himalayas. By accounting for the individual, social and cultural interpretation as well as the context in which risks are perceived, the study sheds light on the local people's risk perception, their perception of climate change and the acceptance of respective adaptation strategies. The local inhabitants live in close relation to their natural environment and are well aware of the natural hazards they are exposed to. Floods and landslides are the most prominent natural hazards they perceive as a risk. Climate change, however, is not perceived as having a direct impact on the local inhabitant's lives for now, but it is acknowledged as an existing problem. Through a deep analysis of people's risk perceptions, major risk networks are carved out, which reflect the complex risk landscape of the Seti River Valley. The valley's remoteness, the difficult road access and unbalanced power dynamics pose major threats to the local population, which in turn have an amplifying effect on other perceived risks and the perception of adaptation measures. Access to livelihood resources and unequal power dynamics strongly influence the way people adapt, as well as their attitude towards adaptation measures. In order to negotiate adaptation strategies and to contextualize risks in an encompassing framework, risk networks create an important baseline. With a social science approach of such a multi-disciplinary issue, this thesis attempts to contribute to the production of joint knowledge in climate change adaptation through a better understanding of the local people's risk perceptions.

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Abbreviations

ACA	Annapurna Conservation Area
ACAP	Annapurna Conservation Area Project
CBS	Central Bureau of Statistics
CCA	Climate Change Adaptation
DHM	Department of Hydrology and Meteorology
DRR	Disaster Risk Reduction
EWS	Early Warning System
GLOF	Glacial Lake Outburst Flood
IPCC	Intergovernmental Panel on Climate Change
IUNC	International Union for the Conservation of Nature (new: World Conservation Union)
LDC	Least Developed Countries
LEG	Least Developed Countries Expert Group
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NCCIS	Nepal National Climate Change Impact Survey
PCI	Problem Centered Interview
SDG	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

1. Introduction

1.1 Relevance

The impacts of climate change are manifold throughout the world. The need for climate action is described in the UN Sustainable Development Goals as one of the biggest challenges of our time (UN 2019; access: 20.04.2019). While the natural sciences put high emphasis on climate change research, a profound knowledge about the natural processes, climate change trends and mitigation measures have been developed and serve as a basis for policy making. Only recently, social science studies about the effects of climate change on the local population have received more recognition within the global debate (Jurt et al. 2015). However, in social science, many aspects of climate change remain unexplored. Since such a diverse group of people is affected by climate change (IPCC 2014), the need of its holistic understanding is an imperative. Therefore, climate change must not only to be understood from a natural science perspective but also from a social science perspective.

The research site of this master's thesis is located in the Western Hills of Nepal along the Seti River, where a big flash flood disaster devastated the valley upstream from Pokhara in 2012. Seventy-two people died in the flood and many more have been displaced (Hanish et al. 2013: 1; Kargel et al. 2013: 0). Such events are likely to increase in number and intensity in the future, especially in the highly sensitive high-mountain environment of the Himalayas (IPCC 2014, Schneider et al. 2014; Kargel et al. 2013; Bhandary et al 2012). A variety of future natural hazards are predicted and call for immediate climate change action (Kargel et al. 2013: 7). Climate Change Adaptation measures have to be carefully established with an encompassing approach of different risk frameworks. While from one perspective, relocation might seem less severe, the affected self-sufficient farmer, who is dependent on farming land, might have a different opinion. Reforestation and nature conservation may sound reasonable, but might have broader consequences for the local dependents of the forest. While the natural science perspective on Climate Change Adaptation is necessary, considerations regarding the social, economic and cultural context of the local population and their individual risk perception have to be treated equally and be incorporated in every assessment for adaptation measures (Huggel et al. 2020).

In order to face the challenges of climate change and its adaption strategies it is important to understand the risk perceptions of local people (Jurt et al. 2015). Risk perception determines people's actions and responses to risks (Sherpa et al. 2019), acts as the baseline for policymakers to improve their decisions in Climate Change Adaptation (Tanner et al. 2018) and the awareness of risks is a prerequisite for the adaptation strategies' acceptance and the people's incentives to adjust (Dahal and Hagelman 2011; Huggel et al. 2020). Despite the agreement on the importance of risk perceptions, there are several perspectives reflected in the scientific literature on how to best investigate risk perceptions of the local population. Followed by Douglas and Widlavsky's recommendation, the present study assesses risk perceptions by taking into account the individual, social and cultural interpretation as well as the contexts in which risks are perceived. Moreover, in the scientific literature natural hazards often refer to loss of life and material loss. Rarely, the broader consequences of natural hazards regarding social, cultural and economic factors are being addressed (Jurt 2009: 1). This is also argued by Blaikie et al. (2013), who emphasize the wider effect of natural hazards on the vulnerability of people's livelihoods in the future and not only at the time of the disaster. Therefore, Jurt emphasizes the need

for risk networks (2009: 100), which go beyond the risk of natural hazards and imbed the accompanying social, political, cultural and economic risks. Risk networks build an important baseline to negotiate adaptation strategies and to contextualize risks in a holistic framework.

In the aftermath of the Seti Flood in 2012, several investigations were carried out to evaluate the causes of the disaster. Specific suggestions and the urgent need for adaptation measures were declared (Hanish et al. 2013; Kargel et al. 2013; Japanese Disaster Survey Team 2012; Bhandary et al. 2012). The proposal for solutions seemed to be already drawn, but who engaged the local population? To which extent did the perspectives, knowledge and experience of the local inhabitants of the Seti River Valley attract interest? The following quote of a respondent suggests a certain imbalance regarding the inclusion of different perspectives: *"They came by helicopter. Two, three times. The helicopter landed next to our house. They quickly asked a few questions and then flew towards Machhapuchhre Himal. They flew away and probably wrote a report in their computers."* (Interview 8)

The disregard of local people's opinions and perceptions can lead to a decreased acceptance of adaptation measures. For instance, the case of lake no. 513 in Peru, where the implementation of an early warning system led to its destruction by a group of local inhabitants, underlines the importance of the collaboration with the local population and the encompassment of their perceptions. The incident at Lake 513 is neither unique to Peru nor to other regions in the high-mountain environments, but a response which has to be taken seriously and reflected in any case (Huggel et al. 2020: 51). Besides the matter of acceptance, the loss of information for the development of adequate adaptation strategies has to be equally noted when neglecting local people's perceptions. With a social science approach of such a multi-disciplinary issue, this thesis attempts to contribute to the production of joint knowledge in climate change adaptation through a better understanding of local people's risk perceptions.

1.2 Research Objective and Research Questions

On a global, regional and local scale the need for climate change action is urgent (IPCC 2007). In terms of Climate Change Adaptation, the importance of risk perception is increasingly being emphasized. This is also being reflected in the development process of Nepal's National Adaptation Plan (NAP), which highlights the need to incorporate local people's risk perception and to ensure that no one is left behind (MoFe 2018; Tanner et al. 2018). The NAP's intended focus raises the question of how people in far remote areas, such as the rural high-mountain environment of the Himalayan valleys, perceive risks. This particular issue has drawn the attention of the present study, which takes an interest in the hazard prone Seti River Valley in Nepal. How do people in the rural and mostly remote Seti River Valley perceive the risks of natural hazards – intensified by climate change? What is the context in which risks are perceived and to what extent are which different risks connected? How do local inhabitants perceive climate change adaptation strategies? This master's thesis aims to illuminate individual perspectives of the local people, who live in the rural Western Hills of Nepal. By means of the following research questions, the above-mentioned objectives are being tackled. The main research questions are complemented by sub-questions which either extend the topic or serve to better approach the main research questions.

Research Questions

Which natural hazards are perceived as a risk by the local inhabitants of the Seti River Valley?

- *What meanings does the natural environment and specifically mountains hold for the local people?*
- *What role does climate change play in the local inhabitants' perception of risks?*
- *How was the Seti Disaster 2012 perceived by the local inhabitants?*

How are present adaptation measures perceived by the local inhabitants of the Seti River Valley?

- *What adaptation strategies have already been implemented and how are they perceived by the local population?*
- *Are there any adaptation measures that have been established by the local population?*

What interconnected risks come along with the perceived risks of natural hazards?

- *How do the local inhabitants manage their livelihood and what challenges do they face in their daily life?*
- *What risk networks exist in the Seti River Valley?*

1.3 Structure of the Thesis

The present thesis is structured within eight chapters, which address the following topics.

Chapters "*2 Climate Change and Climate Change Adaptation"* and *"3 Risk and Risk Perception"* build the theoretical foundation of the study. First, an overview of climate change in high mountain areas is presented, followed by an outline of climate change in Nepal. The third chapter provides an insight into Climate Change Adaptation with specific focus on Nepal. Later, the applied concept of risk and risk perception is illustrated and located within the scientific literature.

In chapter *"4 Study Area"* the research location is described based on geographical, topographical and climatic features as well as typical natural hazards of the region. Further, the demographic, economic and cultural structure of the study area is outlined.

Chapter *"5 Methodology"* presents the applied methods for the entire qualitative research process. In the last section of the chapter, the positionality and ethical considerations are emphasized.

In chapter *"6 Results"*, the findings of the field work are presented by following the structure of the research questions and their sub-questions. The topics of risk perception, perception of climate change, adaptation measures and interconnected risks are addressed.

Chapter *"7 Discussion"* includes an analysis of the presented results, which are discussed based on theories and related studies from the scientific literature. The analysis involves the prevailing risk perceptions, the acceptance of adaptation measures and the adaptive capacity of the local population. In a last section, the interconnections of the detected risk networks are revealed.

Chapter *"8 Conclusion"* rounds up the thesis by concluding the main findings and reflecting on limitations and strengths of the present study.

2. Climate Change and Climate Change Adaptation

2.1 Climate Change in High Mountain Environments

Recent changes in climate have manifold impacts on human and natural systems all over the world (IPCC 2014). As defined by the Intergovernmental Panel on Climate Change (IPCC), climate change *"refers to any change in climate over time, whether due to natural variability or as a result of human activity".* (IPCC 2007: 27). These changes put the society and ecosystems at risk, which is why the United Nations (UN) declared Climate Action as an urgent goal within the Sustainable Development Goals (SDGs) (UN 2019; Access: 20.04.2019). In particular, high-mountain environments, such as the Alps, the Andes or the Himalayas, are highly sensitive to climate change. About one fifth of the earth's continental areas are covered with mountain systems. Those regions covered with snow and ice show a strong reaction to warming due to their proximity to melting conditions (Haeberli & Beniston 1998). Glacier and snow cover retreat leads to changes in hydrological regimes, including variations in melt runoff, and the formation of new lakes. Both bear a high risk to communities in high-mountain areas (Salzmann et al. 2014; Costa & Schuster, 1987; Mergili et al., 2011). Since the melt water runoff from mountains feeds many of the world's largest rivers, mountain systems have a significant impact on the world's population (Haeberli & Beniston 1998). Schneider et al. (2014) further highlight the risk of cascading effects of mass movement processes such thawing of permafrost leading to rock slope failure, which in turn bears the potential to result in a glacial lake outburst flood (GLOF). In addition, Haberli and Beniston (1998) emphasized the high risk of mass movements, such as rock slope failure or landslide, on steep slopes in high mountain areas. Subsequently, climate change in the sensitive high-mountain environment has large impacts on the ~915 million people living in mountain areas, which is why there is an urgent need for effective adaptation strategies in those areas (Salzmann 2014; McDowell 2019: 19).

2.2 Climate Change in Nepal

Nepal is located in the Hindu Kush-Himalayas, a geographically and culturally unique high-mountain environment with some of the world's tallest mountain peaks. The Hindu Kush-Himalayan region is known to be one of the most fragile and ecologically sensitive environments on the globe (Singh et al. 2011). The amount of ice and snow stored in the immense Himalayan mountains is the third largest in the world and serves as water source to the 1.3 billion people living downstream of these mountains (Lutz et al. 2015; Singh et al. 2011). While it is widely understood that the Hindu Kush-Himalayan region is a climate change hot spot, only little scientific knowledge and data are available for this specific region. According to Lutz et al. (2015) the predicted temperature change for the Himalayas is consistent over various models. On the other side, precipitation trends vary widely. Panthi et al. (2015) display that most of precipitation trend studies of South Asia segregate the Himalayas from their analysis by reason of its complex topography and lacking hydrological records. Hence, the need for a deeper understanding of the Hindu Kush-Himalayas remains high and its assessment has to be driven forward. Only then, the consequences of climate change on this fragile high-mountain environment can be fully understood and the region will be able to get prepared to adapt to them.

In particular, Nepal is facing this challenge. There, the analysis of observed climatic trends is limited by the short length of historical meteorological records (Patra & Terton 2017). Therefore, precipitation trends could not be observed with adequate significance. Temperature trends, however, show a clear trend despite the short period of data record (DHM 2017). The time period between 1971 and 2014, in which data has been recorded, is analyzed by several authors and provides insight into the effects of climate change on Nepal's temperature and precipitation. However, for the development of a National Adaptation Plan (NAP) it is crucial to forecast the climatic changes in the future. Therefore, the Ministry of Forest and Environment (MoFE) in cooperation with the International Centre for Integrated Mountain Development (ICIMOD) modelled medium-term (2016– 2045) and long-term (2036–2065) climate change scenarios for Nepal.[1] The Department of Hydrology and Meteorology (DHM) analyzed in respect to the need for reliable climatic data for the NAP process the historical data (1971 – 2014) and published their findings of climatic trends in Nepal in the DHM 2017 report (MoFE 2019). The trends from the DHM (2017) and further authors, as well as the scenarios developed by the MoFE (2019) will be presented in the following.

2.2.1 Change in Temperature

The DHM identified in its analysis of the available time period that Nepal's mean annual maximum temperature is increasing significantly with a yearly rate of 0.056°C (DHM 2017). Another statistically significant change was found by Baidya et el. (2008) as well as by McSweeney et al. (2012) who observed a decrease of cold days and nights. Regarding the mountain regions, Baidya et el. (2008) identified that the mountain regions show a stronger increase in temperature than the lowlands. This is also confirmed by the recent analysis of the DHM (2017), that observed an increase in positive temperature trend from Terai (lowlands) towards the High Himalayas. Furthermore, their district-wise analysis shows a high annual temperature increase in the study area (Kaski district). Regarding the winter maximum temperature, the Hill Regions show a significant positive trend, while the highest increase of maximum winter temperature was found in the High Himalayas (DHM 2017).

The climatic scenarios show that the annual mean temperature is likely to increase up to 1° C in the short-term and up to 2° C in the long-term period. Seasonally, the temperature is likely to rise in all seasons with the strongest increase in the post-monsoon season (+ 1.3 – 1.4°C / + 1.8 – 2.4°C). The temperature increase in the winter season is equivalent to the annual average. There is a strong increase of number of warm days and nights and a 50 percent decline of cold days and nights predicted (MoEF 2019). Given these scenarios, the MoEF (2019) concludes that extreme climate events are likely to increase in number and intensity.

[1] *"The study used Global Circulation Models (GCMs) from the CMIP5 dataset, which also forms the physical science basis of the IPCC's Fifth Assessment Report (AR5)".* (MoFE 2019: X).
"The models were selected for two Representative Concentration Pathways (RCPs), RCP4.5 and RCP8.5, keeping in mind the uncertainties of the projected future changes". (MoFE 2019: 7).

2.2.2 Change in Precipitation

The DHM (2017) states that the observed precipitation data shows high uncertainty regarding precipitation trends. For Nepal, no significant trend could be observed since the precipitation regimes vary intensely throughout entire Nepal. For several districts, however, rarely significant trends could be detected. For the high-mountain environment no statistically significant decrease could be observed. The DHM, however, points out that the small data amount makes it extremely difficult to find significant trends (DHM 2017). Thus, for the development of the NAP, the climate scenarios were stated to be essential. These scenarios predict that despite for the pre-monsoon season the annual mean precipitation is likely to increase in both time periods (+ 2–6% / + 8–12%). The pre-monsoon season is likely to face a decline, while the post-monsoon season will show the highest rise (MoFE 2019). While the scenario predicts an increase in precipitation for all Nepal, the climatic trend analyzed by the DHM (2017) showed a significant decreasing trend in precipitation for the study area (Kaski district). Nevertheless, there was no significant trend for consecutive dry or wet days or for the amount of rainy days or extremely wet days identified for the study area (DHM 2017). Regarding extreme precipitation events, the scenarios predict that the number of rainy days is likely to decrease whereas the intensity of the single events is predicted to show a strong increase (MoFE 2019). Karki et al. (2017) confirm this prediction with their observation of a significant climatic trend of an increase in extreme precipitation events. The MoFE concludes that regarding the intensification of precipitation events, water-related hazards are more likely to occur in the future (MoFE 2019).

2.2.3 Climate Change Impacts on the High Mountain Environment

Given the increasing temperature trends and scenarios, which are even more distinct in the High Himalayas, the sensitive high-mountain environment will be strongly affected. The IPCC states that glacier melt in the Himalayas, due to raising temperatures, is predicted to increase flood events and rock slope failure caused by destabilizing effects of glacier retreat, and decreased river flows due to affected water resources originating from the glaciers (IPCC 2007). Further, the MoFE predicts more water-related risks, such as flash floods, landslides, mudflows or GLOFs, due to the intensification of precipitation events. As mentioned by the DHM (2018), almost 75 percent of all disasters in Nepal already happen due to landslides and floods. The UNDP (2012) underlines the already existing impacts of climate change, which are water shortage in the dry season by reason of retreating glaciers, the formation of glacial lakes and the accompanied risk of GLOFs and flashfloods, landslides and erosion due to erratic precipitation events. These will likely be intensified with proceeding global warming. All the above-mentioned hazards, emerging from climate change or being intensified as a cause of it, will have a strong impact on the mountain communities, the water resources of the whole country and beyond its borders. Thus, they will also be affecting renewable energies such as hydropower (UNDP 2012).

2.3 Climate Change Adaptation

According to the IPCC, Climate Change Adaptation (CCA) is the adjustment responding to expected or already experienced effects of climate change in natural and human systems. Since warming is

unavoidable to a certain degree, caused by past emissions, adaptation strategies will be essential to address the effects of climate change (IPCC 2007: 25, 27). In addition, the United Nations Environment Programme (UNEP) puts emphasis on CCA and declares that climate change mitigation is no longer enough to tackle the impacts of climate change. Although it is vital to take climate change mitigation actions to reduce emissions of greenhouse gases, affected regions and the people located in these regions have to start to develop adaptation strategies. Therefore, CCA started to be politically discussed and finally found its response in the 2015 Paris Agreement with a specific goal for CCA. The UNEP is acting as a development agency of CCA Programs worldwide but set a priority on supporting countries with adaptation knowledge for the development of National Adaptation Plans (NAP) (UNEP 2020; Access: 12.06.2020). MCDowell et al. (2019) point out that for the design of CCA strategies it is necessary to consider the social, cultural and political settings in which climate change is perceived. This is because the effects of climate change are experienced individually and within a specific context. According to Bassett and Fogelman (2013), the social context is necessary to consider as well since it uncovers the prerequisites for adaptation. Thus, the design of CCA strategies requires attention and collaboration from different disciplines and stakeholders to meet its demands and to result in suitable adaptation measures. For instance, this goal is addressed by *Knowledge for Climate*, an international network which adopts the approach of joint knowledge production to contribute to interdisciplinary research on CCA (Knowledge for Climate 2020; Access: 13.06.2020).
On the national level many countries committed to CCA action and started to develop specific NAPs to the prevalent conditions and needs in their countries. So did Nepal and developed the National Adaptation Programme of Action (NAPA) which will be presented in the following section.

2.3.1 Climate Change Adaptation in Nepal

Nepal already faces a variety of climate change impacts. Particularly water related hazards, such as GLOFs, landslides and floods increased in number and intensity and pose a major threat to local communities (Bishokarma 2017). Out of these reasons, the Government of Nepal articulates adaptation to climate change as a key priority to safeguard the country's population and its diverse and rich cultural and environmental resources. Nepal committed to develop a NAP to be able to counter the multiple impacts of climate change in the country. Based on the Climate Change Policy, developed in 2011, and the previous strategy, the NAPA 2010, the Government of Nepal launched the process of developing a new NAP in 2015 which is still in progress (MoFE 2018).

For the development of the NAPA, Nepal's first adaptation plan, a series of national and regional workshops were conducted and numerous consultations with the civil society were held. The goal was to understand the impact of climate change on the society and to incorporate a wide range of perspectives in the process of adaptation strategy development and prioritization. According to the Ministry of Environment, the NAPA puts a special focus on livelihood support to increase the adaptive capacity of the local population. The reason for this prioritization was the NAPA being part of Nepal's development strategy which is driven by the top priority goal of reducing poverty in the country. Since the NAPA was developed with support of the Least Developed Countries Expert Group (LEG) they could profit from the experiences of other Least Developed Countries (LDC). The cautionary lessons learned from other LDC's experience are amongst others to ensure inclusive participation of different actors, the representation of the needs of the most vulnerable groups and the integration of local perceptions

of climate. The adaptation options which were outlined reflect the countries diverse geographical preconditions, given by the fact that Nepal ranges over all climatic zones from 70 m a.s.l. up to 8848 m a.s.l. For the Hill Regions in particular, the prioritized adaptation options were, amongst others, to strengthen the development of early warning systems throughout the country, improve climate change education, detect safe settlement zones, analyze the impact of climate change on tourism and the economy in mountain regions, enhance vulnerable groups' adaptive capacity and to conduct a Vulnerability Mapping and Zoning Program (MoE 2010).

In 2015, the NAP process started, which builds on the NAPA and incorporates the lessons, which were drawn from the NAPA's implementation (MoFE 2018, MoFE 2019). Thereby, a deliberate and thoughtful approach was adopted, which considers Nepal's specific natural and social conditions and, according to their slogan, will *"leave no one behind"* (MoFE 2018: 17). Thus, they established "the Unique features of Nepal's NAP Process", which are needed to reach their goal.

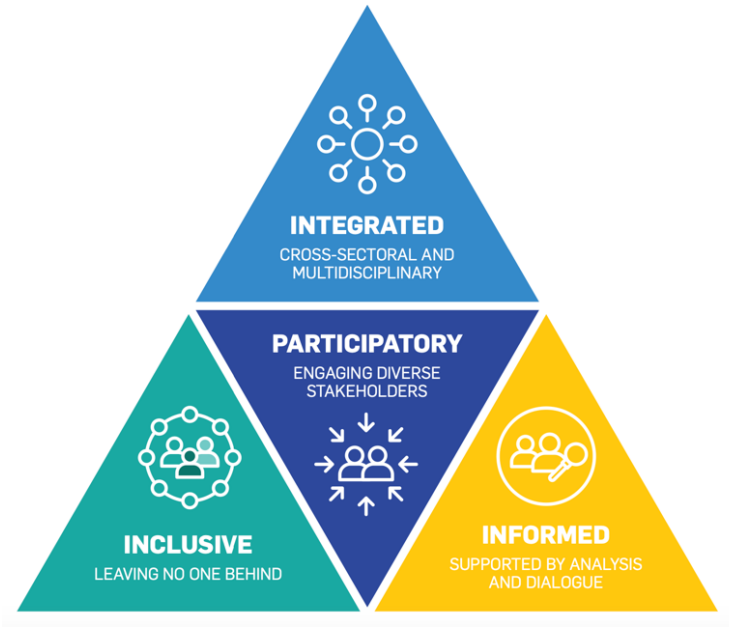

Figure 1: Unique features of Nepal's NAP Process (Source: MoFE 2018)

The NAP process should be inclusive, informed, participatory and integrated. Thus, the aim to leave no one behind is ensured by a participatory and inclusive process, which incorporates the wide range of perspectives gained in the previous NAPA workshops and the best available scientific data about climate change (MoFE 2018).

3. Risk and Risk Perception

3.1 The Concept of Risk

Risk is a widely used term and concept by scientists, policy makers and the society. Regarding the definition of the term "risk", no consensus is found in science or in the public understanding of the term (Renn 1998). A definition which is relatively broadly formulated is proposed by Renn (1998: 51): "*Risks refer to the possibility that human actions or events lead to consequences that affect aspects of what humans value.* With this rather broad definition of "risk", Renn leaves space for both the desirable and the adverse nature of risks. As argued in another work by Renn (1985), particularly in economic theory risk has to be accounted for both, benefits and losses. Furthermore, Machlis and Rosa (1990) argue with regards to the existence of desirable risks in terms of a stimulus or thrill for risk-taking activities, that risk definitions should include the positive and negative nature of risks. However, for this study the inclusion of desirable risks is not relevant, which is why risk is understood as the adverse consequence of natural hazards or human activities. This understanding is reflected in the definition of risk by the IPCC: *"The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain."* (IPCC 2018: 557). Therefore, this research follows the understanding of risks being an object of harm and not a potential benefit. The definition of risk by the IPCC further states that the for the assessment of climate impacts the term risk refers to climate-related hazards (IPCC 2018: 557). Yet, the definition of risk used for this research does not only focus on natural hazards as a trigger for risks but as well on other "risk objects". Risk objects, as defined by Hilgartner (1992: 41), are "things that pose hazards, the source of danger, the entities to which harmful consequences are conceptually attached." Consequently, risk objects can be natural hazards, political structures, economic constrain or power dynamics to name only a few. Hilgartner (1992) argues that this distinction is relevant since natural scientist accept risk objects, such as natural hazards, as objective matters of the reality, whereas social scientists emphasize the social construction of risk objects. Thus, an individual may indeed perceive the objective risk of natural hazards as a risk but may also perceive other risks which are subjectively constructed on the base of one's social, political, economic and cultural context. This is also underlined by Jurt (2009), who observed that natural hazards are not perceived as autonomous risks but rather as a part of risk networks that also include social, cultural, economic and political risks. In this context, she opposes the scientific debate which mainly focuses on the loss of life and property when it comes to natural hazards and does not consider further risks related to it. Douglas & Wildavsky (1982) are further exponents of a holistic understanding of risks which are embedded in the cultural and social context.

Nonetheless, risk objects on their own do not create a risk. The IPCC further defines risks to *"arise from the interaction between hazard, vulnerability and exposure".* (IPCC 2014: 36). Also, Blaikie et al. (2003) point out that risk compounds of a hazard and the varying degrees of vulnerability of the risk prone people and their livelihoods. Whereas "*Exposure"* can be defined by the presence people or their livelihoods in a place or setting that could be harmfully affected (IPCC 2018), *"Vulnerability"* is a far more complex concept, which found large attention in scientific literature and is widely discussed. At this point, the concept of vulnerability after Blaikie et al. (2003) will be addressed in more detail.

3.1.1 Vulnerability

To understand risks or disasters, it is crucial to consider the different levels of vulnerability of different group of people (Blaikie et al. 2003). Fineman and Grear (2013) argue that vulnerability is a universal phenomenon, means all people are vulnerable, but at the same time it is very particular and shows that not all people are vulnerable to the same degree. Vulnerability has therefore to be detected by analyzing the social system and the power dynamics of the people and not by the natural forces (Blaikie et al. 2003). Hewitt (1983) provides a similar perspective by underlining that asymmetrical power relations enhance the vulnerability of the people more than just the exposure to natural hazards of a place. When defining vulnerability, Blaikie and colleagues (2003) distance themselves from any concepts of vulnerability, which solely relate it to poverty. They argue that poverty is certainly correlated to vulnerability but is definitely not a simple causality. Earlier concepts of vulnerability, which tended to focus exclusively on the conditions and processes in people's lives which make them vulnerable, shaped the perspectives towards this causality. Blaikie and colleagues emphasize that a sole focus on people's limiting conditions runs the risk of framing the vulnerable people as poor, passive and incapable victims. In the late 1990s various authors added to their understanding of vulnerability the notion of "capacity" (e.g. Dow 1992; Watts & Bohle 1993; Anderson and Woodrow 1998). So did Blaikie et al. (2003) and suggest to set a stronger focus on the people's capacities since, as they argue, every individual possesses certain capacities to adapt and protect themselves. Their definition of vulnerability includes the notion of capacity and experienced wide acceptance among other social scientists: *"By vulnerability we mean 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."*(Blaikie et al. 2003: 11). As mentioned before, they lay the focus on the people's social and cultural setting, such as their livelihood, which determines their vulnerability and capacity to adapt.

A further important approach, which Blaikie et al. (2013) follow to determine vulnerability, is the "Access Model". Their understanding of vulnerability does not only measure the consequences of a hazard at the time of the incident but focuses strongly on its effect on future livelihoods. With livelihood they mean all resources, such as political, social and material resources, individuals or group of people have access to for sustaining their lives. The effect on future livelihoods can be analyzed with the access model, which highlights the level of access people have or do not have to resources needed to sustain their livelihood and reduce their vulnerability before and in the aftermath of a disaster (Blaikie et al 2013: 12). Access, therefore, is strongly connected to the capacity to recover from a disaster and the amount of time needed to find back to pre-disaster conditions. The amount of access shapes the preconditions for future disasters and is an indicator of the people's vulnerability. People having less access are more vulnerable and need longer, if at all, to find back to "normal". Thus, their individual precondition for future disasters is worse and their capacity to adapt less. Out of these reasons, people having better access show a lower vulnerability and a higher capacity to adapt, what again lowers their vulnerability for future events. Accordingly, access is a determinant for vulnerability, which in turn influences the perception of risks (Blaikie et al. 2003).

3.1.2 Adaptive Capacity

Adaptive Capacity is a concept which often appears in relation to vulnerability. The capacity to adapt counters the processes that make people vulnerable (Blaikie et al. 2003). According to Engle (2011) adaptive capacity is "the ability to mobilize scarce resources to anticipate or respond to perceived or current stresses." (Engle 2011: 648). Although humans are intrinsically adaptive characters, the adaptive capacity varies to a great extent among and within populations. The origin of this unequal distribution is, similar to the access model from Blaikie et al. (2003), the limited access to economic, technological, political and social resources for a certain share of the population (Engle 2011).

3.1.3 Risk Networks

The aim of risk networks is to expose interconnections between different prevailing risks. People may perceive interconnections between risks, which influence each other reciprocally. If one risk diminishes or enhances, it will affect the perception of an interconnected risk. The understanding and detecting of risk networks is particularly crucial when addressing adaptation strategies. By acknowledging interconnections between risks, adaptation strategies can be applied more efficiently. Reversely, the neglect of interconnections and the sole focus on one obvious risk can pose a barrier for the effectiveness of adaptation measures.
It can be stated that risk networks go beyond the risk of natural hazards and imbed social, political, cultural and economic risks (Jurt 2009: 100). The author refers to the understanding of Douglas and Wildavsky (1982) who believe that risk perception is socially imparted. This is why the social and cultural context have to be addressed (Jurt 2009: 106). However, risk networks do not display one individual's risk perception but reveal similar patterns found between the risk constellations of a group of people, community or region (Jurt 2009).

3.2 Risk Perception

Risks are perceived in manifold situations in life. This broadens the scope of scientific debate about the perception of risk largely. Respectively, contributions from natural sciences, psychology, economy, sociology and anthropology meet and create controversy, criticism but also convergence to a certain degree. There are two epistemological positions reflected in the different approaches on risk perception. On the one hand, a realistic position can be found which is based on the belief that risks are from an objective nature. On the other hand, there is a constructivist position which claims that risks are socially constructed. In the following three approaches which were seminal for the understanding of risk perception will be presented. The realistic position is represented in the technico-sientific approach. The constructivist position is presented in the cultural theory approach as well as in the constructivist approach (Jurt 2009).

3.2.1 Technico-Scientific Approach

An exponent of the technico-scientific perspective is Lupton who understands risks as objective, taken-for-granted phenomena. Thus, a risk can be measured and calculated (Lupton 1999). The psychometric model, which was a result of technico-scientific approaches, has been established in the field of psychology by Fischhoff et al. (1978). The authors disclose that risk perception is explained by cognitive features what results in a varying perception of risks by laypersons and experts (Fischhoff et al. 1978). In the same way Jungermann and Slovic (1993) argue and underline that risk perceptions are driven by an individual's knowledge, experience and values. While risks are taken for granted, their perception is a function of the risk's properties (Sjöberg 2000). Constructivists criticized this approach for its neglect of the social and cultural context in which individuals perceive risks (Renn 1998; Douglas 1992).

3.2.2 Constructivist Approach

The constructivist approach presents an opposition to the technico-scientific approach and their conviction of an objective truth, which takes risks for granted. From the constructivist's perspective, risks are socially constructed and the perception of risks is influenced by the settings and processes in which risks are constructed (Jurt 2009). This approach was strongly influenced by Beck's seminal notion of the "Risk Society" in which risks are human-made due to their pursuit of wealth (Beck 1986). Risks are therefore constructed by the risk society and their activities and not properly addressed regarding their root causes (Blaikie et al. 2003).

3.2.3 Cultural Theory Approach

The cultural theory approach is largely differing from the technico-scientific approach and focuses on the embeddedness of risks in a social and cultural context. Douglas and Widlavsky (1982) claim that this context strongly influences people's perception towards risks, and in turn, the perceived risks are a reflection of the conditions they are living in. By neglecting these prerequisites, risk perception cannot be acceptably assessed. In addition, the consideration of the social and cultural context is essential since risk perception is affected by one's social affiliation to a specific group. Thus, a potential collectiveness of risk perception can be assumed (Douglas & Wildavsky 1982). The cultural theory approach gets criticized by Sjöberg, who explains the success of this theory only in the "persuasive power of speculation" (Sjöberg 2000: 6). Furthermore, he underlines his critique with the advice not to reduce risk perception to the social context. Renn (1998) also admits that risk should not solely be seen as a result of perception and social construction, but underlines its importance to be integrated in the evaluation of risks. He explains Douglas and Wildavsky's notion of risk perception being part of a social and cultural construct as follows: *"Confining undesirable consequences to physical harm excludes other consequences that people might also regard as undesirable, but physical harm may be the only consequence that (almost) all social groups and cultures agree is undesirable".* (Renn 1998: 54). This quote underlines the subjectivity of risks and highlights the importance of considering the social and cultural context in which risks are perceived.

3.3 Risk Perception in Scientific Literature

Risk perception has been studied in a variety of fields which is why there is a large range of risk perception studies in literature. Besides the perception of GLOFs, Dahal and Hagelman (2011) present in their paper a selection of risk perception studies, with addressed natural hazards. There were important studies conducted considering earthquakes (Lindell and Prater, 2002), floods (Wong and Zhao, 2001), flash floods and landslides (e.g. Wagner, 2007), and natural hazards in general (Jurt 2009) – to name only a few. Since the risk perception of GLOFS has been only rarely studied, Dahal and Hagelman's study serves as an important contribution to fill this gap. Furthermore, their investigation in the downstream region of Tsho Rolpa lake, enable an insight in the perception of risks of the local population in Nepal's Himalayas (Dahal & Hagelman 2011). Only recently, the risk perception of GLOFs in the Sagarmatha (Mt. Everest) National Park in Nepal has been studied by Sherpa et al. (2019). Beside the perception on natural hazards, various studies on the perception of climate change in mountain areas were conducted lately as well (eg. Byg & Salick 2009; Becken et al. 2013; Shijin & Dahe 2015; Tanner et al. 2018).

In their study, Sherpa et al. (2019) found a correlation of risk perception of GLOF and the people's proximity to the lake in the Sagarmatha National Park. However, the first ranked risk was the risk of earthquakes, but not GLOFs. As indicated by Tversky and Kahneman (1974), human perceptions of risks are strongly influenced by cognitively available events of past or common hazards. Since Sherpa and colleagues conducted their study only one year after the devastating earthquake in Nepal (2015), Tversky and Kahneman's theory serves as a plausible explanation for the GLOF being ranked on second position after earthquakes. Furthermore, Sherpa et al. (2019) observed that the perception of GLOFs are influenced by age, livelihood and previous experiences of disasters. Wagner (2007) agrees that prevailing experiences of hazards have a strong effect on local people's risk perception. Regarding the age and risk perception of GLOFs, a negative correlation was found. This implies that old people perceive GLOFs less frequently as risk than young people. In addition, people working in the tourism sector perceived GLOFs more frequently as a risk than people earning their livelihood from agriculture (Sherpa et all. 2009). Both findings are explained by Sherpa et al. with the better access of young people and people affiliated to tourism to the media, and, consequently, to information about the threat of GLOFs.

Wagner (2007), who conducted research on the perception of flash floods and landslides, argues that the perception of natural hazards is determined by the people's understanding of their occurrence. When the trigger of a natural hazard, for example heavy rainfall, is visible, it is better understood and subsequently perceived as a risk with a higher likelihood. If the cause of a danger is neither intuitive nor visible to the people, the risk perception will be lower.

Dahal and Hagelman (2011) conducted their study on risk perception in the area of the Thso Rolpa Glacial Lake in the Eastern part of Nepal. According to the scientists, there is a high probability of a GLOF from the Thso Rolpa Lake. The study reveals that the majority of the downstream population shows a low risk perception with regards to a GLOF from Thso Rolpa. The authors explain the given situation with the occurrence of false alarms in the past what resulted in a false sense of security within the population. They add that the belief of many of them in a higher power, god or government, enhances the feeling of being protected.

3.3.1 Perception of Climate Change

A recently conducted, extensive climate change impact survey in Nepal shed light on the population's perception of climate change. The Nepal National Climate Change Impact Survey 2016 (NCCIS) was conducted by Nepal's Central Bureau for Statistics (CBS) with support from "Action on Climate Today" and covered 5'060 households all over Nepal (Tanner et al. 2018: 4). As reported by Tanner et al. (2018) the people were asked in qualitative interviews to recall their experiences of weather changes over the last years and observed impacts from climate change. The results from the survey show that the awareness of climate change in Nepal is low. Half of the respondents are not aware about climate change. Furthermore, there is a gap between rural and urban areas detected: while the awareness in rural areas is lower than in urban areas, it is the lowest in mountain households. Although half of the respondents were aware of climate change, 31 percent of the respondents in the Western Mountains (study area) did not register any changes regarding the climate. Since the understanding and awareness of climate change has been observed as low, climate change was not perceived as a global phenomenon. That was indicated by the primarily local causes of climate change, such as deforestation, urbanization and human activities. However, 41 percent believe in climate change being a natural phenomenon. Drought, flood, disease, insects, GLOF and hailstorms were mentioned to be impacts of climate change (Tanner et al. 2018: 4-5).

With regard to the NAP process the perceptions of the local population were compared with the historical temperature data analyzed by the DHM. Since the trend analysis is impacted by a certain degree of uncertainty due to the short record period, data from perception surveys can be applied for validation of the historical trends as well as a knowledge foundation for CCA strategies. The comparison of the two data sets showed a strong convergence in terms of temperature change (Tanner et al. 2018: 6).

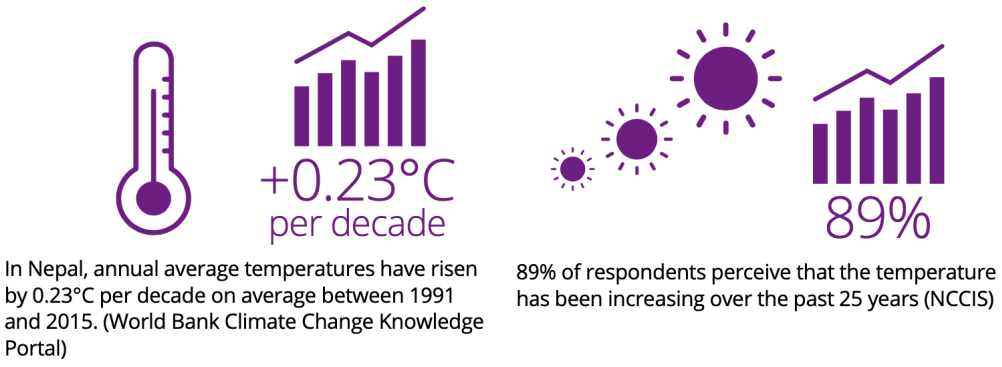

Figure 2: Comparison of the historical record data and the population's perception data with regards to temperature change (Source: Tanner et al. 2018)

Similarly to the NCCIS, a global survey on the awareness of climate change in 2009 revealed that half of the population in Nepal is not aware of climate change or has never even heard of the term. In rural areas the term climate change was less known than in urban areas (Gallup 2009; Access: 02.07.2020). Besides this large-scale survey of local people's perception of climate change, several studies with foci on particular regions were conducted. Byg and Salick (2009) found a similar situation with regards to the term climate change in Eastern Tibet, where the population was not familiar with the term itself.

However, their perception of the climatic changes, such as rising temperature, glacier retreat and less snow coverage, were detailed and agreed with scientific climate records. Additionally, climate change was often perceived as a moral and spiritual issue (Byg and Salick 2009). A study from Becken et al. (2013), which was conducted within the Annapurna Conservation Area (ACA) in lower Mustang, displays that the local population is well aware of the term climate change and shows in addition a profound understanding of it. The authors argue that the dominant presence of tourism in the valley, which is on top of that a highly discussed matter in terms of pollution and environmental degradation, leads to increased awareness and understanding of climate change.

3.3.2 Risk Perception and Climate Change Adaptaion

Many authors point out the importance of considering and acknowledging of local people's risk perception in relation to adaptation strategies. Sherpa et al. (2019) underline that risk perception determines the people's actions and responses to risks. Dahal and Hagelman (2011) claim that awareness of risks is a prerequisite for the acceptance of adaptation strategies and the people's incentives to adjust. Tanner et al (2018), in consideration of the NAP, emphasize that risk perceptions are the baseline for policy-makers to improve their actions in CCA. Hence, to understand risk perception in a holistic way, all roots of risks such as economic, social, cultural and political ones have to be addressed (Jurt 2009). Therefore, an assessment of risk perception has to include the cultural and social context in which risks are perceived (Douglas and Widlavsky 1982). As Huggel et al. (2020) report in the lessons learnt from the implementation of a GLOF early warning system in Peru, the recognition of risk perception, traditional knowledge and cultural narratives is essential for the development of suitable CCA strategies and to ensure their acceptance in the local population. The authors admit that the understanding and the consideration of the individually varying risk perceptions of local inhabitants pose a challenge, however, they also stress that this process is indispensable for a long-term success of CCA strategies. To tackle these challenges, Renn (1998: 66) calls upon an integrative approach within the field of risk management and CCA: *"The dual nature of risk as a potential for physical change and as a social construction demands a dual strategy for risk management."*. Huggel et al. (2020: 51) add on, that a multidisciplinary and participatory collaboration is needed and encourage to *"to give the social science a more prominent role."*

4. Study Area

Figure 3: Annapurna IV (7525 m a.s.l.) photographed from Kabuje village at dawn. Origin of the rock slope failure, which triggered the Seti Disaster 2012. (Source: Photo by the author).

4.1 Seti Valley

4.1.1 Location and Topography

The study site of the present research project is located in the Western Hill Region of Nepal along the *Seti River*. The Seti River springs from the Annapurna Range and flows down southwards along the Pokhara Valley, which is located in the *Kaski District*. Pokhara City is the district headquarter, touristic hot spot and the second largest city of Nepal (Adhikari & Seddon 2002: 75). The Seti River runs along a very steep profile in the northern part close to the Annapurna Range, followed by a gentle profile towards Pokhara City. The study area is located all along the Seti River and can be divided in three areas: Upper Seti, Kharapani and Lower Seti. Upper Seti and Kharapani are located in the upper part of the Seti river at an elevation of 1500 to 1200 m a.s.l. Upper Seti is closest to the mountains and is located on the bottom of the steep and narrow gorge, which originates in the Sabche Cirque, a huge high-mountain depression surrounded by Machhapuchchhre Himal, Annapurna III and Annapurna IV (Hanisch et al. 2013: 1). Kharapani lays further downstream but still belongs to the hilly region of the Lesser Himalaya. Lower Seti is an area which is located right at the city border of Pokhara at lower elevation of 900 m

a.s.l. It is worth mentioning that the altitude from the Annapurna Range to Pokhara City remarkably decreases from up to 8000 to 820 m within a short distance of only 45 km (Hanisch et al. 2013: 7). This fact illustrates that the Seti Valley is considerably exposed to potential mass movements on the steep slopes of the High Himalayas, which will be further outlined in the section *4.3 Natural Hazards.*

Moreover, the villages in Upper Seti and Kharapani belong to the Machhapuchchhre Rural Municipality. Lower Seti with the settlements of Gosti (Lamachaur) and Lalten Bajar belongs to Pokhara Lekhnath Metropolitan City. The division is relevant because the Machhapuchchhre Rural Municipality is located within the boundary of the Annapurna Conservation Area (ACA) while Lower Seti is not part of it. This marks a significant difference between Upper Seti / Kharapani and Lower Seti regarding the results.

Machhapuchchhre Rural Municipality is divided in nine wards. Upper Seti belongs to ward no. 1 and includes the villages of Karuva, Sandal, Ebang, Tallatora, Kabuje and Jimerbari. Jimerbari is the very last settlement of the valley, right at the bottom of the extremely steep Seti Gorge coming from the Sabche Cirque. Kharapani, located in ward no. 2, is a larger settlement and the last village which is accessible by the motor road coming from Pokhara. From Kharapani upwards only a footpath leads to the villages in higher altitude. Lower Seti is an area close to Pokhara City where two larger squatter settlements, Ghosti (Lamachaur) and Lalten Bajar, were established right at the riverbank.

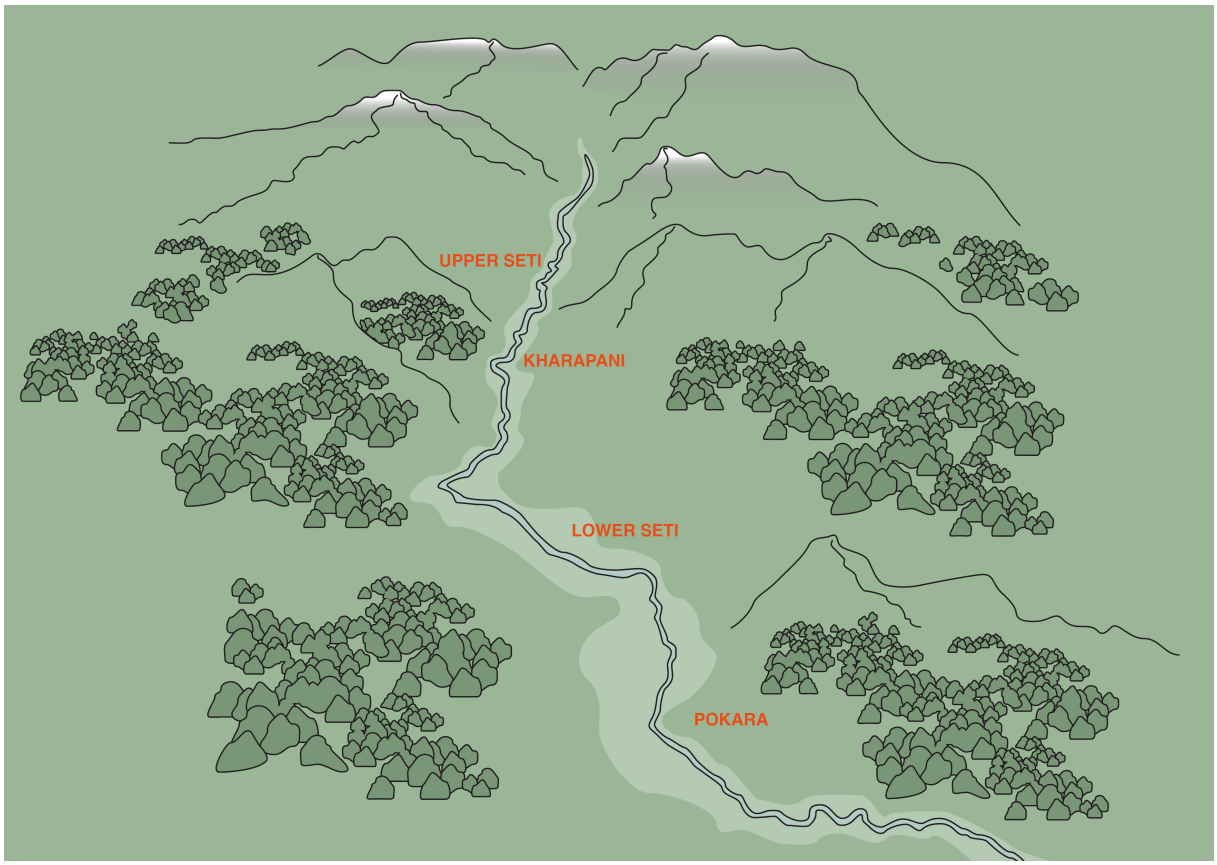

Figure 4: Upper Seti, Kharapani and Lower Seti. This illustration shows the study area along the Seti River, originating from the Annapurna range (Source: Illustration by Naomi Eggli).

4.2 Climate

The topographical features of the Seti River watershed result in a unique variation of climatic conditions. In the south at an elevation of 1000 m a.s.l. a sub-tropical climate is predominant. Following the river northwards, the climate changes with increasing altitude from temperate to cool conditions. The northernmost part of the watershed in the High Himalayas is dominated by an alpine climate (Rimal et al. 2015: 959-960). In Upper Seti and Kharapani at an elevation between 1200 – 1500 m a.s.l. a temperate climate is predominant (Dangal 2011: 1). The southern slopes of the Annapurna range are intensely rain-laden and governed by the annual monsoon season, which generally starts at the end of May and lasts until September. During the summer monsoon 80 percent of the annual rainfall occurs (DHM 2018: VII). At Lumle weather station, which is located within the Kaski district and next to the study area of Upper Seti / Kharapani, the annual precipitation is 5700 mm. For Lower Seti the annual precipitation adds up to 3967 mm (Rimal et al. 2015: 959). Accordingly, the Seti River Valley with more than 5000 mm of annual precipitation in the upper parts and a little less in the southern section is among the wettest areas of Nepal (Soliva 2002: 324). This is illustrated by the following figure with the mean monsoon precipitation of Kaski District.

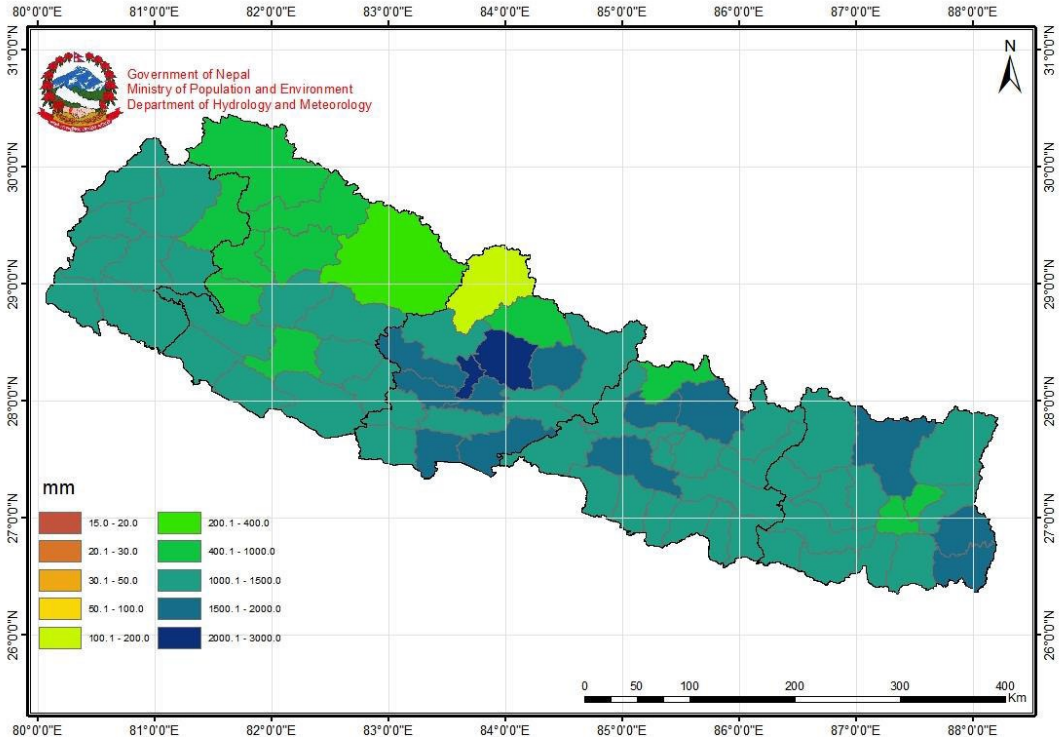

Figure 5: Monsoon precipitation: Dark blue classification for the entire Kaski district (2000 – 3000 mm) (Source: DHM 2017).

4.3 Natural Hazards

The Seti River Valley is a disaster-prone area due its topography, geology and climatic conditions. Steep slopes surrounded by high mountain peaks ranging up to 8000 m a.s.l., monsoonal climate, fragile geomorphic features and the frequency of earthquakes sum up to a high risk of natural hazards in the

valley. The riverbanks on both sides of Seti are reported as areas of high flood hazard risks (Rimal et al. 2015: 966). Since the study area is located at the riverbanks along the Seti River, water related risks are predominant. Especially prone to flood events in the study area are the settlements of Sandal, including Ebang and Tallatora, Jimerbari, Kharapani and the squatter settlements in Lower Seti (Rimal et al. 2015: 971). Nonetheless, due to heavy monsoon rainfall, steep hillsides and the loose geological structure, landslides are among the most frequent natural hazard in the valley (Soliva 2002: 324).

While seasonal floods caused by extreme weather events during the monsoon season are a common risk in the valley (Rimal et al. 2015: 968), flash floods, such as the massive event on May 5th in 2012, which occurred in the dry season, are exceptional hazards. However, they are likely to replicate and occur with an increased frequency due to raising temperatures. Increased snow and ice melt combined with extreme monsoonal rainfall incidents could liquefy the large amount of sediments in Sabche Cirque and cause further and bigger debris flow disasters (Kargel et al. 2013: 6-7). Further, the potential energy of collapsing ice from the hanging glaciers above Sabche Cirque could result in major sediment mass movements from the unconsolidated Annapurna formation (Kargel et al. 2013: 7). Glacial lake outburst floods (GLOF) have not been experienced in recent times and the formation of glacial lakes has not been observed so far. However, regarding the hazard history of the valley, GLOF disaster are not unknown to this place. In the 15th century, a major GLOF event from Machhapuchchhre lake covered the valley in 50 – 60 m of deep debris (UNDP 2012: 23) and in ancient times around 13'000 years ago, the outburst of a massive supraglacial lake created the of the terraced formations of the Pokhara Valley (Kargel et al. 2013: 5). Kargel et al. (2013) point out that in case of continuous glacier retreat, GLOFs are a potential future risk since the precondition of a voluminous ice basin in the Sabche Cirque is given. (Kargel et al. 2013: 8). Besides GLOFs, dam formations are possible more frequent in the upper parts of the river due to landslides, which block a river passage temporarily and can result in a flash flood due to the outburst of the newly formed pond (Rimal et al. 2015: 969, Kargel et al. 2013: 7).

Concerning the dense settlements along the riverbank, especially in the lower parts of the Seti River, the outlined hazards may cause major threat to human lives (Rimal et al. 2015: 959).

4.3.1 Seti Disaster 2012

On May 5th in 2012, a massive rockfall event of 22 million cubic meters occurred, originating from the south west flank of Annapurna IV. About 1500 m of free fall induced a tremendous potential energy to the falling mass. Its impact on the snow-covered glacier surface resulted in the melting of the snow and the pulverization of the glacier beneath (Bhandaray et al. 2012: 15-16, Hanisch et al. 2013: 3). Huge amounts of water mixed with the sediments formed into a hyper-concentrated debris flow which ran down the valley with extremely high speed. The thunderous sound of the so-called sturzstrom, as indicated by Hanish et al. (2013), could be heard from the upmost villages. It made some of the people alert and they escaped to the forest. For many, however, it was too late. The debris flow devastated the valley upstream from Pokhara and affected mostly the villages in Upper Seti and Kharapani. 72 people died in the flood and many more were displaced (Hanisch et al. 2013: 1; Kargel et al. 2013: 0). Because of the distance between Kharapani and Lower Seti of about 20 kilometers, the settlements in Lower Seti and Pokhara City could be warned (Hanisch et al. 2013: 6). Thanks to the prior warning, the large number of people carrying out river activities, such as sand extraction, could be saved from the flash flood. The most affected settlements were Khrapani and Sandal, including Tallatora and Ebang, while Kharapani

counted the highest number of victims (Bhandary et al. 2012: 11-12). Kharapani was well known for its beautiful riverbanks where numerous tea shops made the place to a popular picknick area. Besides, the presence of natural hot springs attracted visitors from all over the region, including foreign tourists. On Saturdays, which is the day of rest in Nepal, Kharapani was the main destination for families and other visitors coming from Pokhara City. Since the disaster happened on Saturday, May 5th, the death toll could have been much larger. Luckily, the first wave of the mudflow reached Kharapani early, at 09.38 AM, when most of the visitors where still on their way (Bhandary et al. 2012: 13). In Upper Seti large areas of agricultural land were devastated and a high number of livestock killed. Given the fact that the inhabitants of Upper Seti are self-sufficient farmers, the loss of livestock, agriculture land and its harvest caused serious harm to their livelihoods (Bhandary et al. 2012: 11).

In the aftermath of the flash flood, the Seti Valley attracted several research teams, who tried to uncover the causes of the disaster. Since the event took place in the dry season, the prevalent mystery was the origin of the vast amount of water. The primary assumption of a GLOF event or a blockage of the river was disproved quickly (Bhandary et al. 2012: 16, Hanisch et al.: 2). There is now a consensus that the rock slope failure at Annapurna IV is the trigger of the disaster, which in turn led to a series of different events. Further processes are still uncertain, but on the base of profound investigations a hypothesis was proposed: The pulverized rocks mixed with melted snow and ice due to frictional heat and the potential presence of hidden huge water pockets or even a hidden lake at the point of confluence led to the devastating, hyper-concentrated slurry flow, sweeping down the valley (Bhandary et al. 2012; Hanisch et al. 2013; Kargel et al. 2013)

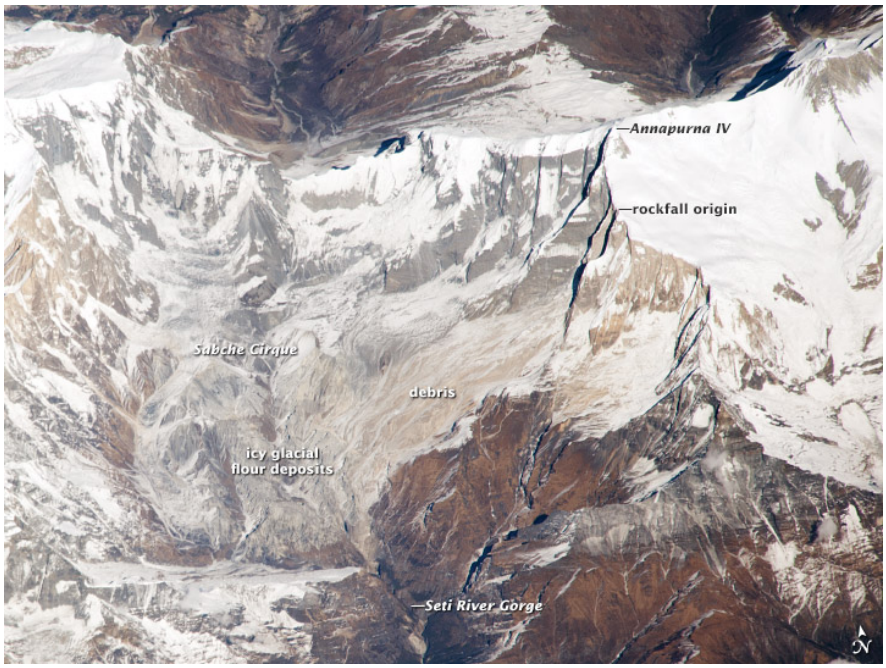

Figure 6: High mountain depression, Sabche Cirque surrounded by Machhapuchchhre Himal, Annapurna III and Annapurna IV. (Source: NASA Earth Observatory 2014)

The Seti disaster in 2012 with its still enigmatic processes has drawn interest of numerous scientists and government officials. Since the disaster is related to gradual effects of climate change and an event similar or even worse than the disaster in 2012 is likely, the need for action is urgent (Kargel et al. 2013: 9, Bhandary et al 2012: 17). Various recommendations were proposed and further deep investigations in the area and a reliable projection regarding possible future events were declared necessary. A clear

consensus on the inevitability of an early warning system in the Seti River Valley is displayed in the postulation of Hanisch et al. (2013), Kargel et al. (2013) and Bhandary et al. (2012).

4.4 Annapurna Conservation Area Project

The Annapurna Conservation Area (ACA) counts as the largest protected area in Nepal and is located north of Pokhara in the hills and mountains of west-central Nepal (Bajracharya et al. 2006: 2768; Soliva 2002: 323). Covering an area of 7629 km^2, ACA stretches across five districts and thereby comprises the scenic beauty of Mustang, the impressive peaks of the Annapurna and Dhaulagiri Range and the ecological diversity of the southern slopes of Annapurna. For this reason, it is not surprising that ACA is the most visited trekking destination within Nepal (Soliva 2002: 323-324). Interestingly, ACA is not a National Park, as already implied by its name, but an exemplary model of participatory nature conversation. In the late 1980s, the International Union for the Conservation of Nature (IUCN) started to follow the then established belief that the necessary foundation of sustainable development is the combination of nature conservation with the participation of the local communities as well as empowerment of the respective inhabitants (Stocking, Perking & Brown: 167 as cited in Soliva 2002: 73). The Annapurna Conservation Area Project (ACAP), with its establishment in 1986, took over the role of a pioneer in the participatory nature conservation and is renowned as a successful role model in the international context (Soliva 2002: 133; NTNC 2019; accessed: 23th of May 2020).

Given the fact that the ACA is the most visited trekking area, one could assume that the population within ACA sustains their livelihood from tourism. Indeed, this is true for a few communities along the famous *Annapurna Circuit* (only 14.9 % of ACAs' population). The Seti Valley, however, is not within reach of the rewards from tourism (Bajracharya et al. 2006: 2765). There, the population is mostly dependent on agriculture and the utilization of forest products (Bajracharya et al. 2006: 2768, 2773). In the 1980s an urgent need for conservation was raised due to deforestation and erosion as a consequence of mismanagement (Soliwa 2002: 124). Nevertheless, the intended approach was not forced upon the local communities but relied on their cooperation. Upreti (1991: 30 as cited in Soliva 2002: 135) states it as follows:

> *"We have to rethink the management policy of seeking the cooperation of local people in protection instead of relying on force. Public awareness is the essential tool in the conservation activities. And to gain public sympathy we should support their socio-economic and cultural aspirations."*

In order to enhance the livelihood of local communities and to conserve the resources of the unique mountain ecosystems, ACA was declared as a multi-use conservation area. The local communities of the protected area are encouraged to conserve but at the same time allowed to use the resources under certain regulations (Bajracharya et al. 2006: 2770). Despite the integrative intent, it seems obvious that this interplay also might create tensions. Besides various benefits due to village development projects such as improvement in sanitation and other infrastructural improvements, awareness programs and trainings in sustainable farming, the local population has to face a number of costs due to restrictions in the use and selling of forest products (Bajracharya et al. 2006: 2772-2773). Potential areas of conflicts and different perceptions on ACAP are outlined in the results section (*6.5.1.3 ACAP: Nature Conservation and Awareness Programs).*

4.5 Demography

The Machhapuchchhre Rural Municipality includes 5512 households. It is more interesting, though, to have a closer look at the Wards. Machhapuchchhre Rural Municipality is divided into nine Wards. Ward no. 1, including the villages of *Upper Seti*, is sparsely populated with only 325 households. On the contrary, Ward no. 2, where Kharapani is located, shows a much higher population density with 879 households (CBS 2011).

Municipality / Ward	Total households	Total Population
Machhapuchchhre Rural Municipality	5512	21868
Ward no. 1 (Upper Seti)	395	1729
Ward no. 2 (Kharapani)	879	3442

Table 1: Population of Kharapani and Upper Seti: Number of households and total population in Machhapuchchhre Rural Municipality and Ward no. 1 and 2 (Data Source: CBS 2011)

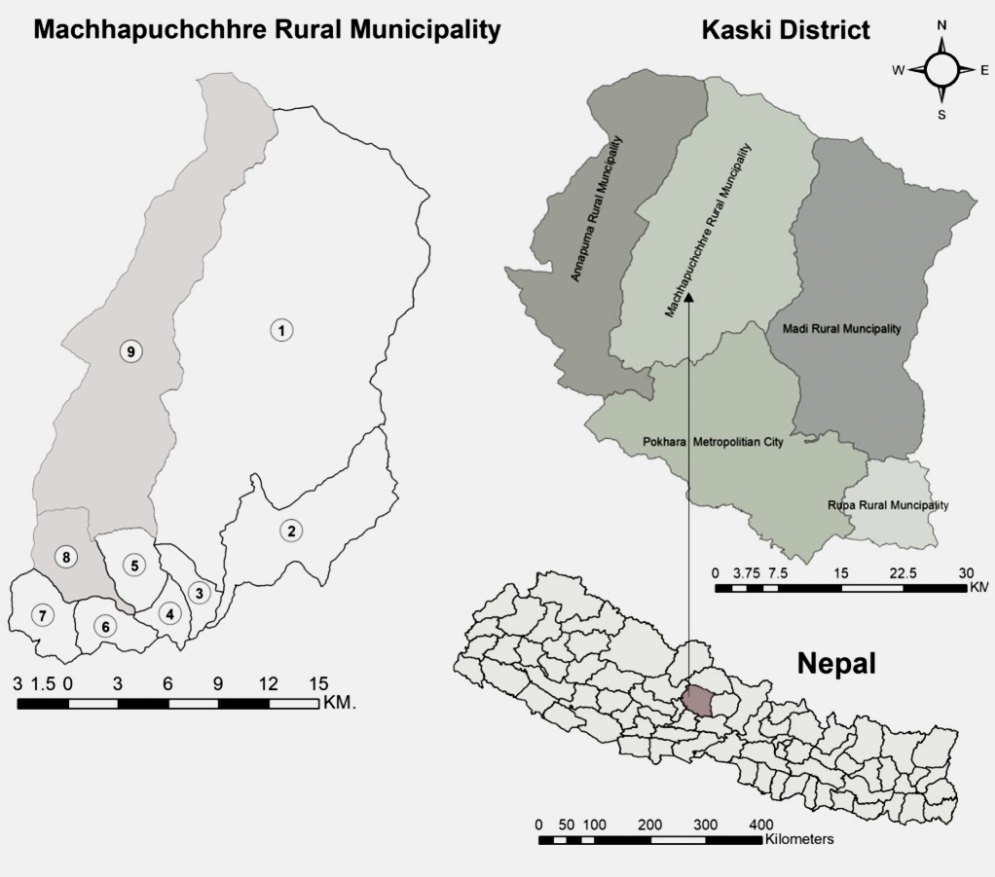

Figure: The map showing Ward no. 1 and 2 (left) in the Machhapuchchhre Rural Municipality of Kaski district (right). (Source: Adhikari et al. 2019)

4.5.1 Sex Ratio

Significant for the Western Hill Region, including the Machhapuchchhre Rural Municipality, is the high proportion of outmigration (21.9%) from the rural villages to cities or foreign countries (Speck 2017: 427). Since the group of migrants mainly consists of young men, a clear gender imbalance in the population can be identified within the study area. Ward no. 1 (referring to Upper Seti) has a sex ratio of 84.9, which lays clearly under the districts' average of 92.44 and the national average of 91.6. So does ward no. 2 with only a slightly higher sex ratio of 88.3 *(number of males per 100 females)* (CBS 2011; CBS 2012: 3, 40).

4.5.2 Literacy Rate

The adult literacy rate of Machapuchchhre Rural Municipality is 62.49 percent and thus lies far below the districts literacy rate of 80 %, which at the same time is one of the highest literacy rates in Nepal. (CBS 2014: 242, 243; CBS 2011a, Access: 13.05.2020). The respective wards are representative for the Municipality and show a similarly low literacy rate of 61.56 percent in Ward no. 1 and 60.98 percent in Ward no. 2 (CBS 2012). This disparity within the district can be explained by the presence of Pokhara City with its status as an administrative center for the district, the Gandaki Province as a whole and the entire West Central Region (Adhikari & Seddon 2002: 75). The increase in administrative job opportunities and the existence of Pokhara University attracted a large number of educated people (Adhikari & Seddon 2002: 81). In terms of overall literacy in Nepal, a gap of roughly 20% can be found between urban and rural areas (CBS 2014: d).

4.5.3 Squatter Settlements

The settlements of Lower Seti are built on public land, often referred to as *Slum area* or more formally Squatter settlements. Since the majority of the squatters occupied the land illegally, they are not included in the statistical data (Adhikari & Seddon 2002: 133). Hence, a detailed declaration of the sex ratio or the literacy rate as stated above cannot be made. Neither is the number of households recorded. However, based on the statements of the interviewees living in the squatter settlements, the number of households can be estimated as follows:

Settlement in Lower Seti	Households	Population	Household Size
Gosti[1]	45	270	6
Lalten Bajar[2]	150	750	5
Shanti Tole[3]	60	360	6

Table 2: Estimated population of Lower Seti. This table is based on estimations from the interviewees. Compared with Google Earth Images and literature the estimation seem to be highly reasonable. (Data Source: Interview 211, 242, 253)

Overall, it can be stated that these settlements are densely populated. Further, Adhikari & Seddon describe the living condition in the squatter settlements of Pokhara as very poor with a low literacy rate of 40 % (Adhikari & Seddon 2002: 135).

4.6 Caste and Ethnicity

Nepal is inhabited by 126 different castes or ethnic groups (CBS 2012: 4). Interestingly, literature about Nepal usually differentiate the terms caste and ethnicity whereas in Nepali language this distinction does not exist. The Nepali term *jaat* includes both of the terms at once (Müller-Böker 1998: 15). However, this should not indicate that the castes are not important anymore in Nepal. Even though the caste system is lawfully suspended since 1963 and with the new constitution in 1990 discrimination was forbidden by law (Stash & Hannum 2001: 357), it still has a strong and structurally discriminating effect on the lowest castes such as the *Hill Dalit* including *Sarki (shoemakers), Kami* (blacksmiths) or *Damai (tailor and musicians)* (Krämer 1996: 232; Soliva 2002: 83-85). The Hindus from the *Hill Castes,* which immigrated from India in mediaeval times, settled in the hilly regions of Nepal. They brought along their pre-existing caste system, which represents the social structure with the top ranked castes already occupied by *Bahun (Brahmin)*, *Thakuri* and *Chhetri* and the lowest ranked occupational castes allocated to *Dalit*. The pure middle-rank of the hill castes, *Vaishya*, did not come along on the way to the Western Hills (Soliva 2002: 83; Bennet et al. 2008: 2). Besides the hill castes the higher parts of the middle hills and the Himalayas are mainly populated by the indigenous Tibeto-Burman ethnic groups such as *Gurung, Tamang, Magar, Rai, Limbu, Sunuwar, Chepang*, and others. These various ethnic groups are nowadays designated as *Janajati (indigenous nationalities)*. Back then, in the hill and mountain regions these groups were assigned to the middle rank in the hierarchy of the caste system. Traditionally, Janajati are producing homemade spirits. Therefore, they were called “liquor-drinkers” by the Brahmins and Chhetris, who consider alcohol by the status of their caste as polluted (Bennet et al. 2008: 2).
Since Kaski district is characteristic for a high number of immigrants from other hill districts, a diversity of ethnic groups can be found (GoN 2014: 18; Kargel et al. 2013: 8). Especially in the study area of the Machhapuchchhre Rural Municipality manifold ethnicities such as Chhetri, Hill Brahmin, Gurung, Tamang, Magar and Dalit are represented (GoN 2014: 18). Lower Seti is located next to the city center of Pokhara and belongs to the Pokhara Lekhnath Metropolitan City. Since Pokhara is a preferred destination for a vast number of migrants, mainly from hilly areas of Kaski district or the west central region, it represents a multi-ethnic migrant hotspot (Adhikari & Seddon 2002: 80) The respective settlements in Lower Seti, though, are built on public land and are mostly home for labor workers in the river sand extraction. Regarding the earlier remarks on the caste system, a higher percentage of Dalit, the occupational castes, are expectedly found there (Adhikari & Seddon 2002: 222; Upadhyay 2014: 8). The sample of lower Seti (*5.2.3 Sample of the Local Inhabitants*) represents exactly this condition. In summary, it becomes clear that the study area of Upper Seti, Kharapani and lower Seti provides a diverse setting in terms of caste and ethnicity.

4.7 Economy

In the hilly regions of Kaski district subsistence farming is the main activity to sustain the local population. Especially for the higher regions, such as Upper Seti and Kharapani, a mixed livelihood strategy is characteristic. Farming is often combined with animal husbandry and the extraction of forest products. For most farmers the harvest does not cover their food consumption on its own for which reason many participate in supplementary non-farming activities. Outmigration for employment in foreign countries, seasonal laboring jobs in the urban areas and most importantly the selling of non-timber forest products, handicrafts and vegetables at the market in Pokhara are common and essential income sources for this particular region (Adhikari & Seddon 2002: 216-219). Thus, the people from Upper Seti and Kharapani are highly dependent on the harvest of forest products (Bajracharya et al. 2006: 2768).
As mentioned earlier, many inhabitants of Upper Seti and Kharapani are migrants from other hilly regions. Due to their poor living condition as self-sufficient farmers they could not afford safer lands in the urban area and settled right at the riverbank of the Seti River (Kargel et al. 2013: 8).

Figure 7: Harvest season for bamboo. A major income source fort he local inhabitants in Upper Seti. (Source: by the author)

The squatter settlements of Lower Seti have no farming land, which is why the population fully depends on daily wage labor. Most of them earn their money by extracting sands from the river. Seti River means *White River*, which indicates a high portion of sediments in the water. The squatter settlements around Pokhara represent the poorest neighborhoods in town with many of their inhabitants living under the poverty line. Their capacity to buy a piece of land or even pay a rent is very low, which is why they reside on the exposed public land next to the river (Kargel et al. 2013: 8; Adhikari & Seddon 2002: 133-135).

Figure 8: Sand collection in Lower Seti. The collected sand is deposited aonthe riverbank. (Source: Photo by the author)

4.7.1 Tourism

Since none of the respective settlements in the study area are located along the trekking routes, no direct income derives from tourism in this region. At least the population within ACA may experience indirect benefits from tourism due to the financing of village development projects from the ACAP entrance fee. Nonetheless, tourism in the Seti Valley is a highly discussed matter. As analyzed by a representative from the tourism sector in Pokhara, the main reason for the absence of trekking routes in the Machhapuchchhre Rural Municipality is the fact that Machhapuchchhre Himal, which crowns the Seti Valley, is not allowed for climbing. It is believed that Machhapuchchhre Himal is a sacred mountain (Bhattarai 2008: 26). Further reasons are the difficult terrain towards the mountains and the extremely dense forest in the lower parts. Nevertheless, the desire for sustainable tourism in the Seti Valley has been raised by many interest groups. At the same time the “holiness” of “her”, Machhapuchchhre Himal, has been politically discussed. Scents of the economic potential in this region let some people deny the belief in her holiness. On the other hand, those who mainly fear the destruction of the untouched nature, fight for the virginity of Machhapuchchhre Himal. The future of tourism in the Seti Valley is not drawn yet but for sure a strongly discussed and sensitive topic (Interview 28, Expert, 2019).

5. Methodology

The present research is located in social science and follows a qualitative research approach. Qualitative research is widespread and entirely approved in social science (Flick et al. 2010: 13). While quantitative research focuses on measurements and quantification, the epistemological principle of qualitative research is "*understanding" (*Helfferich 2011: 21, Flick et al. 2010: 14). Qualitative research demands to describe phenomena and life-worlds from the perspective of the involved actors in order to provide the individual inside-out perspective (Flick et al. 2010: 14). This research's aim of disclosing individual perspectives of risks and understanding the social realities of the local population can therefore be fully met with a qualitative research approach. In addition, the ontological position of this research is predicated on the belief that reality is socially constructed. This ontological "anti-foundationalist" position and the subjective epistemological position, which advocates that there is no "objective truth", explicitly claim for qualitative methods (Marsh & Furlong 2002: 26-27).

This research's qualitative approach applies the *Problem-Centered Interview (PCI)* after Witzel (1982) for data acquisition, a purposeful sampling strategy after Patton (1990) for the selection of the sample group and finally *Thematic Qualitative Content Analysis* after Kuckartz (2018) for the data analysis. Indispensable in the research process is the reflection of the methodology, which is included in the last chapter of the study.

5.1 Data Acquisition

For the collection of data 28 interviews were conducted. Three of those were expert interviews, while 25 interviews were conducted with the local inhabitants of the research area. Two interviews with the local inhabitants were held as focus group interviews using the same guideline as for the individual interviews. The interviews with the local inhabitants are the centerpiece of this research, while the expert interviews fulfill the function of a deeper insight in selected topics and to contextualize the results. This combination of interviews allowed an appropriate between-method triangulation after Denzin (1978). Importantly, it has to be accentuated that the focus of the triangulation in this research is not to obtain objectivity or the validation of the already known but the gain of greater knowledge and deeper understanding of the data (Denzin 1989: 246 & Denzin & Lincoln 1994: 2; as cited in Flick 2010: 311).

All interviews were conducted personally, either at the respondent's private home or in the offices of the experts. The duration of the interviews varied between 30 and 90 minutes with an average of 50 minutes. The language used was *Nepali* for which reason an interpreter was essential.

For the approach of the research topic and the preparation of the qualitative interviews, informal conversations with local experts from the disciplines of anthropology and natural science were held. Beforehand, the in-depth analysis of scientific literature was a fundamental prerequisite for the preparation of the data acquisition.

5.1.1 Interviews with local Inhabitants

The intention of the interviews was to capture the respondent's perception of risk and their understanding of the environment and changes of it. The problem-centered interview (PCI) after Witzel (1982), of which the principle is to focus on individual understanding of the social reality and subjective perceptions, presented itself as the ideal method to apply for the interviews (Witzel 2000: 1; Witzel & Reiter 2012: 24; Witzel 1982). In problem-centered interviews the researcher's assumptions are confronted with the social reality which leads to a modification or a deeper understanding of the assumed phenomena (Mattissek et al. 2013: 161). When researching about individuals' perceptions, it is crucial for the researcher to be receptive for such modifications and to react accordingly. This is reflected in one of the main principles of the PCI: *the problem orientation*. To put it in a nutshell, Witzel and Reiter (2012) state:

> *"The principle of problem centring aims at research strategies that are able to optimise the respondents' possibilities to explicate themselves. Their points of view regarding the specific problem must have the chance to be brought to bear even if they are opposed to the original interpretations of the researcher or any assumptions possibly underlying the interview or single questions."* (Witzel & Reiter 2012: 27).

Through the second principle "object orientation", the tool for reacting on these requirements is given. The object orientation claims openness and flexibility of the applied methods to give consideration to the demands of the observed object. Thus, it allows an interplay of narrative sections with a guided dialog (Witzel 2000: 3). With the help of a semi-structured guideline the interviewer is then flexible to incorporate the respondent's thoughts and to adjust the questions, topics or style of the conversation (Helfferich 2011: 179-181). According to Flick (2011: 194ff as cited in Mattissek et al. 2013: 167) the PCI belongs to the category of the *guided interviews.* Amendatory, Lamnek declares them as widely open and advises, therefore, the use of a semi-structured guideline in combination with problem-centered interviews (Lamnek 2010: 349f as cited in Mattissek et al. 2013: 160). Moreover, for the collaboration with an interpreter, the semi-structured interview guideline was essential. On its base the interviews could be conducted, discussed, adjusted, reflected and improved.

5.1.2 Focus Group Interviews

Two of the interviews conducted with the local inhabitants of the Seti Valley were held as focus group interviews with 5 to 6 respondents. With regard to the different setting of a group conversation the interview followed the same guideline and principles of the PCI as it did for the individual interviews. The focus group interviews took advantage of a situational approach, by using the natural presence of a group instead of creating an unnatural interview situation by interrupting the assembled group for the sake of an individual interview (Flick 1999: 131). Beside this, the benefit of focus group interviews is described as an efficient way of gathering a good amount of manifold data. The holistic spectrum of the information can be achieved thanks to the stimulating dynamics of the group conversation. Hence, a narration of one participant can activate the memory or provoke the opinion of another participant. Nevertheless, attention has to be paid on the inhibiting effect of the group's dynamic on another participants' opinion (Flick 1999: 132; Fontana & Frey 1994: 365; Merton et al. 1956). Thus, the

interviewer's task is to make sure that none of the participants develops a dominant role and drowns the voices of the other participants. At the same time, he or she has to encourage silent participants to raise their voices. Therefore, the interviewer has an active role in organizing the conversation. For a successful focus group interview it is crucial to find a good balance between directive leading of the conversation and a non-directive moderation to leave enough space for the development of group dynamics which in turn can bear new information (Flick 1999: 131f; Fontana & Frey 1994: 365; Merton et al. 1956).

5.1.3 Expert Interviews

The expert interviews were held with experts from the fields of tourism, nature conservation (ACAP) and disaster management. For this research, in which the focus lays on the individual's perception and local knowledge, the systemizing expert interview was applied. Bogner & Menz (2009: 47) emphasize that in this category of expert interviews *"it is not the experts themselves who are the object of the investigation; their function is rather that of informants who provide information about the real objects being investigated".* This approach reflects closely the intended focus of this research on the local knowledge and perceptions as well as the applied principle of triangulation in which the new information is amendatory but not comparative. The expert interview with the representative of ACAP exemplifies the above-mentioned: While the expert explained the organization, intentions, principles and the implementation of ACAP, the local population living in the conservation area itself, shared their perception on the actual implication of ACAP on their lives and their knowledge about the implementation and organization of ACAP. Even though the main interest lays on the latter, the expert's knowledge provided the required background knowledge for a better understanding and the contextualization of the information obtained from the local inhabitants. This approach refers to an understanding in which expert knowledge is not placed over local knowledge and the two are not being played off against each other. The expert plays an advisory role regarding the object of research and the received information is seen as factual knowledge (Bogner & Menz 2009: 47; Kruse 2014: 173). The interviewer, with its already gained knowledge about the object of interest, acts as a co-expert and poses specific questions based on previous investigations (Kruse 2014: 170; Bogner & Menz 2009: 47). Thus, divergent perspectives can be uncovered and potential areas of conflict or new interrelations detected. In terms of the between-method triangulation it is particularly interesting when divergence instead of convergence is being revealed. After Flick, triangulation between methods is successful as soon as it performs as a *"route to additional knowledge"* and not only as a confirmation of knowledge (Flick 2004: 183).

5.1.3.1 Experts

The experts in this research are representatives of a specific institution or field of work. Likewise, the shared knowledge is considered as a representation of the respective institution or field and the respondents' individual personality is not matter of interest (Kruse 2014: 168f; Flick 1999: 109) The considered experts belong to different fields and were selected on the basis of topics which emerged as particularly crucial in previous investigations. A governmental representative from the department of disaster management, a representative from the ACAP and a representative from the tourism sector of the study area made up the group of experts.

5.1.4 Interview Guideline

Openness is one of the central principles of qualitative research. It aims to create enough space for the respondent to include thoughts detached from the guideline and to help shape the direction of the conversation. While in quantitative research, with its standardized methods, the respondent fully complies to the questionnaire or the ambition of the interviewer, qualitative research allows or even strives for the respondent's active and to a certain degree directive participation (Helfferich 2011: 114). Notably for the identification of individual perceptions it is mandatory to grant the respondents enough space to unfold their perceptions. Thus, for the design of the interview guideline among other aspects, the openness has to be taken into account. The design of the interview guideline is an essential step in the preparation of the field work and should not be underestimated.

According to Helfferich's principle *"as open and flexible … as possible but at the same time as structured as needed to accomplish the research's aim"*, the guideline was designed (Helfferich 2011: 181; own translation). With a semi-structured guideline, space for narration, flexibility for unexpected turns of the conversation but also a purposeful setting can be ensured. Witzel & Reiter describe the interview guideline of problem-centered interviews as a tool for "securing both the problem centring of the interview and the comparability of the individual interviews" (Witzel & Reiter 2012: 51). It helps to organize the researcher's interest and background knowledge thematically and serves as an aid of memory for the course of the interview (Witzel & Reiter 2012: 51). In case an interview flattens the guideline can provide new stimuli or support the interviewer to regain orientation if the conversation wanders far from the research object (Witzel & Reiter 2012: 52). Nevertheless, after the principle of the PCI and linked to the principle of openness described above, the interview guideline should mainly be seen as a facilitation of the process in the background. The main attention should be paid to the topical guidance established by the respondent (Witzel & Reiter 2012: 52). Analogously, Helfferich (2011) underlines that a guideline must not be a barrier for new ideas and various perspectives raised by the respondent. Thus, the guideline should not involve too many questions or be strongly condensed (Helfferich 2011: 180).

5.1.4.1 The Way of Asking Questions

An interview guideline is not a simple catalogue of discrete questions, it is rather a complex construct reflecting the research object (Helffreich 2011: 181). For a successful interview a couple of aspects have to be considered when establishing the questions.

First and foremost, the approach of the interview has to be deliberated in advance. The introduction of the research's aim and the disclosure of the purpose of the interview can be determining factors for the course of the interview. Importantly, the respondent has to be informed about the purpose, scope and the intended use of the research project. However, it has to be avoided that the interview gets biased due to the respondent's prejudice of the research topic. Hence, the wording of the introduction has to be chosen wisely (Kruse 2014: 259). To exemplify: In practice, the term climate change was never mentioned in the introduction of the research's purpose although it is an essential component of it. This way, an early prepossession of the respondent's thoughts about the research object could be avoided.

Further, the composition of the guideline should consider the degree of complexity of the questions. For a successful interview it is important to make the respondent feel competent to answer the questions right from the start. Thus, an easy opening question, which stimulates an unforced narration is suggested (Helfferich 2011: 181). Narrative and descriptive questions which stimulate elaborate answers are placed in the beginning, whereas more complex and controversial questions come into operation at the end of the conversation (Helfferich 2011: 180). Right before closing the interview, it is the respondent's turn to add final personally relevant thoughts, which have not been raised in the course of the conversation (Helfferich 2011: 181).

5.1.4.2 Formulation of Questions or Stimuli

While closed-ended questions are not recommended for qualitative research, open questions or narrative stimuli are conducive. Still, attention has to be paid on the formulation of the questions or stimuli so that they do not predispose a certain kind of answers. For example, questions which anticipate specific answers, in terms of social desirability, should be avoided. Likewise, it is not recommended to use suggestive questions which manipulate the respondent's answers on grounds of allegations (Kurse 2014: 219).

Another perspective on the formulation of questions offers the *within-method triangulation*. The within-method triangulation is part of the methodological triangulation. In comparison to the already introduced *between method triangulation*, this method focuses on the subscales within the interview guideline (Flick 2010: 310). The intention of the within-method triangulation is, again, to enlarge the spectrum of knowledge gained through asking a question. It follows the principle of combining narrative stimuli with particular questions. In turn, this reflects the concept of PCI which suggests using the strengths of both, narrations and dialogic questions, in combination. At first the object of interest gets approached through narrations about personal experiences with the topic. Later in the conversation the same object gets addressed with specific questions which are targeted on definitions and more general thoughts on the topic (Flick 2010: 312).

With the example of *climate change* the within-method triangulation can be demonstrated: First, the respondents were stimulated to talk about changes in their lives and changes in their environment, without even mentioning the term *climate change*. Later the respondents were directly asked about the meaning of the term and to define *climate change*. This approach helps to get additional perspectives on the object of interest (Flick 2010: 313). Mostly, the combination of narration and specific questions, offers a way to address complex topics without making the respondents insecure. Thus, a blockage or hesitation of the respondents' thoughts, due to a term they are not familiar with or misunderstand, can be avoided.

5.1.4.3 Designing the Guideline

To apply the above described requirements of an interview guideline, the *SPSS* method suggested by Helfferich (2011) provided assistance. SPSS[2] represents four steps in the development of the interview guideline. The first step advises to *collect* all questions which are relevant to the research topic. In a next step the collected questions were *reviewed* regarding the above-mentioned aspects and suggestions

[2] *The principle of **SPSS** originates from German literature. The letters stand for **S**ammeln (english: to collect), **P**rüfen (engl.: to review), **S**ortieren (engl.: to sort)), **S**ubsumieren (english: to subsume) (Helfferich 2011:182-185).*

and were drastically reduced to roughly half of the amount of questions (Helfferich 2011: 182-185). In the following step, the questions were *sorted*, on the one hand, thematically and, on the other hand, by means of the structural advices underlined above. Finally, the questions were *subsumed* with a significant question or stimulus for each of the beforehand sorted bundles. Nevertheless, sub-questions are still allowed and serve as a checklist for additional topics which might be relevant to address (Helfferich 2011: 185).

Thus, the interview guideline was organized in thematic blocks and started with simple and open questions about the respondent's personal understanding of and relation to environment, involving water, mountains and forest. It proved well as an introductory block and let the respondents feel comfortable and competent. The subsequent blocks considered the respondents' risk perception, the Seti Disaster and adaptation strategies. Only close to the end of the conversation more conceptional topics were raised and sensitive question, for example questions regarding the government, were tackled. The complete interview guideline can be found in the appendix.

As Flick advises, a pretest was conducted before the start of the interviews (Flick 2000: 79). The pre-test should help to reflect on the questionnaire and to discover potential weak points of it. Beside smaller adjustments on the guideline, it served as a clarification of certain aspects between the interpreter and the researcher. Moreover, the pretest was a useful practice to get familiar with the guideline, as well as with the procedure of the interview and to get to know each other in the setting of interviewing.

5.1.4.4 Handling and Flexibility of the Guideline

To develop the interview guideline is a fairly individual task. Either the questions are well formulated or only sketched in keywords. Another way to design the guideline could be a mind map as suggested by Kurz et al. (2007: 471). In this case, only the key topics are displayed, visually grouped and connected with each other. Due to the need of an interpreter and the fact that the researcher herself had to render part of the control, the use of a well-structured and formulated guideline was beneficial. It was the main medium to make sure that the interpreter met the aim of the researcher. Nevertheless, the interpreter still had the freedom to flexibly adjust the guideline to the conversation and the respondents. As Hopf (2010) suggest for semi-structured interviews, the guideline was handled flexible enough to adapt the order and the formulation of the question for the sake of a better flow of the interview or to be fully responsive to the individual respondents (Hopf 2010: 351). In the course of the fieldwork the interpreter and the researcher also developed a mind map with key words. It was a supplement to the guideline and was applied as a means of communication between the interpreter and the researcher. During the interview the interpreter could tick off already addressed topics what in turn helped the researcher to gain an overview and to be part of the organization and structuring of the interview.

During the course of the field work, new topics emerged, which were not considered before but relevant for answering the research question. The interplay of deductive and inductive approaches, as suggested by the principle of the PCI, allows to align the focus during the research (Witzel 2000: 1). Such new key points were incorporated in the guideline and were often discovered as pathbreaking inputs. As an example: At the time the field work was conducted it was the season of bamboo collection. The harvesting of bamboo in this particular area is restricted to one month in a year and triggers mixed

feelings within the population. When conducting the interviews this topic was raised and it quickly emerged as an important and complex issue. Hence, it was included in the following interviews. Presumably this topic would not have been raised beyond the harvesting season. Therefore, it seems important to react flexible on new insights and findings from the field. Even though new impulses from previous interviews are essential and improve the guideline, attention has to be paid on the comparability of the interviews. To avoid a fallacy in the results, it was inevitable to reflect on these effects and to consider them in the analysis of the data. Overall, the handling of the guideline occurred flexible and the consideration of various situations and individual respondents was key.

5.1.5 Interpreter

An identified challenge for this research posed the language. For the sake of profound conversations, the interviews were held in Nepali. The need for an interpreter made the process of data collection more challenging. Various considerations regarding the procedure of interviewing were required which are presented in the following section.

5.1.5.1 Interviewing with help of an interpreter

Not only the guideline but also the skills of the interviewer have to allow openness and flexibility. In diverse situations the interviewer has to respond to the interviewee and be able to detach from the guideline (Helfferich 2011: 180). This involves a thorough preparation in such way as to enable the interviewer to interact freely and focus on the respondent instead of the guideline. Since in this research the interviewer was not the researcher herself but an external interpreter, the preparation included a deliberate briefing. The interpreter was introduced to the principles of qualitative research and the significance of the interviews' openness and the receptivity for the respondents' thoughts. Further, the interpreter herself studied the research's concept and guideline intensely. Remaining questions were clarified, the general understanding of the research discussed and finally some in-depth reflection about the usage of different words and formulations was done. The intention of the latter was to better understand the cultural specificity of language and to ensure the transfer of the researcher's intended meaning. This convergence was particularly important for the translation of the guideline to Nepali language. The interpreter's experience from prior field work in a qualitative research project emerged as a huge benefit for the collaboration. The familiarity with common formula for success, such as active listening or a respectful approach of the interviewees and her adaptive capacity to almost every situation mirrored her experience (Mattissek et al. 2013: 166).

To avoid too much interruption during the process of interviewing, the interviews were not translated simultaneously. Therefore, the interpreter oriented the researcher only between the blocks, what has been discussed and in which direction the conversation was going. This enabled a natural flow of the interview and prevented idle time for the respondents. The researcher took advantage of the role as a person in the background and focused intensely on the observation of the interview. Thereby, the setting, feelings, atmosphere, disturbances and irregularities, were observed and noted in a field protocol (Flick 2000: 83; Kruse 2014: 284). At the same time the researcher was able support the interpreter with inputs about key topics and to keep an overview of the conversation. At this place, the abovementioned mind map, where already addressed topics were ticked off, was crucial.

Most important when working with an interpreter is the debriefing of the interviews. In the aftermath of each interview the interpreter recapitulated the conversation. The researcher asked questions regarding the key topics and together a conclusion of new results and objects of interest was drawn. If needed, the guideline was adjusted or new topics were added. Such alterations were precisely documented in the field protocol. Given that most of the interviews were held in Nepali, the debriefing and the researcher's notes in the field protocol were the only way to gain insight into the results of the ongoing field work. Throughout the entire course of the field work a thoughtful practice of reflection and exchange was maintained.

5.2 Sampling

5.2.1 Sampling Strategy for the Local Inhabitants

The considered sample group of a research project has a significant impact on the validity of the research, wherefore it should be selected consciously (Kruse 2014: 142). Contrary to quantitative random samples, qualitative samples should be chosen purposefully. The aim is to select information-rich cases to answer the research question (Patton 1990: 169). Within a purposeful sampling strategy, different methods can lead to the adequate sample. The criterion sampling serves as a strategy to find information-rich cases by selecting only cases which, for example, fulfill the prerequisites to answer the research question (Patton 1990: 176). Similarly, Hellferich (2011) describes a strategy whereof a combination of contraction of the sample and maximal heterogeneity within the sample group emerges. The attempt is to define the group of interest within a narrow scope but to keep the sample of this group as diverse as possible (Helfferich 2011: 173). Regarding the present research the strategy was applied as follows: The criteria which defined the scope were *a specific research area, the interest in the local population of this particular place and the vicinity of their homes to the river*. Within this scope, the sample should in contrast be as heterogenous as possible to enlarge the credibility. The sample group should represent a variety in terms of age, gender, religious affiliation, caste / ethnicity or profession. The purpose of the heterogeneous sample was to broaden the spectrum of perceptions but not to reify stereotypes (Kruse 2014: 253). The flexibility of qualitative research allows in the aftermath to disclose a not fulfilled criterion as a limitation of the scope of validity instead of labeling the results as completely invalid. For example, when women are highly underrepresented in the final sample, the researcher has to display this circumstance as a limitation of the results' validity (Helfferich 2011: 174).
The snowball sampling which is a commonly used sampling strategy was deliberately not considered for the sake of heterogeneity (Patton 1990: 176). Too obvious seemed the bias resulting from snowball sampling (Kurse 2014: 255). The only information which was retrieved from previous respondents was based on geographical information about further settlements.

Scope	Local population Living in the Seti Valley close to the river
Criteria	Variety in terms of age, gender, caste / ethnicity, religious affiliation, profession

Table 3: Samoling Strategy (Source: by the researcher)

5.2.2 Sampling Strategy for the Experts

The sampling strategy for the expert interviews followed the opportunistic sampling after Patton (1990: 179). The experts were chosen *"on-the-spot"* based on newly gained insights about the research object. This strategy takes advantage of unexpectedly offered opportunities after the field work already has started. Patton describes it as a strength of qualitative methods to follow *"wherever the data leads"* and to allow *"samples to emerge during field work."* (Patton 1990: 179) He claims that not all decisions can and have to be made in advance. It is exactly the frankness for new ideas or topics that make a difference (Patton 1990: 179).

5.2.3 Sample of the Local Inhabitants

The sample group was composed of local residents from the Seti River Valley. All interviewees live alongside the river and some of them even work in the river for the extraction of sand. Fortunately, in the present research the goal of a heterogenous sample in terms of age, gender, caste and ethnicity was achieved. Since the Western Hill region, where the study is located, shows Nepal's highest proportion of migrants, in particular young men, it was assumed that the demand for a heterogeneous sample in terms of age and gender might pose a challenge (Speck 2017: 427). Favorably it was not the case and also young male respondents are represented in the sample. The sample consists of 17 male and 19 female respondents. The age ranges from the youngest respondent of 20 years to the oldest participant of 75 years, whereas all age groups are well represented. Despite the researcher's concern, different castes could be displayed in the sample as well. Since many families migrated to the Seti River Valley from other districts in Nepal, the sample also includes various ethnical groups (Kargel et al. 2013: 8). Regarding the religious affiliation most of the respondents belong to Hinduism which is in turn also the major religion in Nepal. Nevertheless, also Buddhists and Christians are well represented in the sample group. Most of the residents from *Upper Seti* and *Kharapani* are self-sufficient farmers. Only the residents from the *"slum area"* earn their living by extracting sand from the river or other labor work. Therefore, the respondents' profession was not decisive for the sampling strategy but undoubtedly of interest concerning the results.

The respondents live alongside the Seti River between Pokhara City and the valley head in Jimerbari. The colors in *Table 4* indicate whether the respondents are residents from *Upper Seti, Kharapani or Lower Seti. Upper Seti* are the villages which are close to the mountains and the gorge of the river. Karuva is the main village in the Upper Seti area with roughly 20 households. The other villages further upstream, such as Ebang, Tallatora, Kabuje and Sandal are tiny settlements consisting of two or three households each. Jimerbari is the uppermost settlement of the valley, right at the valley head where only one household remained. *Kharapani* is the area which was the most affected in the Seti disaster in 2012. Kharapani is located further downstream but still in the hilly area of the Kaski district. *Lower Seti* is an area close to Pokhara City where the inhabitants along the river live on public land, also called the *"slum area".* It is divided in two larger settlements, Gosti (Lamachaur) and Lalten Bajar.
Since these three locations are quite distanced from each other, they are categorized in groups. More about the meaning of this categorization will be displayed in the results and in the discussion.

The following table displays the sample in detail:

Interview	Gender	Cast / Ethnicity	Religious affiliation	Age	Location
1	male	Brahmin	Hindu	75+	Karuwa
2	male	Chhetri	Hindu	62	Karuwa
3	female	Magar	Hindu	30	Karuwa
4	male	Magar	Hindu	51	Karuwa
5	male	Magar	Hindu	22	Karuwa
6	female	Tamang	Christian	20	Sandal (Ebang)
7	female	Magar	Hindu	30	Sandal (Tallatora)
8	female & male	Magar	Hindu	32 / 35	Sandal
9	female & male	Magar	Hindu	46 / 45	Sandal
10	male	Tamang	Hindu / Buddhist	37	Sandal
11	female	Tamang	Christian	22	Kabuje
12	female & male	Magar	Hindu	60 / 60	Jimerbari
13	female & male	Tamang	Christian	26 / 29	Kabuje
14	male	Magar	Hindu	36	Karuwa
15	male	Gurung	Buddhist	52	Kharapani
16	female	Magar	Hindu	22	Kharapani
17	female	Dalit	Christian	69	Kharapani
18*	female male female female	Gurung Gurung Chhetri Tamang	Christian Christian Hindu Buddhist	56 57 40 45	Kharapani
19	male	Gurung	Buddhist	65	Kharapani
20	male	Brahmin	Hindu	46	Kharapani
21*	female female female female male	Tamang Dalit Dalit Tamang Dalit	Buddhist Hindu Hindu Buddhist Hindu	58 38 26 29 23	Gosti
22	female	Dalit	Hindu	36	Gosti
23	female	Dalit	Hindu	27	Gosti
24	male	Dalit	Hindu	58	Lalten Bajar
25	male	Dalit	Hindu	40	Lalten Bajar (Shanti Tole)

** Interview 18 and 21 were conducted as Focus Group Interviews*

Table 4: Sample group of the local inhabitants in the Seti River Valley (Source: data collected by the researcher).

5.2.4 Sample of the Experts

As already described in chapter *5.1.3.1 Experts*, the experts were representatives of different fields of interest. The considered experts were selected on the base of newly gained insights from the field work which emerged as particularly crucial to answer the research question and required further investigation.

The table below shows an overview:

Respondent	Field of work or Institution
Expert 1	Representative of the ACAP
Expert 2	Representative of the tourism sector in the area of ACAP (research area)
Expert 3	Representative of the department for disaster management, Pokhara

Table 5: Sample of the Experts (Source: data collected by the researcher)

5.5 Accessing the Field

Before heading to the field an intensive preparation, including the acquisition of geographical and cultural knowledge, studying of maps and mostly exchange with natives or experts of the region was key. Great support was received from Prof. Dr. Müller-Böker, who provided her background knowledge about the Nepali culture from her lifelong experience as a researcher in Nepal and suggested valuable contact persons on the ground. Another key person was Sarah Speck, a Ph.D. student from the Department of Geography of the University of Zurich, who conducted her research in a nearby area and shared seminal insider information about the field. The company of the interpreter facilitated the access to the field to a great extent, the more so as she already roughly knew the study area from a prior research project in the neighboring villages. While her main task was to conduct the interviews, she acted additionally as a field collaborater which was highly appreciated. On site, a local acquaintance from the place where the field work started, who moreover worked as a trekking guide for several years, provided assistant information about safety, behavior and the current condition of the trails due to the ongoing heavy rainy season.

Generally, it can be stated that the access to the field happened without bigger obstacles. The most obvious challenges which were faced, were due to natural circumstances such as landslides, which blocked the trails. At least, the dependence on transportation, which is a major obstacle in the rainy season, could be avoided since the villages were approached only by foot. Even more attention was paid on the safety of the interpreter and the researcher. Although the rainy season posed some challenges in accessing the field it was perceived as an important circumstance for the authenticity of the research project. The approach of the interview partners, however, occurred smoothly. Almost everyone was interested in the research and willing to participate. Presumably it was advantageous that the interpreter and the researcher faced the obstacles to reach the most remote places of the valley on foot. On the one hand, it was important for the researcher to experience the environment of the place and the significance and consequences of living in such a remote place. On the other hand, it helped to encounter the local population at eye level due to the shared experience of a later in the course distinguished central topic: the road access and its difficulty.

Figure 9: After hours of hiking, the researcher and her collaborater reached the study area in the middle of the rain forest. (Source: Photo by the author)

When approaching the people first and foremost the interest of the research was revealed and their consent for the participation in the research inquired. If they agreed to participate the interpreter asked for permission to record the conversation and informed about the anonymity and confidentiality of the data. Only thereafter an interview would be started and recorded. Further thoughts about ethical considerations will be pointed out later on in the reflection of the methodology.

5.6 Data Analysis

5.6.1 Transcription

All interviews were recorded and subsequently transcribed. A transcription is a process by which an audio file gets transferred in a written form and serves as a tool for further analysis of the data. Kowal and O'Connell accentuate transcripts' importance as follows: *"Transcripts are needed to make fleeting conversational behaviour permanently available on paper for scientific analysis."* (Kowal & O'Connell 2004: 248). Transcribing is always a selective process because it is impossible to entirely represent the vast amount of data which is held in primary data from the actual conversation or secondary data which the recordings comprises (Kowal & O'Connell 2004: 249, Davidson 2009: 38). This regards the range of accentuation or order of words, non-linguistic behavior, such as laughter, or even non-vocal features, such as gestures (Kowal & O'Connell 2004: 248). Thus, transcripts should not be seen as "the objective truth" of the conversation. Green et al. (1997) understand a transcript as *"a text that "re"-presents an event; it is not the event itself"* and put emphasis on the "myth of the objective transcript." (Green et al.

1997: 172). The selectivity of a transcript should, therefore, be unfolded in the process and reflected in the analysis of the data.

Since the interviews were conducted in Nepali, the transcripts were done by the interpreter herself. This situation added even more complexity to the process. When establishing transcripts, a bundle of decisions have to be made beforehand or while transcribing. Similar to the interview briefing, an in depth briefing of the interpreter about the guideline of transcriptions was needed. The researcher prepared a detailed manual *(10.2 Transcription Guideline)* which included rules and advice for transcriptions. They mirrored important decisions and considerations made by the researcher beforehand. Kowal and O'Connel (2004: 251) recommend to transcribe only conversational features which in turn are subject of the analysis. Similarly, Ochs (1979: 44) states: "A more useful transcript is a more selective one." This might be advantageous for a research project where the transcriber and the researcher are the same person. Tough for the present research, the transcriber was instructed to transcribe as accurate and detailed as possible. Underlying this expectation was the fact that selective decisions regarding the necessity of additional information should be conducted by the researcher and not by the transcriber. The transcripts represented the first encounter with the entire data collected in the field wherefore the aim was to not deprive the researcher of any relevant information. Still, the legibility was considered as the spelling of English words followed the *"standard orthography"* instead of a phonetic transcription (Kowal & O'Connell 2004: 250). In the presentation of the results, direct quotes from the respondents were transformed to formally accurate English sentences.

Besides the detailed instructions on the principles of transcriptions cultural considerations had to be taken into account. The intermediate step of translating the interviews from Nepali to English language required to reflect on the language used in terms of intercultural meanings. Negligently, in the scientific debate questions about equivalence of meanings are often not addressed or presumed as irrelevant (Riessman 2008: 42). It has to be considered that words do not necessarily have a comparable sense across languages or cultures (Riessman 2008: 46). Again, the communication between the researcher and the translator, or in this case the transcriber, was key for the quality of the results. Thorough reflections about the equivalence of a word in English or cultural meanings of specific phenomena were performed.

Additional to the manual, a template was provided to make sure that all of the transcripts hold the same structure. In a separate section, each transcript included a brief description of the setting, characteristics and potential difficulties of the interview. The information derived from the interpreter's notes and were complemented with the researcher's observations from the field protocol. When analyzing the data, this particular information helped to contextualize the data and to recognize possible limitations.

5.6.1 Qualitative Content Analysis

The aim of qualitative content analysis is to reduce the complexity of the data. This process underlies a specific research-driven perspective, theoretical or empirical, which defines the characteristics of interest. On the basis of pre-defined characteristics, text passages get codified and thus assigned to

specific categories (Früh 2004: 42 as cited in Kuckartz 2018: 32). The designation of characteristics of interest can either happen before or while working with the data and results in a system of categories and subcategories. The a-priori construction of categories is also labeled as *deductive category construction* and is a theoretical approach. Based on previous knowledge, theoretical orientation, the problem statement or the research's interview guideline itself, categories are established. This process happens detached from the empirical data. On the other hand, the *inductive category construction* follows an empirical approach where categories are exclusively built on the basis of the empirical data. Albeit the two approaches are opposed, they can still be applied alternately (Kuckartz 2018: 63-64).

When coding data and thereby reducing complexity, a certain amount of information gets lost or at least filtered. To some extent this is the aim of the procedure itself. To other parts though, it might be an unintentional consequence of a stringent and solely deductively developed system of categories (Früh 2004: 42 as cited in Kuckartz 2018: 32). If the construction of categories occurs only deductively, unforeseen topics which were raised in the interviews will slip through the system of already determined categories, although they were of importance for the research's aim (Kuckartz 2018: 95). Saldana (2009: 8) calls upon the importance of inductively produced categories and explains it as follows: *"Coding is not just labeling, it is linking: 'It leads you from the data to an idea, and from the idea to all the data pertaining to that idea'* (Richards & Morse 2007: 137 as cited in Saldana 2009: 8)". For the present research a combination of deductive and inductive established categories appeared conducive and was applied after Kuckartz' *"Thematic Qualitative Content Analysis"*.

5.6.1.1 Thematic Qualitative Content Analysis

The thematic qualitative content analysis is a stepwise procedure of analysis which allows an interplay of deductive and inductive category building (Kuckartz 2018: 97). It is a suitable method to apply in problem-centered interviews (PCI) (Kuckartz 2018: 98). The mergence of theory orientation and openness, which is a purpose of PCI, gets reflected in the deductive-inductive category construction. Moreover, the inductive category building serves as the major aim of PCI, namely, to point out subjective perspectives of the respondent through the detailed integration of the empirical data (Witzel 2000: 1; Kuckartz 2018: 95, 97).

The following steps, suggested by the procedure after Kuckartz (2018: 97 – 121), were applied for the data analysis of the present research project: First of all, the deductive category building was conducted based on previous knowledge of the researcher, the research question and the major topics from the interview guideline. These categories are mainly *"thematic categories"* which were often directly implicated by the questions from the interview guideline (Kuckartz 2018: 34). For example, if a question addresses the livelihood of the respondents an implicit thematic category would be *"income generation"*. In a next step the first engagement with the data took place and the text passages were codified by means of the deductive categories. At the same time, the researcher took notes, when new relevant topics or distinctive features arose. On the base of the first encounter with the data and the analysis of it, subcategories were constructed inductively. The inductive category building can either serve as precision, modification or a differentiation of the already existing categories. Besides that, also completely new categories can be established when unforeseen topics were raised in the interviews (Kuckartz 2018: 95). Although inductively established categories can be *"thematic categories"* as well, they are often of a more complex nature and so-called "*analytical categories"*. Analytical categories are

the result of a deeper analysis of the data and go beyond a descriptive characteristic. They try to reflect interrelations from thematic categories (Kuckartz 2018: 34). For example, the sub-category "necessary evil" includes statements which show the conflict between statements from the thematic categories "Faith" and "Economy". Thus, when a statement reveals that the belief in something gets denied for the hope of economic betterment, it would be coded as "necessary evil". In a last step all the material is exposed to a second cycle of codification, including the modified or newly built inductive categories. For the codification of the interviews the software MAXQDA 2020 was used.
In the aftermath of the codification follows the analysis of the categories, subcategories and their interconnection with each other. After initially analyzing the categories on a smaller scale, the analysis over the wider categories followed (Kuckartz 2018: 119). Specifically, for the analysis of the risk perception interconnections between different risks were carved out and *risk networks* after Jurt (2009) established. They stem from a deep analysis and uncover connections which are not apparent at first glance (Jurt 2009: 100). As a means of visualization some interconnections between and within categories were displayed in concept maps. The visual organization and linkage facilitated the process of revealing interconnections (Kuckartz 2018: 120).

5.6.1.2 The Subjectivity of Coding

As displayed in the process of Kuckartz' *"Thematic Qualitative Content Analysis",* the qualitative content analysis is a systematic way of analysis in which simultaneously the understanding and the interpretation of the data play a crucial role (Kuckartz 2018: 26-27). *"Systematic"* stands for its rule-bounded and stepwise codification of the entire data but the building of categories and the codification of text passages is largely linked to subjective and interpretative decisions (Kuckartz 2018: 27, 64). Also, Saldana (2009: 7) underlines what Sipe and Ghiso (2004) experienced in their research: "'All coding is a judgement call' since we bring 'our own subjectivities, our personalities, our predispositions, [and] our quirks' to the process (Sipe and Ghiso 2004: 482-3 as cited in Saldana 2009: 7)". Saldana highlights that coding is a cyclic act and that no data is perfectly coded after the first cycle (Saldana 2009: 8). Regarding the interpretative and subjective nature of the coding procedure it is in any case recommended to go through the data more than once and reflect on the codification. It has to be avoided that relevant information gets lost due to insufficiently reflected coding.

5.6.2 Risk networks

The aim of risk networks, as already mentioned in chapter *3.1.3 Risk Networks*, is to expose interconnected risks. Those risk networks go beyond the risk of natural hazards and imbed social, political, cultural and economic risks. The establishment of such encompassing risk networks is tough bound to an intense analysis of the empirical data (Jurt 2009: 100). Based on the prior analysis of the categories and their interrelations, the interviews with their risk constellations were compared among each other (Jurt 2009: 29-30). On grounds of this investigation two risk networks could be carved out. These risk networks do not solely display one individual's risk perception but reveal similar patterns found between the risk constellations of the individual respondents. The respective risk networks are presented in the results.

When trying to investigate risk networks it is crucial to keep an openminded view on the data. As mentioned before, coding is a subjective and interpretative act, in which potentially relevant

information might get filtered. Therefore, it is advisable not to have a rigid view on the categories and the coded material within these categories but to try to look at the data from different perspectives. When establishing risk networks, the researcher should stay flexible and in an inductive sense pay regard to new encounters. Only then, networks with all their small linkages can be detected and uncovered.

5.7 Positionality

According to England (1994), positionality is the reflection of one's own placement within a social, cultural and political context. The reflection of positionality is crucial to ensure transparency on the researcher's lens, since it influences the process and outcome of the study. Flick (1999: 71) argues that in qualitative studies a researcher can never be seen as a neutral person since he or she brings along a specific position or gets assigned to a position by the respondents. Therefore, the cultural background, social status, educational level and gender of the researcher and her or his position in relation to the participants needs to be reflected.

To reflect on one's own position or on the position of a research collaborator is not only important for the sake of transparency towards the reader but also a crucial step for the researcher to understand which factors may influence the interviews and may influence the data analysis. The importance of acknowledging the subjectivity in a reflective manner is stated by Helfferich (2011: 155; own translation) as follows: *"The impossibility of objectivity is not a deficit, but the starting point of qualitative research. Therefore, the focus should rather not lay on the pursuit of objectivity, but on an appropriate handling of subjectivity."* Reflecting on the positionality of the researcher and the interpreter is, thus, a way of addressing the subjectivity of a research project.

5.7.1 Researcher's Positionality

Before the researcher went to the field, she reflected on her position as a female educated student in social science, coming from a Western country and a different cultural context with a privileged social status. As Rose (1997) points out, especially the cultural normativity plays a crucial role when researching in a different cultural context. To the researcher it was clear that she was in a position of power due to her privileged background as a Western scientist. This "unavoidable" problem is emphasized by Lynn Staeheli and Victoria Lawson (1995: 332 as cited in Rose 1997: 307): *"When Western feminists enter developing settings, they cannot escape the power relations that exist between those societies or between themselves as academics and their research subjects, even when they wish to do so."* Within the context that is being studied, this position can place the researcher as an outsider, whereas the respondents are insiders (Bourke 2014). Thus, the outsider status could obstruct the researcher's insight due to the selection of information insiders feel comfortable to share with outsiders. Since the power dynamics where a reflected manner by the researcher, she could at least try to approach the local people on eye level and to achieve an insider status, although the power dynamics are existent. Taking this into account it gets even more crucial to encounter the vis-à-vis with full respect.

A further factor which was reflected beforehand was the autonomy of the researcher who was not affiliated to any institutions and did not conduct the research in the government's interest. This enabled the researcher to represent a neutral position towards other interest groups. Despite the efforts, the researcher's position itself cannot be neutral since it is always influenced by the cultural norms, experiences and personal interests the researcher holds.

5.7.2 Interpreter's Positionality

Since the present study was conducted in collaboration with a local interpreter, also her positionality had to be reflected. Similar to the researcher's lens, Temple and Young (2004: 171) argue, 'the translator always makes her mark on the research, whether this is acknowledged or not. Turner (2010: 206) criticizes that in times in which positionality has become an indispensable matter in social science, the positionality of interpreters is rarely addressed. She argues that interpreters bring along their cultural and social background, such as ethnicity, cast and class, their values and norms in the same way as the researcher do and, therefore, have to be taken into account (Turner 2010: 211). Besides the interpreter being a Nepali female student in the field of natural science, not much was known about her positionality prior to the fieldwork. However, the fact of her being educated already implied a certain social status, which will be reflected at the end of the report.

5.8 Ethical Considerations

For qualitative interviews, ethical considerations are vital to avoid doing harm to the research's participants. The present research project is engaged in very personal narration and thoughts of individual participants. Beside a strong reflection of the researcher's positionality and action several *codes of ethics* have to be followed (Hollenbach & Müller-Böker 2012: 3). To *avoid doing harm* to the respondents the researcher has to be aware of the sensitivity of the addressed topics. Questions should not embarrass or provoke the respondents. Since risk perception is a sensitive and personal topic, the researcher made sure not to judge the participants' perceptions or to compare them to other perceptions or knowledge. Further it is crucial to ensure the *anonymity* of the respondents and *confidentiality* with regards to the collected data. All interviews were anonymized since the retracing of the information to a specific person did not matter to the topic. First, the respondents were informed about the anonymization of their statements and were then asked for permission to record the interviews. However, the villages in which the interviews were held are named in the report since they are object of interest regarding the respondent's geographical exposure to risks. One of the most important considerations is the notion of *informed consent.* Respondents should previously know to what kind of research they agree to participate so that they can individually decide whether the participation could have negative consequences for them or not. Thus, when approaching the people, first and foremost the interest of the research was revealed to an extent which did not bias the subsequent interview but ensured that no decisive information was withheld. Lastly, the spent time and shared knowledge, views and perceptions by the participants of the study should be acknowledged by ensuring them to get access to the results of the study by the time a report is written. Therefore, in the end of the conversation, the respondents were asked about their interest in the results and the researcher left space for further thoughts or questions about the research (Hollenbach & Müller Böker 2012: 3-4).

6. Results

The results of the field work are presented by order of the research questions and sub-questions. First, the meaning of the respondents' natural environment is described followed by their perception of natural hazards. Later, the effects of adaptation strategies are presented and in the last section, interconnected risks are displayed. All presented results completely rely on the respondents' statement from the interviews. A distinction between the different research areas of Upper Seti, Kharapani and Lower Seti has only been made if location-dependent topics were discussed. Other than that, a holistic view on the regions was pursued to not miss interconnections between them.

6.1 River, Mountain and Forest

What meanings does the natural environment and specifically mountains hold for the local people?

In the beginning of every conversation the people were asked about the natural environment in their place of living. The goal was to understand what meaning nature, forest, rivers and the mountains hold for them and how they perceive their natural environment. Since the people from Upper Seti and Kharapani live in a largely different natural environment than the people in lower Seti, their perceptions are presented separately.

6.1.1 Upper Seti & Kharapani

6.1.1.1 The Natural Environment

The inhabitants of Upper Seti and Kharapani are strongly connected to the nature surrounding them. They feel pleasant towards their place of residence particularly in regard to the climate and surrounding mountains.

> *"The environment of our place is a very pleasant one. The air and the water of the place are refreshing thanks to the nearby mountains. It is very comfortable living in such climatic condition, where it is neither too hot nor too cold."* (Interview 18)

They were mostly referring to the pleasant climatic conditions at their place of living compared to the much hotter and unpleasant climate in the city. For all of the respondents, nature has significant value and is seen as important for their lives. One of the respondents describes nature as follows:

> *"Nature means the resources such as hill, mountain, trees, plants, river, streams and forest areas. We are born in the nature of this place. We have been using the resources such as forest, water, air, land of this place in our daily life. So, we have a close relationship with the nature. But we think that we should live in a friendly manner with nature. The resources should be treated with care and utilized effectively."* (Interview 14)

6.1.1.2 Water and Rivers

Interestingly, there are differing perceptions when referring to nature in general versus specific components of nature. Without reserve, forest and trees were perceived as an essential component of the natural environment. When talking about water and rivers, many residents underline the importance of the latter but raise concerns at the same time.

> *"These plants and trees are the sources of the air. We know that though we have not studied. If there is not any plant, then the environment is obviously deteriorated. That is why the plants and trees are important. As well, if there is no river in the place, then there is nothing. There will not be irrigation. But it is also that the river sometimes destroys our lives and lands. However, it is needed. [Laughing]"* (Interview 2)

Indeed, water in connection with the river is perceived as beneficial for sustaining daily life but always comes along with fear and drawbacks such as the damage of agricultural land. Some describe the presence of the river as a necessary evil. Some even state that the river has only drawbacks to their lives, while others perceive more benefits of the river than disadvantages or observe them as being in balance. At a closer look, for the people from the villages of Sandal, Tallatora, Ebang and Jimerbari, who live right at the riverbank, the drawbacks dominate over the benefits and in any case the river is only seen as a necessary evil. People from Karuva and Kabuje perceive benefits and disadvantages equally. The inhabitants of Kharapani, the most affected area of the Seti disaster in 2012, perceive the river as more beneficial than costly. The opposed perceptions are reflected in the following two quotes:

> *"For me, I think it has done more harm. I don't think it has benefited us more." (Interview 7)*

> *"I don't think there are drawbacks. Of course, there are more benefits." (interview 16)*

Despite these differences, all of the respondents name the presence of water as a mandatory requirement for the irrigation of agricultural fields. Water scarcity is not mentioned to be a problem in this area. Next to the domestic use of water such as for cooking, washing and drinking purposes, the respondents from Upper Seti put emphasis on the benefits of water for generating electricity. The strong current of Seti allows for hydropower plants which in turn provide electricity to the valley.

The origin of water is described as of the phreatic water from the forest; in terms of a cyclic process of precipitation, storage in the forest and evaporation; or as allocated from high altitudes and the snow-covered mountains. Most of the respondents emphasize a clear connection between river water and snow melt. While they are familiar with the melting of snow, the term glacier or ice is rarely mentioned.

6.1.1.3 Mountains

Mountains have different meanings for the respondents, while the general reaction regarding mountains shows a positive attitude. Mountains are seen as the Nations' identity and pride, as a matter of health thanks to the favorable climate, and as a source of energy and happiness. On the other hand, certain threats are ascribed to the mountains. Nearly half of the respondents link mountains with unexpected disasters such as the Seti Disaster in 2012. They associate the mountains with a hidden threat which causes flooding without rain.

The upper parts of Annapurna range and the peak of Machhapuchchhre Himal can be spotted from all of the villages but are described as not being easily accessible to them. Only one single respondent had

visited the bottom of Machhapuchchhre Himal which is, according to the respondent, accessible within three days. The respondents characterize a mountain by its snow cover. Hills are green or black and mountains appear white. In terms of farming, the respondents explain that snowfall in the mountains has a direct impact on the hail in the village. If there is good snowfall, there will be less hail and in turn the fields and crops will not be damaged. Other describe that snowfall in the right place (referring to the mountains) at the right time is an indication for a good farming season. Mountains are also seen from an economic perspective in this way:

> *"A mountain is a gift from nature. It has the capacity to attract tourists. So, it is one of the important factors that can help to develop tourism in a place."* (Interview 14)

When the topic of tourism was raised it was always accompanied by the debate about the holy mountain, Machhapuchchhre Himal. There is no common belief whether mountains are sacred or not. Some respondents believe that the gods reside in the mountains. Especially Machhapuchchhre Himal is seen as "the" sacred mountain which is why it is restricted for climbing. Others denied the sacredness of the mountains or even dismissed it as a *"blind belief"*.

6.1.1.4 Forest

As indicated earlier, forest is perceived as being vital for the environment. However, its importance is often referred to an economic component. The people's livelihood strategies are being described to strongly depend on the forest and its products.

> *"The only resources we have here for our survival is the forest. You have also seen that there are no large agricultural lands here. We depend on the forest products for our survival. We get vegetables like the bamboo and Niuro from the forest. Sometimes, we can also collect medicinal plants when it is allowed, by paying certain charges. So, for the people of this village, the forest is an important resource from which they can earn and maintain their livelihood."* (Interview 13)

Interestingly, these needs are not seen as short-term requirements but are often combined with sustainable notions as respondents consider future generations.

> *"The forest is important. For the future. It's the only way of survival for the future generation. So, we don't destroy it."* (Interview 3).

6.1.2 Lower Seti

6.1.2.1 River and Mountains

In Lower Seti the predominant perception of the people's natural environment is related to the river and the mountains. Forest is not considered in their descriptions of the natural environment due to the absence of the forest in the urban settlement and the independence of their livelihoods from the utilization of forest products. Since the respondents live next to the river and their livelihood fully depends on the extraction of sands from the river, it bears an important meaning to them.

> *"The positive thing about the river is that the river is the lifeline of the people living here. They can feed themselves only when they work in the river. So, the main source of income for the people is from the river."* (Interview 21)

While the role of water in Upper Seti and Kharapani is mainly seen in terms of irrigation for the farming lands, its purpose in Lower Seti is seen as the means of transportation of sands and stones. The benefit of the river is placed over its risk, which is on the one hand omnipresent but on the other hand repressed due to the economic dependence on the river.

> *"I would say it has more benefits for us since people are dependent on it. The only drawback is that we have a fear in our mind that the flood may happen anytime. We cannot sleep peacefully, having in mind the pervasive fear of flood."* (Interview 21)

Since the water level of the river is low in the dry season, the respondents agree that floods only occur in the monsoon season. Floods seem unpredictable to them since they are triggered by monsoon rainfalls in the higher altitude.

Besides the river, the mountains are also described as meaningful to the people. Mountains, according to the respondents, provide benefits since they are the origin of the water in the river with its sands and stones. As indicated by the respondents, the proof that the river water originates from the mountains is its cold temperature due to the snow melt. Since they work in the river each and every day, they know the river's condition very well. Furthermore, they characterize the river as dirty since the portion of sediments and glacier flour is high. The name of the river, *Seti*, which means *white* is therefore referable to the high number of particles in the water.

As stated by the inhabitants of Upper Seti and Kharapani, beside their role a source of water and sediments, mountains are seen as a matter of happiness.

> *"I feel refreshed and happy to see the mountains. I can see the green hills below and the mountains of Annapurna and Machhapuchchhre at the top. Every morning I go a few meters ahead towards the east direction to observe the view and have a tea."* (Interview 25)

6. 2 Perceptions of Natural Hazards

Which natural hazards are perceived as risks by the local inhabitants of the Seti River Valley?

The most mentioned natural hazards by the local inhabitants across the study area is flood. In Upper Seti and Kharapani landslides are the second most mentioned natural hazard. Flooding and landslides are often mentioned in the same breath. Beside the two dominant natural hazards, earthquakes evoke less frequently and are never mentioned first. Others note natural hazards such as strong winds or hail. GLOF is mentioned only by one respondent in Upper Seti and is seen as the reason for the Seti disaster in 2012. Other than that, there are no statements regarding GLOFs or descriptions indicating the process of GLOFs.

On the whole, the study area is perceived by the respondents as hazardous. Respondent 18 and 19 from Kharapani state that they are afraid of flooding and flash floods, such as the disaster in 2012, but generally feel safe at their place of living. Respondent 5 from Karuva explains that his village is strongly exposed to natural hazards, but his house is in a safe corner, so he is not afraid of living in the place.

> *"I think my place is safe. But my neighbor's places are at risk. Although we live in the same village, our residential places are distributed. The houses uphill are not safe. So, talking about the village as a whole, it is not safe. I think there are many dangers for people living in Karuva."*

All other respondents report to feel unsafe or afraid of living in their residential place. Some respondents categorize the valley itself as a highly risky place with lots of natural hazards and see the cause in the *"geographical structure"* (Interview 14). One respondent even assesses the risk of the place in numbers.

> *"For this place, the danger from the nature is about 80 %, out of 100%."* (Interview 6)

6.2.1 Flooding

As already displayed in the previous section, water and rivers are in most cases directly connected with fear and threat in terms of flooding. In Upper Seti and Kharapani flood is seen as a threat to agriculture land, livestock and human lives. Therefore, the risk of flooding is not only perceived as a harm to the people themselves but also to their livelihoods.

> *"If the water level in the river increases it may result in flood. Our house and land will be drowned. If the speed of the flood is very high, it will sweep away the house and kill us."* (Interview 15)

In contrast, the respondents from lower Seti see floods as the necessary evil for the transportation of the sediments. While in the dry season there is too little water and current in the river, the rainy season provides the ideal condition for their activity.

> *"We are affected either way. We are affected if there is flood in the river and also when there is no flood because the sands are brought to our place by the flood.* (Interview 21)

For them, flooding has to be considered from different perspectives and supports rather than harms their livelihood. Nonetheless, the fear of flood is not diminished by its benefit of transporting sands and stones. The respondents state that they are well aware of the risk they are exposed to when working in the river but see no other option than braving the consequences.

> *"The river may sweep us away while working. But we do not have any other choice than taking the risk."* (Interview 21)

In the following statement, an outside perspective on the situation of the river laborers is displayed.

> *"Actually, we escape whenever the water level rises in the river but those people [who work in the river] will go to the river for the extraction of the sand. Since they are dependent on the river for maintaining their living, they are happy when there is a flood."* (Interview 24)

Moreover, few voices from Upper Seti assign guilt to the people who extract sand and stones from the river; they see the sand extraction as a cause for the unbraked flow of water that in turn results in flooding.

Although some benefits derive from flooding's extraction of sands and stones, in all settlements of the study area the exposure to flood hazards is described as a major strain in their lives. It is expressed in fear, hopelessness and dissatisfaction with their residential place. Many compare their place of living with other places and raise the desire to live in a safer place. When talking to them about their emotions the following statements stood out the most.

> *"There is a danger from the river. The water level keeps on changing and we have to live in fear for about six months."* (Interview 6)

> *"In Myagdi there were forests and hills. But there was no danger of flood like in this place. That place [Myagdi] was better than this place [Kharapani]. There was no need to be afraid from the environment but here we have to live in fear."* (Interview 16)

> *"The main problem is that we cannot rest peacefully even during the nighttime because we have to check time and again whether there is flooding or not. But there is no place to go since we are sustaining our lives only with great difficulty."* (Interview 21)

The background and interrelations for unpromising situation of the local inhabitants in Lower Seti will be analyzed in more detail in the discussion *(7.3.2 Land Ownership, Squatters and Power Dynamics)*.

6.2.2 Landslide

Landslides are only regarded as directly affecting natural hazards by the inhabitants of Upper Seti and Kharapani. The respondents from Lower Seti name landslides as a consequence of heavy rainfall at the higher altitudes and as an intensifier of floods, but never mention them as a hazard of which they are directly affected. The inhabitants from Upper Seti and Kharapani explain the cause of landslides as strong monsoonal rainfalls, which saturate the underground and cause mass movements on the steep and unstable hilly slopes of the valley. Landslides are therefore exclusively assigned to the rainy season. Furthermore, they see a relationship between flooding and landslides. One respondent describes this effect as follows:

> *If there is heavy rainfall and the water level in the river increases, it can result in flooding. That may be one reason. And the other reason is that if the river gets blocked by a landslide and the blocked portion gets burst, it will result in flooding too.* (Interview 10)

Besides the monsoonal rainfall as the trigger for landslides, the respondents mention unmanaged road construction and deforestation as reinforcing factors for the instability of the already weak slopes. In turn, the major negative effect of landslides is perceived to be the road damage. In terms of fear the respondents state to be afraid of landslides but they do not put as much emphasis on it as they do on flood hazards. Some even observed a decline in the frequency of landslide events and therefore state to be less afraid of landslides than flooding.

6.2.3 Earthquake

Half of the respondents consider earthquakes as a present natural hazard in their place of living. Earthquakes are described as an unpredictable danger which can occur any time. Compared to flood hazards which, according to the respondents, happen on a regular basis, earthquakes happen only rarely. When talking about the risk of earthquakes, all of the respondents refer to the massive earthquake in 2015. Other incidents are not being mentioned. Apart from a few respondents, they state not to be familiar with the root cause of earthquakes.
Since the massive earthquake in 2015 and the Seti disaster in 2012 happened within a short time frame, and on top of that both events occurred in the same month, Baishakh[3], the respondents expressed difficulties to order the events chronologically. For a few respondents this resulted in confusion about relief actions in the aftermath of the disaster. Upon reflection they were all able to distinguish the two events and the repercussions of each.

6.3 Seasonal Hazards and Irregularities

How was the Seti Disaster 2012 perceived by the local inhabitants?

6.3.1 Rainy Season

The rainy season evokes threats such as floods and landslides. As mentioned before, landslides are exclusively perceived as a hazard which occurs in the monsoon season. At first glance, the local people's perceptions of flood hazards show a similar theme. Floods occur mainly in the rainy season and the dry season is seen as free of hazards.

> *"In the rainy season, there is the risk of flood and landslide in this place. We are not afraid to live here in winter. The problems are only present in the rainy season."* (Interview 9)

Almost all respondents state that there is no risk of natural hazards in the dry season. Even though, the respondents clearly relate the origin of water as snow melt, only respondent 7 indicates that floods can happen in absence of rainfall.

> *"Snow – yes, we are afraid of the presence of the mountain. When the snow melts, the river gets wider. For the occurrence of floods, it is not necessary to rain, if there is melting of snow."*

However, a closer look reveals that the people are also aware of irregularities. Since they experienced an exceptional flooding event in the dry season, they highlight that floods are unpredictable and can happen anytime. In any case, what comes to their mind first when thinking of flood hazards is their occurrence in the rainy season. Only on second thought do they mention the possibility of irregular

[3] *Baishakh refers to the Nepali Calendar "Jestha". Month Baishakh starts in mid-April and lasts till the first half of May. Therefore, the earthquake on April 25th, 2015 and the Seti disaster on May 5th, 2012 fall within the same month in the Nepali Calendar.*

flooding. One respondent explains that he learnt only after the Seti Disaster in 2012 about the potential of floods in the dry season.

> *"Actually, the problems of flood and landslide were supposed to take place during the rainy season, from Ashadh to Bhadra [June/July to August/September]. But that year [2012], it happened in Baishakh [April/May]. Later, we learnt that flood hazards cannot be predicted. It can happen at any time."* [4] (Interview 10)

Although they are afraid of such exceptional events, the majority of the respondents states to feel safe in the dry season. In many statements the Seti Disaster was even described as an intensifier of their fear of the annual flooding in the rainy season.

> *Now, whenever there is heavy rainfall and I observe an increment of the water level in the river, I am scared that the disastrous flood recurs.* (Interview 8)

Some people underline that their fears disappear altogether with the rain. They forget about natural hazards when the sun is shining and the clouds disperse. The disaster in 2012, however, is far from being forgotten.

6.3.2 Seti Disaster 2012

The narratives of the people regarding flood hazards always are associated with the Seti Disaster in 2012. It is seared in the local inhabitants' minds and clearly determines their perception of water related risks. The disaster is being described as the most devastating natural hazard they have faced in their life so far. The respondents explain the event in much detail and with lots of emotions.

> *There was fear in everyone's mind. The river showed its dangerous nature. That fear, (.) it became memorable to people. [shaky voice] We cannot forget that incident.* (Interview 2)

They point out the exceptional nature of the event since they have never experienced such a flood in the winter season. They feel that something like this has never happened without rainfall and add that since Seti it has never happened again. One respondent (12) recalls another devastating flood beside the event in 2012. Respondent 12 locates the event many years back and presumes that it happened in 2003. It was way less detrimental than the event in 2012 but still had a damaging potential. Of another historical event respondent 12 is not aware. The remaining respondents cannot recall any other flooding event similar to the devastating flash flood in 2012. Beside this massive event, they only refer to the "normal" seasonal flood which happens every year due to heavy monsoon rainfall. Respondent 15 is the only respondent that puts an emphasis on the frequency of such events, and states that not every flood harms people and such large disasters may only happen every 20 years.

Description of the event

The respondents from Upper Seti who experienced the flood first narrate that they were having lunch when suddenly a loud noise appeared.

[4] *The months "Ashadh, Bhadra and Baishakh" are referring to the Nepali Calendar "Jestha".*

> *"We heard this loud noise and thought that there was a helicopter in the sky producing such sound. Then we heard an even louder sound and thought the helicopter had crashed. Later, we saw stones and woods rolling over in the river which was full of mud."* (Interview 6)

All of the respondents from Upper Seti and Kharapani described this distinct noise in comparison of a helicopter. The ones who could escaped to the uphill regions but for many it was too late. They report to have experienced great loss. Their agriculture land was covered in mud; they saw family members being drowned by the flood and watched the houses, shelters and livestock being swept away. What remained was solely ruin and devastation.
The inhabitants of Lower Seti state that they received a warning from the villages in higher altitude, which is why they could escape and save their lives from the devastating muddy flow.

The Aftermath of the event

The disaster attracted attention from many relief organizations, scientists, and of course, from the government. The respondents recount that many helicopters brought scientists to the valley and several investigations took place. The implications due to these investigations and the attention from different actors were that shortly after the event an early warning system was installed and one settlement in Upper Seti was relocated. At the riverbank in Kharapani a buffer zone was designated in which settlements were not allowed anymore. As displayed by the following two statements, besides the designation in Kharapani, no other area was restricted for settlements although all of the riverbank settlements were declared as danger zones.

> *"Actually, the government and the researcher found out that the geological structure of the riverbank from Jimerbari to Pokhara, is very fragile and dangerous to live." (*Interview 14)

> *"We know that there is a high risk of flood. But no one has told us not to live here. (Interview 12)*

Respondent 26, an expert from Pokhara, sees the major problem in the behavior of the riverbank dwellers and refers, in contrast to the statements of the local population, to the existent neglect of disasters by the local population.

> *"We lost a lot of lives. But our problem is that we forget everything very soon. Shortly after the disaster, people started again living at the exact same place." (interview 26, Expert)*

Furthermore, the expert explains that the problem is not about them having a choice or not. He claims that the villagers have no awareness about the severity of the situation and only relate back to their ancestors who lived in this place for ages. He argues that due to the rareness of such events they believe that the disaster will not happen again and have started to settle back in the place of the disaster. He underlines that such events will become more frequent in the future and that it is urgently required to make the villagers aware of their imprudence.

Causes of the event

When the respondents explained the root cause of the disaster, they mention that their knowledge derives from scientists who did the investigation in the valley. After the scientists finished their observations, they informed the villagers about the origin of the disaster. The mentioned causes by the

respondents differ but have a common component: the blockage of the river. The most mentioned trigger of the disaster was the occurrence of an avalanche which in turn blocked the river. When the holding capacity of the blockage was exceeded, the blocked river burst and resulted in the flash flood. For some this explanation made little sense since the river turned into a mudflow which carried a large number of trees. They conclude that the flood must have resulted from a landslide which blocked the river. Only one respondent refers to a rockfall event at Annapurna which could be observed from their place of living. But for them too, the rockfall resulted in a blockage of the river. Two respondents mentioned the term GLOF as the reason for the flash flood. To summarize, all the respondents attributed the natural reason for the disaster to the mountains and agree on a blockage of the river or blockage of water in from of a glacial lake which burst and resulted in a devastating flood.

> *The presence of the mountains can lead to disasters like the one which happened in 2069 B.S. [2012 A.D.]. The water from the mountain affects the lives of people. (interview 15)*

The inhabitants from Lower Seti state that they have not heard about the actual reason of the flood since nobody has informed them. However, they have notice of some rumors which correlated with the explanation of the avalanche occurrence.

Furthermore, one respondent explains the cause of the disaster not by any effects of nature itself but believes that God's anger is responsible for the disaster. It is explained that the hot springs in Kharapani got polluted by dirty people who are not supposed to enter the pond.[5] The disrespect of this holy place led to the disaster as a sign of the god being angry. Additionally, the respondent perceives the pollution of the ponds in Kharapani and the misbehavior of the people as the logical reason why Kharapani was the most affected area by the disaster. Another respondent states natural causes for the disaster first but agrees on the religious cause as well. Besides these two, the other respondents raise this reason as a rumor they heard from others but deny such beliefs and keep hold of the scientific explanation. However, the majority states that it is true that Tatopani[6] [Kharapani] area is getting polluted and the religious values are being disrespected by many people. They state that they believe in gods, follow the religious values and that holy places have to be treated reverentially. But they clearly separate religious issues from the cause of natural hazards, which are not in any way related to each other. Some also reported that it is the belief of the old generation and that "people living in the 21st century would not belief such reasons for a natural disaster" (Interview 24). Others deny these beliefs completely and appeal to focus on "how to be safe from floods rather than blaming god for our fate" (Interview 21).
It can be summarized that the represented opinions differ within the local inhabitants and the reason for natural disasters are perceived differently by the respondents.

[5] *As dirty people the respondents refer to women having menstruation, bad people, strangers, people from lower castes and people consuming alcohol when entering the pond.*

[6] *Tatopani is a Nepali word which can be translated into English as "hot water". "Tatopani" indicates places where natural hot springs are present, wherefore many places in Nepal are being called Tatopani. In this case, Tatopani is referring to the village "Kharapani".*

6.3.3 Dry Season

Considering the aforementioned perceptions of water, river and flood hazards, it is clear that there is not much risk assigned to the dry season or at least that the risk is not perceived as pervasive and therefore is neglected with respect to risk perception. The respondents ascribe less fear to the dry season, observe the river as pleasurable without drawbacks and describe the dry season as hazard free. This is complemented by their perception of water scarcity. While there is in general rarely an incident of water scarcity being reported, also for the dry season itself the respondents do not consider it as a problem. The people trust in the steady flow of the river and never faced a shortage in drinking water. Considering the monsoon rainfalls, merely three statements about a late onset are made. The respective respondents explain that the monsoon season started late, which in turn affected the crops. Since the rainfalls were not entirely omitted and only set in late, according to them, the damage was not too bad. In addition, one respondent names a single drought incidents 20 years back, which resulted in forest fires.

6.4 Perception of Climate Change and its Effects

What role does climate change play in the local inhabitant's perception of risks?

To approach the local people's perception and knowledge about climate change they were primary asked about changes in their natural environment and livelihood practices. The term "climate change" was only raised in a last step, when the people were asked about its meaning and significance for their place of living.

6.4.1 Perceived Changes in the Natural Environment

Almost all of the local inhabitants did not perceive any major changes in their natural environment. They state that the temperature, rainfall pattern, water flow in the river and their agricultural activity have not changed compared to the past. Regarding the forest, many point out that the forest volume has increased and that it is in better condition now. Related to this, one respondent pointed out that the establishment of the Annapurna Conservation Area (ACA) has brought many changes and resulted in the rehabilitation of the forest. As a perceived change in the environment, two of them reported the presence of mosquitos and reasoned it by the establishment of toilets within the houses. Earlier, the waste used to be far from the house which is why there were no mosquitos. Furthermore, the respondents often refer to the seasonal changes in their environment, which they perceive as natural and cyclic. Some of them also state that the changes in nature over a long period of time are part of a natural process since nature is a dynamic system.

Out of all of the respondents, only three of them perceived major changes in their natural environment. These are, according to them, changes in the snowfall and rainfall pattern, increased temperature and related to the latter a habitat shift of animals and plants. One of them reports that unseasonal snowfall occurred which means that the snowfall shifted from December/January to March/April, which in turn affects the crop. Another respondent states that less landslides and floods occurred since there was no

continuous rainfall as it used to be in the past. The last of the three respondents mention that the temperature is increasing, and wild animals and plants shift their habitat to higher altitude.
Regarding snow coverage and glacier retreat, statements have only been made by the three interviewed experts. They agree that the temperature is rising, which results in a shorter period of snow coverage in the Himalayas. They indicate that in recent years the mountains' snow cover melted quickly; whereas in the past the Himalayas appeared white all year long, they now look black for most of the year.

6.4.2 The Term "Climate Change"

Most of the respondents declare that they are familiar with the term climate change. Only a few respond that they have never heard of climate change before. The ones who state to be familiar with the term explain it with different levels of accuracy. One part of the respondents indicate that they have heard the term but can neither explain it nor do they know what it means. Single respondents relate their description to weather and its changing characteristics. Others describe the term by means of its reason and name that climate change is induced by pollution, population growth, deforestation and ozone layer depletion.

> *"It is said that this change is because of the environmental pollution. But I don't know what it means."* (Interview 12)

When addressing pollution, they refer to pollution from human activities, industrial pollution, smoke in the air, pollution from vehicles and pollution from garbage. The remaining respondents explain climate change by its causes and point out that climate change results in increased temperature, heavy rainfall, flood and landslides. Only at this point do the respondents refer more often to a perceived increase of temperature. One respondent state that he learned about climate change in school and gives a more profound definition of climate change.

> *"Climate change means change in rainfall and the atmospheric condition. Because of climate change, there may be irregular rainfall in unexpected times such as in winter. It may also affect the farming system, the wildlife and almost every aspect in life."* (Interview 21)

6.4.3 Effects of Climate Change

Two respondents who are involved in activities related to climate change[7] presented their views on climate change in a more detailed way. They explicitly correlate climate change with the Seti Disaster in 2012 and refer to the investigations of the scientists.

> *"For example, the flood incident in the dry month Baisakh [April/May]. I think it is because of the climate change. It is said that because of the fluctuation in the temperature, the rock in the mountain was cracked. In a meeting where the local people and the experts had participated the scientists said that in the future also, there are possibilities of similar floods because of the global warming." (Interview 14)*

[7] *For the sake of anonymity it is not further declared in which activities the respondents are involved.*

"The flood is affected by climate change. The rising temperature might affect to break off the entire glacier." (Interview 20)

However, the other respondents do not ascribe the reason of the disaster in 2012 to the effects of climate change and in general report not to feel directly affected by it. The only effect which is reported is that in relation to climate change the forest is being conserved and a conservation project was established, which influences their life.

6.4.4. Responsibility

The responsibility for climate change is either ascribed to nature itself, human behavior or specific factors such as pollution. Some could not answer this question since they have not heard about climate change before. Others, though, who described that floods result from climate change could not depict the reason or responsibility for it. From the ones who had an opinion about the responsibility, one half ascribed it to the humans and the other half to nature itself. The following statements represent the two major perspectives on the responsibility of climate change.

> *"I think it is all because of the human activities. They are responsible for different types of pollution such as the smoke produced by the industries. Human beings interfered with the natural processes of nature and then the nature tried to remain in its natural shape which sometimes resulted in the catastrophic events."* (Interview 4)

> *"I don't think the changes are because of the human beings since human beings cannot control these things [temperature and rainfall]. The changes are because of the nature itself. But the human beings have to adjust to any changes for their survival."* (Interview 24)

6.5 Adaptation Measures

What adaptation strategies have already been implemented and how are they perceived by the local population?

Are there any adaptation measures that have been established by the local population?

The National Adaptation Programme of Action (NAPA) describes a number of Climate Change Adaptation (CCA) measures in their catalogue. In the research area were some of them found. Whether these measures are located in CCA or rather belong to Disaster Risk Reduction (DRR) will be outlined in the discussion. In this section the perception of the local people on these measures is presented. Furthermore, findings about measures established by the local population themselves are explained.

6.5.1 Perception of Implemented Measures

6.5.1.1 Early Warning System

Shortly after the disaster in 2012 several investigations about the root cause of the hazard event took place and adaptation measures were implemented. One year later, an early warning system was installed in Upper Seti. Its instruments were placed right next to the uppermost settlement of the valley in Jimerbari. The alarm, however, was installed further downstream in Karuva.

Figure 10: Display and alarm of the EWS in Karuva. (Source: Photo by the author)

In the interviews the early warning system was an omnipresent topic. Beside of one single person, all respondents from Upper Seti and Kharapani confirm to know about the existence of an early warning system in the valley. They refer to the "machine" in Karuva at the shop wall which will ring whenever there is the chance of flood. Furthermore, they point out that the measuring instruments are placed in Jimerbari but most of them have not seen them with their own eyes since the place is far away from their homes. The villagers state that they are not well aware about the functioning of the system but explain that the alarm will ring whenever the water level in Jimerbari rises and exceeds a certain point. According to them, the alarm rang only once when the water level was high, but it did not result in flooding. Three of the respondents from Upper Seti and Karuva state that the early warning system is functioning while all of the others confirm that it is out of order and does not provide any pre-information at the moment. Some state that it has been working only for a few months, other say it has been working for about two years but they agree that it has not been working for many years now. Two respondents who had a deeper insight in the installment process of the early warning system explained the circumstances and depict what has led to the unsatisfying situation in their village.

> *"What is the meaning of an early warning system if it does not provide pre-information? It means nothing! The machine was installed soon after the disaster happened, but the responsible authorities did not care about it. No one payed attention on its maintenance and monitoring."* (Interview 14)

> *"Actually, the situation was like that. Under the supervision of the government, an institution installed the system. The installing institution has their working period. In that time, that institution is responsible for monitoring, recharging and maintenance of the instruments. The time got expired. After expiration of their working period, they left. If there was a formation of another institution for monitoring and maintenance of this system, then probably it would have*

been in good condition now. But there wasn't. If there is no institution responsible for its maintenance, then the system is useless and does not help the people." (Interview 4)

As ensured by one of the experts, the responsible authorities are aware of the problem and promise to act very soon.

"I know it is in Karuva and the fact that it is not working came up in one of our meetings 15 days ago. We were planning to solve it really soon." (Interview 28, Expert)

Despite the fact that the early warning system is not working in order, the attitude towards it is positive. All of the respondents state that it is crucial for their survival to receive pre-information which is why they are happy about the installment. One respondent amends that it is certainly good to have such instruments even though they are not a guarantee for survival. The respondents from Jimerbari who live right next to the measuring instruments state that it is good to have an early warning system, but it does not matter to them since they will not receive any pre-information. Nevertheless, the inhabitants of Sandal, Ebang, Tallatora and Kabuje, which are not within reach of the alarm signal as well, point out the importance of the installment and express feelings of relief to have it. Yet, one of them adds that it would be better to install an alarm at every house since they live dispersed and not everybody can here the alarm signal from their houses.

"I'm happy to have such installment in my place. It makes me feel save. However, in my opinion, it would be better to have the alarm in every house of the village. Everyone will be aware of the flood at once and can escape." (Interview 13)

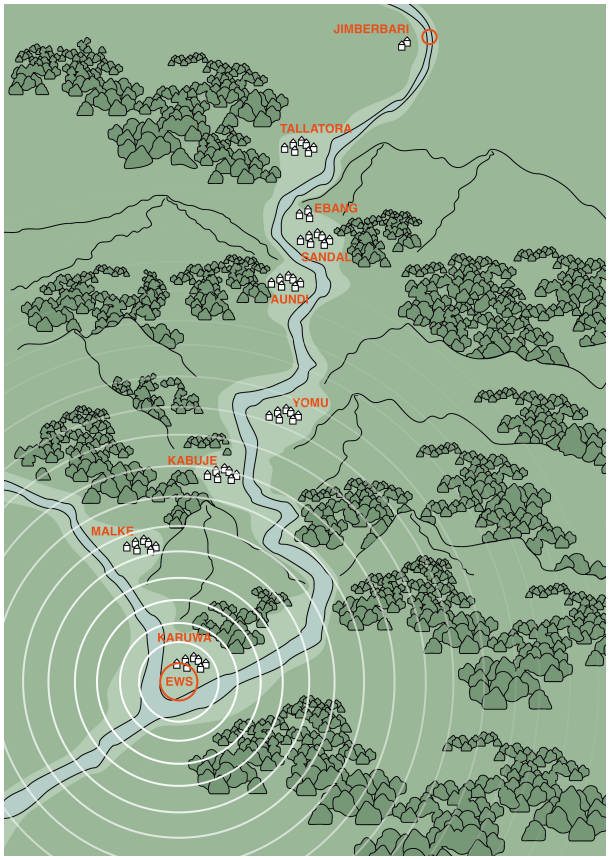

Figure 11: Reach of the early warning system's alarm. The alarm, which is placed in Karuva will not reach to the settlements of Ebang, Tallatora and Sandal in case of an incident. (Source: own data collection; illustration by Naomi Eggli)

Based on the narrations of the respondents, this illustration (Figure 10) displays the problem of the inappropriate placement of the early warning system's alarm in Karuva. The alarm is not within reach for the villages of Sandal, Ebang and Tallatora, which are located in higher altitudes. The reason for the unfortunate placement of the alarm is according to respondent 14 clearly connected to the lack of inclusion of the local inhabitants by the responsible authorities. He mentions that not a single awareness program was held to inform the local population about the installment. Just after the completion they provided quick information about the functioning of the system.

> *"I think it is good to install such system, but it is not effective to put the warning system here. It should be kept in Kabuje and Sandal. They live at a distant place from us. In case of the flood, these places are affected earlier than us. Actually, I will describe the situation of that time when the experts came to install it. It was proposed to be installed in the topmost house of Kabuje. The house owner was an old woman. When the experts went to install the machine over there, without advance information, the woman did not allow installing it on the wall of her house because she was not aware about the machine and she was frightened that someone steals the machine and she gets blamed for it. The house of that woman was also very small and old, like an old hut. So, she did not allow installation there. The experts decided spontaneously to install it here [at the wall of the shop in Karuva]."* (Interview 14)

Given that no awareness program was held, the alarm is out of reach for many villagers and the fact that the system is out of order, he argues that the people will forget about the system and it will lose its meaning.

In Lower Seti only one respondent reports to be familiar with the installation of the early warning system in Upper Seti and confirms that the system is working. The other respondents have not heard about the installment before but agree on the importance and need of an early warning system. As explained by them, it is necessary to get pre-information because only that way people can escape and lots of lives can be saved.

Figure 12: Measuring instrument of the EWS in Jimerbari. (Source: Photo by the author)

6.5.1.2 Relocation

In the aftermath of the Seti Disaster in 2012 one relocation project has been conducted including the households of Sandal, Ebang and Tallatora. Due to the bridge that was flushed away from the flash flood, the inhabitants from the respective settlements were trapped on the other side of the river without having access to any facilities. Owing to these circumstances, these nine households were resettled to a piece of land at higher altitude, far from the river. The relocation was executed by the government, but the financing derived from Annapurna F. M., a radio station which raised money for the victims of the Seti Disaster. The victims were relocated to a place called Sano Kobang in the middle of the forest. The officials from the Village Development Committee agreed to settle them on this piece of public land since no one could afford to buy new land for the relocation. Notwithstanding of this area being part of the conservation area and therefore being prohibited for settlements, it led to a conflict between ACAP and the relocated people. ACAP did not agree with the relocation in the middle of the forest but it was already too late. Since the relocation was an emergency, no proper planning took place and the importance of a cooperation with ACAP was neglected by the government officials.

The respective respondents express mixed feelings about the project, as perhaps the negative aspects overweigh the positive. One respondent speaks about the relief they felt when receiving support. Since they lost their house and farming land they were in an extremely desperate situation and any help was embraced. However, the respondents reflect that it was only a short-lived relief. They point out that soon after the relocation it became clear to them that they are not able to sustain their livelihood in the new place since there was no farming land existing.

> *"There is no agricultural land over there. And only the house will not feed us. We have to work for earning and to feed ourselves. That's why we returned here."* (Interview 8)

After four years of living in the middle of the forest, the bridge was rebuilt. From then on, nothing hindered them from returning to their old lands where they rebuilt their houses and started living there again. Since they were living on public land the respondents recount that they felt like slum dwellers and were not accepted. As respondent 6 describes, the need to not be dependent on others for their food and living on their own lands was strong.

> *We lived there for about four years and then we managed to return in order to work in the fields and get food for ourselves. From that time, we are living here, working in the field, managing our living on our own.* (Interview 6)

The respondents show disappointment about the relocation project since the had the hope of being resettled to a better place. They point out that a better place is a safe place with facilities and not a place where thy have to live in dependence and blame of others. If it is not possible to sustain their livelihood in any safe place, they would always return to the unsafe places. As a positive aspect they amend that in times of heavy rainfall they can escape to the houses in the safe place to spend the night. Nevertheless, the majority of the respondents wish to move away if they only could afford safer lands.

> *"Despite the warning, we are compelled to live close to the river. Though they are aware about the dangers, we are forced to live in such place."* (Interview 6)

6.5.1.3 ACAP: Nature Conservation and Awareness Programs

ACAP, as already described in chapter *4.4 Annapurna Conservation Area*, is a nature conservation project with a participatory approach. It is declared as a multi-use area where nature conservation and livelihood development are reconciled (Bajracharya et al. 2006). As indicated by the respondents it gets often called "the peoples project" which implies that the nature should not mainly be protected by ACAP but by the people living in the conservation area. The representative of ACAP reveals that according to the government's National Adaptation Programme of Action, ACAP is jointly responsible to take CCA actions. For the study area he declares them to be mainly awareness programs about climate change and disaster risk reduction and the conservation of the forest to protect the settlements from natural hazards (Interview 27, Expert). Considering the perceptions of the respondents from Upper Seti and Kharapani, who live within ACA, the project brought many changes to their live. Most of them support the activities of ACAP and state that they have been doing a very good job in forest conservation but when digging deeper it sounds out that some strains might go along with the conservation of the forest. For the sustainment of their livelihood the respondents are dependent on the extraction of forest products, such as bamboo. Yet, due to the conservation of the forest the harvest of forest products has been restricted what leads to economic constraints for the community. Coming back to the intent of CCA through awareness programs launched by ACAP, the respondents state not to observe any action. Although awareness raising is an important pillar of the activities of ACAP, the respondents punctuate that no awareness programs related to climate change and the risk of natural hazards took place in past years. Hence, it is not perceived as a matter by the local population. Nevertheless, they point out that there is a high interest in their community to learn more about climate change and to take part in respective awareness programs.

6.5.2 Measures established by the local population

There were several adaptation measures existing, established by the local population. The local population made no distinction between disaster risk reduction and climate change adaptation. They simply call the measures *"adaptation strategies to prevailing natural hazards".*

The respondents recount the existence of an individual warning system which has been established after the Seti Disaster in 2012. On initiative of inhabitants of Lower Seti, Kharapani and Upper Seti, they assembled and exchanged their phone numbers. In case of a flash flood hazard or a rapid increase of the water level, the inhabitants from Upper Seti will inform the people in Kharapani and Lower Seti. The respondents agree on this being an effective way of warning. Already in 2012, people from the lower parts could have been saved thanks to the pre-warning they received from the villagers in upper parts. However, to ensure that everyone gets informed they saw a need of organizing it properly which is why they held a meeting. As an identified challenge they mention that their cell service is not always ensured. Additionally, power-cutoffs on a daily basis, especially in the rainy season, emerge as another obstacle to maintain the individual warning system reliably. Respondents from Upper Seti add on that they will not receive any warning since they will be the first ones to encounter the disaster.

As a short-term strategy, the escape to the forest was named. Respondents from Upper Seti and Kharapani report that they shift to the forest for a couple of days if there is heavy rainfall and the risk of a flood hazard increases. Some report that in the rainy season they spend the night in a tent at higher

altitudes and only come back to lower altitudes to work on their agricultural lands. Although they highlighted some strategies, the majority of the respondents express feelings of hopelessness and feel unable to cope with such situations. They show desperation due to having no other option than exposing themselves to the risks.

> *"What to do? If it happens suddenly, then we will die. If possible, we will escape, otherwise we will die. The people who have money go to the city. But people like us cannot afford to live there. Despite of floods and landslides, we have to live here. There is no option."* (Interview 7)

A few respondents express a fatalistic perspective and put emphasis on the nature's will and power. *"When the disaster should happen, it will happen. There is nothing to do."* (Interview 19)

In contrary, a strong community sense was found in Lower Seti. The riverbank dwellers in the squatter settlements report the construction of a dam which should save them from massive flash floods. They united within the community and started building the dam on own initiative. Initially from every household 200 NPRs were collected but later they received financial support from the British Red Cross. They report that with the dam construction the flood can be controlled and they are now living more safely than in the past. Furthermore, one respondent depicts that she demanded from her community in the squatter settlement to be proactive and educate themselves about prevailing risks and appropriate behavior in case of a hazard event.

> *"I requested them not to stay passive as no one will help us if we don't fight for ourselves. It is useless to stay at home. We have to educate ourselves so that we know what can be done during the time of disaster or emergency." (Interview 21)*

6.6 Interconnected Risks

How do the local inhabitants manage their livelihood and what challenges do they face in their daily life?

Which risk networks exist in thhe Seti River Valley?

6.6.1 Remoteness and the Desire for Road Access

"The road" was remarkably often raised as a topic by the local inhabitants of Upper Seti, in connection with various aspects, such as when addressing natural hazards, facilities in the village or their economic situation. In the following section, the interconnection of the road access and the remoteness of their residential place with other perceived risks will be presented.

6.6.1.1 Livelihood Challenges

As a perceived risk in their lives the respondents name without exception the economic risks they face each and every day. The sustainment of their livelihood is seen as a huge obstacle which gets hampered by several factors. There are no job opportunities in the village and as outlined beforehand the business with forest products is restricted by ACAP. However, these constraints are mostly put into perspective

by a more dominant concern. The remoteness of their place is named as a major risk in their life. To sustain their livelihood they have to reach the market in Pokhara. If they get sick, they have no easy access to health services and if their children want to attend school they have to walk far on dangerous roads. The respondents describe that if the road gets damaged by flood or a landslide blocks the road, they will not reach the market anymore. In turn, they cannot sell their forest products and lose their income. In emergency they may not reach the hospital due to the remoteness of their place and if the condition of the road is bad the children are not able to attend school. According to them, these factors lead to a strong will to leave the village and live in a less remote place with more facilities. Hence, they hope for the government to establish a road access to their settlement, which would make their place much less exposed to risks. Also, the risk of flood and landslides is in many cases attached to the damage or blockage of the road.

> *"The roads are damaged by the flood and landslides time and again and we are unable to connect with the market. In the rainy season we are often stuck for weeks and face major challenges. We cannot even move."* (Interview 5)

> *"The main problem is the road. The road where we have to walk daily for our survival [to get food, to go to market] is not good and it is the main problem. But the road across that bridge often gets blocked by landslides. As well the children have to face this problem. It is difficult for them to go to school during the rainy seasons."* (Interview 6)

> *"For the roads, the presence of the river has created problems. And in the rainy season, we often have to face the problem of landslides and road damages. Despite being only a few kilometers far from the city, our place is very remote."* (Interview 13)

6.6.1.2 Hydropower

In the valley there are several hydropower plants proposed or already in planning. Especially Upper Seti is the site which is under investigation. One project has already been accepted and many more are in the process of approval. The perception of the population towards hydropower is positive in nature. The reasons which are named by the respondents are the electricity supply which gets ensured thanks to the project and employment opportunities, but most importantly, the road which has to be built for the construction of the hydropower plants. The hydropower companies promised to build a road which leads from Kharapani all the way up to Jimerbari. Although the hydropower establishment might bring negative impacts as well, the villagers only put emphasis on the road construction which will facilitate their lives to a large extent. One respondent criticizes the government for its slow development activities and points out that the hydropower companies will take immediate action and the road will be constructed soon. Yet, due to landslides and flooding the road construction was interrupted many times and turned out to be a major challenge.

> *"The roads are very difficult. The road constructed in this area is damaged by the landslide and the road to the upper region is even more difficult. I think they will not be able to reach there. It will be very difficult to construct the road.»* (Interview 12)

Besides natural obstacles of constructing a road in Upper Seti, ACAP is in charge of giving permission for the establishment of roads in the conservation area. One respondent who is a delegate of ACAP highlights potential negative aspects. He names future air pollution due to vehicles, habitat shift or extinction of animals, increase of landslides by reason of destabilized slopes, conflicts of relocation regarding road construction, destruction of the forest and endangering of the social structure and local values on account of strangers arriving in the valley. At the same time, the delegates from ACAP are also aware of the benefits and the need of the hydropower plants for the development of the villages and the construction of the road. Therefore, ACAP discussed with the hydropower company certain options and declared specific zones where the establishment of hydropower should not disturb or interfere.

> *"We have been flexible to a certain point so that it would be easier for them as well. But in certain cases, we strictly said that the establishment of the hydropower should not interfere. Though, no matter how hard we try, there will be some negative effects that we have to accept. We are conscious of such threats but still hope for a good environment from the establishment of the hydropower and the development of the villages."* (Interview 4)

The discussion about hydropower exemplifies how important the road access to the local population is.

6.6.1.3 Sacred Mountains and the Development of Tourism

As outlined in chapter *4.7.1 Tourism*, tourism in the study area is hampered by the prohibition of climbing Machhapuchhre Himal. Earlier in the results, also the different perspectives on mountains being sacred or not have been displayed. When addressing tourism, the question about the sacredness of Machhapuchchhre Himal was discussed by the respondents. Half of the respondents believe that it is a holy mountain whereas the other half do not belief that god resides in Machhapuchchre Himal. Regardless of their beliefs, the majority of the respondents claim that the mountain should be opened for climbing since it bears a great potential for the development of the village. Village development includes, according to them, economic betterment and a proper road access.

> *"Mountains are given by the nature. If people want to try to climb them, then it should be allowed. And that can also bring positive changes to people with the construction of roads and the entry fee of the tourists. People can earn something for their living if the tourism is promoted. So, I think climbing should be allowed."* (Interview 13)

6.6.1.4 The Road

To conclude, the three foregoing paragraphs highlight the importance of the road access in different areas of the local people's lives. Remoteness seems to be a major risk for the local inhabitants which is intensified by other risks such as natural hazards. Implicitly, road access and the management of the road is described as a solution or betterment of their challenging living condition. On the other hand, damage or blockage of the road highly intensifies all of the perceived risks. Therefore, according to respondent 4, opinions which are not supporting the road construction are better kept silent.

"If I say that the motor ways may involve drawbacks, then people will think of me as the negative one. They think I am a person who is against the development of infrastructure in the village." (Interview 4)

6.6.2 Illegal Squatters and the Dependence on the Government

In Lower Seti the inhabitants earn their living by extracting sand from the river. Their livelihoods depend on the river, which is why they settle on the water's edge. As displayed in chapter *6.5.1.2 Relocation*, landownership is of great importance for the local population. Given the fact that the people in Lower Seti settle on public land, another risk is brought into focus.

6.6.2.1 Sand Collection and the Settlements on Public Land

The river laborers' dependence on the river has been revealed beforehand by the fact that they see the river as a necessary evil. Similarly, they perceive floods as a threat to their lives but at the same time as the indirect source for their income. They face big obstacles to maintain their livelihood and live highly exposed to the risks of the river. Yet, there is another risk which it is strongly connected to their beings as squatters. The inhabitants of Lower Seti explain that next to the risk of unpredictable floods, their biggest fear is from the government.

"The major dangers are from the flood and the government that it might take action anytime." (Interview 22)

"Apart from the flood, we are living here illegally. This place is our temporary residential area. Actually, we are not safe here because we are not secure about our residence. There is a fear that the government can prohibit our settlement any time and we have to move from here." (Interview 21)

After the disaster in 2012 all the inhabitants of the squatter settlement left the riverbank to live in a safer place. They tried to live in rent but could not maintain their costs, not even for a few months. After six months everyone had returned to the public land. They point out that it is not their desire to live in such a risky place. However, according to them, the government sees them as illegal people and is not going to help them in any way. Rather they have to fear the government. The prohibition of their settlement would entail severe consequences.

"Since our economic condition is poor, we have no option than living here. The only hope for us is that if we can work hard and save money while living here, probably in the future we would get out from this place to safe areas." (Interview 25)

"The main thing is that we are living on public land that is also close to the river. But we live here under compulsion, it is not our desire. The government may think that we are living here on our own will. It does not have good opinions towards the people living in the slum areas. We are not seen equally as the other people. In case the flood happens again and affects our living, the government is not going to help us since we are living here illegally. But still, we depend on them. That's why we have to keep silent and fight for ourselves." (Interview 23)

Furthermore, they remark that the government has even more power over them. It decides whether the collected sand can be sold or not.

> *"If the government had good opinions towards us, the tender would not have been closed in the rainy season. The poor people should be given the right to work and manage their living. If the tender is closed, then how can we work and manage the expenses? We have just collected the sand but cannot sell it and have to wait for the government to give permission. The only thing we can do is to wait, because no one wants to do illegal things."* (Interview 21)

This situation intensifies their fear of floods since the collected sand is deposited at the riverbank until they get permission to sell it. Hence, they fear that in case of flood their whole effort and income source would be swept away by the river.

From the perceptions of the local population in Lower Seti is clear that major dependencies are prevalent and the risk of flood is strongly connected with other risks. Relocation is a highly sensitive matter to them and the risk of being forced to move away by the government is perceived as equally serious as the risks originating from the river. Living in insecurity, they try hard to maintain their livelihood day by day.

7. Discussion

7.1 Risk Perception

Based on the individuals‘ economic, social and cultural background, risks are subjectively perceived. In the previous section the different perceptions have been presented. Although the sample group is largely heterogenous, including people from different age, gender, caste and occupation groups, similar patterns of risk perceptions could be observed and specific connections between risks detected. Less represented perspectives are taken into account and put into perspective as well. A deeper analysis of the results helps to understand interconnections between the individual risk perceptions.

7.1.1 Causes and Occurrence of Flood Hazards

Nature has an important meaning for the local inhabitants of the Seti River Valley. For Upper Seti and Kharapani the forest, river and mountains play an important role while for Lower Seti mostly the river and mountains are essential. The people’s connection with the natural environment is strongly related to their risk perception. What is visible and matters to them affects their understanding of natural hazards and whether or not they perceive them as a risk (Wagner 2007). The analysis of the results showed a contradiction between the main causes of flood hazards, the perception of their occurrence and the connection to the disaster in 2012, which will be discussed in more detail. On the one hand, the local population perceives that flood hazards occur mainly in the rainy season and are caused by heavy rainfall. However, the origin of water is most often allocated to the snow melt in the mountains. Only one respondent pointed out that due to the snow melt floods can occur also in absence of rainfall. Beside this statement, the reason for floods was only assigned to heavy rainfall. On the other hand, the devastating flood in 2012, which occurred in the dry season and was not caused by heavy rainfall, is for all of the respondents a haunting experience which was mentioned as a major risk in their lives. Nevertheless, the dry season is perceived as hazard free.

In order to explain these discrepancies, certain aspects of risk perception have to be addressed. First of all, the predominance of flood hazards in the local people’s risk perception can, to some extent, be explained by the persistently strong presence of the Seti Disaster in the local inhabitants’ minds. As found by Tversky and Kahneman (1974), human perceptions of risks are strongly influenced by cognitively available events of past or common hazards. This is also confirmed by Sherpa et al. (2019) who studied the risk perceptions in the Sagarmatha National Park in Nepal. They explain their finding that earthquakes appear as the most perceived risk with the still fresh memory of the devastating earthquake in 2015 (Sherpa et al. 2019). Also, Wagner (2007) agrees on that and puts emphasis on the influence of prevailing experiences on local people’s risk perception. Yet, floods as the most dominant risk are perceived to occur in the rainy season while the Seti Disaster happened in the dry season. By having a closer look on the explained reasons for the disaster, it becomes clear that the respondents’ explanations strongly differ from each other. Furthermore, the statements are always accompanied by the respondents expressing their uncertainty about the actual reason and them admitting not to have a clear concept about the root cause. Since they were only told by the scientist about the disaster’s causes, they cannot grasp it in a detailed way and the reason for a flood happening in the dry season

remains unclear to them. Wagner (2007) clarifies that the understanding of a hazards, which is a precondition for perception of risks, depends mostly on the visibility of the causes and the experience of similar events in the past. Hence, the extraordinary nature of the Seti Disaster with causes which are not visible or tangible for the local population leads to a low perception of risks in the dry season. The fact that snow melt is considered as the origin of the river water but not as a trigger of floods can again be explained by Wagner's findings that hazards are more often perceived as risks when they are visible to the people (Wagner 2007). Since only the peaks of the mountains can be spotted from the valley and in the monsoon season the mountains are generally covered in clouds and thus not visible, the potential of snow melt as a trigger for an increase in water level has not been stated by most of the respondents. In contrast, the seasonal flood hazards can be easily explained by the visible factor of heavy rainfall and are a commonly experienced hazard in the rainy season. Given these circumstances it can be assumed that the cognitive memory of a catastrophic event, in this case the Seti Disaster in 2012, intensifies the perceptions of the regularly experienced risk of flood hazards in the rainy season.

Another reinforcing effect for respondents' description of the winter season as hazard free, despite having experienced a major disaster in this season, was the fact that the research was conducted in the middle of the rainy season. Hence, rainfall, water and floods were dominant matters in the people's daily lives and thus present in their minds. In addition to the already increased presence of water the country faced numerous flooding incidents all over the country when the field work started. This certainly influenced the respondents' perception on the occurrence of water related risks in the rainy season. In contrast to the prevailing challenges, the potential risk of a flash flood in the dry season might not have appeared on top priority.

In general, it can be stated that the inhabitants of the Seti River Valley not only are well aware of the risk of natural hazards, such as seasonal floods and landslides but also agree that there is the potential risk of a devastating flood hazard in the dry season. This finding is contrary to what Dahal and Hagelman (2011) found in the area of the Thso Rolpa Glacial Lake in the eastern part of Nepal. According to the scientists there is a high probability of a GLOF from the Thso Rolpa Lake. However, the study reveals that many of the local inhabitants living downstream of the glacial lake do not perceive a GLOF from Thso Rolpa as a risk. Dahal and Hagelman point out that one dominant reason for the low risk perception is that the local population assigns the responsibility to a higher power such as gods and they trust in god that they will not be threatened. Although single respondents from Upper Seti and Kharapani believe in god's anger as the cause of the Seti Disaster, they still perceive flood hazards as a risk which they are afraid of. Thus, contrary to the findings of Dahal and Hagelman, the belief in a higher power does not result in unawareness or a false sense of security of the local population (Dahal & Hagelman 2011). However, for the development of appropriate CCA strategies it remains essential to consider cultural perspectives and narratives (Huggel et al. 2020).

7.1.2 Climate Change

Although water scarcity is not a major problem according to the majority of the respondents, some respondents highlighted crop damage due to a late onset of the monsoon, unseasonal snowfall or hail. Interestingly, the late onset of the monsoon was experienced only a few weeks before the field work

was conducted. Still, only one respondent mentioned it and perceived it as a problem. The question concerning possible reasons for the differing perception cannot be fully answered, but some factors may offer an explanation. At the time when the interviews were held, the rainy season had already started and there was a sufficient amount of water to fulfill the daily needs as well as to irrigate the fields. Often it was even the case that it was pouring during the course of the interviews. The abundance of water may have led to a distortion in the people's perception of water scarcity or to their oblivion of the late onset of the monsoon. However, it could be argued that this is an unjustified accusation. Since all of the respondents from Upper Seti and Kharapani work as subsistence farmers, observations of the natural environment are part of their daily life and may therefore not simply be neglected due to the presence of rainfall and sufficient availability of water. Another explanation could be that the respondent's crop damage was in fact not induced by the late onset of the rainy season, which would explain why others did not experience crop damage. However, the fact that the respective respondent experienced crop damage and correlated it with the absence of rain, explains why the rainfall pattern was perceived differently. As Wagner (2007) explains, risk perception is strongly connected to prior experiences of risks. In terms of an interconnected risk, the respondent who perceives a change in the precipitation patterns may have already experienced problems regarding the crops in earlier times, which in turn reinforces his perception of the main risk (Jurt 2009).

Although most of the respondents had heard of the term climate change beforehand, climate change per se was not strongly perceived as being present or having an effect on the local people's lives. This was mainly reflected by the marginal changes the respondents observed in their environment. Only a few, who are engaged in climate change related activities, showed a more profound perception of it. This result is congruent with the finding from the NCCIS, which declare that particularly in the Western Mountains a large number of respondents did not report any changes in climate (Tanner et al. 2018). After Matias (2017), climate change impacts can be distinguished by rapid and slow onset hazards. Rapid onset hazards, such as flash floods, are more frequently perceived as low onset hazards, such as gradually increasing temperatures or changing amount in precipitation (Sherpa et al. 2019). Therefore, it can be argued that changes in the rainfall and snowfall pattern, increasing temperatures or a late onset of the monsoon were only perceived by a few respondents due to their gradual and slow onset.

A global survey of the awareness of climate change in Nepal displays that half of the country's population is not aware of climate change, whereas the awareness was lower in rural than in urban areas (Gallup 2009; Access: 02.07.2020). The result of the global survey consistent to the findings of the national survey, NCCIS, which additionally points out that the awareness is lowest in mountain regions (Tanner et al. 2018). Contrary to the findings of the two surveys, the term "Climate Change" was not new for most of the respondents in the study area. The existence of the ACA, which includes major parts of the study area, may be the source of the increased familiarity with the term. Becken et al. (2013) who conducted another study in the ACA, focusing on the perceptions of climate change in lower Mustang, show a similar result and point out that the local population of lower Mustang are well aware of the term Climate Change. However, findings from outside of the ACA, as presented in the study of Byg and Salick (2009), regarding the perception of climate change in Eastern Tibet, depict that the local population is not aware of the term. Yet, it should be mentioned, that despite the familiarity of the term within the study area, there was no profound knowledge about climate change observed. The causes of climate change were, similar to the perceptions of the of the NCCIS (Tanner et al. 2018), mainly assigned

to local phenomena such as human activities pollution, population growth, deforestation or to nature itself. Tanner et al. (2018) argue that due the lacking understanding of climate change as a global phenomenon, people ascribe the causes to proximate or visible factors. Hence, the fact that the term was only indistinctively understood and rarely climate related risks were perceived puts the focus on the promoted availability of awareness programs in the study area. As displayed in the results, the respondents underline that no climate change related awareness programs have been held in their villages although ACAP is putting great emphasis on the importance of awareness programs to enhance the adaptive capacity of the local population towards climate change and related risks (Interview 27, Expert 2019). They are referring to the National Adaptation Programme of Action (NAPA) which declares the raise of awareness as a major pillar for CCA (MoE 2010). On this basis one could accuse ACAP to promote awareness raising only to get access to CCA funds. Soliva (2002) underlines similar criticism on ACAP with respect to its participative approach and questions the discrepancy between rhetoric and action. However, it would be narrow-minded to denounce ACAP due to lacking awareness programs since it has achieved remarkable efforts in forest conservation (Bajracharya et al. 2006), which are as well acknowledged by the local population. Nevertheless, since the respondents state deep interest in awareness programs related to climate change it would be more than desirable to transform the rhetoric into action.

7.1.3 The Effects of the Seti Flood on the Perception of Risks

In the respective areas of Upper Seti, which were badly affected by the disaster in 2012, the drawbacks deriving from the river overweigh its benefits. Due to the challenges they had to face in the aftermath of the flood, it is not surprising that they perceive the river as a threat rather than a blessing. Interestingly, the inhabitants of Kharapani, who live in the most severely affected area by the Seti Disaster, perceive more benefits than drawbacks of the river. At this stage it is necessary to clarify what is indicated by the ascription of being the most severely affected area. As stated by several authors (e.g. Kargel et al. 2013; Hanisch et al. 2013; Bhandaray et al. 2012; Japanese Disaster Survey Team 2012), Kharapani was the most affected area in terms of loss of life and property. Jurt (2009) underlines this and emphasizes that across the scientific debate about natural hazards the focus lies mainly on the two factors, loss of life and material loss. However, she strongly suggests to contextualize the perception of natural hazards beyond these losses and highlights the importance of economic, cultural, social and political risks when considering the perception of natural hazards (Jurt 2009: 1). Jurt's suggestion can be paralleled by Blaikie et al.'s (2003) understanding of vulnerability. They point out that concepts of vulnerability should not only consider the loss of life and property at the time of the hazard event, but also much rather put emphasis on the damage of future livelihoods (Blaikie et al. 2003: 12). Considering the two areas, Upper Seti and Kharapani, differences in terms of access to resources, that people need to sustain their livelihood, can be found. While the villagers of Upper Seti were trapped first and later relocated to a completely new place without the resources they need to sustain their livelihood, the villagers from Kharapani did not face such obstacles. Since they live in a less remote place, have proper road access to the city and their area was center of attention for many relief organizations, they managed to recover quickly from the disaster. Thus, as described by the respondents in Kharapani, the impacts of the disaster were not as severe for them as they were for the respective villagers in Upper Seti. The access model, established by Blaikie et al., underlines this by emphasizing the importance of

people's level of access to life-sustaining resources before and in the aftermath of a disaster. This is strongly connected to their capacity and time needed to recover from a disaster. Yet, for the perception of risk the preconditions for future hazards are also crucial (Blaikie et al. 2003). As the settlements of Kharapani are less remote, the respondents from this area appear to be less vulnerable in terms of access. Besides, it must be mentioned that the current inhabitants of Kharapani live with a 50 m distance to the river. The designation of a buffer zone did not allow the people to settle back at the riverbank. Since they now live a little further from the river, they reported to feel safer. Hence, their capacity to recover from the disaster and to protect themselves from future hazards let them perceive the river not only as dangerous but also beneficiary. In terms of vulnerability after the understanding of Blaikie et al. (2003), the villagers from Upper Seti showed much more difficulties to rebuild their livelihoods after the disaster than the villagers of Kharapani. Therefore, the perception of the river as a major risk, which only brings drawbacks to their lives, can be assigned to the lower capacity of them to adjust their livelihood compared to the villagers in Kharapani. In particular their preconditions for future disasters did not change and the omnipresent topic of a difficult road access makes them even more vulnerable.

7.2 Adaptation Measures

The local people's attitudes towards risk reduction or CCA measures are strongly driven by the perception of their natural environment and prevalent risks (Huggel et al. 2020). Therefore, the analysis of the latter is key for the development of successful and locally accepted CCA strategies. In the following, the perceptions of the local population in the Seti Valley towards the established early warning system and the relocation project will be discussed. Finally, the local people's capacity to adapt as an important factor of vulnerability assessment will be examined.

7.2.1 Early Warning System

In 2013, one year after the devastating Seti Disaster, an Early Warning System (EWS) has been established in the upper parts of the Seti Valley. The project was conducted on the government's behalf and implemented by the Department of Hydrology and Meteorology (DHM) in collaboration with the United Nations Development Programme (UNDP) and UK Aid Direct as international donors (Interview 28, Expert). As stated by Gurung (2019), the increased risk of similar future flash floods, due to global warming, demanded urgent action and, therefore, the EWS was established only a year after the flood. However, it is not finally documented whether the initiative was on behalf of CCA or a result of rapid risk reduction response to the disaster. Nevertheless, in Nepal's NAPA to Climate Change is declared that the establishment of EWS is a top priority of CCA actions in Nepal (MoE 2010). Hence, the necessity to discuss the EWS in Upper Seti on behalf of CCA in Nepal is at hand.

On the basis of prior literature research about EWS, the case of Lake 513 in Peru came into focus. As documented by several authors (e.g. Huggel et al. 2020; Fraser 2017, Willer 2017), an existing EWS at the Glacier Lake 513 in the Peruvian Andes was dismantled by a large number of local farmers who believed the EWS to be the reason for the delayed onset of the monsoon (Fraser 2017). As underlined by Huggel et al. (2020), the incident at Lake 513 is neither unique to Peru nor other regions in the high

mountain environments but experiences beyond the case of Lake 513 are hardly documented in scientific literature. Thus, the establishment of early warning systems was already presumed to be a highly sensitive topic in mountain communities before heading to the field. However, as common in problem centered interviews, the researcher's prior theoretical conception got confronted with the social reality (Mattissek 2013: 161). The researcher had to detach from theory and inductively follow the prevailing perceptions of the local population. In contrast to the case of lake 513 in Peru, the local population of the Seti Valley shows a strong acceptance of the EWS. This can be explained with the beforementioned high awareness of natural hazards which are perceived as major risks by the local population. Indeed, this explanation is supported by Dahal and Hagelman (2011) who claim that awareness of risks is a precondition for the acceptance of adaptation strategies as well as for individual incentives to adjust. Further, only a few respondents explained the cause of a disaster based on a religious understanding and, as mentioned above, the local population's perspectives on mountains in terms of religious value are divergent. Still, cultural narratives have to be taken into account when developing CCA measures. Moreover, even though the acceptance of the EWS appeared to be high in the local population, the incident of the installment being denied by a local inhabitant is a vivid example for the importance of including the local population in the process of developing of adaptation strategies.

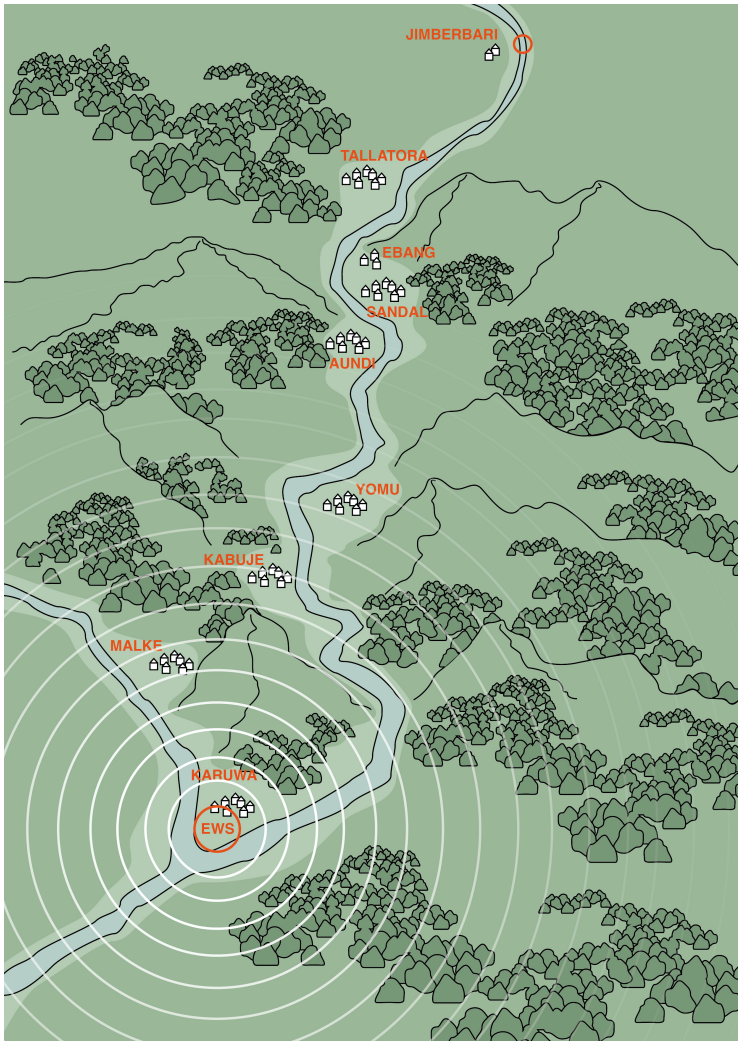

Figure 13: Reach of the early warning system's alarm.

(Source: own data collection; illustration by Naomi Eggli)

The house owner from Kabuje denied the placement of the display board on the wall of her house because she was afraid of being blamed if the equipment got damaged or stolen. The fact that neither an investigation of the place nor a collaboration with the local community took place beforehand resulted in an inappropriate placement of the alarm, which rather led to a false sense of security than to an actual prevention of the exposed inhabitants.

Brown et al. (2019) see the root cause for this incident in Nepal's governance of EWS. They disclose that the DHM, who was in charge of the installment, is solely responsible for the dissemination of early warnings but not for securing the acceptance of such systems or the understanding of the way the system functions. Brown et al. (2019) argue that due to unclarified responsibilities there is a lack of efforts to integrate local communities in the establishment of EWS on the one hand and a lack of awareness programs about the functioning of the systems on the other hand. Kargel et al. (2013) who declared an urgent need for an EWS establishment in the valley after the Seti Disaster in 2012, also emphasize the importance of the local population to understand the functioning of the EWS since they see the residents as a crucial part of the system. However, the proposed engagement with the local population is rather not formulated in a collaborative way of having a dialogue but more in directive and educational manner: *"Residents will have to be a part of the system, so it will be important to engage with the residents (…) in educating them on the nature of the hazard environment and training them in the use of the warning system."* (Kargel et al. 2013: 9). Their suggestion solely puts emphasis on the understanding of the experts' perspective of "*the hazard environment"* and excludes the local population's perceptions of the latter. In contrary, as lessons learnt from the establishment of the EWS at Lake 513, Huggel et al. (2020) accentuate the need for understanding and acknowledging traditional knowledge and narratives and to consider them when developing adaptation measures. Brown et al. (2019) suggest therefore, that questions of responsibility have to be clarified before establishing an EWS and that a stronger sense for collaboration with the residents should be developed. Huggel et al. (2019) further point out that for the collaboration with the local population an interplay of experts from different disciplines is needed and special attention should thereby be put on the representation of voices from the fields of social science.

It can be summarized that all of the respondents from the study area expressed a positive attitude towards and high acceptance of the EWS. The need of an EWS was perceived as urgent and essential. Thus, for the study area the establishment of the EWS is reflected as a suitable strategy for CCA. Nonetheless, the local population has to be engaged in its development. The placement of the alarm should be discussed and optimized with the local population and, most importantly with regard to the broken EWS, the system must be maintained by the responsible authority.

7.2.2 The Relocation Project

As presented in the results, the relocation project was perceived as an unsuccessful and disappointing adaptation measure by the local population. Since they could no longer maintain their livelihood independently and were pushed in even bigger dependence due to fact that they were resettled on public land, the risks of the new supposedly safe place were perceived much stronger than the present risk of flood hazards when living next to the river. This case exemplifies the importance raised by Douglas and Wildavsky (1982) of a holistic understanding of risks by not only addressing natural hazards but also,

as Jurt (2009) suggests, encompassing all roots of risks such as economic, social, cultural and political aspects. In this case, two main risks can be pointed out, which are not related to natural hazards.

First, affected people were relocated to a place in the middle of the forest without access to farming land. Since farming is their main activity to sustain their lives, they could no longer maintain their livelihood strategy and became dependent on external help. Thus, living in a place without farming land and not being able to sustain their livelihood appeared to them as a more severe risk then living close to the river. Again, the access model after Blaikie et al. (2003) plays a crucial role as the relocation changed their access to life-sustaining resources. The fact that they could no longer access their main resource of their livelihood strategy made them more vulnerable. Thus, they felt a stronger exposure to risks in the new place then in the old one, which is why they instantly moved back to their old lands once the bridge was rebuilt.

Secondly, the fact that the people were resettled on public land and were no longer considered as landowners played an essential role for the disaffirmation of their new homes in the relocation area. In Nepal, land ownership has a strong cultural, social and economic value and still determines the political power, social status and economic prosperity of a family or individual person (Dhakal 2011: 1) Further, Dhakal (2011: 1) adds that especially for the rural farmers, land ownership is the most significant asset. Thus, for these people the relocation led to a rapid change in power dynamics and a loss of their social status and economic capital. Indeed, the respondents expressed that they felt like "slum dwellers". Adding to that, is the condition that most often Dalits, who are situated at the bottom of the caste system's hierarchy, belong to the landless residents of Nepal. According to Dhakal, Dalits show with 50 percent the highest percentage of landless people among all residents in Nepal (Dhakal 2011: 22). At this point, cultural values and power structures come into account. The deprivation of landownership was perceived as a severe risk of losing their social status within the community and being perceived by them as people from the lower class.

Since those people settled back to the place of disaster, they were accused by several actors of exposing themselves voluntarily to risks. "Risks" from the perspectives of the critics referred to natural hazards only. As already mentioned, an expert from Pokhara declared that the people who settled back at the place of disaster have no awareness of the risks and are therefore acting in an imprudent way. This statement, however, excludes the local people's perception of risks, which leads to an unjustified conclusion of them acting thoughtlessly. As displayed in the results, the respondents are well aware of the risk of flood they are exposed to. Their decision of settling back, though, is based on a complex construct of risks which goes beyond the risk of flood. Also Kargel et al. (2013) heavily accuse the local people for living in such a risky place: *"They settled along the marginal public lands without caring about the risk of flood havoc or in a calculated gamble knowing that there is some risk. (…) they were busy in eking out their livelihoods and became less careful about the risk and stayed at their own dwellings"* (Kargel et al. 2013: 8). With the notion of "not caring about the risks", they accuse them of voluntarily exposing themselves to "the risk" and do not consider in which relation the risk of flood stands to other risks. This is exemplary of a narrow-minded understanding of risk which advances the view of risks being an objective matter of which people are aware or not. They simply assume that the people perceive risks in the same way as the scientists do by referring to "the risk" as the prevalent risk. Further, Kargel et al. blame the people themselves for the high death toll of the Seti Disaster in 2012: *"We also gathered information about the human root causes of the high death toll (…). Nature and the law, if both had been*

respected by Seti Valley residents, would not have caused a disaster of this magnitude." (Kargel et al. 2013: 0). The accusation of people not respecting nature is ignoring the existence of cultural values, local knowledge, differing social, economic, cultural and political preconditions and individual perceptions of risks.

Blaikie et al. (2003) strongly disagree with the notion of people exposing themselves voluntarily or because of a lack of awareness to risks. On the base of several case studies, which focus on people settling in flood plains or on dangerous hill slopes, they emphasize that living in an unsafe place is certainly not the people's choice but rather the consequence of economic constraints and the necessity to sustain their livelihood. Moreover, they point out that not only economic stress but also the factors class, caste, ethnicity, gender, age and health status determine the exposure to risks. This is in line with the presented findings of the local people's seeing themselves to be at risk of losing their social status in the relocation area, which was one reason for them to move back to the place where they are not exposed to this specific risk. Blaikie et al. (2013: 10) relate the critics' accusations with prevalent views from the time before the idea of vulnerability emerged, which ascribed the causes for disasters to limitations of human rationality and misperception of nature (e.g. Burton et al. 1978; Whittow 1980). They underline that such views do not consider the context in which risks are perceived and therefore do not understand the involuntary nature of exposure to risks. Therefore, the people from Upper Seti, who were relocated but moved back to their original lands, should not be portrayed as incautious fatalists neglecting the risk of natural hazards. Much rather, should they be seen as people who perceive risks within a cultural, social, economic and political framework and make decisions according to the perceived risks and their livelihood strategies to sustain life.

Regarding the specific case of Upper Seti, the understanding of the cultural, social, economic and political importance of land ownership and its acknowledgment as well as the consideration of the people's livelihood strategies in the planning of the relocation would have been indispensable prerequisites for a successful relocation. Since they have been neglected, the project failed to meet its intention. Relocation is already a sensitive topic by its nature since, according to Calhoun (1972), it is leads to social and cultural disruption of the affected people (Calhoun 1972 as cited in Hough 1988). Also Brown and Perkins (1992) agree that relocation entails disruptions that put stress on the relocated people's lives. Given that sensitivity, relocation projects should not be a result of emergency actions but of a deliberate process of analyzing social, cultural, political and economic conditions of the respective community.

7.2.3 Adaptive Capacity of the Local Population

Earlier concepts of vulnerability tended to focus on the conditions and processes in people's lives which make them vulnerable. Blaikie et al. (2003) criticize that, although it is important to assess these processes, the sole focus on people's limiting conditions involves the danger of framing them as incapable and passive victims. They emphasize that every individual possesses certain capacities which counter their limiting conditions and make them less vulnerable. Therefore, they strongly suggest to highlight not only the people's limitations but also their capacities to adapt, cope and protect themselves.

Considering the adaptive capacity of the local population in the study area, the results show that several adaptation strategies exist, which were established on the initiative of the local population. The conclusion of Burton et al. (1993) that people with a high level of risk perception are more likely to adapt in a proactive manner is consistent with the findings of the present study. The local inhabitants of the study area strongly perceive natural hazards such as floods and landslides as risks which is why they developed certain adaptive strategies. However, the local population of Lower Seti can be described as slightly more proactive then the inhabitants of Upper Seti. While the respondents living in the squatter settlements in Lower Seti believe that they cannot count on any help from outside, for example from the government, they developed an energetic attitude towards self-protection. Moreover, the respondents living in Upper Seti more often expressed feelings of hopelessness, although they implemented certain adjustments to their livelihoods. Findings from Dahal and Hagelman (2011) show that feelings of hopelessness were accompanied by ascriptions of responsibility towards the government, which in turn led to a false sense of security. This finding is not consistent with the case of Upper Seti since the respondents expressed to be afraid and aware of the risk albeit they feel hopeless at times. Reversely, however, it strengthens the point that squatters who belief not to receive any help from outside develop a proactive behavior. Overall, as advocated by Blaikie et al. (2003) it was found that the respondents in the Seti Valley do possess adaptive capacities, though not always to the same extent, and should therefore under no circumstances be characterized as helpless or vulnerable victims.

7.3 Interconnected risks

7.3.1 Remoteness and the Road Access

Based on the results it becomes clear how strongly the respondents from Upper Seti perceive remoteness as a risk and how vital the access to a proper road appears to them. Aspects from everyday life but also natural hazards such as floods and landslides are represented in close connection to the road access. “The Road” is perceived as the abolishment of their remoteness and as a prevention from a bundle of risks in their live. The importance of an access road to the city can be reasoned by the access model after Blaikie et al. (2003). The road enables them to access “resources” that they need for sustaining their livelihoods, such as access to the market, health facilities, school and information. The risk of living in a remote place with limited access to resources overweighs many other risks such as the increased risk of landslides due to road construction. Even though the local population is aware of the destabilizing effect of road construction on the steep slopes of the valley, they perceive being hindered to access the market to sell forest products or the hospital in case of emergency as a bigger threat to their livelihoods. In turn, the importance of the road access and their perception of remoteness as a risk reinforces the risk perception of landslides and flood because they bear the potential to cause damage on the road or even block their access to the city. On this account, also negative aspects, that for example emerge from the establishment of hydropower plants, are being accepted. However, when it comes to hydropower it has to be mentioned that the local population perceives not only the road construction, but also the employment opportunities and the ensuring of electrical power supply as a benefit. Yet, the electrical power supply is in turn closely connected to the perception of remoteness. Being able to watch the news, to receive information, or to charge one’s mobile device for receiving flood warnings from the DHM, may reduce their feeling of remoteness and the attached risks.

Another important aspect to consider is that the fact of living remote without having a proper access to the city is in turn seen a cause for their poor economic situation due to lack of employment opportunities in the village. Because they fully depend on farming which, however, is not a sufficient source to maintain their livelihood, other sources for income generation are vital. Thus, the restrictions from ACAP on the extraction of forest products, which is the sole existing income source of the villagers, results in a higher economic pressure on the people's livelihoods. This goes in line with Mishra's cautionary notion that the establishment of conservation areas can result in difficulties to sustain traditionally developed livelihoods of the local population (Mishra 1982). Hence, the development of tourism in the valley is seen as an alternative opportunity for income generation and therefore welcomed by the respondents. It could facilitate their access to resources and thereby reduce their vulnerability (Blaikie et al. 2003). Although some believe that Machhapuchchhre Himal is a sacred mountain, they state that for the sake of economic advance the ban to ascend the mountain should be suspended. This vivid example shows how tradeoffs are made by reason of other risks being perceived as more severe.

To conclude, the interconnections of the risk network and the perceived hierarchy of risks can be highlighted. The presented network of risks is dominated by the risk of remoteness and not having proper road access. Natural hazards such as floods and landslides are perceived as major risks but are often seen as an enhancement of the risk of remoteness. Notwithstanding that people are aware of the negative reinforcing effect of road construction on landslides, it is not perceived as a risk. Economic risks are perceived very strongly; however, they are mostly being reasoned by the lack of proper road access. Thus, economic strains have an enhancing effect on the top priority risk. Eventually, road construction is perceived as diminishing the most severe risk in their lives.

It is crucial to consider such risk networks for the establishment of CCA strategies. As highlighted by Huggel et al. (2020), the success of CCA strategies depends on the acceptance of the latter by the local communities, which in turn is conditioned by their perception of risks. Therefore, the risk network provides a valuable insight in a complex construct of individual risk perceptions by acknowledging the local people's economic, social and cultural preconditions. On the one hand, it highlights which risks are perceived by the local population but, on the other hand, also explains how these risks are connected with each other and perceived within a specific social, cultural and economic setting. Hence, as Jurt (2009) foregrounds, diminishing or enhancing factors of the people's perception of risks can be deduced.

7.3.2 Land Ownership, Squatters and Power Dynamics

Landownership is a symbol of power, economic welfare and social status in Nepal (Dhakal 2011). This was illustrated beforehand with the example of relocating prior landowners on public land and thereby transferring them to "landless people". Yet, the people from Lower Seti, despite living on public land for a long period of time, may have been landowners, or part of a family owning land, too. Many of them reported that they left their lands in the villages to sustain their livelihoods with the economic opportunities of urban areas. They moved to public lands due to economic constraints in the villages and to the riverbank to be closest to their source for income generation. Importantly, the people did not settle on the public land at the riverbank on a voluntary basis but as a consequence of their livelihood strategy which founds on the economic opportunity of the sand extraction from the river.

Blaikie et al. (2013) found in several case studies that landless people often settle in unsafe places since they have no better alternative. The local people from Lower Seti strongly depend on the river for their economic activities. However, they perceive the river as a high risk and threat to their lives. Therefore, the risk and the benefits from the river have to be traded off against each other. The risk network, though, goes beyond this risk.

Landless people in Nepal have a lower status in the society (Dhakal 2011) and are at the mercy of legal authorities. This precondition already creates strong power dynamics which will be revealed in the following. The local people in Lower Seti perceive the government as a risk in their lives. This perception is based on two interrelated strains. The first strain is strongly determined by the cultural and social context, within which they are living and perceiving risks. They believe that the government has no good intentions towards them, since, according to the squatters, they are associated with illegal people who do not deserve any support. The second strain reflects their strong dependency on the government due to its authority to regulate the sand business and the power of restricting them to live on the public land. In turn, the perception of the government as a risk to their lives, is reflected in the way they act. On the one hand, they developed a proactive attitude to protect themselves and display a deep sense of community to tackle the obstacles together. On the other hand, they "learned" to be silent and do not demand any help out of fear of the government's power.

Being displaced from their settlements arose as a major risk to the people in Lower Seti. As Calhoun (1972) states, displacement of people from their lands can lead to increased poverty (Calhoun 1972 cited in Hough 1988). Thus, displacing the landless population from their squatter settlements is a highly sensitive matter and reinforces their poverty even more since their rent paying capacity is very low. Hence, the fear of being forced to move away by the government is tremendous and therefore the government, who has the power to displace them is perceived as a dominating risk.

Furthermore, the government owns the decision-making authority over the allowance of the sand selling. Thus, in order to sustain their livelihood they depend not only on the river, which transports the sand and stones, but also on the government to give allowance to sell the sand. Assuming they do not give permission, as it was the case when the field work was conducted, the sand is deposited at the riverbank and lasts there until the tender is accepted. This further dependency on the government reinforces their perception of the risk towards floods, since the river may sweep away the deposited sand and with it their effort and income source. Not being allowed to sell the sand, however, is perceived as an economic risk, which deviates from the dominating risk, "the government".

Hewitt (1983) argues that asymmetrical power relations can enhance the vulnerability even more than the probability of natural hazards in a place. Considering the strong ruling power dynamics in Lower Seti, it becomes evident that the risk of being displaced and the tender being closed by the government is perceived equally if not even stronger than the risk of a flood hazard. As Hewitt (1983) argues, the given dependency leads to less power of the local population, which in turn makes them more vulnerable. At the same time, since the squatters do not hope for support from the government, they have proven that they are not helpless victims and developed a proactive attitude towards self-protection. This, in turn, as Blaikie et al. (2013) point out, raises their capacity to adapt and diminishes their vulnerability to a certain degree. The river, however, remains, as phrased by a respondent from Lower Seti, *"the people's lifeline and death sentence at the same time."*

8. Conclusion

The present study aimed to elude the local people's risk perception in the Seti River Valley in Nepal. The inhabitants of the Valley live exposed to a bundle of natural hazards. This is due to steep valley steep slopes, weak geological structure, the occurrence of intense monsoon rainfalls and the decreasing glacier and snow cover in the Himalayas. Such a hazard prone area attracts attention and raises the question on how the local population perceives risks in their environment.

The study has shown that the local inhabitants live in close relation to their natural environment and that they are well aware of the natural hazards they are exposed to. Floods and landslides were declared to be the most important natural hazards perceived as a risk. Yet, thanks to a deep analysis of the local people's perceptions, risk networks have been carved out, which revealed that the risk of floods and landslides are accompanied by several other risks. Their livelihood strategies, their cultural background and their embeddedness in a social construct involving power dynamics, influenced the way the local inhabitants perceived risks. Based on these factors, the local inhabitants perceived further risks that go beyond natural hazards.

While all of the respondents were facing economic strains due to lacking income sources, they perceived specific interconnected risks, which enhanced the risk of flood and landslides. In Upper Seti the dominating risk was *Remoteness*, strongly connected with the missing *Road Access*. In Lower Seti, the *Government* appeared to be a dominant risk. This originated from the fact that the inhabitants of lower Seti are landless and live as squatters on public land. Access to livelihood resources and unequal power dynamics strongly influenced the people's vulnerability, which in turn effected the perception of risks. Since vulnerability appears as a component of risks, risk perception determines partly from the people's vulnerability.

Another important determinant is the adaptive capacity, which is influenced by vulnerability and the awareness of risks. In the Seti River Valley, the inhabitants were aware of risks such as flood and landslides and manifested several strategies to adapt to these risks. This reflected that they certainly possess an adaptive capacity. However, the perception of a relocation project showed that the willingness to adapt will decrease if the adaptation measure enhances the people's vulnerability. It turned out clearly that for the successful implementation of CCA strategies, the local inhabitants' social, economic, cultural and political environment has to be addressed and considered to avoid harm on people's livelihoods.

Moreover, it was observed that the Seti Disaster in 2012 has had and still has a strong influence on the local people's risk perception. The event intensified their fear of natural hazards and made some of the inhabitants even more vulnerable to future events, since they had limited access to livelihood resources and could only slowly recover. The enhanced fear and awareness of unpredictable floods was directly reflected in the high acceptance of the early warning system. Out of that reason, early warning systems appeared to be a suitable CCA measure for the Seti River Valley but they strongly demand the incorporation of the local population in the implementation process to ensure effectiveness and to create benefits for all of the exposed inhabitants.

The local people's awareness of natural hazards as risks in their lives remains an important prerequisite for CCA. However, climate change was only linked by a few respondents to present or future hazards.

The study showed that the local population was aware of climate change and assessed it as a problem but did not perceive direct effects to their lives. Awareness programs which also include marginal groups of people in the valley were demanded by the local inhabitants of the Seti River Valley. Therefore, awareness programs should be incorporated in CCA strategies since they can help to enhance the linkage between climate change and its effects and increase the individuals' actions to adapt to climate change.

As natural hazards were perceived as a risk by the local inhabitants of the Seti River Valley, an important baseline for CCA in this specific region exists. The risk networks, however, uncovered the complexity of the local people's risk perception, which went beyond floods and landslides. The perceived risks were strongly linked with other risks potentially enhancing or diminishing the perception of interconnected risks. The present study suggests that the incorporation of the gained understanding of the local people's risk perception will support effective long-term CCA strategies within the Seti River Valley and enhance their acceptance among the local inhabitants. Moreover, the study proved that multidisciplinary and participatory approaches are required for CCA and that the contribution from the social sciences plays a vital role in this process.

8.1 Reflection of Limitations and Strengths

Owing to the ontological the belief of a socially constructed reality and the subjective epistemological position to which the present research underlies, the reflection of the research process is an essential step for its completion. As suggested by Helfferich (2011: 155), the *"impossibility of objectivity"* has to be accepted and subjectivity be reflected. In the following, the researcher's and interpreter's positionality will be reflected based on the experiences from the field work. Subsequently, limitations and strengths of the methodology will be analyzed.

8.1.1 Positionality

Prior to the fieldwork the researcher's reflected on her as a female educated student in social science, coming from a Western country and a different cultural context with a privileged social status. To which extent this position influenced the field work and how the research participants responded to it will be presented next.

The most influential effect which was felt by the researcher and the interpreter was that both of them are educated and were also perceived as educated by the respondents. This was reflected by many of their statements with reference to *"the educated people, like her".* Many respondents declared themselves as uneducated since they believed that only people from the cities or people with proper jobs are educated. Foreign people were perceived to be educated per se. This perception of educated people was revealed by the respondents in the conversations. Thus, many respondents separated themselves from the educated people, to which the researcher and the interpreter, according to them, belong. This separation is assumed to have resulted in a more powerful position of the researcher and the interpreter. An observed effect caused by this imbalance was that people hesitated to share their thoughts because they felt to not be educated enough to answer. A special effort was needed to create confidence that their opinions were as valuable as the ones from educated people. However, most of

the time the researcher and the interpreter managed to make the respondents feel comfortable to answer according to their knowledge.

The researcher's role was perceived to be more powerful, which was reflected in the demand for help from some respondents. They stated that foreign people, such as the researcher, are able to support the poor ones. The researcher often felt to have an outsider status due to her foreign background. In contrast, the local interpreter was rather perceived as an insider which could partly balance the power dynamics and provided a deeper insight in the people's opinions and perceptions.

The effects related to gender were not a clear matter to the researcher beforehand. In the course of the fieldwork no negative gender-based effect was observed. Rather the interpreter and researcher were perceived as a harmonic and equated team by both of them being young, female students. Since the sample shows an equitable share of female and male respondents, no conclusion can be drawn from this.

Due to the impression of the researcher and the way the interviews took their course, the respondents quickly built up confidence in the interpreter and researcher. This is assumed due to many critical statements towards institutions and the government, which would not have been shared if the interpreter and the researcher were perceived as representatives of a specific group of actors. Several statements about the young age of the interpreter and the researcher indicated that they were not perceived as being that powerful or influential, which in turn enabled them to approach the respondents on eye level. With the introducing notion of the interpreter that they were "only" students she may have influenced this perception, which, however, resulted in a positive effect.

The interpreter's positionality was not fully revealed but showed some influencing aspects. The interpreter being a natural scientist may have affected her way of asking questions. Although she was introduced to the qualitative methods in social science and contributed to a prior research project in the field of social science, she might have interviewed the people in a different manner as a social scientist would have done it. Due to the language barrier, the effects of her position as a natural scientist remain open. The way she interacted with the respondents was perceived to be highly respectful and balanced in terms of power dynamics. Yet this is only an impression of the researcher, whereas her social status depending on the respective respondents definitely had an influence. Only once, her cultural values clearly unveiled when she refused to talk to "liquor drinkers". Thus, they might also have been influential in other situations. However, when collaborating with local scientists it is essential to accept and respect their cultural values.

Overall, the researcher's positionality, as well as the interpreter's and her reflected actions, definitely influenced the results of the research. The outcome of the interviews might have differed if the researcher were not a privileged, educated, foreign student and the access to certain information might have been limited by reason of her positionality. In particular, the analysis of the data may have been influenced by the researcher's cultural background, knowledge and understanding of cultural phenomena.

8.1.2 Methodology

Several limitations, as well as some strengths can be pointed out on the applied methods. The most obvious and influential limitation to this research project was the language barrier. Several aspects such as the applied wording, cultural meaning of statements and the translation effect entail uncertainties. Already the fact that a second person's subjectivity played in the process of data collection decreases the precision. Due to a bundle of methodological considerations before, during and after the field work, the limitations of the language barrier could be alleviated but surely not smoothed out entirely. In terms of data analysis, a previously identified challenge was the subjectivity of the codification process (Saldana 2009). The cyclic coding as a means of reflecting on the researcher's subjectivity proved to be a valuable method, as the coding was considerably improved in the second cycle.

As described before, the respondents often felt uncomfortable at first and not competent enough to answer. Looking back, more emphasis could have been placed on an easy opening question and generally on the guideline's complexity, so that they would have felt more comfortable right from the start.

Moreover, the research design, which allowed an interplay between inductive and deductive approaches, proved to be a fruitful way to do justice to the topic of risk perception. This was reflected in the many new aspects that came to light during the interviews and could thus be included in retrospect. As demonstrated by the example of the early warning system, the researcher's previous theoretical conception was confronted with the social reality (Mattissek 2013: 161). Thus, the researcher had to break away from theory to be receptive to the unexpected.

Lastly, the fact that the field work was carried out in the middle of the rainy season increased the perception of water-related risks, but also led to authentic statements by the respondents regarding their perceptions. Although this is an effect that was not directly influenced by the methodology, but by the timing of the fieldwork, it had an impact on the results.

8.2 Outlook

The present study contributed to a better understanding of the local people's risk perception in the Seti River Valley in Nepal. The understanding of risk perception is an important baseline for the development of CCA strategies. Yet, Nepal's government is approaching the final stage of the NAP developing process. After completion of the latter, a reinvestigation of the research area would be crucial to analyze the intended strategies of the NAP for this specific region. Based on the findings of this study, the establishment of a local adaptation plan can be supported.

Although this study was able to shed light on their risk perception of the local inhabitants of the Seti River Valley, it provides solely a small-scale insight of a specific region. Already within a small number of people, risk perception varies strongly. Thus, it would be valuable to pursue the consideration of local people's perception in a larger scope to be able to find suitable CCA strategies for the immensely diverse Himalayan region. For further research projects in this area a collaboration with ACAP is assumed to be fruitful since ACAP emerged as an important actor among the integration of community development and nature conservation. ACAPs experience and expertise is a valuable resource for projects which strive for acceptance within local communities.

The process of understanding and acknowledging risk perceptions in an encompassing way and their consideration within policy making should be a consistent element in CCA. Thus, investigations of local people's risk perception beyond the Himalayan region are recommended to be carried forward at present time as well as in future times too.

9. Bibliography

Adhikari, Jagannath & Seddon, David (2002): Pokhara. Biography of a Town. Kathmandu: Mandala Book Point.

Adhikari, Mahendra, Thapa, Rashmi, Kunwar, Ripu Mardhan, Devkota, Hari Prasad & Poudel Prakash (2019): Ethnomedicinal Uses of Plant Resources in the Machhapuchchhre Rural Municipality of Kaski District, Nepal. Medicines,6(69). doi:10.3390/medicines6020069

Anderson, Mary B., & Woodrow, Peter J. (1998): Rising from the ashes: Development strategies in time of disaster. Intermediate Technology Publications, London.

Baidya, Saraju K., Shrestha, Madan L., Sheikh, Muhammad Munir (2008): Trends in daily climatic extremes of temperature and precipitation in Nepal. Journal of Hydrology and Meteorology, 5, 38–51.

Bajracharya, Siddhartha B., Furley, Peter A., Newton, Adrian C. (2006): Impacts of community-based conservation on local communities in the Annapurna Conservation Area, Nepal. Biodiversity and Conservation 15: 2765–2786.

Beck, Ulrich (1986): Risikogesellschaft. Auf dem Weg in eine andere Moderne. Frankfurt a.M.: Suhrkamp.

Becken, Susanne, Lama, Anu K., & Espiner, Stephen (2013): The cultural context of climate change impacts: Perceptions among community members in the Annapurna Conservation Area, Nepal. Environmental Development, 8, 22-37. https://doi.org/10.1016/j.envdev.2013.05.007

Bennett, Lynn, Dahal, Dilli Ram and Govindasamy, Pav (2008): Caste, Ethnic and Regional Identity in Nepal: Further Analysis of the 2006 Nepal Demographic and Health Survey. Calverton, Maryland, USA: Macro International.

Bhandary Netra P., Dahal Ranjan K. & Okamura Mitsu (2012): Preliminary understanding of the Seti River debris-flood in Pokhara, Nepal, on May 5th, 2012. A report based on a quick field visit program. ISSMGE Bulletin 6 (4): 8–18.

Bhattarai, Krishna P. (2008). Nepal. New York: Infobase Publishing.

Bishokarma, N.K. (2017): Capacity Gaps and Needs Analysis Report: Livelihoods and governance sector. Climate Change Management Division, National Adaptation Plan Formulation Process.

Blaikie, Piers, Cannon, Terry, Davis, Ian, & Wisner, Ben (2003): At Risk. Natural hazards, people's vulnerability, and disasters. 2nd edition. London etc.: Routledge.

Bogner, Alexander & Menz, Wolfgang (2009): The Theory-Generating Expert Interview: Epistemological Interest, Forms of Knowledge, Interaction. In: Bogner, Alexander; Littig, Beate & Menz, Wolfgang (eds.): Interviewing Expert. Basingstoke: Palgrave Macmillan, p. 43-80.

Bourke, Brian (2014): Positionality: Reflecting on the Research Process, The Qualitative Report, 19(33), 1–9.

Brown, Barbara B. & Perkins, Douglas P. (1992): Disruptions in Place Attachment. In: Altman, Irwin & Low Setha M. (eds.): Place Attachment. New York: Plenum Press.

Brown, Sarah, Budimir, Mirianna Lovell, Emma, Meechaiya, Chinaporn & Wilkinson, Emily (2019): The Governance of Nepal's Flood Early Warning System. Opportunities under Federalism. Working Paper. BRACED.

Burton, Ian, Kates, Robert W. & White, Gilbert F. (1978): The Environment as Hazard. 1st edition. New York: Guilford Press.

Burton, Ian, Kates, Robert W. & White, Gilbert F. (1993): The Environment as Hazard. 2nd edition. New York: Guilford Press.

Byg, Anja, & Salick, Jan. (2009): Local perspectives on a global phenomenon-Climate change in Eastern Tibetan villages. Global Environmental Change, 19(2), 156–166. doi:10.1016/j.gloenvcha.2009.01.010

CBS (Central Bureau of Statistics) (2011): Table 2.1: Households, population and average household size by Ward Level. Population_GaunPalika_and_Ward_Level_Formatted. ‹https://cbs.gov.np/population-of-753-local-unit/› (As at: 2011; Accessed: 13th May 2020).

CBS (Central Bureau of Statistics) (2011a): National Data Profile. Kaski. Machhapuchchhre Rural Municipality. Literacy Rate Local. ‹http://nationaldata.gov.np/LocalLevel/Index/40502› (As at: 2011; Access: 13.05.2020).

CBS (Central Bureau of Statistics) (2012): National population and housing census 2011. National Report. Kathmandu: Government of Nepal, National Planning Commission Secretariat.

CBS (Central Bureau of Statistics) (2014): Population Monograph of Nepal. Volume II. (Social Demography). Kathmandu: Central Bureau of Statistics.

Costa John E. & Schuster Robert L. (1987): The formation and failure of natural dams. Vancouver, Washington: U.S. Geological Survey.

Dahal, Khila R., & Hagelman, Ronald (2011): People's risk perception of glacial lake outburst flooding: A case of Tsho Rolpa Lake, Nepal. Environmental Hazards, 10 (2), 154–170. doi:10.1080/17477891.2011.582310

Dangal, Rameshwor (2011): Country profile Nepal. Disaster risk management: Policies and Practices in Nepal. Kobe: Asian Disaster Reduction Center.

‹http://www.adrc.asia/countryreport/NPL/2011/FY2011B_NPL_CR.pdf›

Davidson, Christina (2009): Transcription: Imperatives for Qualitative Research. In: International Journal of Qualitative Methods, 8(2), p.1-52.

Denzin, Norman K. (1978): The Research Act. A Theoretical Introduction to Sociological Methods. 2nd edition. New York: McGraw Hill.

Dhakal, Suresh (2011): Land Tenure and Agrarian Reforms in Nepal. A Study Report. Kathmandu: Community Self-Reliance Centre.

DHM (Department of Hydrology and Meteorology) (2017): Observed Climate Trend Analysis in the Districts and Physiographic Regions of Nepal (1971-2014). Kathmandu: Department of Hydrology and Meteorology.

DHM (Department of Hydrology and Meteorology) (2018): Standard Operating Procedure for Flood Early Warning System in Nepal. Kathmandu: Department of Hydrology and Meteorology.

Douglas, Mary & Wildavsky, Aaron (1982): Risk and Culture. Berkeley: University of California Press.

Douglas, Mary (1992): Risk and Blame: Essays in Cultural Theory. London: Routledge.

Dow, Kirstin (1992): Exploring differences in our common future(s): the meaning of vulnerability to global environmental change. Geoforum, 23(3), 417-436. doi:10.1016/0016-7185(92)90052-6

England, Kim (1994): Getting personal: Reflexivity, Positionality, and Feminist Research. The Professional Geographer, 46(1), 89–89. doi: 10.1111/j.0033-0124.1994.00080.x.

Engle, Nathan L. (2011): Adaptive capacity and its assessment. Global Environmental Change, 21, 647-656. doi: 10.1016/j.gloenvcha.2011.01.019.

Fineman, Martha A. & Grear, Anna (2013): Vulnerability: Reflections on a New Ethical Foundation for Law and Politics. Farnham: Ashgate.

Fischhoff, Baruch, Slovic, Paul, Lichtenstein, Sarah, Read, Stephen, & Combs, Barbara (1978): How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. Policy Sciences, 9, 127–152. doi:10.1007/BF00143739

Flick, Uwe (1999): Qualitative Forschung. Theorie, Methoden, Anwendung in Psychologie und Sozialwissenschaften. 4. Auflage. Reinbek bei Hamburg: Rowohlt Taschenbuch Verlag.

Flick, Uwe (2000): Episodic Interviewing. In: Bauer Martin W. & Gaskell Georg (eds.): Qualitative Researching with Text, Image and Sound: A Practical Handbook for Social Research. Sage, p. 75–92.

Flick, Uwe (2004): 4.6 Triangulation in Qualitative Research. In: Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2004): A Companion to qualitative research. Translation. London, Thousand Oaks, New Delhi: Sage.

Flick, Uwe (2010): 4.6 Triangulation in der qualitativen Forschung. In: Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2010): Qualitative Forschung. Ein Handbuch. 8. Auflage. Reinbek bei Hamburg: Rowohlt Taschenbuch Verlag.

Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2004): A Companion to Qualitative Research. Translation. London, Thousand Oaks, New Delhi: Sage.

Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2010): Qualitative Forschung. Ein Handbuch. 8. Auflage. Reinbek bei Hamburg: Rowohlt Taschenbuch Verlag.

Fontana, Andrea & Frey, James (1994): Interviewing: The Art of Science. In: Denzin, Norman, Lincoln, Yvonna S. (eds.): The Handbook of Qualitative Research, Thousand Oaks: Sage Publications, p.361-376.

Fraser, Barbara (2017): Learning from a flood-alarm system's fate. Carhuaz, Peru: EcoAméricas.

Gallup (2009): High Risk, Low Awareness of Climate Change in Nepal. <http://www.gallup.com/poll/124658/high-risk-low-awareness-climate-change-nepal.aspx> (As at: 2009; Access: 2.07.2020)

GoN (Government of Nepal) (2014): District Transport Master Plan (DTMP). Ministry of Federal Affairs and Local Development; Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR); District Development Committee, Kaski Volume I: Main Report.

Green, Judith, Franquiz, Maria, & Dixon, Carol (1997): The myth of the objective transcript: Transcribing as a situated act. TESOL Quarterly, 21(1), p. 172–176.

Gurung, Gehendra (2019): Case study 1: Seti River EWS in Pokhara Metropolitan City. In: Brown, Sarah, Budimir, Mirianna Lovell, Emma, Meechaiya, Chinaporn & Wilkinson, Emily, (eds.): The Governance of Nepal's Flood Early Warning System. Opportunities under Federalism. Working Paper. BRACED, p. 37-38.

Haeberli, Wilfried & Beniston, Martin (1998): Climate change and its impacts on glaciers and permafrost in the Alps. Ambio, 27, 258–265.

Hanisch, Jörg, Koirala, Achyuata & Bhandary, Netra P. (2013): The Pokhara May 5th flood disaster: a last warning sign sent by nature?. Journal of Nepal Geological Society, 46, 1-10.

Helfferich, Cornelia (2011): Die Qualität Qualitativer Daten. Manual für die Durchführung qualitativer Interviews. 4. Auflage. Wiesbaden: VS Verlag für Sozialwissenschaften.

Hewitt, Kenneth (1983). Interpretations of Calamity. From the viewpoint of human ecology. Boston: Allen & Unwin INC.

Hilgartner, Stephen (1992): The Social Construction of Risk Objects: Or, How to Pry Open Networks of Risk. In: Short, James F. & Clarke, Lee (eds.): Organizations, Uncertainties, and Risk, pp. 39–53, Boulder: Westview Press.

Hollenbach, Pia & Müller-Böker, Ulrike (2012): Field Research: Proper planning does make fieldwork a 'bit' easier. Zürich: Universität Zürich. [Online] Available at: https://www.geo.uzh.ch/dam/jcr:a6bce099-6ffd-4e0e-b756-515cb6692a76/Fieldwork_Master_2012-09.pdf (Accessed: 10th of April 2019).

Hopf, Christel (2010): 5.2 Qualitative Interviews – ein Überblick. In: Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2010): Qualitative Forschung. Ein Handbuch. 8. Auflage. Reinbek bei Hamburg: Rowohlt Taschenbuch Verlag.

Hough, John L. (1988): Obstacles to Effective Management of Conflicts Between National Parks and Surrounding Human Communities in Developing Countries. Environmental Conservation, 15(2), 129–136. doi:10.1017/S0376892900028939

Huggel, Christian, Cochachin, Alejo, Drenkhan, Fabian, Fluixá-Sanmartín, Javier, Frey, Holger, García Hernández, Javier, Jurt, Christine, Muñoz, Randy, Price, Karen, Vicuña, Luis (2020): Glacier Lake 513, Peru: Lessons for early warning service development. In: WMO Bulletin. The journal of the World Meteorological Organization. 69 (1) – 2020, p. 45-52.

IPCC (2007): Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Edited by Parry, Martin, Canziani, Osvaldo, Palutikof, Jean, von der Linde, Paul, Hanson, Clair. Cambridge, UK: Cambridge University Press.

IPCC, (2014): Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, Pachauri, Rajendra K. & Meyer, Leo A. (eds.). IPCC, Geneva, Switzerland, 151 pp.

IPCC (2018): Annex I: Glossary. Matthews, J.B. Robin (ed.). In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Masson-Delmotte,

Valérie, Zhai, Panmao, Pörtner, Hans-Otto, Roberts, Debra, Skea, Jim, Shukla, Priyadarshi R., Pirani, Anna, Moufouma-Okia, Wilfran, Péan, Clotilde, Pidcock, Roz, Connors, Sarah, Matthews, J.B. Robin, Chen, Yang, Zhou, Xiao, Gomis, Melissa I., Lonnoy, Elisabeth, Maycock, Tom, Tignor, Melinda & Waterfield, Tim (eds.). In Press.

Japanese Disaster Survey Team (2012): Survey report on the Seti River flood May 5, 2012. Accessed at: https://www.sff.or.jp/nepal/osirase/121009Setikawagenchichousahoukokusho_English.ver.pdf

Jungermann, Helmut, & Slovic, Paul (1993): Charakteristika individueller Risikowahrnehmung. In: Bayerische Rück (ed.): Risiko ist ein Konstrukt. Wahrnehmungen zur Risikowahrnehmung. München: Knesebeck. 89–107.

Jurt, Christine (2009): Risk from Inside and Outside. Perceptions of Natural Hazards in the Context of Social, Cultural, Economic and Political Risks – A Case Study in South Tyrol. Dissertation. Birmensdorf: WSL.

Kargel, Jeffrey S., Paudel, Lalu, Leonard, Gregory, Regmi, Dhananjay, Joshi, Sharad, Poudel, Khagendra, Thapa, Bhabana, Watanabe, Teiji, & Fort, Monique (2013): Causes and Human Impacts of the Seti River (Nepal) Disaster of 2012. Glacial Flooding & Disaster Risk Management Knowledge Exchange and Field Training; High Mountains Adaptation Partnership: Huaraz, Peru, 1-11.

Karki, Ramchandra, Hasson, Shabeh ul, Schickhoff, Udo, Scholten, Thomas, Böhner, Jürgen (2017): Rising Precipitation Extremes across Nepal. Climate, 5(1), 4. doi:10.3390/cli5010004

Knowledge for Climate (2020): Our joint knowledge production approach in research and education. https://www.knowledgeforclimate.net/?page_id=25785 (As at: 2020; Access: 13.06.2020)

Kowal, Sabine & O'Connel, Daniel, C. (2004): 5.9 The Transcription of Conversations.
In: Flick, Uwe, von Kardorff, Ernst & Steinke, Ines (2004): A Companion to qualitative research. Translation. London, Thousand Oaks, New Delhi: Sage.

Krämer, Karl-Heinz (1996): Ethnizität und Nationale Integration in Nepal. Eine Untersuchung zur Politisierung der Ethnischen Gruppen im Modernen Nepal. Beiträge zur Südasienforschung. Südasien-Institut Universität Heidelberg, 174. Stuttgart: Franz Steiner Verlag.

Kruse, Jan (2014): Qualitative Interviewforschung. Ein integrativer Ansatz. Weinheim: Beltz.

Kuckartz, Udo (2018): Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung. 4. Auflage. Weinheim: Beltz.

Kurz, Andrea, Stockhammer, Constanze, Fuchs, Susanne, & Meinhard, Dieter (2007): Das problemzentrierte Interview. In: Buber, Renate & Holzmüller, Hartmut H. (eds.): Qualitative Marktforschung: Konzepte – Mehtoden – Analysen. Wiesbaden: Gabler, p. 463-475.

Lindell, Michael K., & Prater, Carla S. (2002): Risk Area Residents' Perceptions and Adoption of Seismic Hazard Adjustments. Journal of Applied Social Psychology, 32(11), 2377–2392.

Lupton, Deborah (1999): Risk. London: Routledge.

Lutz, Arthur F., Immerzeel, Walter W., Litt, M., Bajracharya, S., Shrestha, Arun B. (2015): Comprehensive Review of Climate Change and the Impacts on Cryosphere, Hydrological Regimes and Glacier Lakes. FutureWater Report 147.

Machlis, Garry E. & Rosa, Eugene A. (1990): Desired risk: broadening the social amplification of risk framework, Risk Analysis, 10, 161–68.

Marsh, David & Furlong, Paul (2002): A Skin not a Sweater: Ontology and Epistemology in Political Science. In: Marsh, David & Stoker, Gerry (eds.): Theory and Methods in Political Science, 2nd edition, London: Palgrave Macmillan, p. 17-41.

Matias, Denise M. (2017): Slow Onset Climate Change Impacts: Global Trends and the Role of Science-Policy Partnerships. Discussion Paper, 24/2017. Bonn: Deutsches Institut für Entwicklungspolitik.

Mattissek, Annika, Pfaffenbach, Carmela & Reuber, Paul. (2013): Methoden Der Empirischen Humangeographie. 2. Auflage. Braunschweig: Westermann.

McDowell, Graham, Huggel, Christian, Frey, Holger, Wang, Frances M., Cramer, Katherine, Ricciardi, Vincent (2019): Adaptation action and research in glaciated mountain systems: Are they enough to meet the challenge of climate change?. Global Environmental Change. 54, 19-30.

doi:10.1016/j.gloenvcha.2018.10.012.

McSweeney, Carol, New, Mark, & Lizcano, G. (2012): Nepal. UNDP Climate Change Country Profiles.

‹https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Nepal/Nepal.lowres.report.pdf›

Mergili, Martin, Schneider, Demian, Worni, Raphael, Schneider, Jean F. (2011): Glacial Lake outburst Floods (GLOFs): challenges in prediction and modelling. Proceedings of the 5th International Conference on Debris-Flow Hazard Mitigation: Mechanics, Prediction and Assessment, Padua, Italy, 14–7 June; 2011. p. 973–82.

Merton, Robert K., Fiske, Marjorie & Kendall, Patricia L. (1956): The focused interview. Glencoe, IL: Free Press.

Mishra, Hemanta R. (1982): A delicate balance: tigers, rhinoceros, tourists and park management vs. The needs of local people in Royal Chitwan National Park, Nepal. In: McNeely, Jeffrey A. and Miller, Kenton R. (eds.): The Third World Congress on National Parks and Protected Areas. Bali, Indonesia, 1984. Washington, DC: Smithsonian Institute Press, p. 197–205.

MoE (Ministry of Environment) (2010): Nepal National Adaptation Programme of Action (NAPA) to Climate Change. Kathmandu: Government of Nepal.

MoFE (Ministry of Forest and Environment) (2018): Nepal's National Adaptation Plan (NAP) Process: Reflecting on lessons learned and the way forward. Kathmandu: Ministry of Forests and Environment.

MoFE, (Ministry of Forest and Environment) (2019): Climate change scenarios for Nepal for National Adaptation Plan (NAP). Kathmandu: Ministry of Forests and Environment.

Müller-Böker, Ulrike (1998): Kasten und ethnische Gruppen. In: Müller-Böker, Ulrike & Kollmair, Michael (eds.): Bericht zur Nepalexkursion 1997. Zürich: Geographisches Institut der Universität Zürich.

NASA Earth Observatory (2014): Making sense of Nepal's Seti River Disaster.

‹https://earthobservatory.nasa.gov/images/82937/making-sense-of-nepals-seti-river-disaster› (As at: 24th of January 2014; access: 20th of March 2020).

NTNC (National Trust for Nature Conservation) (2019): Annapurna Conservation Area Project (ACAP). Goal. ‹https://ntnc.org.np/project/annapurna-conservation-area-project-acap› (As at: 2019; access: 23th of May 2020).

Ochs, Elinor (1979): Transcription as theory. In: Ochs Elinor & Schieffelin Bambi B. (eds.): Developmental pragmatics. New York: Academic, p. 43–72.

Panthi, Jeeban, Dahal, Piyush, Shrestha, Madan, Aryal, Suman, Krakauer, Nir, Pradhanang, Soni, Lakhankar, Tarendra, Jha, Ajay, Sharma, Mohan & Karki, Ramchandra. (2015): Spatial and Temporal Variability of Rainfall in the Gandaki River Basin of Nepal Himalaya. Climate, 3, 210-226. doi:10.3390/cli3010210

Patra, Jyotiraj & Terton, Anika (2017): Review of current and planned adaptation action in Nepal. Ottawa, Canada: IDRC. Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA). ‹https://idl- bnc-idrc.dspacedirect.org/bitstream/handle/10625/55959/IDL-55959.pdf?sequence=1›

Renn, Ortwin (1985): Risk Analysis – Scope and Limitations. In: Otway, Harry & Peltu, Malcolm (eds.): Regulating Industrial Risks: Science, Hazards and Public Protection, p. 111–27. London: Butterworths.

Renn, Ortwin (1998): Three decades of risk research: accomplishments and new challenges. Journal of Risk Research 1, 49-71. doi: 10.1080/136698798377321

Riessman, Catherine K. (2008): Narrative methods for the human sciences. Los Angeles: Sage.

Rimal, Bhagawat, Baral, Himlal, Stork, Nigel E., Poudyal, Kiran & Rijal, Sushila (2015): Growing city and rapid land use transition: Assessing multiple hazards and risks in the PokharaValley,Nepal.Land,4(4),957-978. doi:10.3390/land4040957.

Rose, Gillian (1997): Situating knowledges: Positionality, reflexivities and other tactics. Progress in Human Geography, 21(3), 305–320. doi: 10.1191/030913297673302122.

Saldana, Johnny (2009): The coding manual for qualitative researchers. Los Angeles: Sage Publications.

Salzmann, Nadine, Huggel, Christian, Rohrer, Mario, Stoffel, Markus (2014): Data and knowledge gaps in glacier, snow and related runoff research – A climate change adaptation perspective. Journal of Hydrology, 518, Part B: 225-234.

Schneider, Demian, Huggel, Christian, Cochachin, Alejo, Guillén Ludeña, Sebastián & Garcia Hernandez, Javier (2014): Mapping hazards from glacier lake outburst floods based on modelling of process cascades at Lake 513, Carhuaz, Peru. Advances in Geosciences, 35, 145–155.

Sherpa, Sonam F., Shrestha, Milan, Eakin, Hallie & Boone, Christopher G. (2019): Cryospheric hazards and risk perceptions in the Sagarmatha (Mt. Everest) National Park and Buffer Zone, Nepal. Natural Hazards 96, 607–626. https://doi.org/10.1007/s11069-018-3560-0

Shijin, Wang, & Dahe, Qin (2015): Mountain inhabitants perspectives on climate change, and its impacts and adaptation based on temporal and spatial characteristics analysis: A case study of Mt. Yulong Snow, Southeastern Tibetan Plateau. Environmental Hazards, 14(2), 122–136.

doi:10.1080/17477891.2014.1003776

Singh, Surender P., Bassignana-Khadka, Isabella, Karky, Bhaskar S., Sharma, Eklabya (2011): Climate change in the Hindu Kush-Himalayas. The state of current knowledge. Kathmandu: ICIMOD.

Sjöberg, Lennart (2000): Factors in Risk Perception. Risk Analysis 20(1), 1-12.

Soliva, Reto (2002): Der Naturschutz in Nepal. Eine akteurorientierte Untersuchung aus der Sicht der Politischen Ökologie. Kultur, Gesellschaft, Umwelt, 5. Münster: Lit-Verlag.

Speck, Sarah (2017): "They Moved to City Areas, Abroad": Views of the Elderly on the Implications of Outmigration for the Middle Hills of Western Nepal. Mountain research and development, 37(4), 425 – 436.

Stash, Sharon & Hannum, Emily (2001): Who Goes to School? Educational Stratification by Gender, Caste and Ethnicity in Nepal. Comparative Education Reviews, 45(3), p. 354-378.

Tanner, Thomas & Acharya, Sunil & Bahadur, Aditya (2018): Perceptions of climate change: Applying assessments to policy and practice. Action on Climate Today, Learning Paper.

Temple, Bogusia & Young Alys (2004): Qualitative Research and Translation Dilemmas. Qualitative Research 4(2): 161–178. doi:10.1177/1468794104044430.

Turner Sarah (2010): Research Note: The silenced assistant. Reflections of invisible interpreters and research assistants. Asia Pacific Viewpoint, 51(2), 206–219.

Tversky Amos & Kahneman Daniel (1974): Judgment under uncertainty: Heuristics and Biases. Science, 185(4157), p. 1124–1131. doi:10.1126/science.185.4157.1124

UN (United Nations) (2019): Goal 13 Climate Action. ‹https://sustainabledevelopment.un.org/sdg13› (As at: 2019; Access: 20.04.2019)

UNDP (United Nations Development Programme) (2012): Community-Based Flood and Glacial Lake Outburst Risk Reduction in Nepal. Nepal Project Document. ‹https://www.adaptation-undp.org/sites/default/files/downloads/submission_october_2012_nep_ldcf_prodoc_15nov2012.pdf›

UNEP (United Nations Environment Programme) (2020): Climate Change Adaptation.

‹https://www.unenvironment.org/explore-topics/climate-change/what-we-do/climate-adaptation› (As at: 2020; Access: 12.06.2020)

Upadhyay, Prakash (2014): Squatters Formation Process and Waft of Transformations in Pokhara, Nepal. Contribution to Nepalese studies, CNAS, Nepal: 173-204.

Wagner, Klaus (2007): Mental Models of Flash Floods and Landslides. Risk Analysis, 27(3), 671–682. doi:10.1111/j.1539-6924.2007.00916.x

Watts, Michael J., & Bohle, Hans G. (1993): Hunger, famine and the space of vulnerability. GeoJournal, 30(2): 117-125. doi: 10.1007/BF00808128

Whittow, John (1980): Disasters: The anatomy of environmental hazards. London: Allen Lane.

Willer, Hildegard (2017): Wenn Antennen den Regen vertreiben. Welt-Sichten, 4.

Witzel, Andreas (1982): Verfahren der qualitativen Sozialforschung. Überblick und Alternativen. Frankfurt/New York: Campus.

Witzel, Andreas (2000): The problem-centered interview [26 paragraphs]. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 1(1), Art. 22. [Online] Available at: http://nbn-resolving.de/urn:nbn:de:0114-fqs0001228 [Accessed 23th May 2020].

Witzel, Andreas & **Reiter**, Herwig (2012): The problem-centred interview. London: Sage.

Wong, Koon-Kwai, & **Zhao**, Xiaobin (2001): Living with floods: victims' perceptions in Beijiang, Guangdong, China. Area, 33(2), 190–201.

Illustrations

Eggli, Naomi (2020): The illustrations were designed on behalf of the present research project.

10. Appendix

10.1 Interview Guideline

Research Questions	***What risks (connected to climate change) do local inhabitants in the Seti River Valley perceive?*** - *Which natural hazards are perceived as a risk by the local inhabitants of the Seti River Valley?* - *How are present adaptation measures perceived by the local inhabitants of the Seti River Valley?* - *What interconnected risks come along with the perceived risks of natural hazards?*
	- Ask as open as possible in the beginning, and then in more detail
Introduction	Namaste! How are you? My name is Isabelle, I'm a (master) student and I'm interested in the villages along the Seti river.
Information about the project	*(I don't want to indicate «climate change» / " risks")* I am interested in your daily live, how you live in the villages along the Seti River and what challenges you face in daily life.
Procedures	I will ask questions and you will reply. If you have any questions or if you do not understand the question, do not hesitate to ask. You can also tell other stories, not related to the question. Important: there is no right or wrong in the answers. It's just about your opinion / experience. Is it ok, when I record the conversation?
Livelihood	

	Can I ask you – how does a normal day looks like in your family / village?
	Where do you live?
	Do you own land?
	How do you earn a living? Is your family living with you?
Nature	What is your relation to nature? How do you interact with the environment?
Mountains	What meaning do mountains have for you? Are you afraid of the mountains?
Water River	When we talk about water, what comes to your mind first? Which role does water play in your life? / What does water mean for you? Is it important? Why? How do you use the water channel? Do you have enough water to live? Where does the water come from? (mountain?) or… What do rivers mean to you?
Dangers	Do you have any fears? What challenges do you face in daily life? Do you know any dangers coming from nature (water, high mountains)? Which dangers are the most important? Are you scared of water?

	Are there any dangers related to water? If yes: What kind of dangers do you know? Only in the monsoon time? Also in the dry season? Have you ever had too much water? Have you ever had too little water (water scarcity)? When? In which context? How is it, when you have too little water? Why there is too little water? Does it happen regularly? Did it change over the years? How is it, when you have too much water? Do you remember mudslides, floods, flash floods? Why do floods happen, do you have an idea? Do floods cause damage? Are they a danger? Are you scared of floods? Did they change? If yes: Why? Is water rather a benefit or a danger? For whom water poses a danger? For whom water brings benefit? Which dangers are you most concerned of? Is the main problem water scarcity or flooding?
Risks	What scares you? What are your challenges and concerns in life?

	Does the water bring risks / danger? Was there any event you can remember (at the Seti river)? Do you feel save in your home? What are your concerns? Concerns / challenges / threats / fears
Seti river disaster	*First, I will ask about threats / concerns. See if they talk about the Seti disaster. If it doesn't come up, it is maybe not so important. If they are not talking about Seti, I will ask directly.* Was there a specific flooding event in the past that you remember? If yes: What happened? Were you affected by it? If no: Do you remember the flash flood in the Seti river from 2012 / 7 years ago? What happened? Were you affected by it?
Climate Change / Causes	Has something changed with the nature in the past few years? Any changes with the water flow? Did the river change in the last years? Did the dangers change? Did the monsoon change? If yes: Why do you think it changed? Can you think of reasons for this changes?

	Do you think the reason for the changes is nature or the humans? Why? How? Do humans cause problems for the nature? Are you scared of the future? Do you think nature will change in the future? What could happen?
Adaptation	How do you adapt to the changes? Livelihood Agriculture How do you adapt due to dangers? How are you going to face the challenges? What are you doing to prevent yourself / yourselves from flash floods? Is the government helping you? How do you feel about adaptation strategies? Are you getting informed about dangers? Do you inform yourself? *Many young people are leaving the villages. How do you adapt to that?*
Government	What do you think about the government? Is the government aware of the dangers? Is the government taking action? Should the government take action? If different perception between local people and government:

	- Why do you think the government has another perception of the dangers? Trust / confidence: Do you trust the government? If not: Why not? Do you trust the scientists (foreigners)? If not: Why not?
NGOs	Can you think of other actors in relation to the dangers? Are there other people informing you about changes? (NGOs) Are there other people helping you?
Questions	Do you have any questions for me? Do you have any further comments? Something you want to tell? Are you interested in the results?
Finish	Age Gender Cast / ethnicity Village (Name) (contact details)
Portrait	Can I take a portrait of you?
Thanks and good bye	Thank you for your time. It was a very interesting conversation. And it was really important for us to talk to you.

10.2 Transcription Guideline

Transcription of Interviews – short guideline for Urmila

- **Change as little as possible!!** Accurately represent each speaker's words, conversational quality, and speech patterns.
- Do **not summarize or interpret** the recorded audio files.
- Make it easy to read and understand. Use the correct (and not phonetic) spelling of words (in English) (and do not try to improve on the sentence structure and grammar of the original spoken, even when translating into English).
- Be complete. Be careful to transcribe **all** the words and transcribable sounds (if the translation into English allows) including guttural sounds like ah, and in their order of occurrence. Use square brackets [ ] with discretion to note audible expressions of emotion such as [laughs] when one speaker does, or [tape turned off and on again], and to describe what is happening [reading from newspaper] or (sometimes) how words are spoken [with tears in his eyes] etc.
- Note who transcribed and date of transcription.

Proprietary Data: Data gathered through this study is the property of lead researcher (Isabelle Henzmann) under the auspices of the University of Zurich, Switzerland. The research assistant(s) will not, in the present or future, use the data gathered (audio files, photographs, interview transcripts) to publish papers, studies, articles or books or to make presentations without prior explicit and written consent from Isabelle Henzmann. Public use of any audio files or photographic data obtained in the field will require approval from lead researcher.

General format

- For each interview start a new transcript, indicate transcript with title "Interview #" (→ see template)
- Save the file as "Interview#_date_village_your initials" (Interview 01_23.04.19_Ghachowk_UA)
- Write down: place, date and time (if possible), people involved in the interview, short description of the surrounding (if you remember / notes (e.g.: in front of the house, inside, …) and other relevant circumstances (e.g.: heavy rain) (→ see template)
- Use "I" for interviewer (e.g.: Urmila I1 and Isabelle I2) "P" for participant (number if more than 1 participant), use **bold** for **I** / **P**
- Do not use **bold**, *italic* or underline (see exceptions)
- For each comment in the conversation use a new line (leave blank line in between each comment)
- Start every sentence capitalized, finish every sentence with a punctuation mark.
- Use the prepared template for the transcriptions (word)

Pauses

- For a short pause use (.), for a longer pause use (..) Use the same indication in all transcripts.
- Use [pause] if there is a long pause (e.g. thinking, hesitating to answer, shy) (according to APA format!)
- For an interruption or a pause in the recording use [int. pause]
- Write down the filling words (ehm, hmmm, …)

Nonverbal communication

- Identify all nonverbal communication such as pause, laughter, crying, sighing, cough, breath (audible ex/inhalation), etc.
- Identify nonverbal communication in brackets [ ] and not parentheses ( )

  P: Yes, Gurung of course, what else? [laughing]

- Be consistent with how the same behavior is identified – e.g. don't use one time [laughing] and the next time [laugh]
- Try to include important gestures *(e.g. descriptions with the hands of the rolling flood)*

Inaudible material

- If any words or sentences are truly inaudible (because of noise, fail of voice recorder etc.), type (inaudible) (→ Try to avoid this, if possible!) and put time of the recording e.g. (inaudible 23:25)
- For any guess of the inaudible word / phrase type ((text))

Emphasized words

- Here: *italicize* words that the participant emphasizes during their talk (not so often)

  P: I really, really, *really* was in need of medicine back then.

Direct speech

- Use double quotation marks if there is a direct speech. (e.g.: P1: She said, "Don't bother telling me".)
- Also use double quotation marks for internal dialogues (direct speech). (e.g.: And then I thought to myself, "What if I can't make it?".)
- Do not use quotation marks in indirect speech. (e.g.: The man said that he was in a hurry.)

Miscellaneous

- When a person trails off on a word (doesn't finish it), or changes their thoughts part way through a sentence, type a long dash afterwards (this is called an "em dash"- note: it is not the same as a hyphen). As well if there was a false start / unfinished sentence.

  P: To go the res– the restaurant. Rather than:
  P: To go to the rest, restaurant.

  P: Weren't we going to– Okay, never mind.

- If a person stutters do this: m-m-moist
- If a person talks in a way that is not grammatically correct, type "[sic]" immediately after the error to indicate. This is to indicate what they really said rather than an error in the transcript!

  P: She's wrote [sic] to the government.

- Note also if there was accent, dialect or another mother tongue (than Nepali)
- If there are curse words in the audio, transcribe them word for word
- Note (if possible) when people are joining / leaving an interview because this could have influenced the answers of the participant (e.g so he / she couldn't speak freely anymore when for example the daughter- in-law is around etc.)
- For numbers that are nine or less, write out the number ("seven" instead of "7")x
- When words are spelled (e.g. names) use - (e.g. U-R-M-I-L-A)
- Italicize foreign expressions used (e.g. Climate Change)

Transcription symbols (Indicate if you use any further symbols for the transcripts)

(( ))	For any comment of analyst on any topic or explanation of word use ((this is an explanation of X)) As well for a guess of an inaudible word use ((text))
[text]	Nonverbal communication
[...]	Three dots between square brackets indicate that some material of the original transcript or example has been omitted – or transcript starts/ends im middle of another talk.
[	Beginning of overlap (verbal, or music or other noise)
//	// Double obliques indicate the point at which overlap by the next speaker begins.
(.)	Short pause
(..)	Longer pause
[pause]	Long pause (thinking, hesitating, shy, …)
[int. pause]	Interruption, recording stopped

Personal Declaration

I hereby declare that the submitted thesis is the result of my own, independent work. All external sources are explicitly acknowledged in the thesis.

Olten, 31.07.2020

Place, Date

Signature