

BARRIERS TO CLIMATE CHANGE ADAPTATION AND SUSTAINABLE
LIVELIHOODS: CONFLICTS IN KNOWLEDGE, POLICY AND
MANAGEMENT OF FORESTS IN BATULANTEH WATERSHED, SUMBAWA
INDONESIA

by

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*“Great trouble comes from not knowing what is enough
Great conflict arises from wanting too much
When we know enough is enough
There will always be enough. ”*

—Tao Te Ching

ABSTRACT OF THE DISSERTATION

Barriers to Climate Change Adaptation and Sustainable Livelihoods: Conflicts in
Knowledge, Policy and Management of Forests in Batulanteh Watershed, Sumbawa
Indonesia

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Pamela McElwee

Smallholders who live in the forest margin of tropical forests in developing countries are the most vulnerable population, what has been aggravated due to the consequences of climate change. The complexity of their adaptation to climate change is growing along with the increasing importance of the tropical forests to mitigate climate change on a global scale, which has manifested in forest protection policies in developing countries. Through analyzing a case study of the Batulanteh Watershed, this dissertation examines smallholders' livelihood under the structural constraint of forest protection policies and their vulnerability and adaptation to climate change. The dissertation addresses five goals: First, examining the rationale and the goals of smallholders' livelihood and the government's policy in the upper watershed and how climate change influences both conflicting parts; second, investigating smallholders' perceived vulnerability; third, elucidating smallholders' climate change knowledge

and the role of traditional ecological knowledge for smallholders' adaptation to climate change; four, analyzing smallholders' adaptation and the factors that influence smallholders' adaptation to climate change; five, studying the role of adaptation to climate change policy to reduce smallholders' vulnerability to climate change and the barrier for developing a climate change adaptation policy.

This dissertation research seeks to provide new insights that reveal a more understanding of the link between climate change policy and vulnerability and adaptation of the vulnerable population to climate change, hence providing theoretical contributions to the field of Sustainable Livelihood Approach, Political Ecology, Vulnerability, Maladaptation, and Risk Perception. To guide the research inquiries, multiple methods have been employed including a household survey, focus group discussions, participant observation, semi-structured and in-depth interviews, and archival research.

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List of Abbreviations

APBN	Anggaran Pendapatan dan Belanja Negara (National Revenues and Expenditures Budget)
APBD	Anggaran Pendapatan dan Belanja Daerah (Regional Revenues and Expenditures Budget)
APEKSI	Asosiasi Pemerintah Kota Seluruh Indonesia (Association of the Indonesia Municipalities)
Bappenas	Bappenas Badan Perencanaan Nasional (National Planning Agency)
Bappeda	Badan Perencanaan Daerah (Regional Planning Agency)
BMKG	Badan Meteorologi, Klimatologi dan Geofisika Indonesian Agency for Meteorological, Climatological and Geophysics
BNPB	Badan National Penanggulangan Bencana (National Agency for Disaster Management)
BIG	Badan Informasi Geospasial (Geospatial Information Agency)
BPD	Badan Permusyawaratan Desa (the Village House of Representative)

BPPT	Badan Pengkajian dan Penerapan Teknologi (Agency of Technology Assessment and Application)
CA	Conservation Agriculture
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
GHG	Green house gasses
ICCTF	the Indonesia Climate Change Trust Fund
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
JICA	the Japan International Cooperation Agency
JMHI	Jaringan Madu Hutan Indonesia (Indonesia Forest Honey Network)
JMHS	Jaringan Madu Hutan Sumbawa (Sumbawa Forest Honey Network)
KPH	Kesatuan Pengelolaan Hutan (Forest Management Unit)
LIPI	Lembaga Penelitian Indonesia (Indonesia's Science Institute)
Musrenbang	Musyawarah Perencanaan Pembangunan (Development Planning Forum)
NGO	Non-Governmental Organization
PDAM	Perusahaan Daerah Air Minum (The Regional Drinking Water Supply Company)
PE	Political Ecology

NTB	Nusa Tenggara Barat (West Nusa Tenggara)
ENSO	El Niño Southern Oscillation
RPJMD	Rencana Pembangunan Jangka Menengah Daerah (Medium Term Development Planning)
SLR	sea level rise
LULUCF	land-use change and forestry
CO ₂	Carbon Dioxide
NTFP's	Non Timber Forest Products
NAPAs	National Adaptation Plans of Action
REDD+	Reducing Emissions from Deforestation and Forest Degradation Plus
RT	Rukun Tetangga (neighbourhood groups)
RW	Rukun Warga (community groups)
SLA	Sustainable Livelihood Approach
TEK	Traditional Ecological Knowledge
TKW	Tenaga Kerja Wanita (Women Migrant Worker)
UNFCCC	the United Nations Framework Convention on Climate Change

*Dedicated to my late grandfather and grandmother who had
been smallholders for their whole life. This dissertation is for
the good memory of them.*

Chapter 1

Introduction

1.1 Introduction

Major floods have become so frequent and severe in the last few years in downstream Sumbawa City that they have been drawing huge attention at national levels, and rendering shocking effects at local levels. Photographs and videos on social media have circulated showing roofs of houses submerged from the floods, broken bridges, damaged roads and crops, and people using used tires as floats to escape from the rising waters. Residents have used Facebook status updates to spread warnings about torrential rains and flood warnings, reminding others to keep praying to God to save them from the floods. Many people told me that they have never seen floods as frequent and severe as the ones in the last few years, and that they were occurring in places where no floods had ever been recorded. Almost everyone agreed that the floods have occurred more often since maize cultivation in the uplands boomed in the last few years and more forests were converted into arable land.

Government officials working in forest-related agencies have taken advantage of the floods to justify their importance, and portray their work as noble. They too

have posted on their social network accounts, focusing on how hard they have tried to plant trees to increase the forest cover and how challenging their work is when no one supports their effort. They often posted on social networks that floods were a result of the ignorance of the communities living in the forest margins, receiving many comments on their posts showing support for the government, telling the rangers to be patient and keep their spirits high to continue with their tree planting programs. Local elites from the villages around the upland forests also post comments to show their alignment with the government and point fingers for blame on other villagers. Representative sentiments were that they found it difficult to ban community members who cut down the forest, as that resulted in hostility to local officials.

The blame toward smallholders living around the forest for downstream floods has only grown in recent years. Some people urged that the names of forest destroyers in the villages should be reported and arrested immediately. Some powerful people also insist that villages should be punished in a more systemic manner by not giving them more help and business licensing and to exclude them from government programs. The negative comments about smallholder forest dwellers continue to roll back and forth between the government, community leaders, political leaders, local elites, and many others, most of whom live downstream and far from the reality of the smallholders' lives. Rather than consider that smallholders too might be affected by flooding and climate change, smallholders continue to bear the blame, even though the floods are not necessarily even caused by forest degradation on the upper watershed. Higher rainfall and global shifts in patterns of hurricanes, as well as the policy of growing corn in almost all parts of Sumbawa (not just the uplands) could be one cause of flooding, rather than local scale forest degradation. Notably, there is no scientific

research on forest degradation itself in Sumbawa in order to assess patterns and rates of change over time, although this has not stopped officials from blaming deforesting locals.

In contrast, not many years ago, the people who lived in downstream areas referred to the uplands as sites of intact nature with an abundance of water, even dripping from the cliffs along the road, contributing to the coolness of the microclimate. The upland inhabitants were portrayed as those who dwelled in nature, such as by gathering honey in the forest, hunting wild deer, and harvesting abundant fruits and vegetables. The downstream inhabitants felt secure that the forest in the uplands would sustain their water supply. But lately when domestic tap water is no longer flowing smoothly as usual, the forests in the uplands have begun to capture the attention of downstream residents and change their perceptions of their upstream neighbors. The Regional Drinking Water Supply Company (PDAM) occasionally issues announcements in local newspapers to let their customers know that tap water will not flow on certain days and certain hours. The reasons for the tap water disruption varies, including flooding in the upper reaches of the river, which requires time to clear up the turbid waters due to sedimentation as well as to clean pipes clogged by sediment and decreased water discharge due to long droughts. The announcements of the tap water disruption have also begun to be frequently broadcasted through mosques to reach a wider population.

I was one of those downstream residents concerned about water supply. As I had a good connection with governmental officers who worked on forestry, I was exposed to their concern to protect the watershed and to sustain the water supply. They emphasized to me that the upper watershed was heavily degraded and in a critical state. They showed me a number of reports on soil erosion and related a story

about the loss of springs, the increase of forest conversion for agriculture, resulting in increasing water problems and flooding. Not surprisingly, all these facts seem to justify reforestation and restoration of critical lands (to be carried out by government foresters, of course). They emphasized that the Bantulante watershed was a “type one” watershed that needed the greatest attention from the national level. They also shared that their efforts at reforestation have failed over and over again because the local inhabitants were not enthusiastic about planting trees, thus the seeds planted were not maintained and consequently died. At that time, that story convinced me enough to develop a forest conservation education project in the upper watershed with the local NGO that I established. The project goal was very simple: To save the water supply by increasing forest cover.

During my stay with the community for the forest conservation education project, I naively tried to justify the idyllic and romantic imagination I had held about the forest and the people who lived there. However, I ended up seeing children, old people, in fact nearly everyone, queuing for water from early morning at springs and water wells. Some people would walk for hours to get water. I started to realize that the people who have been blamed for and marked as forest destroyers did not even have clean water for their daily needs, while the forests surrounding them had served the downstream inhabitants’ water needs. I start to face the reality that the lives of the upstream smallholders were not what I had thought.

My time with the education project coincided with stricter enforcement of regulations on forest access. Most of the smallholders in the upper watershed I met were in a panic, concerned that their life was about to get harder because suddenly forestry officers came and installed new boundary markers to widen the forest areas

prohibited for exploitation. As one resident told me,

“Many lands are closed. Closed by the forestry officer. Many opened accessible areas are now closed. We feel like being pressed harder and harder. We are farmers and a father. We have children and we have to think about them. Our land is dry land and can only be planted once a year during the rainy season. How do we live if lands are closed? We are getting swarmed.”

The changes in policy regarding forest access and ownership in the upper watershed were done without local consultation. The local people stated that forestry officers simply came to the village bringing a new map of forest boundaries. The local people feel the stricter conservation has had serious livelihood affects. They complained that even without new boundaries, the rain-fed land was already very limited. Some smallholders who tried to ignore the new forest boundaries ended up in jail. For example, when I did a forest transect at the boundary of the forest, I happened to encounter a man who suddenly ran away very fast into the forest the first time he saw me. I asked the local guide who he was and why he was running away. My guide related that the man was the father of one of the participants of my forest conservation project, a child who was the most talkative, always singing dancing, and laughing. He was a contrast to his father who seemed like a ghost in the forest. The local guide told me that the man had been released from prison one month ago for converting the forest into agricultural land last year, and since that time, he had become completely a different person, from an easy-going person who loved to crack a joke with a big laugh to a man who did not want to interact with people since his release from prison. He spent all his time working in his land and rarely came back to the village, running away whenever encountering new people for fear they were a government officer who would take him to jail again. In an angry tone, my guide expressed his opinion that the new forest rules were an injustice for him and other

people in the village because they believed that the man had not behaved illegally because they did not accept the government claims to the forests. They also told me that the government was being more active in jailing those that broke the new rules, although from their perspectives they were doing what they always did in the past. Locals complained that they had no choice, because life was so difficult for them that they had to take such risks in order to survive.

Since that time, the story of the conflicts between smallholders and the state in the upper watershed has lingered in my mind, mixed with my growing understanding about climate change and its impacts. I kept on thinking about what kind of life these smallholders will have under the impact of climate change, since even without climate changes in the past they had obviously struggled to make both ends meet. Climate change potentially will increase the pressure on them as the culprit for water problems and severe floods downstream. They must face the impacts of climate change locally, which will exacerbate their water scarcity and environmental degradation problems in the upper watershed. They will also potentially become the subject of climate change policies on mitigation through forest protection, constraining their access to forests. When circumstances force them to clear the forest, as a last resort to adapt to climate change impacts on agriculture, they will face law enforcement and the threat of jail. In other words some of the most vulnerable populations are not likely to get proper attention to their needs for adaptation to climate change, but rather will be blamed for resulting impacts.

This is a pressing issue on a global scale: Around 1.2 billion people worldwide live in tropical forest margins, of which 90% are considered in poverty and practicing agriculture as a major livelihood (Meijaard et al., 2013). Tropical forests comprise

some of the most species-rich habitats in the world and provide many ecosystem services (Meijaard et al., 2013). However, between 1990-2000, 4.2% of the world's total natural forest area (16.1 million hectares) was lost, with most of this occurring in the tropics (Perman, 2003). Smallholder farmers are often blamed as the major cause of forest lost in the tropics (Benhin, 2006), despite the fact that the main drivers of deforestation are in fact industrial-scale and export-oriented agricultural production (DeFries et al., 2010).

The most serious problem of forest degradation occurs in the upper reaches of watersheds, where headwater streams, which comprise 60-80% of the cumulative length of river networks, are located (Benda et al., 2005). Nearly half of the world's population is affected in various ways by the degradation of upper watershed areas. About 10 percent of the Earth's population lives in mountain areas with high slopes, while about 40 percent occupies the adjacent medium- and lower-watershed areas. About 10 percent of the Earth's population lives in mountain areas with high slopes, while about 40 percent occupies the adjacent medium- and lower-watershed areas (FAO, 2006). FAO, 2006 further notes the existence of serious problems of ecological deterioration in many watersheds, mostly in developing countries. Soil erosion can have a devastating impact on rural inhabitants who depend on rainfed agriculture in mountain and hillside areas, and soil degradation threatens the livelihood of millions of people and constrains the ability of countries to develop a healthy agricultural and natural resource base (FAO, 1994). The fragility of mountain ecosystems makes the impacts of unsustainable development more severe and more difficult to correct than in other areas of the world, hampering livelihood improvement for mountainous inhabitants and preventing them from taking responsibility for the preservation of

natural resources and to fulfill their role as mountain stewards (*FAO, 2011*). Several studies about smallholders in mountain ecosystem also show that smallholders are often the victims of discourse about environmental degradation used to justify certain development projects or interests of more powerful actors (Guthman, *1997*; Forsyth and Walker, *2008*).

Forests in developing countries have become very central to climate change mitigation efforts because carbon emissions from deforestation and forest degradation comprise the second largest source of anthropogenic carbon emissions after the energy sector (IPCC, *2007*). Deforestation is considered as one of the biggest causes of carbon stock depletion, estimated around 0.22 gigatone decrease annually during the period 2011 - 2015 (IPCC, *2007*). Deforestation results in immediate release of the carbon originally stored in the trees ; therefore, forests in developing countries have become a major target for climate change mitigation to reduce global warming and maintain biological diversity (IPCC, *2007*). These climate change mitigation policies, often known as Reduced Emissions from Deforestation and Degradation or REDD+, will have impacts on the livelihood of smallholders who live in the forest perimeter, given that policies that focus on increasing forest cover that may limit the access of smallholders to forests important for their livelihood. Furthermore, at the same time, their natural resource based livelihood will be hit the most by the impacts of climate change, and their response options for adaptation will likely require them to rely more on forest resources. Not only will the limited access to forests caused by mitigation policies and forest restrictions for watershed protection make it more difficult for the smallholders to get out of their poverty, but also it will limit their access to the resources needed for adaptation when climate change hits. The limited access

to forests will potentially force smallholders to undertake actions that will make them more vulnerable to climate change, leading to a vicious cycle.

It is this circumstance that inspired me to undertake this dissertation research. On the one hand, reducing climate vulnerability of the most marginal populations is a must. On the other hand, it is also crucial to acknowledge that smallholders' actions to get out of poverty and to adapt to the impact of climate change will also have consequences that are important for the environment and for the population in downstream areas, not to mention the increasing importance of the tropical forests to mitigating climate change on a global scale. Therefore, in this dissertation I will explore this nexus of: (i) smallholders' livelihood under structural constraints of forest protection policies and the conflicts that they have engendered, (ii) smallholders' vulnerability to and knowledge about climate change, and (iii) smallholders' adaptation to climate change in the upper watershed context of Indonesia. At the country level, this research will help to understand the complexity of the daunting task of the Indonesian government to reduce the vulnerability of their most vulnerable populations, who happen to be blamed as one of the major causes of deforestation, while at the same time fulfilling their commitment to mitigate climate change. Not only will a better understanding on smallholders' lives in the forest margins help apprehend the link between mitigation and adaptation to climate change conceptually, but also to potentially help improve the development of adaptation policy, which it is currently still lacking.

1.2 Research Questions and Dissertation Goals

To guide my inquiries, I proposed five main research questions for my dissertation to answer: First, what are the rationales and goals of smallholders' in pursuing their livelihood aspirations, how do these conflict with government policy in the upper watershed, and to what extent does climate change influence these (conflicting) goals? Here, I am interested in understanding the different goals of different stakeholders in the upper watershed, why those goals are different, in what way the goals are coming into conflict, and what are the outcomes have been for different stakeholders. This question is motivated by scholarship in political ecology and livelihoods research. While scholars in political ecology have explored smallholders' livelihoods and their impact on the environment primarily as an output of structural and policy constraints, some studies using the Sustainable Livelihood Approach (SLA) have considered smallholders' livelihoods as a set of deliberate choices. My research highlights how and to what extent the structural constraints and the deliberate choices have together shaped livelihood actions and aspirations in the upper watershed. Moreover, I am also interested in better understanding the conflicting goals under the context of climate change in order to provide insights on the links between government policy and smallholders' adaptation, and if there are common points of concern between the two.

Second, how do smallholders perceive their livelihood stressors and their vulnerability to these stressors? By posing this question, I am interested in examining the stressors in smallholders' livelihoods, understanding to what extent climate change

stressors are impacting smallholders' livelihood compared to other non-climatic stressors, and how climate change stressors are intertwined with other non-climatic stressors. Relying on literature on climate vulnerability and adaptation, I explore to what degree the idea of 'double exposure' of both climate stressors and stressors related to globalization impact smallholders in Indonesia (O'Brien and Leichenko 2001). I am also interested in understanding vulnerability from the point of view of the vulnerable, their potential biases in perception of vulnerability, and factors that might lead people to perceive themselves to be more vulnerable to some stressors over others. The answer to these questions will further foster discussion on how perceptions of vulnerability can influence adaptation to climate change.

Third, how does smallholders' knowledge about climate change, and in particular smallholders' traditional ecological knowledge (TEK), increase or reduce smallholders' vulnerability to climate change? By posing these questions, I am interested in knowing whether smallholders are able to develop their knowledge base on climate change and to use it to reduce their vulnerability to climate change. I am also interested in understanding the factors that act as barriers, as well the opportunities, for the development of climate change knowledge as an interface between TEK and governmental climate change knowledge. These questions are important to provide a better understanding on the debate on the importance of TEK for climate change adaptation. Some scholars believe smallholders will be able to adapt to climate change by using TEK, but, on the contrary, some others provide evidence that TEK is less useful in rapidly changing environments (Lazrus, 2015; Linden, 2016; Vlek, 2000; Lebel, 2013; Kelman and West, 2009).

Fourth, how are smallholders adapting to existing climate changes in the upper

watershed, which are successful and which appear to be maladaptive, and what factors influence these outcomes to respond to climate change? By posing these questions, I am interested in finding the significant characteristics in smallholders' responses to climate change in the upper watershed context and in what way the actions taken increase or decrease smallholders' vulnerability. How can the potential use of smallholders' adaptation aspirations and climate change knowledge be used to remove the barriers to successful adaptation?

Fifth, how has the government of Indonesia developed their climate change policies, in what ways do these policies increase or decrease the vulnerability of smallholders, and what are the factors that act as barriers or enablers to encourage successful climate change adaptation at national and local levels? By posing this question I am interested in knowing the narratives and goals of climate change policy in Indonesia, the processes by which they are developed, and the output of those processes in terms of assistance to smallholders, particularly in helping reduce smallholders' vulnerability. This research also questions how climate change adaptation policy can be successfully developed and integrated with other existing development goals in places like Indonesia, which are often contradictory.

1.3 Literature Review

While questions related to smallholders' livelihood under the context of climate change have been widely investigated by the literature on vulnerability and adaptation, an additional study on smallholders' livelihoods in the forest margins in the context of existing conflict as well as climate stressors highlights new directions and

challenges in reconciling climate change mitigation and adaptation policies. Considering that forest resources are central for many competing interests from multiple stakeholders at multiple levels, I use political ecology and SLA approaches to explain the different and conflicting goals between smallholders and government. Furthermore, to understand smallholders' vulnerability and adaptation to climate change, I use vulnerability, risk perception, and maladaptation literatures. To further understand the links among smallholders' vulnerability, adaptation and policy, I draw on the climate change adaptation and policy literatures.

1.3.1 Smallholders' Livelihood and the Environment

The relationship between smallholders' livelihood and the environment has been explored in both SLA and political ecology literatures. In the SLA literature, human well-being and environment are seen as inextricably linked; rural people's well-being is obtained through the use of nature's capital and services through various means of livelihood strategies (Dietz, Rosa, and York, 2009; Bebbington, 1999; Scoones, 2009; Chambers and Conway, 1992). The strong link between smallholders' livelihood strategies and the use of natural capital is seen not only in terms of increased well-being, but also in terms of the sustainable use of natural resources (Chambers and Conway, 1992; Scoones, 2009). The ecological environment is believed to be the determining factor that affects rural people's livelihoods, where in turn the use of resources will shape the local environment (Chambers and Conway, 1992; Leach, Mearns, and Scoones, 1999). Thus, SLA realizes the important need for balancing the basic conflict between two competing goals of ensuring a quality of life and living

within the limits of nature (Chambers and Conway, 1992). In SLA, increased well-being or environmental degradation are seen as the outputs of rural people's livelihood choices, who often live in unfavorable ecological settings with water scarcity, fragile environments, drought, and land degradation that exposes them to potentially risky livelihoods dependent on natural resources and climate, such as shifting cultivation (Wani, Rockstrom, and Oweis, 2009). SLA also focuses on livelihood goals that are believed to be the driving factor behind smallholders' livelihood strategies. People choose the way they use their assets, their productive and reproductive activities, and investment strategies based on their goals and aspirations (Adato and Meinzen-Dick, 2002; Ellis, 1998; Jansen et al., 2006). Therefore, livelihood strategies are a reflection of smallholders' preferences, priorities, and goals (Haan and Zoomers, 2005). Smallholders' livelihood strategies are deemed as deliberate choice instead of a product of asset availability and influences of structural constraints (Haan and Zoomers, 2005; Füssel, 2007). Smallholders will not turn available assets into livelihood strategies if they do not fit with their goals. Thus, environmental degradation can be an outcome of a deliberate choice of smallholders in using the natural resources to meet their aspirations.

Political ecology expands on how to see smallholders' livelihoods beyond the smallholders themselves and their use of the environment. Political ecology literature considers that farmers cannot be blamed for unsustainable livelihoods, which can instead be considered as a manifestation of a failure of the state and the market (Robbins, 2011; Li, 2002). Often, policies taken related to smallholders in rural areas are not compatible with complex realities, and may be made based on imaginations about rural people as natural resource dependent, subsistence-oriented, and traditional. This

view is partial and does not reflect the reality, because rural people are actually dynamic with diverse interests (Li, 2002; Leach, Mearns, and Scoones, 1999). Moreover, rural people do not live in a vacuum, but are interacting with active social ecological changes at multiple scales (Chambers and Conway, 1992). Li, 2002, for example, has noted that rural people's livelihood aspirations do not always conserve nature, because rural people are strategic, rational actors rather than ecologically noble savages. Livelihoods that do not conserve nature such as temporary or permanent conversion of forest to agricultural uses have long been part of the livelihood repertoire of rural people (Li, 2002; Kleinman, Pimentel, and Bryant, 1995). There is a need to see the driving causes of livelihoods that degrade the environment as a manifestation of existing social-ecological and political contexts such as insecure tenure, population growth, land exploitation and settler influxes that have reduced the areas available to rural people and forced them into narrow range of choices relating to their livelihoods (Li, 2002).

Therefore, in this research, SLA and Political Ecology (PE) are adopted to understand the competing goals between smallholders and the government. SLA gives better understanding on the extent of smallholders' deliberate actions to choose their livelihood strategies and to use the environment, while PE gives better understanding on the narratives and discourses surrounding the goals of government's policy on forest and the inhabitants of the forest margin. The understanding of the competing goals is critical to think of what matters for each actor as a component to define concepts such as vulnerability. My research contributes to highlighting the conflicting goals in the context of climate change that result between mitigation policy of the government and smallholders' adaptation options. My research also contributes to

the identification of possible common points between the conflicting goals under the context of climate change.

Such understanding of the links between forest mitigation policy, vulnerability, and adaptation options is necessary given that forest lost in Indonesia has been on the increase from 1950 - 2010 (Tsujino et al., 2016). Forest conversion into agriculture by smallholders is one of the major causes of forest degradation, among other causes, including population growth, forest logging, resettlement, road construction, international commodity demand, policy, forest fires, and global environmental factors (Sunderlin and IAP, 1996; Geist and Lambin, 2002; Wicke et al., 2011). Deforestation rates have slowed since 2011, which is considered as a positive outcome of regulation of forestry practices coupled with the promotion of a tree planting movement (Tsujino et al., 2016), although the ways this may have increased local vulnerability are not well-understood. The clearest links between smallholders' livelihood and climate change have been studied under the context of REDD+ projects. In Indonesia, REDD+ has been utilized by state institutions both at the national and provincial levels to strengthen centralized control over forest territories (Setyowati, 2014). REDD+ in Indonesia shows little benefit for the local people in that it has failed to create alternative livelihoods given that project implementation has primarily focused on conservation activities (Setyowati, 2014). The fact that REDD+ aimed to improve smallholders' livelihoods but has thus far failed to reach its goal raises a question of how smallholders who live in the margin forest can reconcile forest conservation with sustainable livelihoods. If deforestation rates are declining, is this due to changes in smallholders' livelihood strategies that makes them no longer use forest lands, or is this increasing forest cover occurring because of the success of mitigation policy

conducted at the expense of smallholders' livelihoods? My research contributes to better understanding of the conflicts between mitigation and adaptation policies by giving empirical evidence from a context where climate-vulnerable populations are being subjected to mitigation policy with little benefit to their livelihoods.

1.3.2 Smallholders and Climate Change

Vulnerability can be explained by a combination of risks, including the physical aspect of climate change, related hazards exogenous to the social system, and social factors (Adger, 1999). Several studies emphasize that smallholders' livelihood systems experience a number of interlocking stressors such as market shock, enclosure of land by outsiders, and population growth along with climate change (Morton, 2006; Bebbington, 1999; O'Brien and Leichenko, 2000). O'Brien and Leichenko, 2000 have emphasized the importance of incorporating globalization stressors in the analysis of vulnerability to climate change, which they have called "double exposure." By acknowledging these two intertwined stressors in smallholders' livelihoods, vulnerability analysis produces different outcomes compared to analysis conducted with separate stressors (O'Brien and Leichenko, 2000). Scholars also emphasize that vulnerability needs to be differentiated among different groups of people and places (O'Brien et al., 2007; Fussel, 2007). For example, smallholders who rely on agriculture can be a particularly vulnerable population (O'Brien et al., 2004; Hallegatte et al., 2015). At the same time, despite being hit by the impact of climate change, smallholders receive limited support from social safety nets (Hallegatte et al., 2015). Thus, smallholders may end up making choices for coping that will increase their vulnerability (Agrawal, 2008). These negative outcomes of adaptation actions, often called maladaptation

(Barnett and O'Neill, 2010), have become a major concern of some scholars, especially in the context of policy for climate change adaptation (Juhola et al., 2016; Barnett and O'Neill, 2010; Atteridge and Remling, 2017).

However, some scholars believe that smallholders can be responsive and adaptive to climate change, because they are sensitive to it and they have accumulated information and knowledge to create strategies to cope with and adapt to climate variability and weather extremes (Adger et al., 2003; Berkes, 2012; Leonard et al., 2013; Egeru, 2012). The proponents of TEK in particular have argued that it is important and already a strong basis for smallholders' lives in developing countries, as it is specific to the local environment and social conditions (Berkes, 2012; Lebel, 2013). Therefore, when climate change hits, TEK can shape the process and outcomes of adaptation because it is a part of social, economic, and cultural systems, and influences individuals' preferences, beliefs, daily practices, perceptions and responses to climate change (Leonard et al., 2013). Moreover, incorporating TEK in climate change policy is thought of as a participatory approach that can reflect community values and local cultures (Egeru, 2012; Lazrus, 2015; Nyong, Adesina, and Elasha, 2007). However, researchers also acknowledge that TEK may not be sufficient for smallholders to adapt to climate change given that climate change is new, large in scale and magnitude, rapid, unpredictable, multifaceted, with the potential to be drastic and unprecedented in human history. Thus, TEK may not have time to accumulate and get it stored in social-ecological memory to provide guidance on adaptation (Lazrus, 2015; Parry et al., 2007; Vlek, 2000; Adger et al., 2003; McNeeley and Huntington, 2007; Berkes, 2012). Local knowledge is also considered to be prone to confirmation bias and sometimes inaccurate, and it may be contested (Lebel,

2013). Hence, TEK cannot be a panacea for adaptation (Kelman and West, 2009).

Consequently, smallholders' ability to develop their TEK by combining it with scientific knowledge is believed to be crucial to dealing with climate change (Lebel, 2013; Wisner, 2010). Some scholars show that it is not easy to blend scientific knowledge with TEK; for example, some studies have shown that traditional climate knowledge systems act as barrier for adaptation such that raising awareness by providing scientific information about climate change has no significant effect on changing public perception or affecting cognitive and risk judgement because people already have existing knowledge systems (Nicholls, 1999; Sundblad, Biel, and Garling, 2007; Patt and Schroter, 2008). While some scholars agree about the importance of climate change knowledge for adaptation, they also note that responses to climate change are a reflection of knowledge on climate change (Füssel, 2007; Adger, Arnell, and Tompkins, 2005; Scannell and Grouzet, 2010; Kuruppu and Liverman, 2011). Thus, this research will give a better understanding on whether TEK helps smallholders to adapt to climate change or acts as a barrier for adaptation in the context of Indonesia. This research will also give more insights into what way conflicting livelihood goals act as a barrier for smallholders to develop and use their TEK to adapt to climate change. My research also contributes to the TEK literature by investigating: (i) how important TEK is for smallholders' livelihood and (ii) how declining TEK might complicate future climate change adaptation. The TEK discussion so far is centered around the assumption that TEK indeed exists and being practiced by smallholders, however, by linking rural livelihoods and changes over time with the use of TEK, this research will give a better understanding of whether or not TEK is likely to be useful when integrated into adaptation policy.

1.3.3 Perception: the Way the Vulnerable Population See Themselves

Some scholars have criticized the fact that resource constraints, financial, technical, and institutional determinants are considered more important for adaptation than people's perceptions (Grothmann and Patt, 2005; Pelling, 2010; Kuruppu and Liverman, 2011), leading some to advocate for more attention to the "view from the vulnerable". Cognitive and behavioral factors are being increasingly acknowledged as a constraint to successful adaptation along with other factors (Adger, 2006). Adaptation is potentially hindered by psychological barriers consisting of limited cognition about the problem, ideological world views that tend to preclude pro-environmental attitudes and behavior, comparisons with key other people, sunk costs and behavioral momentum, discredence toward experts and authorities, perceived risks of change, and positive but inadequate behavior change (Gifford, 2011).

Perception is a *sensation interpreted in the light of experience* (Webster's New Collegiate Dictionary 1981), and perception can identify an individual's response to an environmental stimulus, can direct their behavior and can guide their participation in group action (O'Riordan, 1971). Research in perception, attitude, and behavioral relationships suggests that perceptions are precursors of attitudes and actions (Ervin and Ervin, 1982; Rogers, 2003). Bayard and Jolly, 2007 have stated that before people can engage in certain positive actions, they need to be aware of the phenomenon and its impact on their wellbeing, perceive the seriousness of the problem, and develop a positive attitude towards it.

Smallholders' perception that has been intensively investigated in the context of climate change is primarily risk perception. Thus, the discussion is centered around

specific or multiple hazards to raise people's risk perception in order for them to support adaptation measures from the government or donors. Hence, hazards that are external to community are the starting point in risk perception research and very central to the concept (López-Marrero and Yarnal, 2010). In addition to important findings that people tend to focus on everyday risks rather than on climate change risks (López-Marrero and Yarnal, 2010), research on perception also reveals other biases in risk perception (Grothmann and Reusswig, 2006). As opposed to a hazard that is external, people's vulnerability is something more internal to communities based on their characteristics (Adger, 2006).

Therefore, this research will explore perceptions of vulnerability in order to open new understandings in order to complement, validate or contradict some of our literature on risk perception and how it can be used for adaptation to climate change. The perceptions of the vulnerable is important for more participative approaches in adaptation to climate change, and this research on vulnerability perception and potential biases will give new understanding in incorporating it into adaptation to climate change. This research also contributes to the risk perception literature by showing the needs to put attention on the positive experiences in people's lives in order to understand both their risk and vulnerability perceptions. So far, risk perception literature primarily focuses on negative risk experiences, while the element of positive change through time is not covered. My research contributes to look more comprehensively at positive experiences in smallholders' lives that influence risk perception, which is critical to understanding what has potential to reduce vulnerability. Risk perception studies in the context of developed countries reveals that vulnerability and age are not a significant determinant of risk perception. However, general beliefs such as political

orientations and climate change-specific beliefs are the most prominent determinants of risk perception (Safi, Smith, and Liu, 2012). Research on climate knowledge and culture in Indonesia shows that risk perception around climate change is not a priority for stakeholders (Bohensky et al., 2016). For many Indonesian households, climate change may appear to be less urgent than other problems, or that households may feel absolved by addressing it (Bohensky et al., 2016). My research contributes to further understanding the type of problems that outweigh climate change for smallholders in marginal environments, thus posing barriers to adaptation action.

Additionally, economists have argued that capacity to aspire is very important to break the poverty trap. Poverty is believed to be a result of lack of aspiration, known as “aspiration failure” (Appadurai, 2004; Ray, 2006), as aspiration contains motivations to change that trigger effort to make it happen. Aspiration is also a form of voice and expression of views that are oftentimes lacking from the poor or being ignored by the poor (Appadurai, 2004). Aspiration is an important component to help to understand decision making and individual well-being (Stutzer, 2004). Human beings form aspirations regarding future outcomes throughout their lives that derive from what they consider desirable, necessary or appropriate (Matthey, 2010; Karlsson et al., 2004). Aspiration refers to a subjectively established goal for achievement. Furthermore, Stutzer, 2004 suggests that subjective well-being depends only on gap between aspirations and actual situation (e.g. income) and not on the absolute level as such. Thus, the higher the ratio between aspired and actual situation, the less satisfied people with their life. Since human being are constantly drawing comparison from their environment, from the past or from their expectations of the future, they notice and react to deviations from aspiration levels (Stutzer, 2004). This

has implication on their decision making related to what livelihoods strategies they want to do in the future. Aspiration tends to be above the level already reached. People will want to make changes for their livelihood strategies for the future if current livelihood strategies presented do not fulfill aspiration related to their well-being (Stutzer, 2004). However, the understanding on how aspiration could stimulate positive climate adaptation or reinforce vulnerability to climate change is still lacking. Thus, this research also contributes to the understanding of the use of the concept of aspiration to combatting the negative impacts of climate change that has not yet been explored by the literature on adaptation.

1.3.4 The Voice and Vulnerability of the Poor and Climate Change Adaptation Policy

Some scholars strongly believe that the management of natural resources should take into account relevant ideas, experiences and contributions from all stakeholders including local communities in the search for sustainable solutions to ensure that they will be economically viable, socially acceptable, and environmental sustainable (Chambers and Conway, 1992; Scoones, 2009). Ampaire et al., 2017 mentioned that the existing climate change adaptation policies are top down, lack of participation of multi-stakeholders, and exclude local communities as a result of limited technical and financial capacity, political interferences, and the absence of functional implementation structures across national, district and community levels. Policy for adaptation to CC should be participative and enable social learning of multistakeholders (Collins and Ison, 2009). Due to the uncertainty of climate change and lack and limited future climate projections some scholars emphasize the important for social learning

for adaptation to climate change that require participation from multi-stakeholders (Mustelin et al., 2010).

Although smallholders' vulnerability has been extensively researched, how the views of the vulnerable is being integrated into decision-making processes in climate change adaptation policy is still lacking. Climate change adaptation policy is quite new in the context of many developing countries. So far, research on adaptation policy has often focused on the best approach to increase the adoption of climate change policy and also on barriers to adoption. Some scholars have argued that climate change adaptation policy needs to be integrated in already established policy and existing concerns (Dupuis and Biesbroek, 2013; Adu-Boateng, 2015). Limited perceptions of development and political co-benefits are considered as some of the barriers of adaptation to climate change policy, among other concerns such as weak external pressure, absence of normative mechanisms, and the tensions in negotiating national directives and local priorities. However, some scholars argue that trying to achieve co-benefits can act as a barrier for adaptation, as co-benefits can make policies lose substance to really address the issue of climate change (Dupuis and Biesbroek, 2013). Tying climate change adaptation to other existing objectives also makes it difficult for policy transformation to be materialized as one of the major contributions of adaptation policy (Kates, Travis, and Wilbanks, 2012), as co-benefits may make the urgency to build new institutions, legislation, physical interventions, or research programs becomes less evident or even absent (Nightingale, 2017). Other researchers also focus on the dynamics between the national and local level government in managing climate change adaptation policy. They find that the risk of increasing the conflict between national and local level government will exacerbate vulnerability, instead of

alleviating it Marino and Ribot, 2012; Marino and Ribot, 2012).

However, in the context of Indonesia, understanding of how climate change policy may increase the conflicts between local government and smallholders and whether it will increase the vulnerability of the most vulnerable is still lacking. Due to the fact that adaptation to climate change policy development is quite new in the context of developing countries, empirical evidence about the barriers and opportunities to develop climate change policy are still lacking. Thus, Indonesia, which began to develop their climate change mitigation and adaptation policy in the last few years, is the ideal place to study the early stage of climate change adaptation policy development, both at the national and local levels. Moreover, the study of climate change adaptation policy in Indonesia, due to the fact that the most vulnerable populations live in the forest margins, considered important for mitigation to climate change and also the center of the conflict between the government and smallholders, will potentially bring new directions to the policy of adaptation. In addition to providing empirical evidence on the development and implementation of climate change policy, this research also contributes to the understanding of how vulnerable people voice their vulnerability and how these voices can reach policy makers, which is still lacking in the climate change policy literature.

1.4 Dissertation Methods

To understand smallholders' life, I employed qualitative research that draws on methods that reveal and interpret the complexities, context and significance of people's understanding of their lives. Qualitative research seeks to understand the ways

different people experience the same events, places, and processes as a part of a fluid reality constructed through multiple interpretations and filtered through multiple frames of reference and systems of meaning-making (Hay, 2010). While deploying this method, I also used participant observation methods to allow careful and in-depth critical analysis of smallholders' lives and vulnerability. In August 2015, I returned to Indonesia to conduct a the field research in three selected villages in the upper watershed of Batulanteh, in Sumbawa District. These three villages are excellent places to pursue the purpose of this study, because they are surrounded by the government-owned forest, and their inhabitants rely heavily on natural resource-based livelihoods. They are affected by forest policy, climate change, and other stressors at the same time. Despite the fact that all three villages are located in the upper watershed, the major smallholders' livelihoods are different: the majority of smallholders in Batudulang village earn their livelihood from coffee and candlenut plantations, while most of the inhabitants in Kelungkung Village earn their livelihoods from dryland rice farming, whereas smallholders in Sampak Village earn their livelihood from maize. Sampak Village is the most remote village compared to the two villages, due to the poor road infrastructure. By choosing these villages, I wanted to compare and understand the factors that influence rural livelihoods, vulnerability and smallholders' adaptation to climate change. In collecting the data, I combined multiple methods, including semi-structured and in-depth interviews, household surveys, focus group discussions and participant observation. I spent 3 months performing these activities, which involved more than 72 research participants. Details of each research activity are described below.

1.4.1 Semi-structured and In-depth Interviews in Sumbawa

Interviews are excellent methods of gaining access to information about events, diversity of meaning, opinions, views, complex behaviors, motivation, and experiences. Interviews can also be used to seek out opinions of different groups, including marginalized groups, whose opinions are rarely heard. In an interview, informants use their own words or vernacular to describe their own experiences and perceptions (Hay, 2010). The interview may also give the informant cause to reflect on their experiences. Interviews requires researchers to show respect for and empowers those people who provide the data that in an interview the informant's view of the world should be valued and treated with respect. Due to the face-to-face verbal interchange used in interviewing the informant can tell whether a question is misplaced. Furthermore, researcher's own opinions and tentative conclusions can be checked, verified, and scrutinized to disclose significant misunderstanding that had not previously identified. Interviews are very relevant for this research that focuses on smallholders' life under the context of climate change, because it requires them to share their knowledge, opinions, perceptions, and experiences that are relevant to them. Moreover, because my research is related to marginal rural people in an upland watershed, whose opinions are rarely heard, interviews are an excellent method whereby the subjects are allowed to voice their opinions and views and to reflect on their experience and knowledge.

1.4.2 Local Government Agencies

I performed semi-structured and in-depth interviews in three local government agencies relevant to smallholders' livelihood in the watershed: the Agriculture Agency

of Sumbawa District, the Forest Management Unit of Batulanteh Watershed, and Regional Development Planning Board of Sumbawa District. In the three government agencies, I interviewed the head of each agency. I also extended my analysis by conducting an interview with two field officers from the Forest Management Unit of Batulanteh in order to understand day-to-day challenges between the officers who face the smallholders directly during the implementation of certain policies and programs. It helped me to know which on-going programs are being implemented at the time of my research and how the government promotes the program to smallholders. I was able to explore the government's goals in the upper watershed of Batulanteh, governmental perceptions on smallholders' livelihood and sustainable options in the upper watershed, the policies implemented in the upper watershed, their knowledge of climate change, and the challenges to develop adaptation policy in their agency. I also interviewed two officers from the Subdistrict of Batulanteh Office that helped me understand the dynamics of Musrenbang (community meetings) and smallholders' participation in the decision making process at village, sub-district and district level.

1.4.3 Smallholders in the Three Villages

In the village sites, I performed in-depth interviews with villagers and village leaders to deepen the topics discussed during focus group discussions, especially on the change of livelihoods as well as on the access to forest resources. In Sampak Village, I interviewed the head of the village, four people aged 62 to 70 consisting of two men and two women, ten adults (five men and five women), ages between 35 to 50, and five young people, ages between 18 to 23 consisting of three men and two women. While in Kelungkung Village, I interviewed the head of the village, four older

people aged between 60 to 75 who are the religious and community leaders, twelve adult ages between 27 to 37 (seven men and five women), and five young people ages between 18 to 23. In Batudulang Village, I interviewed three community/religious leaders ages between 65 to 75, ten adults ages between 32 to 55 consisting six men and four women, and seven young people ages between 18 to 24. The interviews helped me understand the changes in the life of people, how smallholders have responded to such changes, and what goals and aspirations they hold for the future. I also delved further into local residents' perception on the government policy and programs.

1.4.4 Household Survey

In quantitative research, questionnaires are used commonly to generate claims about the characteristics, behavior, or opinions of a group of people (the 'population') based on data collected from a sample of that population. The sample is selected carefully to be representative of the population. On the other hand, questionnaires used in qualitative research are likely to be used as a part of mixed-method research aimed at establishing trends, patterns, or themes in experiences, behaviors, and understandings as part of analysis of a specific context, without seeking to make generalizable claims about whole population (Robinson, 1998; Hay, 2010).

Using a list of residents available in the village office (Batudulang village had a population of 862 people and 248 households, whereas Kelungkung Village consisted of 1,650 inhabitants and 475 households and Sampak Village consisted of 105 households (Sumbawa District Statistical Bureau, 2009)), random sampling was used to select a total of 72 respondents from 72 households from the three villages to be involved in the survey. Through household surveys, I gathered socio-economic data in both

sites to better understand household income levels and asset distribution (including land ownership), and collected detailed data on resource based livelihood strategies. I used the household survey to see some common and different characteristics of the livelihoods in the upper watershed in terms of livelihood type, dynamic, assets, management, income, and land tenure. The survey also helped me to get basic household demographic and socioeconomic information that is useful for understanding of the socio-economic factors influencing variation of livelihoods strategies among different households and villages. At the household level, I explored the information from both men and women in each household to see whether their livelihoods are differentiated based on their gender that will help further to understand the vulnerability based on gender differences. In order to triangulate the data gathered from the household surveys, participant observation and interviews with villagers were conducted, through which I also gathered more in-depth information about the change in the village, concerns and issues being raised by the villagers, and the strategies taken by the villagers in the response to changes.

1.4.5 Document Review

Document review helps re-evaluate taken-for-granted concepts and develop a comparative perspective (Hay, 2010). This method was relevant for my research in trying to understand the narratives and goals of government policy and to compare government plans and programs in the upper watershed with local people's goals and aspirations. I conducted document reviews to gather primary source documents such as policy documents, relevant government/non-government reports, meeting notes, and secondary literature produced by other scholars. I gathered and reviewed climate

policy documents for the national and local government. For the national government climate change related policy, I reviewed the national action plan of the Government of Indonesia on mitigation and adaptation to climate change. In order to understand the local government policy on climate change, I reviewed the local government's planning document for 2016 – 2020. I conducted content analysis of project documents (meeting notes, plans and reports) to understand the project rationale, tactics and strategies taken by the proponents to translate the policy on the ground, and how they navigated through local complexities.

1.4.6 Focus Group Discussion (FGD)

Interaction among members of the group is a key characteristic of focus group discussion (FGD) research method, and it is that which helps differentiate focus groups from the interview method, where interaction is between interviewer and interviewee. The interactive aspect of focus groups also provides an opportunity for people to explore different points of view, and formulate and reconsider their own ideas and understanding (Hay, 2010 p. 117).

In each village, I undertook FGDs for different groups of people: adult men, women, and young people. From the list of respondents and inhabitants, in each village, I gathered around 7 – 10 people from the same age and gender: adult men, women, young people, and older people. In each village, I asked help from one or two farmers to gather the FGDs in their house. For the FGD, I used PRA tools including listing, ranking, seasonal calendars, and time lines. PRA is a growing family of approaches and methods to enable and empower people to share, analyze, and enhance their knowledge of life and conditions, and to plan, evaluate, and reflect upon

them (Chambers, 2005). Participatory methods provide an excellent opportunity to elicit the voices of different actors, particularly those from the local level who are the most vulnerable population (Chambers, 1994; Chambers, 2005), given the importance of involving stakeholders at various levels and using bottom-up approach to study sustainable livelihoods.

Listing and ranking consisted of asking participants to identify their livelihood problems/concern and aspirations, followed by ranking their concern and aspirations. This was to understand further the perceived livelihood stressors on smallholders. Seasonal calendars consisted of asking participant to break down their livelihood portfolio into a one-year calendar of activities. Due to the fact that smallholders' livelihoods are highly related to season, I used calendars to understand how smallholders manage their livelihoods. The calendar visualizes the distribution of seasonally varying phenomena (such as economic activities, resources, production activities, problems, illness/disease, migration, and natural events/ phenomena) for a current year (Somesh, 2002).

1.4.7 Observation

I used observation method to provide complementary evidence. The intent is to gain added value from time 'in the field' and to provide a descriptive complement to more controlled and formalized methods such as interviewing (Hay, 2010). I conducted observation while staying in the three villages, where I was able to participate in some of their livelihood strategies and events such as honey gathering, land clearing, and rain prayer rituals: I could observe directly the vulnerability related to certain livelihood strategies. I was also able to observe some livelihood practices considered

destructive to the environment such as forest clearing for agriculture. I was able to observe their livelihood problems such as queuing for water, walking long distances to get the water, and also disputes related to water that helped me understand the gap between people's perception and actual problems. Observation also allowed me to understand the "hidden" vulnerability that might be missed from formal interviews or surveys due to the biases in perception, such as the different order of eating from men and women that reveals the patriarchal causes of vulnerability.

1.5 Background Area and Research Context

In order to pursue the aim of this research, I chose Batulanteh Watershed in Sumbawa as my study area. In some respects, it is an ideal place to conduct the study on the adaptation of the most vulnerable people who are at the same time subjected to the forest conservation policy, including mitigation to the climate change policy. As well as being typical of the socio-political contexts of many countries in the tropical Asia-Pacific region, Sumbawa is representative of its geographical and ecological characteristics, being dominantly rural, far from the national government, and remote from political and urban centers. Sumbawa Island in the province of Nusa Tenggara Barat (NTB), is one of the poorest regions of Indonesia, and where communities are highly dependent on rain-fed agriculture for their livelihoods (Butler et al., 2014). Therefore, rural livelihoods are highly vulnerable to current climate variability and future change, as any variation in rainfall quantities and/or increased variability will have a significant impact on their livelihoods.

Studies on historical rainfall variability show that dry season rainfall in Sumbawa is

significantly correlated with the El Niño Southern Oscillation (ENSO), while the wet season rainfall is weakly correlated with ENSO (Kirono et al., 2016). Analyses of the observed seasonal rainfall data highlight cyclical variability and long-term declines. Climate projections for Sumbawa also show that rainfall is projected to slightly decline (1% to 6%, depending on season and location) by 2030 and Sumbawa's dry season rainfall by the 2050s is projected to decrease by 6% (Kirono et al., 2016). The models project the rainfall decline will particularly fall during the transition months (i.e. March–April) and early wet season months (i.e. October–November) by 2080. The projected changes will potentially impact the first growing period for rice during November–March. Rainfall may also be insufficient to meet water demand for many crops in the second growing period of March–June (Kirono et al., 2016).

Batulanteh watershed is situated in Sumbawa Island, Sumbawa District, Nusa Tenggara Barat Province, Indonesia and covers a surface area of 200.64 km² (Figure 1.1) with altitude ranges from sea level to 1730 meters in elevation and slope ranges from 9% to 45%. The total population of the watershed is approximately 47,461 (2014). The 2007 Map of Land Use from Sumbawa District Forestry Agency shows that forest is the dominant land use in this watershed (about 46%), followed by shrubland (about 31%), unirrigated farmland (about 13%), residential (5%), irrigated farmland (4%), and grassland (1%). In Batulanteh Watershed, about 77% of the government-owned forested areas are categorized as protection forests, 13% are production forests, and about 3% are conservation forests. About 8% of the forests are managed under community forestry schemes. Agriculture is the principal economic activity in the area. Dryland farming that relies on direct rainfall is practiced in the upland watershed, where topography does not support holding water from rain

for long time (Figure 1.1). There are two kinds of dryland farming: sedentary and not sedentary (which is usually called shifting cultivation).

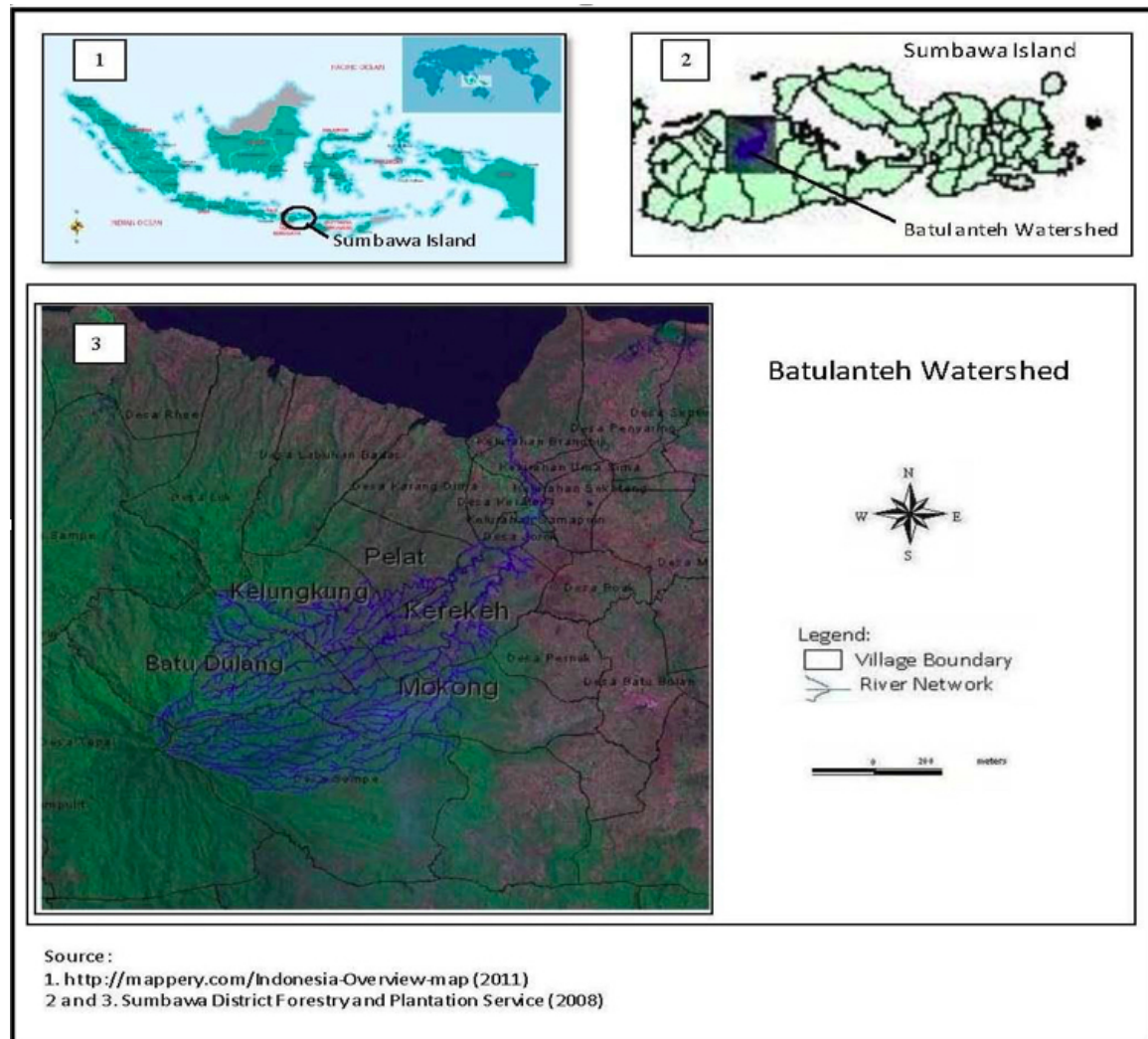


FIGURE 1.1: Map of Batulanteh Watershed

The need to conserve forest in the upper watershed of Batulanteh is justified by a study conducted by the government Forestry and Plantation Service indicating that the watershed is highly degraded due to the removal of vegetation cover occurring even up to the upland and steep areas (Julmansyah et al., 2008). Vegetation cover



FIGURE 1.2: Dryland farming in the Upper Watershed of Batulanteh

removal coupled with the tropical monsoon climate, characterized by high rainfall amount and intensity, has caused high erosion rate in the watershed, which the reports notes averages 51 ton/ha/year. This condition, the study concluded, has disrupted the hydrological function and productivity of the watershed. The report also asserts that forest removal due to conversion to agriculture and settlement in the watershed has contributed to flooding in downstream area in February 2005, April 2007, and April 2011 in the rainy season and the disappearance of more than 50% of the springs.

Batulanteh Watershed is also categorized by the government as the priority I type watershed in Indonesia. The Indonesian government has prioritized its 470 watersheds, with 60 priority I watersheds, 232 priority II watersheds, and 178 priority

III watersheds. The priority I-type watersheds are the most degraded and in the greatest need for attention and management. These watersheds are characterized by large areas of degraded land, severe soil erosion, high population pressure, and a large investment in building a multipurpose dam (Anwar, 2003). Determining the watershed priority (through Ministerial Decree 284/1999) is one of the watershed management related policies and programs in Indonesia. The GOI also has established conservation and protection forest (through Forestry Act 41/1999), reforesting critical land (through The National Movement on Forest and Land Rehabilitation since 2004), and providing loans for watershed conservation based on the biophysical attributes of the watersheds, without much attention to the local people's problems and needs.

Among other programs, the rehabilitation of degraded forests and lands through reforestation has been a priority for the Indonesian government since the 1970s, and planting trees has been the most recommended and implemented program in Indonesia. In 2003, the government launched the National Movement on Forest and Land Rehabilitation. The movement is to be implemented in 21 of Indonesia's most degraded watersheds (the priority I type) and 10 priority II watersheds, over a total of about 3 million hectare, using a US\$ 1.4 billion reforestation fund. Since the rehabilitation of degraded forest and land in all of Indonesia's 470 watersheds is not possible without people's participation, the government has also introduced an awareness program to encourage local people to plant trees, conserve forests, and promote soil and water conservation. Despite the large amount of money and time to implement the reforestation programs, a report written by the Ministry of Forestry stated that the reforestation programs carried out by local people have been largely unsuccessful owing to lack of planning (Anwar, 2003). The report did not elaborate on this *lack of*

planning factor, but it emphasized the need for public participation.

These watershed management approaches often fail and suffer from a number of problems. One is that these initiatives are top-down and ignore local priorities, situations, norms and knowledge and the active involvement of local people in planning and implementation (Anwar, 2003). This is a common management approach in South East Asia, which emphasizes a top-down approach that does not take into account local community voices, values and local priorities that are oftentimes distinct from those of government planners and managers (Ratner, 2000; Anwar, 2003).

The fact that Batulanteh Watershed is the most degraded watershed makes it an ideal place to study the adaptation of the most vulnerable people under the structural constraints of forest conservation policy, considering that forest rehabilitation and plantation development will continue to focus on degraded forest areas (FAO, 2009). Moreover, under the context of climate change, the GOI has also determined that forest and land rehabilitation in priority watersheds is one of their actions to mitigate climate change. They are targeting forest rehabilitation of around 500,000 hectares in priority watersheds and 1,954,000 hectares of critical land in priority watersheds in 2010 – 2014 in all provinces in Indonesia (Presidential Regulation 61/2011 on National Action Plan to Reduce GHG Emission). The priority action taken for protection and conservation of forests for emission reductions is done through forest area determination and management of forest borders of around 25,000 km in all provinces including West Nusa Tenggara during 2010 – 2014 (Presidential Regulation number 61 about National Action Plan on GHG emission reduction in 2011).

The local government of Sumbawa has determined the upper watershed of Batulanteh should be mostly for forest conservation because it is considered important as

a source of water for the Sumbawa Regency Water Supply Company (PDAM), with approximately 10,000 customers and water sources for two major irrigation works. Therefore, in the spatial planning of the Sumbawa Regency, most part of the Upper Batulanteh Watershed is allocated as protection water catchment areas, intended to provide protection for downstream areas (RPJMD, 2016). This designation of protection forest makes development programs or government actions very limited in the upper watershed. The local government even plans to increase the target of reforestation and rehabilitation on critical lands from 1,086 hectares to 1,321 hectares (document of RPJMD 2016-2021). For the government, forest and critical land rehabilitation primarily involves planting trees on land that was converted by smallholders for agriculture. In addition to being subjected to local forest protection policy, forest boundary enforcement as a part of mitigation policy has also been implemented in the upper watershed of Batulanteh in the last 5 years (2010 – 2015), which rendered a strong reaction from the smallholders, as evidenced by my encounters with formerly jailed residents that I recounted earlier this chapter.

1.5.1 Climate change in Indonesia

Projected climate changes expose Indonesia, as an archipelagic country located on the Pacific Ring of Fire (an area with a high degree of tectonic activity), to a significant risk. Indonesia faces significant exposure from sea level rise (SLR), from the past century of around 0.8 mm/year, now increasing to 1.6 mm/year since 1960 and to 7 mm/year in 1993. Further, within a period of from 1998 to 2008, satellite data indicates an increased chance of daily extreme rainfall in most parts of Indonesia (Bappenas, 2014). Climate change will impact key sectors such as water, marine

and fisheries, health, agriculture and forestry through decreases in water availability; increased risk of flood, drought, and coastal inundation; the spread of dengue fever, malaria, and diarrhea; decreases in rice production; and increases in forest fires (Bappenas, 2014). Moreover, around 11% of its population lives below the poverty line.

Climate change is projected to become more severe in Indonesia based on IPCC-AR4 models. Due to GHGs in the period of 2020 – 2050, projected average surface temperature throughout Indonesia will be approximately $0.8 - -1^{\circ}\text{C}$ relative to recent climatic period in the 20th century averages (Bappenas, 2014). In 2050, SLR is projected to reach 35 – 40 cm relative to year 2000, with a maximum of up to 175 cm in 2100 (Bappenas, 2014). Projection on rainfall changes shows no significant change for period of 2020 – 2050. The models generally show changes in rainfall patterns are more varied in Indonesia both temporally and spatially. There is a trend of reduced rainfall in June-July-August and the transition to the September-October-November in Java and Nusa Tenggara Islands. The models also show that the rainfall in December-January-February have increased in Java and Nusa Tenggara Islands, in contrast with the projection for most areas in the other islands. The projection on weather and climate extreme events is still lacking due to the lack of data and time for analysis.

Forests are central to mitigating climate change in Indonesia, the third largest tropical forest country (with 191.9 M ha of total area, including 9.2 M ha of inland water) (MacKinnon, 1997). As one of the five most species-diverse countries in the world, its forest harbor high biological diversity and provide diverse ecosystem commodities (MacKinnon, 1997). However, the rapid forest loss, which is continuing in

many parts of the country, has put Indonesia as one of the top countries to have the largest decrease in primary forests over the last 15 years (FAO, 2015). The trend of severe forest lost in Indonesia began in the 1970s, while prior to 1970s, Indonesia was almost completely forested (99.2% of the total land area). Forest cover has decreased to 91.0 Mha (49.8% of the total land area) in 2015 (FAO, 2015). Export-oriented log production and global demand were the primary pressures underlying deforestation between 1970 and the mid-1990s, along with cultivation of rice and other crops associated with a growing population and transmigration policy. Furthermore, between the mid-1990s and 2015, illegal or non-sustainable timber harvest and expansion of permanent agricultural areas were caused by the imbalance between global demand and production of Indonesian timber and palm oil (Tsujino et al., 2016). This increasing trend of forest lost happened under the The Basic Forestry Law (Law No. 5 of 1967), which had focused mainly on timber management; it has been replaced by the Forestry Law No. 41/1999 that in contrast to the previous law includes some conservation-oriented policies. It divides forests into the three categories of conservation forests, protection forests and production forests. It also empowers the Ministry of Forestry to determine and manage Indonesia's Kawasan Hutan (National Forest Estate).

Due to the rapid forest loss, Indonesia is facing an urgent task to reduce deforestation due to their high carbon emissions (60%) that come from deforestation, degradation and peatland conversion (Boer et al., 2009). Indonesia is determined to reduce GHG emissions by 26% on its own effort, and up to 41% with international support against the business as usual scenario by 2020, with a 29 percent reduction by 2030. The GOI enacted two Presidential Regulations related to climate change

mitigation: Presidential Regulation No. 61/2011 for GHG emission reduction that serves as Indonesia's action plan for mitigation to climate change, and Presidential Regulation No. 71/2011 for GHG inventory. Emission reductions in Indonesia from land use, land-use change and forestry (LULUCF), waste and energy is addressed by interventions and policy in three sectors: forestry, energy, and waste management. Indonesia is clear and firm in achieving their emission reduction target from LULUCF by enacting a moratorium on the clearing of primary forest and prohibiting conversion of peat lands from 2010 – 2016. In the energy sector, the GOI has embarked on a mixed energy use policy with at least 23% coming from new and renewable energy by 2025 and establishing the development of clean energy sources. Other actions taken include the protection and conservation of its remaining forest, restoring ecosystem function, and sustainable forest management.

Tsujino et al., 2016 has recorded the slowing of deforestation rates since 2011, thought to be the result of regulation of forestry practices coupled with the promoted tree planting movement, with strong coincidence with the changes in forest policy. Indonesia issued Ministry of Forestry Decree SK.323/Menhut-II/2011, Suspension of Granting New Licenses and Improvement of Natural Primary Forest and Peatland Governance ("Moratorium") to suspend the issuance of new harvesting licenses in primary forest and peatland areas, as a part of Government's implementation plan on REDD+. The moratorium has been extended twice by the administration of President Susilo Bambang Yudhoyono in May 2013, and by President Joko Widodo in May 2015. Some changes in forest policy after 2011 were also influenced by changes in other relevant policies such as the Law No. 6 of 2014 on villages, which gave the authority to villages to manage their own assets and natural resources including forest, revenue and

administration. The expanded autonomy was changed by the Law No. 23 of 2014 on Regional Governance, which withdrew authority over natural resource management from district and city governments and shifted it to provincial and national-level governments. Additionally, a Presidential Instruction on Illegal Logging, Law No. 18 of 2013 on the Prevention and Eradication of Forest Degradation, has helped to strengthen law enforcement for individuals, groups and organizations involved in activities that are banned in the forest ¹.

In Indonesia, forests are generally classified into two ownership types: 1) government-owned forests and 2) private-owned forests. The government-owned forests are those located on lands that are owned by the government and therefore they are not subject to taxation, while private-owned forests are those located on lands owned privately and are subject to taxes. A large portion of lands and forests in Indonesia are owned *de jure* by the national government. The government holds the access, withdrawal, management, exclusion, and alienation rights of the lands and forests. The national government through the Ministry of Forestry has the right to assign the government-owned lands as protection, conservation, or production forests and to change their category. Activities that do not change the biophysical attributes of the areas (e.g. research, mining with closed system, tourism, environmental service uses, and non-timber forest products collection) are allowed in the protection forests with permit from the national government.

In addition to its importance for climate change mitigation, Indonesia is a key actor in climate adaptation because of the potentially dire consequences for human

¹<http://www.forestlegality.org/risk-tool/country/indonesia>

livelihoods and well-being, due to the island archipelagic nature of the country (Butler et al., 2014). National Adaptation Plans of Action (NAPAs) were established by the UN Framework Convention on Climate Change parties to link climate adaptation planning to national development processes, and to identify priority activities requiring funding (Hardee and Mutunga, 2010). In order to develop climate change adaptation policy, the GOI developed Indonesia's NAPA, also known as RAN-API (Rencana Aksi Nasional – Adaptasi Perubahan Iklim), in 2007, and the coordination among stakeholders and mainstreaming adaptation actions are their major roles of the RAN-API secretariat. The GOI considers small islands, coastal areas and low lying areas to be more vulnerable than other places such as the highlands. As a result, small islands get special priority in adaptation policy in Indonesia (Bappenas, 2014). Taking a natural hazard approach in Indonesia to define vulnerable populations to climate change also leads them to focus on areas that are highly populated, residential areas, and heavy infrastructure, where they define three islands that are the most vulnerable to risk, namely, Java, Bali and Sumatra.

At the same time, Indonesia's forests play a critical role for local communities' livelihood and for the national economy. It is a challenge for Indonesia to balance its adaptation and mitigation policies, because the people who live in the forest margin are poor and are vulnerable to climate change. Thus, Indonesia faces a daunting task to reduce the vulnerability of its poor forest-dwelling population, while meeting their commitment to mitigate the drivers of climate change. Due to the fact that the rate of deforestation before 2011 was increasing partly due to the expansion of permanent agricultural areas, it implies that smallholders' livelihood in the margin forest has changed. The amelioration of deforestation rates could be at the expense

of smallholders' livelihood and well-being, who are also hit by the impact of climate change.

1.6 Dissertation Structure

This dissertation is organized in six further chapters. In Chapter 2, *Pursuing Livelihood Goals under the Government Discontentment*, I describe smallholders' livelihood in terms of its goal, assets, and livelihood management. In addition, this chapter discusses local government's perception on smallholders' livelihoods, along with the governments' proposed sustainable livelihood options in the upper watershed, and smallholders' reception to the livelihoods proposed. At the end, this chapter discusses the causes of conflicting goals and a potential way to reduce the conflicts. I draw on literature on SLA and political ecology to understand the different goals between smallholders and government, between smallholders who aims for income pursuit and government who aims for forest conservation. Forest conservation goals of the government are aimed at sustaining environmental services provided by the forest ecosystem in the upper watershed for downstream populations, especially for water supply. This conflict prevents smallholders from achieving their livelihood goals because their land and forest-based livelihoods are conducted under conditions of limited access to the forest compounded by low-productivity of rain-fed lands. Programs that the government perceives as sustainable for the environment are not considered viable for smallholders and has not helped them to increase their income.

Chapter 3, *Smallholder and Governmental Knowledge in a Changing Climate*, describes smallholders' knowledge of climate change phenomena and the use of climate

change knowledge in smallholders' livelihood decision-making. This chapter also discusses the barriers for developing and using TEK. Further, this chapter discusses the climate change knowledge of the government and the dynamics between government and TEK on climate change. Despite the fact that smallholders in the upper watershed of Batulanteh perceive changes in climate, their TEK related to climate change is limited mostly due to barriers of belief that climate change is the domain of god. Furthermore, local government's climate change knowledge is also limited and does not help smallholders to develop options and alternatives. A further finding is that the acceptance from smallholders of the government's scientific climate information is influenced by smallholders' trust to the government on other issues, such as forest conflict. In addition to exploring the use and the importance of TEK for smallholders' livelihoods, the chapter shows that TEK is declining due to the changing nature of rural livelihoods that are now more integrated into the market, and smallholders deliberately choose to abandon their TEK systems.

Chapter 4, *Vulnerability from the View of the Vulnerable*, describes smallholders' exposure to climate change and how climate change is intertwined with other non-climatic stressors, especially globalization. This chapter outlines the vulnerable conditions that smallholders experience and how climate change creates and exacerbates them. This chapter also discusses smallholders' vulnerability perceptions and biases. I draw on literature on vulnerability and double exposure to understand the stressors for smallholders' livelihoods, as well as risk perception literatures. The persistent conflict between smallholders and the government over forest utilization prevents smallholders from focusing on the underlying causes of their vulnerability. Despite the fact that smallholders' livelihoods are being affected by climate change

and market volatility, smallholders focus the most on the problem of lack of land. Smallholders' vulnerability perception has a tendency to focus on only some of the underlying causes of stress, and prevents them from perceiving how vulnerable they really are. Factors that lead to this bias in vulnerability perception include culture, belief, experience, marginality, and role in the household and community. Not only do smallholders focus on bad events or negative impacts or situations, but also they internalize the factors that reduce their vulnerability in their risk perceptions.

Chapter 5, *Adapting to Climate Change in the Context of Forest Conflict*, presents smallholders' coping strategies and their adaptation aspirations, including both general aspirations and those more specific to climate change. In order to understand whether the actions and aspirations are maladaptive or successful, strategies and aspirations are analyzed taking into account the assessment of vulnerability of smallholders taken from the previous chapters. Smallholders' adaptation is often maladaptive that their coping strategies can increase their vulnerability. Certain maladaptation outcomes are analyzed further to understand the barriers to successful adaptation. I also discuss in what ways aspiration and climate change knowledge can remove the barriers to adaptation. I draw on the adaptation and maladaptation literatures to help understand the outcomes of smallholders' responses to climate change. Forests are central for the adaptation of smallholders and conflicting goals over forest utilization between locals and the government strongly influences their adaptation to climate change. Furthermore, the government's programs to help smallholders adapt to climate change are absent. Factors that lead to maladaptation in Batulanteh include lack of resources, lack of funds, lack of experts, lack of agency, limited climate change knowledge, a lack of social capital, and conflicts between different levels of

decision-making for adaptation. However, smallholders are able to aspire to actions that reduce their vulnerability to climate change, if they are given information about climate change predictions.

Chapter 6 *Policy Gaps on Adaptation to Climate Change* describes the climate change policy system in Indonesia in general and in Sumbawa District in particular, with specific focus on adaptation policy and local development and implementation. This chapter also presents the gap between formal policies and the vulnerability experienced by smallholders followed by explanations of some of the factors influencing the gap. The chapter also discusses the decision-making process in adaptation to climate change that links the vulnerable population to the decision makers. I draw on adaptation policy literatures to understand the development of policy and its challenges. Climate change adaptation policy is absent in the upper watershed of Batulanteh, caused mostly by an unhelpful co-benefit approach in the national level and conflicts with forest protection policy. Climate change adaptation policy is also absent in local government levels, mostly due to the fact that local policy is developed to fulfill the political promises of the elected leader to their constituent rather than to address the adaptation of the most vulnerable populations. The adaptation policy and programs in the upper watershed of Batulanteh are also lacking due to the fact that the designation of upper watershed as protected areas makes development programs very limited. Moreover, the decision-making platform (known as Musrembang) that connects smallholders and the government excludes the most vulnerable groups from the decision-making process important for adaptation.

Finally, Chapter 7 *Conclusions*, wraps up the main findings of the dissertation, notes gaps in knowledge that have emerged from this case study, and proposes possible

new paths for research in the future.

Chapter 2

Pursuing the Livelihood Goals under the Government Discontentment

2.1 Introduction

When I wrote this chapter in June of 2017, a big flood hit *Bima City* in a district close to my research location, garnering a lot of attention at the national level. The cause of the flood was unclear, whether primarily due to forest conversion into agricultural land in the upper watershed or by storm “Yvette” that passed by close to the city. However, many people pointed their fingers at the illegal logging and forest clearing for maize cultivation, the new popular livelihood, as the cause of the flood. Once again, the local people who live close to the forest in Sumbawa were under a magnifying glass, their livelihoods scrutinized and questioned. As noted in the introduction, oftentimes smallholders’ livelihoods are harshly threatened, resulting in punishment by the government with jail time.

The different perception of and utilization of forest resources is only one example among many others that shows the significant difference between the livelihood

goals of smallholders and government interests in the upper watershed, which is the subject of this chapter. The smallholders' and the government's goals are centered around the same asset: forest land, which is viewed differently by different actors. For smallholders, the forest is potential land to be converted for their income pursuit goals. For the government however, the forest is viewed as a key to sustain environmental services, especially water for the downstream population and also to prevent natural disasters such as flood: thus, their goal is forest conservation. The thesis of this chapter is that both goals have contradictory outcomes. Smallholders' pursuit of income through land-based livelihood is considered by the government as the major cause of environmental degradation in the Upper Batulanteh, while the "sustainable" livelihoods promoted by the government are not economically viable for smallholders who live in persistent poverty. Yet there is a possible convergence of the two goals that is missing from the narrative of government policy. Its absence is largely due to the government's narrow sustainable environment interpretation that centers solely on forest conservation. That is further the case as the government's goal is to benefit populations other than the upper watershed, failing to address the smallholders' needs.

Acknowledging the importance of the forest in the upper watershed, it is crucial to understand the livelihood dynamics of smallholders who live there. Failure to understand such dynamics will jeopardize the environmental sustainability that is not only important for the community in the downstream watershed but also for the smallholders who live in the upper watershed itself. Therefore, this chapter will explore the livelihoods of smallholders in terms of their goals, assets, and strategies. Additionally, this chapter will discuss the perception of the local government regarding

smallholders' livelihoods, the governments' proposed sustainable livelihoods in the upper watershed, along with smallholders' responses to these proposed livelihood alternatives. In conclusion, this chapter will discuss the causes of conflicting goals and potential convergences between the economic and conservation goals of smallholders and the government.

2.2 Literature Review

Sustainable Livelihood Approaches (SLA) and political ecology (PE) literatures are a resource through which to understand the competing goals between smallholders and government. SLA literatures see human well-being and environment as inextricably linked (Dietz, Rosa, and York, 2009; Bebbington, 1999; Scoones, 2009; Chambers and Conway, 1992). A livelihood comprises the capabilities, assets (consisting natural, economic, human, social, and other capitals) and activities for a means of living (Chambers and Conway, 1992; Bebbington, 1999). Livelihood strategies (including assets) are the reflection and the component of the meaning to the person's world that the person tries to create by pursuing their livelihood goals (Bebbington, 1999). SLA realizes that for livelihood to be sustainable, it is important to balance two conflicting goals of increasing well-being of people and environmental sustainability (Chambers and Conway, 1992; Scoones, 2009). Thus, SLA realizes the important need to balance the basic conflict between two competing goals of ensuring a quality of life and living within the limits of nature (Chambers and Conway, 1992).

In the context of rural livelihoods where rural people rely heavily on natural resource- based livelihood, the communities of interest will put greater pressure on

limited natural resources, which will then reach its threshold (Chambers and Conway, 1992). Land degradation, such as decreasing vegetation cover and soil depletion, are outcomes of livelihoods strategies that pose negative impacts towards, for example, decreasing crop yield (Stocking and Murnaghan, 2001). In the context of rural livelihoods that rely heavily on natural resources, sustainable livelihoods must imply avoiding depleting stocks of natural resources that are expected to cause negative impacts to livelihood (Scoones, 2009).). Smallholders' livelihoods are strongly affected by the ecological environment (Chambers and Conway, 1992; Leach, Mearns, and Scoones, 1999; (Wani, Rockstrom, and Oweis, 2009). Thus, for the SLA approach, smallholders' livelihood is central in determining whether there will be environmental sustainability or environmental degradation. SLA implies that in order to sustain the environment, smallholders are the ones who should push the change in their livelihood. This approach also implies that smallholders will sustain the environment indirectly because their livelihoods are strongly dependent on nature and thus they must aim to sustain the environment if they want to sustain their livelihoods.

SLA indicates that smallholders deliberately perform livelihoods that cause environmental degradation since smallholders use their assets as a deliberate choice. Livelihood goals and strategies of smallholders are deemed as their deliberate choice rather than the outcome of asset availability and structural constraint (Haan and Zoomers, 2005; Füssel, 2007). Some scholars believe that livelihood strategies are a product of choice and that people constantly change their everyday life to achieve their livelihood goals. People choose the way they use their assets, their productive and reproductive activities and investment strategies (Adato and Meinzen-Dick, 2002; Ellis, 1998; Jansen et al., 2006). Thus, livelihood strategy is a reflection of

smallholders' preference, priority, and goals (Haan and Zoomers, 2005).

There are a wide range of reasons why rural people undertake certain livelihoods, ranging from meeting a basic subsistence requirement to get into an open economy (Vedeld et al., 2007; Bebbington, 1999). Smallholders can undertake certain livelihoods because they like the work and it is their preference, such as producing their own food (Vedeld et al., 2007). The major livelihood goals of rural poor are often providing for their own sustenance, meeting their various consumptions and economic necessities or income pursuit, to reduce their vulnerability to stressors through coping with uncertainties and responding to new opportunities, to achieve well-being, and to use natural resources sustainably (Chambers and Conway, 1992; Bebbington, 1999; Haan and Zoomers, 2005; Scoones, 2009; Dietz, Rosa, and York, 2009). Livelihood also has a wide ranging meaning for smallholders, such as it being a source of identity and social marker (Haan and Zoomers, 2005) and is also a means to contest unfavorable situations (Bebbington, 1999). Thus, smallholders' conflicting livelihoods with the interest of the government can be considered as the product of deliberate choice of smallholders.

Political ecology literature sees the unsustainable livelihoods of smallholders' as the failure of policy that are far from local reality. The policy of environmental protection and limited development in upland areas are developed based on the imagination of rural people as the subsistence pursuers who practice sustainable traditional way of living (Robbins, 2011; Li, 2002). In reality, smallholders are not traditional that they are dynamic to interact with social ecological changes, very strategic and rational actors rather than ecologically noble savages (Li, 2002; Leach, Mearns, and Scoones,

1999;(Chambers and Conway, 1992). In addition, the temporary or permanent conversion of forest to agricultural uses considered as unsustainable by the government, have long been part of the livelihood repertoire of rural people (Li, 2002; Kleinman, Pimentel, and Bryant, 1995). The negative outcome of smallholders' livelihood for the environment can be seen as manifestation of limited access for smallholders caused by the existing social-ecological and political contexts such as insecure tenure, population growth, land exploration and settler influx that force them into destructive form of agriculture (Li, 2002). Thus, this chapter will try to understand the extent of the deliberate choices of smallholders as well as the structural constraints from the government that influence the livelihoods of smallholders in the upper watershed.

2.3 Smallholders' Livelihood Goals

Smallholders choose particular livelihood strategies for a number of reasons. Income is the major livelihood goal of smallholders in the upper watershed of Batulanteh, as shown in Table 2.1. Smallholders choose livelihoods that are easy to sell, such as candlenut, paddy, and maize as their income pursuit. Smallholders also choose certain livelihoods that allow them to accumulate money in a short period of time, such as becoming migrant workers. Smallholders also choose livelihoods that afford them food security, such as paddy rice. Preserving a tradition requires togetherness: the main reason as to why people choose certain livelihoods such as paddy and gathering forest honey. The younger generations also like the thrill of adventure and the beautiful scenery when gathering honey in the forest.

TABLE 2.1: Smallholders' livelihood goals

Goals	Livelihood strategies	Detailed reasons/motives
Income Pursuit	Candlenut	<ul style="list-style-type: none"> - Smallholders can benefit from it in the long term - It is productive for long-term period of time - Smallholders can harvest the candlenut for three months a year. Even more, smallholders can still get the leftover in a year - It is easy to sell for cash.
	Forest honey	<ul style="list-style-type: none"> - It does not need much money
	Maize	<ul style="list-style-type: none"> - Other smallholders are thought to be more, successful by planting maize. - It requires less labor (only for planting and fertilizer) - The work is easier than planting paddy - It provides more income
	Coffee	<ul style="list-style-type: none"> - It is easy to sell for cash
	Women migrant worker	<ul style="list-style-type: none"> - The money gained could improve the housing condition - The children can go to school
	Guava	<ul style="list-style-type: none"> - Cash
	Logging	<ul style="list-style-type: none"> - Cash
	Farm labor	<ul style="list-style-type: none"> - Cash
	NTFPs	<ul style="list-style-type: none"> - Cash
Subsistence	Livestock	<ul style="list-style-type: none"> - Easy to sell
	Paddy	<ul style="list-style-type: none"> - Staple food

TABLE 2.1: Smallholders' livelihood goals

Goals	Livelihood strategies	Detailed reasons/motives
Sustain culture and tradition	Paddy, forest honey	<ul style="list-style-type: none"> - Preserving tradition, togetherness, adventure - Gathering honey in the forest is adventurous - Beautiful scenery while gathering honey - Togetherness in the forest.
Sustainable environment	X	X

Source: interviews

Livelihoods in the upper watershed are diverse and different smallholders combine multiple livelihoods (Ellis, 1998; Scoones, 2009) ranging from land-based, forestry-based and non-natural resource based livelihoods, to achieve their income pursuit, but overall, smallholders rely most heavily on land-based and forest-based livelihoods (shown in Table 2.2. The land-based livelihoods that are the source of conflict with the government will be discussed more detail in the later section of this chapter.

Table 2.2 also shows the significant difference among the livelihoods of smallholders in the three villages. Kelungkung Village has more diverse livelihoods (14 types of livelihoods) than the other two villages (Batudulang and Sampak Villages with 6 types of livelihoods). Kelungkung Village has more options for forest-based livelihoods, while smallholders in Sampak only have a few livelihood options that rely mostly on agriculture due to their bad road condition, which I will explain further later. Batudulang has more settled livelihoods such as candlenut and coffee. The importance of several different livelihoods in the three villages can also be noted (see Figures 2.1,

2.2, and 2.3). Smallholders in Batudulang Village rely mostly on candlenut and coffee, while smallholders in Sampak Village rely on maize. Smallholders in Kelungkung Village prioritize paddy for their livelihood. Forest honey and candlenut are the major livelihood in all three villages that have been consistently present from the past until today. Overall, candlenut, paddy, and maize are the livelihoods that exist in all three villages with different intensities, while some others are absent in one village but present in other villages. This shows that rural livelihoods are very dynamic (to be discussed in more detail later in the section on assets). The factors and their consequences will be explained further in a later section on cost and income livelihood assets.

Smallholders' livelihoods in the upper part of the Batulanteh Watershed rely more on men (as shown in Table 2.2), showing that men have more livelihood options (17) than women (11) and while livelihood options are increasing for men, the only livelihood option specifically open for women so far is as a migrant worker (known as TKW).

2.4 Types of Livelihood

2.4.1 Land-based Livelihoods

Paddy. Paddy is one of the major livelihoods of smallholders in the upper Batulanteh Watershed. Smallholders mainly plant paddy as a staple food in their rain-fed agricultural lands called *rau* once in a year. *Rau* is the land that smallholders get from converting forest into agricultural land (also known as slash and burn agriculture). Smallholders usually plant candlenut in their *rau* that after some years will

grow and make it impossible to plant paddy anymore.

Maize. Maize is not the staple food in the upper Batulanteh watershed and in Sumbawa in general. Maize is absent in Batudulang Village due to the growing of candlenut trees in smallholders' lands that have left no room for maize. The high production cost of planting maize is the major reason of the absence of maize in Kelungkung Village. The limited land space in Kelungkung Village is also the biggest factor limiting the village's cultivation of maize, resulting in their growing of candlenut as well as other trees.

Smallholders in Sampak Village however, have not planted candlenut on their land yet and have less pressures of population than that seen in Kelungkung Village. The lack of monitoring from the government officials due to the bad road conditions also provides smallholders in Sampak Village more room to maneuver in converting the forest to maize. Forest monitoring is more intensive in Batudulang and Kelungkung Villages due to easier access to them. Moreover, the forest monitoring office is in Batudulang Village, making the government more present there, as well as bringing more government programs compared to the other two villages. Records from forest management units show that there are several cases of illegal loggings and forest clearings in Batulanteh and Kelungkung Village. As a result, some of the smallholders in the two villages especially from Kelungkung Village have been put in jail. There is no recorded information however for Sampak Village.

Mung bean and Pigeon pea. Smallholders often planted mung bean in the past. Lately, smallholders decided not to plant mung bean based on their recurrent harvest failures over the years, mainly as a result of excessive rainfall. Nevertheless, there is another new type of crop that has emerged in the livelihood strategies of smallholders.

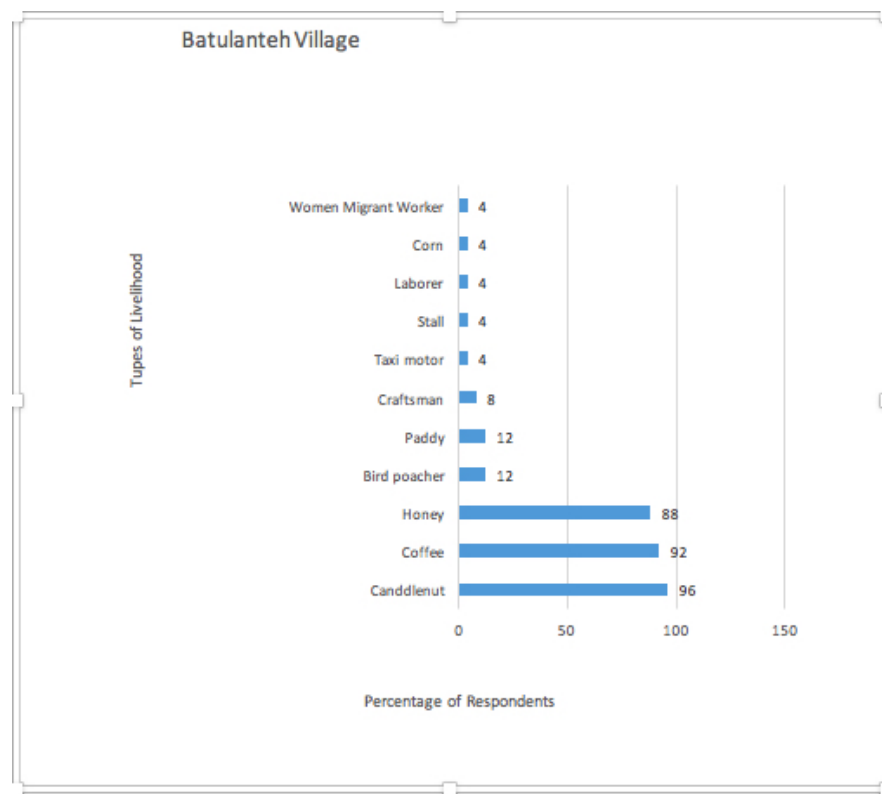


FIGURE 2.1: Livelihood portfolio in Batudulang Village

Smallholders in Kelungkung Village have started to plant lebui, a local name for pigeon pea (*Cajanus cajan*), for the past two to three years in small portions of their land, primarily because of its attractive market price. The latest price of lebui per kilogram is around US\$ 0.96 – 1.1¹. Other reasons why smallholders choose to plant are that it is considered to be easier to grow than paddy, does not require weeding, requires less fertilizer, and has less disease and pest infection.

Candlenut. Candlenut (*Aleurites mollucana*) is also known as kemiri or miri locally, and the nut is often used in Indonesian cuisine. Candlenut trees can reach 10 m tall or more with gray-brown to blackish bark. Candlenut is one of the major

¹US\$1 equivalent to IDR 13,489.1 using the conversion from <https://www.oanda.com/currency/converter/> last accessed on November 10, 2017

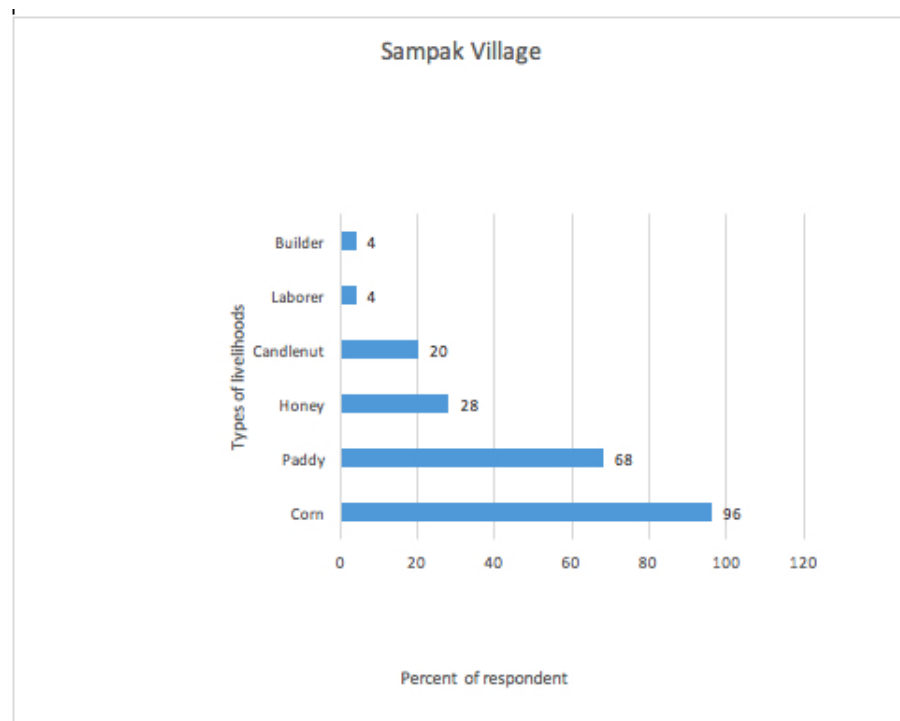


FIGURE 2.2: Livelihood portfolio in Sampak Village

livelihoods of smallholders in the upper watershed, making it a convenient crop to grow due to its low cost of cultivation and maintenance. Smallholders only have to plant the trees, and can leave them for a long period of time once the trees start to produce. For the smallholders who do not own candlenut, they can also collect it wild in the local forest. Candlenut is easy to sell and smallholders can harvest it for about three months. People can also always collect the remaining candlenut on the ground for the whole year to cover everyday expenses when needed.

Coffee. Coffee is one of the main livelihoods in Batudulang Village but is not found in Kelungkung and Sampak Villages. The higher altitude and colder climate in Batudulang Village make it more suitable for coffee. To finance coffee production, smallholders usually borrow money from moneylenders, and pay their debt later after

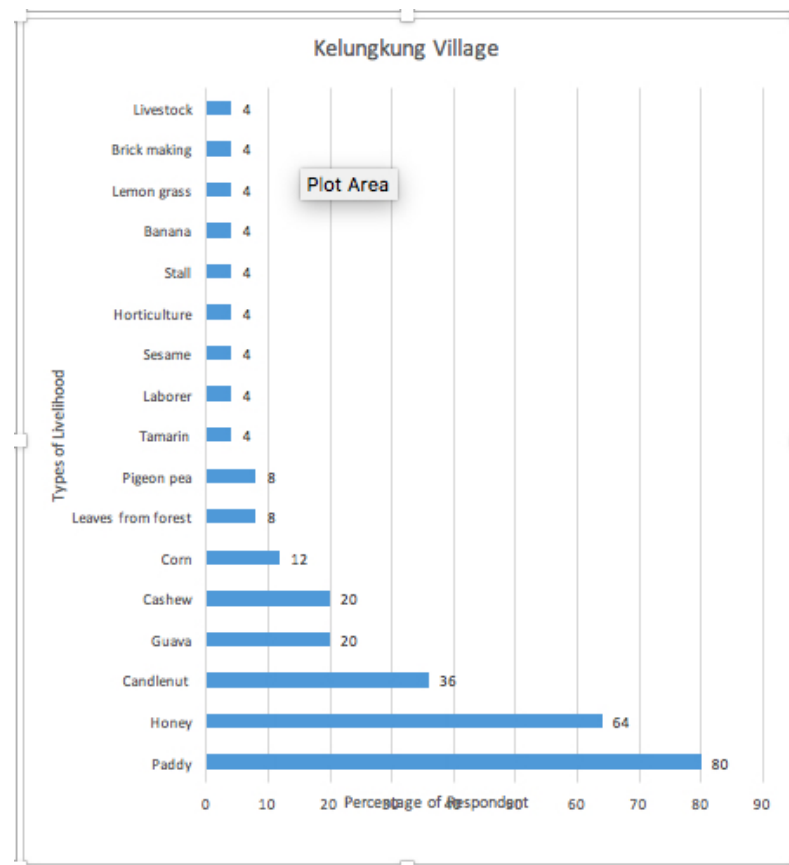


FIGURE 2.3: Livelihood portfolio in Kelungkung Village

selling their candlenut.

Orchard. In my research area, smallholders' land that has been planted with fruit trees is called "keban". Trees that are normally found in keban include banana, mango, candlenut, cashew, guava, etc. Keban was more prevalent in Kelungkung Village compared to the two other villages. Guava and cashew are two viable products from keban that support the livelihoods of smallholders. While guava is still a part of livelihood strategies of smallholders in Kelungkung Village, guava has disappeared from the livelihood portfolio of smallholders in Sampak Village for the past 5 years coinciding with the emergence of maize. There are several possible reasons for the



FIGURE 2.4: Candlenut

disappearance of guava. Smallholders cut down the guava in their land in order to make room for maize. Guava trees also might die because of unfavorable environmental conditions due to the use of fertilizer, herbicide, and pesticide for maize. A significant decline of guava is also recorded in Kelungkung Village in the last few years due to the increase of dead guava tree. The use of herbicides kills the grass around guava. It exposes the soil and makes it more prone to erosion due to the hilly topography of these villages. The erosion exposed the root of guava that makes it easier to collapse and die.

2.4.2 Forest-based Livelihoods

Forest Honey. Forest honey from *Avis dorsata sp.* is one of the most important livelihoods for smallholders in the three villages in the upper watershed. The villages are located close to the deciduous lowland forest that contains a lot of plants and trees



FIGURE 2.5: Candlenut Trees

used for medicinal purposes by the local people. Forest honey from Sumbawa is well-known for many Indonesians. Moreover, forest honey from Batulanteh Watershed is the flagship product of the local government of Sumbawa. Smallholders gather honey in August and December, usually spending 3-4 days and sometimes a week in the forest. The production costs for gathering forest honey is relatively low, around US\$ 3.7 to 14.8 for food, buckets, and ropes. The price of forest honey ranges from US\$ 4.1 to 4.4 per bottle (600 ml). The amount of forest honey that smallholders can get is uncertain, ranging from 10 to 20 bottles, but sometimes collectors return empty handed.

Other NTFPs. Smallholders in the three villages rely on their local forest not only for forest honey but also for non-timber forest products such as turmeric, ginger, fern, and other plants and fruits that are important for local diet. Smallholders also sell



FIGURE 2.6: Honey Gathering

the NTFPs in the local market. Smallholders also sell certain type of plants called *tai angin* from the forest which are used as a cosmetic ingredient to a buyer from Bali, although smallholders do not gather it recently because there are no buyers anymore. Smallholders in Sampak Village also used to rely on selling ferns in the past, but these have disappeared for the past 5 years with the emergence of maize.

Logging and bird poaching. There are two other types of forest-based livelihoods in my research area, namely illegal logging and bird poaching. Illegal logging was recorded in Batudulang and Kelungkung Villages. Buyers usually give some amount



FIGURE 2.7: Honey hives in the trees of the forest

of money in advance to smallholders, who will only do this illegal activity if there is any demand for it. Lack of illegal logging reports in Sampak Village does not mean that there is no illegal logging there, but simply a lack of forest monitoring. Bird poaching is another illegal activity carried out by smallholders in Batudulang and Kelungkung Village. Some species of birds from the local forest are protected species. Younger people primarily become the bird poachers, and they sell the birds to buyers coming from Java for around US\$2. Bird poaching is very tiring, leading locals to poach only when they have no other job. During the time I conducted my fieldwork, there were not any bird poachers due to the lack of buyers.

2.4.3 Non Natural Resource-based Livelihoods

Transnational Domestic Women (*TKW*). Transnational domestic women workers, known as *TKW* ” in Indonesia, is an overseas employment service for women from the lower classes who have low education and skills. This makes them participate in undervalued forms of work, such as domestic service with low-paid, subpar security, and remains mostly unregulated (Silvey, 2006; Wiratri, 2016). *TKW* became very prevalent in many villages in Sumbawa in the 1990s. In Indonesia, between 1983 (the first time *TKW* was recorded) and 1992, there is a significant increase in numbers of *TKW* from 27,671 in 1983 to 158,750 in 1992². Most women become *TKW* to fulfil subsistence needs such as household, food, clothing, education and health expenses. If there is any income left, this can be spent on non-subsistence items such as expensive consumer goods like refrigerators, televisions, radios, motorcycles and cars.

Table 2.3 shows that in the present time, the number of women who become *TKW* is increasing compared with the accumulated numbers of *TKW* in the past. This may be due to the improving image of migrant workers, who used to be considered as a lowly job. *TKW*’s success in supporting the economy of their family by building their house, paying their children’s school, and buying things they could not previously afford improves their image, attracting many more women to become *TKW*. In addition, nowadays, it is easy to become a *TKW*. In the past, a woman who wanted to be a *TKW* must pay a certain amount of money in advance. Now, it is the opposite however as the women are given money if they are willing to be a *TKW*. *TKW* has become part of a global phenomenon and cannot be separated from

²[https : //www.merdeka.com/peristiwa/ini – asal – usul – dan – sejarah – tki – pertama – kali.html](https://www.merdeka.com/peristiwa/ini-asal-usul-dan-sejarah-tki-pertama-kali.html)

the effect of globalization. The rise of middle and upper-class families in many parts of the world, such as Saudi Arabia or elsewhere, has resulted in the hiring of domestic workers from overseas for prestige and convenience (Nurchayati, 2011).

There is a significant difference in the number of TKW in the three villages. This raises a question as to what causes the difference. Higher numbers of women in Kelungkungan than the other two villages can be one reason (see Tables 2.4 and 2.5). Poor road access in Sampak Village makes it difficult for the women in this village to be reached by employment agencies. They also perceive working as a TKW as not being a dignified job. Some bad incidents in the past befell TKW in this village: the return of one TKW in a dreadful condition, extremely thin and scalded, while another TKW was impregnated by her employer, make the people in Sampak village not want to experience such incidents again (the vulnerability of TKW in the context of climate change will be discussed in more detail in Chapter 4). Economic pressure is not too high in Sampak village compared to the other two villages which have good road access. Infrequent visits from traders to the village and infrequent visits from the villagers to the town make has made them feel satisfied with their condition. In the other two villages Kelungkungan and Batudulang it is easier for traders to come and the villagers visit the town more frequently which can make them become more consumptive, thus needing a higher income.

Other non-natural resource-based livelihoods conducted by smallholders include working as farm laborers, handyman, miners, and brick makers. Working as farm laborer is common in the three villages, especially for smallholders who own a small patch of land. In Batudulang Village, smallholders work in other wealthier smallholders' land to harvest coffee and candlenut, earning IDR 60,000 per person per day.

While smallholders in Kelungkung Village often work in other villages to harvest candlenut, women also take use the opportunity to become farm labor to gain additional income.

2.5 Smallholders' Livelihood Management and Assets

2.5.1 Smallholders' Livelihood Management

Tables 2.4 and 2.5 show how smallholders manage their diverse livelihoods throughout the year. Smallholders start their planting season for paddy and/or maize by preparing the land in September, consisting of cutting down the unwanted weeds and grass that grows fast when the land is abandoned soon after the harvest. Smallholders then burn the unwanted weed after they leave it to dry for few days. Smallholders also dig out the root of the weeds, especially the ones that grow big. This period preparing the land for cultivation often becomes the source of conflict between the government and the smallholders because this practice is considered as detrimental for the environment. The government considers that smallholders' slash and burn practice is done in forested areas, while for the smallholders, they claim that they are doing slash and burn practices in areas which have been opened before so the areas can no longer be regarded as forest. This has rendered the government to see paddy and maize as more problematic livelihoods compared to candlenut. However, even to plant candlenut, smallholders must go through the slash and burn stage initially as well.



FIGURE 2.8: Burning the weeds as a part of land preparation in Kelungkung Village

Shortly after the land is ready, smallholders mend the fence and build a temporary house where they will stay during the planting season. Smallholders collect honey in the forest in October and November while waiting for the rain to come to start the planting season. The money gained from forest honey is used for the planting season as well as for daily necessity. The planting season normally starts in November or December and the harvest is in March or April, or even May for maize. While waiting for the harvest of paddy and/or maize, smallholders earn money from candlenut that can be harvested starting from October until January. After the harvest of paddy and maize, smallholders go to gather the forest honey again in June and July. Smallholders in Kelungkung gain additional income from guava and cashew that start to be harvested from November until January. Smallholders in Batudulang harvest

their coffee in June, July and August.

2.5.2 Smallholders' Livelihood Assets

Livelihood strategies are the output of livelihood assets as inputs. Livelihood assets consist of natural, economic, human, social, and other capitals, and access to livelihood assets is considered as one of the most important factors to sustain their livelihoods (Bebbington, 1999). This section shows assets as important for smallholders' livelihoods in the upper watershed, and what factors determine access to those assets.

TABLE 2.2: Smallholders' livelihood portfolio

No.	Type	Resource	Gender		Batudulang		Kelungkung		Sampak	
			M	F	Past	Now	Past	Now	Past	Now
1	Paddy	Land-based	X	X	X	X	X	X	X	X
2	Maize		X	X						X
3	Mung bean		X	X			X		X	
4	Pigeon pea		X	X				X		
5	Farm labor		X	X		X		X		
6	Candlenut		X	X	X	X	X	X	X	X
7	Coffee		X	X	X	X				
8	Guava		X	X			X	X	X	
9	Cashew		X	X			X	X		
10	Tamarin		X	X				X		
15	Livestock		X					X		
11	Forest Honey	Forest-based	X		X	X	X	X	X	X
12	Fern		X				X	X	X	
13	NTFPs		X				X	X		
14	Logging		X					X		
16	TKW	Other		X		X		X		X
17	Brick making		X					X		
18	Taxi motor		X							X
Total			17	11	4	6	8	14	6	6

Source: interviews and survey

TABLE 2.3: Transnational Women Domestic Worker in upper Batulanteh watershed

Village	Present	Past (accumulated)	Total TKW
Batudulang	8	10	18
Kelungkung	28	27	55
Sampak	3	4	7

Source: interviews

TABLE 2.4: Livelihood timeline for months 6 to 11

Livelihood	Month					
	6	7	8	9	10	11
Paddy				Preparing land		Planting
Forest honey	Gathering	Gathering			Gathering	Gathering
Candlenut	Flowering				harvesting	harvesting
Guava		Flowering				harvesting
Maize				Preparing land		
Coffee	Harvesting	Harvesting	Harvesting	Guarding	Flowering	

Source: interviews

TABLE 2.5: Livelihood timeline for months 12 and 1 to 5

Livelihood	Month					
	12	1	2	3	4	5
Paddy	Planting			Harvesting	Harvesting	
Forest honey						
Candlenut	Harvesting	Harvesting				
Guava						
Maize	Planting					Harvesting
Coffee	Trimming					

Source: interviews

TABLE 2.6: Livelihood assets

	Assets	Paddy	Maize	Candlenut	Coffee	Honey	NTFPs	Timber	TKW
Natural	Land	X	X	X	X				
	Forest					X	X	X	
	Water	X	X						
Human	Labor	X	X	X	X	X	X	X	X
	Skill								
	Knowledge	X							
Social	<i>Besiru</i>	X							
	Kinship			X					
Economy	Money	X	X		X				
	Market	X	X	X	X	X	X	X	X
Other	Fertilizer	X	X						
	Road	X	X	X	X	X	X	X	
	Technology	X	X						

Source: interviews

Tables 2.4 and 2.5 show that smallholders' livelihoods in the Upper Batulanteh Watershed require natural, human, social, and economic assets. Smallholders' livelihoods are highly dependent on natural assets (i.e. land, forest, and water), intensive human labor, and markets. I will explain each of the assets and access to them as well as how they relate to each other further below.



FIGURE 2.9: Land preparation in Kelungkung Village

Natural Assets. Smallholders rely heavily on natural resources for their livelihoods. In the upper Batulanteh Watershed, only transnational women domestic workers do not require natural assets. The natural assets that smallholders need for their livelihoods are primarily land and forest. Agricultural and agroforestry based livelihoods such as paddy, maize, candlenut, coffee, and orchards that require land are the major livelihoods of smallholders in the Upper Batulanteh Watershed. Forest-based livelihood is another major livelihood for smallholders as shown by the many sources of

income from timber and non-timber forest products such as forest honey, fern, bamboo, vegetable, medicinal plants, and herbs. Each smallholder household in the upper watershed has 1-2 hectare of land on average, and agricultural lands are primarily dryland that is only productive once a year during the rainy season. Moreover, due to the hilly morphology of the upper watershed making the top soil thin due to high erosion rate, the land is mostly sloped affecting the productivity of the crops. Smallholders inherit the land from their parents and will also need to pass on the land to their children. Along with the population growth, land division will become problematic because smallholders will get less and less land to be shared in the family and they cannot convert the forest for agriculture land as in the past, as the forest is now protected by the government.

Land holdings vary in type and extent in the three villages. Smallholders in Sampak Village mostly own dry land, while smallholders in Batudulang Village mostly own candlenut garden and smallholders in Kelungkung Village mostly own orchards. All respondents in Sampak Village own dry land (100%), and some smallholders also also have irrigated paddy fields (35%) that are not found in the other two villages. Irrigated paddy fields in Sampak Village are flooded with a traditional dam made of wood. Candlenut garden is only owned by 10% of the respondents, indicating that candlenut is not yet developed in Sampak. The average land holding is 1-2 ha of for dry land and around 0.5 ha for the irrigated paddy field. Smallholders in Batudulang Village mostly own candlenut garden (90%) and coffee (40%). Some respondents also own dry land (30%) indicating that forest conversion still occurs in Batudulang Village. The average land holding is 1-2 ha for candlenut gardens and 0.5 ha for coffee.

TABLE 2.7: Land holding types and sizes (average amount per household)

	Sampak	Batudulang	Kelungkung
Irrigated paddy field	35% (mostly 0.5 ha)		
Dry land	100% (mostly 1-2 ha)	30% (mostly 1-2 ha)	
Candlenut	10%	90% (mostly 1 – 2 ha)	
Coffee		40% (mostly 0.5 – 1 ha)	
Orchard			100% (31% 0.5 ha) (40% 1-1.5 ha) (9% 2 ha)

Source: interviews

All respondents in Kelungkung Village own orchards used for planting candlenuts, timber (teak, Indonesian rosewood), cashew nut, banana, jackfruit, corn, vegetable, and lemongrass. Smallholders in Kelungkung Village also use their orchard to plant paddy in the rainy season. The average land holding is 0.5 - 1 ha. Two out of 25 respondents in Kelungkung Village mentioned that they also own dry land, indicating that smallholders in Kelungkung Village have very limited access to converting the forest into dry land and must make ends meet with just 0.5 – 1 ha land per household.

Economics. There are two dimensions of economic assets in my research, which are financial assets (money for production activities) and access to markets (the platform to get money or income). Smallholders need money mostly for the production of their agricultural-based livelihoods, such as paddy, maize, and coffee. Most of the expenditure is for hiring the labor to do the planting and harvesting. From all the livelihoods, maize requires the most economic assets due to its high production costs, which often push smallholders to borrow money from moneylenders with high interest

rates. To receive money for production, smallholders usually engage in livelihood activities that require less capital such as honey gathering and candlenut picking. Smallholders also borrow some money from moneylenders or their family, or sell their livelihood assets such as goats or cows to pay the loan back to the bank. Tables 2.4 and 2.5 show how the market is one of the most important factors for smallholders, as most livelihoods require access to markets. Even smallholders in rural developing countries and in the upper watershed areas are well-integrated within the global, national, and local market. Access to markets in the upper watershed is significantly influenced by access to roads and government programs such as the forest honey market supported by the government.

Human. Human labor becomes an important human asset in the Upper Batulanteh Watershed because most of the smallholders' livelihoods require intensive human labor. The lack of economic assets makes human labor even more important for smallholders. Even though there are many machines that can substitute human labor, such as plowing and other machines, smallholders cannot afford these technological inventions due to their low income. Other human capital is in the form of traditional knowledge on local environment (explained in more detail in chapter 3 on climate knowledge). This knowledge is closely related to certain traditions and rituals in paddy and honey gathering. Knowledge on the local environment also plays a role in resource management, such as the traditional livestock management known as *lar* (explained further in the adaptation to climate change chapter).

Social. One of the most important social assets for smallholders in Sumbawa is in the form of *besiru*, a local term for a system of sharing human labor among smallholders. A smallholder, along with others, helps other smallholders in planting

and harvesting. Once the work is done, they move to another smallholder's land. This system is developed to overcome the problem of intensive human labor needed at certain times. It is also a way to solve the lack of economic assets. However, more recently, smallholders do not rely too much on this system anymore. Smallholders prefer to pay for labor, so that they do not have to wait too long to get the work done. Smallholders chose to borrow money from money lenders to hire labor. Social assets are also needed in gathering forest honey, as smallholders should form a group to go together in the forest. The more people they have in their group, the bigger the opportunity it is for them to get honey because a smaller group will 'surrender' the access to explore the forest and to claim the trees that have honeycombs to the bigger group.

Smallholders also use social capital to find alternative markets for their product. For example, when the price goes down, smallholders bring their candlenut to their family in other villages to be exchanged with rice. Culture and tradition that are part of traditional knowledge also play a role in smallholders' livelihood. By practicing some traditional rituals related to livelihood strategies, smallholders can keep the social bonds among themselves strong, making it helpful to reduce the conflict in the community. Further, a tight-knit social fabric community is one of the deciding factors for the government to bring programs, such as in the case of Batudulang Village. The government avoids bringing programs to the community that has strong internal social conflict, which has been the case in Kelungkung (explained further in Chapter 5).

Technology. Technology is an important asset driving smallholders' livelihood in the upper watershed. The introduction of high yielding and drought resistant paddy

seed has proven to be a success in the upper watershed, especially in Kelungkung Village. The red paddy developed specifically for drylands is suitable for the physical environment of the upper watershed. Smallholders like the paddy for its high yielding, drought resistance, and its resilience to grow well under the shade of candlenut trees. Other kinds of technologies such as mobile phones and television are also important for accessing information needed by smallholders, making information exchanged among smallholders easier. The access to information is one important factor behind smallholders' goals. For example, smallholders in Sampak Village decided to start to plant maize in their land because they received information indicating how smallholders in other villages gained more money by planting maize, sparking their desire to be as successful.

2.6 Smallholders' Livelihoods cost of production and Income

The income pursuit of smallholders' goal makes it important to understand more of their income situation derived from their livelihood strategies. What is the level of their income in relation to their livelihood strategies? The answer to this question helps us give a better understanding on why smallholders put income pursuit as their livelihood goal.

Table 2.8 shows that smallholders in the three villages rely on different income resources. Candlenut and coffee are the biggest source of income for smallholders in Batudulang Village, while smallholders in Sampak Village receive significant income

TABLE 2.8: Income from various livelihoods. 1 US\$ = IDR 13,597.6
(Oanda Currency, Dec 19, 2017)

Source of income	Batudulang (US\$)	Kelungkung (US\$)	Sampak (US\$)
Paddy		51.5 – 180.2	
Forest honey	44.1 – 73.5	0 – 73.5 mostly aprox. 44.1	44.1 – 73.5
Candlenut	73.5 – 294.2	36.8 – 73.5	Aprox 7.4,– 22
Maize			1,323.8 – 1,470.9
Coffee	Aprox 294.2		
TKW		367.7	

Source: survey and interview

from maize. Smallholders in Kelungkung Village who do not have a significant income from land-based livelihood compared with the other two villages mostly receive income from TKW. The costs of production and income gained for each village is explained further below.

2.6.1 Kelungkung Village

TABLE 2.9: Cost of production and income in Kelungkung Village. 1
 US\$ = IDR 13,597.6 (Oanda Currency, Dec 19, 2017)

Source of income	Cost		Yield	Income
	Variable	Total cost		
Paddy (1 ha)	seed 1.5/sack (total \$51.5)		10 - 16 sacks (each sack \$25.7)	Mostly consumed. Selling 2-7 sacks. (\$51.5-180.2)
	Fertilizer urea 4 sacks (total \$29.4)	\$293.4		
	Fertilizer NPK 2 sacks (total \$19.9)			
	Herbicide (\$1.5)			
	Human labor (total \$191.2)			
	- land clearing \$110.3			
	- planting with besiru system \$25.7			
	- Weeding \$29.4			
	- harvesting with besiru system \$25.7			

TABLE 2.9: Cost of production and income in Kelungkung Village. 1
 US\$ = IDR 13,597.6 (Oanda Currency, Dec 19, 2017)

Source of income	Cost		Yield	Income
	Variable	Total cost		
Candlenut		\$0		\$36.8-73.5
Forest honey	Food, rope, bucket	\$3.7-14.7	Uncertain. Each bottle \$4.4	\$0-73.5 \$44.1
Turmeric		\$0	8 kg (1 kg \$0.15)	\$7.4
Cashew				\$47.8
Guava				\$51.5
TKW				\$220.6-367.7
Total		Aprox. \$294.2-367.7		Aprox. \$220.6-294.2

Source: survey and interview

Smallholders in Kelungkung own on average around 1 – 2 hectares of dry land each where they manage to plant paddy, candlenut, cashew, guava, etc. Smallholders mostly prioritize planting paddy and then candlenut, guava and cashew on the same land. The cost of planting paddy varies around US\$ 36.8 to 367.7. The significant range of cost depends on whether smallholders use their own paddy seeds or to buy it, utilize “besiru” labor sharing system or to pay for human labor, buy fertilizer or converting the forest for fertile soil. Smallholders mostly plant paddy for their subsistence. From 10 to 16 sacks of paddy harvested from 1 hectare of land, smallholders usually keep most of it for food until the next season. Even if they sell

it, it will be only a few sacks or if their yields are abundant. To fulfill their daily needs, smallholders rely on income from forest honey, cashew, guava, candlenut, and other NTFPs.

Smallholders in Kelungkung spend around US\$ 294.2 – 367.7 for production costs, which are mostly used for human labor. The profit they get is around US\$ 220.6 – 294.2, which means smallholders do not have a profit margin from the production costs and end up losing instead. But they do not need to spend money to buy rice because they produce it. They can instead rely on getting some small profits if the yields are sufficient to sell the excess.

Because their income is low and there is not as much income as from candlenut and coffee in Batudulang or maize in Sampak, many more smallholders in Kelungkung work as TKW compared to the other two villages. There is no cost to becoming TKW, and the company that sends them abroad will pay all their expenses. They will then pay back with their few months earning. TKWs earn around US\$ 147.1 – 367.7 per month. Their money is used mostly to cover school fees for their kids or other needs requiring significant amount of cash.

To minimize production costs, smallholders use their own labor for most of the work. Smallholders in Kelungkung are also able to apply the besiru system, which is not experienced in the other two villages. Smallholders can also minimize fertilizer costs if they open new forest, since newly opened forests are more fertile, allowing them to save some money on fertilizer, while at the same time being able to get better yields compared to farm lands that have been cultivated several times. As one farmer notes, *"When we open the forest in 2013, we could harvest 29 sacks of paddy. In 2014, in the same land, we get only 16 sacks."* (Anjes, Male, Kelungkung Village,

2016).

2.6.2 Sampak Village

TABLE 2.10: Cost of production and income in Sampak Village. 1
US\$ = IDR 13,597.6 (Oanda Currency, Dec 19, 2017)

Source of income	Cost		Yield (USD)	Income (USD)
	Variable in USD	Total Cost (USD)		
Maize (1 ha)	Seeds 20 kg (\$ 108.8)	\$608.9	6 - 9 tons, each ton \$110.3 – 161.8	\$1,323.8 – 1,470.9
	Fertilizer 10 sacks (\$110.3)			
	Herbicide 5 liters (\$22.1)			
	Human labor (total \$367.7)			
	land clearing \$36.8			
	planting \$110.3			
	harvesting \$147.1			
Forest honey		\$3.7– 7.4	Price per bottle \$4	\$44.1 – 73.5
Paddy		\$22.1 – 73.5	7 - 10 sacks	Consumption
Candlenut from the forest			Few kilograms	Aprox \$7.4-22.1
			\$1.8 – 3.7 per day for few days.	
TOTAL		\$661.9 – 735.4		\$1,323.8-1,470.9

Source: survey and interview

Smallholders in Sampak have 1 – 2 hectares land on average, and are now prioritizing planting maize. Planting maize for cash is relatively new. Six years ago, M. Ali started to plant maize after learning that other smallholders in another part of

Sumbawa had planted this type of maize and gained massive returns from it. Seeing that M. Ali also gained much profit from it, other smallholders began to plant maize in their land. Smallholders' income in Sampak village has now relied on maize for the past 5 – 6 years, since 2010–2011. Before this, they planted paddy for consumption as well as trade. Now smallholders plant paddy only on a small portion of their land and only for their consumption.

Smallholders usually borrow money from moneylender with 50% interest or they use their saving from their previous harvest for the next planting season. From one hectare of land, smallholders get around 9 tons, that they sell for US\$ 147.1 per ton. The total income that smallholders get from one hectare of land is thus around US\$ 1,323.8 – 1,470.9. Despite a tendency toward a decline in the price of maize, smallholders perceived that they always gain some profit from maize. However, even though smallholders perceived that income from maize in Sampak village is significant, this is not entirely true. Smallholders tend to only see how much money they get when they sell maize, but the profit margin from maize is actually very small because the production cost is high, and because farmers must borrow money to cover this cost with interest as high as 50%.

2.6.3 Batudulang Village

Candlenut is the main livelihood of smallholders in Batudulang Village, and candlenut yield and smallholders' income from it are bigger in Batudulang than in the other two villages. Smallholders in Batudulang village own on average around 1.5 — 8 hectares prioritized for planting candlenut. From my observation, even though paddy is almost gone, there are smallholders in Batudulang Village that still practice slash

TABLE 2.11: Cost of production and income in Batudulang village. 1
 US\$ = IDR 13,597.6 (Oanda Currency, Dec 19, 2017)

Source of income	Cost		Yield (USD)	Income (USD)
	Variable (USD)	Total Cost (USD)		
Coffee (1 hectare)	Human Labor	\$ 202.2	100 – 200 kg. \$1.4 – 1.5 per kg	Aprox \$294.2
	Land clearing: \$73.5			
	Harvesting: \$88.3			
	Fertilizer 1 sack US\$ 11			
	Herbicide & pesticide \$ 7.4			
	Sacks \$ 22.1			
Candlenut (1 ha)	Human labor	Aprox \$36.8 – 73.5	200 kg \$ 0.22 – 0.37 per kg	\$73.5 – 294.2
	- harvesting: \$ 0 – 36.8			
	- transportation cost: 1 sack \$ 0.7			
Forest honey		\$7.4 – 14.7		\$44 – 73.5
		\$220.6 – 294.2		\$411.8 – 661.9

Source: interviews

and burn to plant paddy. However, smallholders in Batudulang still open the forest not primarily for planting paddy but candlenut, because before the candlenut grows big in the fourth year, the newly opened land can still be planted with paddy. The income from candlenut depends on the productivity of the trees. Young candlenut (1 to 3 years) is not as productive as the ones that have been producing fruits for 5 years or more. Smallholders in Batudulang save some production costs by collecting candlenut and also cleaning the land by themselves. Only those who own big candlenut

trees will hire people to harvest the candlenut.

Smallholders can get 1 – 5 tons from 2 – 8 hectares of land. The price of candlenut ranges from US\$ 0.22 – 0.37. In Batudulang Village, smallholders usually can get 20 kg of candlenut per day, which is four times higher than smallholders get in Sampak Village of around 5 kg/day. In Batudulang, smallholders can earn a profit of around US\$ 220.6 – 367.7 per two hectares . However, smallholders will have to buy rice because they do not grow paddy anymore. Thus, their profit margin is actually small, around US\$ 73.5 – 220.6 per year because they must spend US\$ 147.1 – 220.6 per year to buy rice.

2.7 Government Perception on Smallholders' Livelihoods

The government of Sumbawa perceives the livelihood of smallholders in the upper watershed as unsustainable and detrimental for the environment, particularly slash and burn as causing an increase in forest degradation, leading to critical land, erosion, sedimentation, temperature, food insecurity, water availability, flood, and downstream water problems. Farming on sloping areas is also believed to be the cause of high erosion rates in the upper watershed. The government also criticizes the land management of smallholders in which they only plant once a year with one crop. For government officials, smallholders could plant various crops to reduce the risk of harvest failure.

“Smallholders are lazy. After planting candlenut in their land, they just leave it until it bears fruit. They do nothing else, for example they do not plant other crops between the candlenut trees. They let the bushes grow rather than planting

it with other crops or plant such as turmeric or other plants that they can sell. Thus, in one year, they can harvest something every 3 or 4 months.” (Regional Planning Agency of Sumbawa District, 2016).

Officials also often criticize that the smallholders do not apply the right techniques in performing their livelihoods. They let their cattle roam freely instead of taking care of it in their land, or farm carelessly by not setting the right spaces between trees and not taking care of their plants. The government also perceives smallholders as over exploitative of the forest resources such as rattan, timber and forest honey. Furthermore, officials criticize smallholders for permitting land grabbing in the upper watershed, especially in Kelungkung Village, as a result of selling their land to the people from the city then converting the forest to get new land.

“They go further and higher to open the forest because they have sold their land that are nearby and close to the road access to outsiders. When they have spent all the money they get from it, they will start to get new land. They convert the forest again.” (Regional Planning Agency of Sumbawa District, 2016).

The government perceives that there are several root causes that lead to unsustainable livelihoods in the upper watershed. Open access and unclear property rights related to forest is one of the major culprits. Poverty also forces smallholders to undertake livelihoods that degrade the environment, as smallholders have a preference to plant short-term cash crop than planting trees that can be harvested after 10-15 years. Furthermore, the government also acknowledges the market demand for certain boom crops such as maize is a factor that degrades forest in large scale and high speed. Certain unsustainable livelihoods such as illegal logging is also happening because of support from certain powerful people and forest monitoring and law enforcement are weak.

The discourse about smallholders in the upper watershed for the government is

that they lack knowledge about the environment, law, agriculture, animal husbandry and land management. They are also thought to have negative characteristics and mentality, in that they are not willing to change their long term unsustainable practices and are reluctant to adopt new ones. The government perceives a lack of agency and leadership in the community for those who are expected to be role models undertaking sustainable livelihoods. Smallholders are also thought to be lazy and only want a shortcut for their life by relying on governmental supports.

“Do you know why smallholders soak their paddy field with water? It is to prevent the growing of grass. They are lazy. They do not want to deal with the grass. Well, there is no grass by doing this, but if they soak their paddy field with water most of the time, the paddy cannot grow well. Paddy requires some period of dry and wet to grow well. They should let the water in, then let it dry. After two weeks, when the land starts to crack, they should let the water in again. The opening and closing of the water that they do not want to do. They just go to their paddy field, let the water in, and left.” (Regional Planning Agency of Sumbawa District, 2016).

“So, smallholders in Sumbawa, they are different from Balinese. Balinese have tribal leaders, and other things, so, they obey their leaders. They are more independent. This is different with smallholders in Sumbawa. They are only interested in the government support. They do not want to do things independently. Even if they get the support, they do not really take good care of it. When the support they get does not work anymore or break, they will ask again to the government. This is a very difficult situation.” (Regional Planning Agency of Sumbawa District, 2016).

2.8 Government's Programs in the Upper Watershed of Batulanteh

Tables 2.1 and 2.11 show that the government's goals are significantly different from those of smallholders; there is hardly any point of commonality between smallholders' goals with those of government. The government's goal is to protect the forest in the upper watershed for the sustainability of ecosystem services, especially water for the downstream population, while the smallholders' goal is to increase income.

The negative perception the government has towards the smallholders plays a role in their aspirations for them. The government sees that the smallholders in the upper watershed should change their livelihoods because they perceive their livelihood as unsustainable and detrimental for the environment. As one official noted, *"They should change their land use management by diversifying crops so that they will have more options rather than to plant their land with only one type of crop in a year"*. (Head of Batulanteh Forest Management Unit, 2016)

Government aspirations include making terraces in sloping areas, planting trees, and intensifying land uses. But these government aspirations oftentimes are not suitable with the reality at the local level, especially the goals of smallholders and the resources available. Below I explore some of these government aspirations and programs for smallholders.

Government aspirations look positive for environmental sustainability based on their goal to conserve the forest and the environment in the upper watershed, such as making terraces in slope areas, planting trees, and intensifying the land. But the government aspiration oftentimes is not suitable with the reality at the local level

TABLE 2.12: Government's perceived sustainable livelihoods

Goals	Government's aspiration/livelihood ideas for smallholders	Viability for smallholders
Sustainable environment	Terrace in sloping areas	Costly, unclear how it will increase the income, reduce yield/income
Sustainable environment	Land intensification	Lack of water
Sustainable environment	Planting trees	Lack of water; it does not address the income goal
Sustainable environment	Set the proper space for the tree planted	
Sustainable environment	Tree maintenance	
Economy	Modern livestock management	Lack of water, lack of land, costly, lack of knowledge and expertise
Resilience to CC	Planting various crops	Lack of water

Source: survey and interview

especially smallholders' goals and the resources available at the local level. Hidayati (2011) concluded that despite the complexities of the issues in the upper watershed of Batulanteh, sensible focus on economic development is likely to be most successful.

2.8.1 Terrace in Slope Areas

Soil erosion is one of the major concerns of the government in the upper watershed of Batulanteh, due to the high erosion rate that makes this watershed a priority I type

watershed needing urgent attention. The government perceives that smallholders' slash and burn livelihood practices for paddy and maize are the cause of the high rates of erosion and that in order to reduce soil erosion, smallholders should make terraces on their land by themselves: *"Ideally, the slope land should be turned into terrace to hold the water longer in the land so it will not become a run off to the river."* (Regional Planning Agency of Sumbawa District, 2016).

However, this government aspiration is beyond smallholders' capacity, in that their land is mostly in sloping and rocky areas, making it difficult for the smallholders to make terraces without the necessary equipment. For the smallholders who need to make money daily, they do not have time to make such terraces after a long laborious day. They also do not have money to hire human labor or heavy equipment to make the terraces.

The government has programs to make new paddy fields that they have attempted in Sampak village. New paddy field establishment is a part of the central government's program through the agricultural agency with the state budget, aimed at improving food security by making new paddy fields on land considered as potential but which has not been developed for agriculture. However, this program has failed to increase local people's income, and on the contrary, as decreased it in some cases. The government changed the dry land of smallholders into terraced paddy field, but the land remains dry because it can only be planted during rainy seasons due to the lack of water and irrigation. The topsoil that is already very thin in the upper watershed was removed during the construction of new paddy fields. Therefore, the maize that smallholders plant in those new fields cannot grow as well as that planted in the land that is not converted into terraced paddy field. As one farmer stated:

What government called as new paddy field is not paddy field at all. Paddy field is the one that we can see in Batu Tering, or Sebasang Village. That kind of land we can call paddy field. What did they make here? Oh my! It is so ugly. It is not even flat nicely. Even more, there will be neither dam nor irrigation. However, if we get dam, it will turn to be a nice paddy field.

The program promoted by the local government did not undergo economic impact analysis, and smallholders' livelihood goals were not part of the program. The government prioritized erosion prevention rather than increasing smallholders' income, shown by the making of terraces for paddy fields even though there are no water resources for them. It decreased smallholders' income by depleting the fertile top soil.

2.8.2 Timber Plantation Program

Timber planting is a result of a discourse put forward by the government in the upper watershed. For the government, timber is one of the livelihoods that should be the mainstay in the upper watershed because it is seen as more compatible with the allocation of the watershed as forest. Timber is considered as a key to substitute for agriculture, which is perceived as the main culprit of deforestation and forest degradation. The government has tried some programs to promote timber, such as in Kelungkung where some smallholders planted teak wood and *Paraserianthes* sp. 5 to 10 years ago as suggested. However, it turned out that after the timber is ready for harvesting, selling timber is not as easy as cropping because the local people must go through certain administrative process and complete documents stating that the logs come from timber planted on their land. This has made the local people reluctant to plant timber producing trees. Even more, smallholders oftentimes choose to sell their land with timber producing stands on the land cheaply so they can

buy other land where they can plant cash crops. In addition, smallholders are also reluctant to plant timber producing trees because they have to wait for many years before they can receive the income from it, while they must fulfil their daily basic needs. Smallholders do not perceive reforestation for future timber as an economically viable option (Hidayati, 2011), confirming the findings from other studies that show the importance of economic factors on how farmers perceive and adopt conservation practices. Smallholders have been reluctant to adopt conservation practices and are less likely to change their production practices to protect the environment if adoption of new practices threatens the economic viability of the farm enterprise (Napier and Brown, 1993; Napier and Forster, 1981; Bayard and Jolly, 2007).

The idea to plant timber oftentimes does not come from the central government but rather comes from the government officers at the local level. In my research area, based on my interview with the head of Forest Management Unit, it turned out that it was his idea to promote certain trees based on his visits to other places during training on agro-forestry. *Now I want to try to persuade the local people to plant cajuput. I have seen in the eastern part of Indonesia, many people plant it. It has economic value. So I am going to try this.*" (Head of KPHP Batulanteh, 2016).

Another official noted:

Now there is a program from Jul, planting cajuput, to protect the forest. So in order to succeed, we back up the program with planting maize so that the local community can have some interim income because farmers here do not want to wait long. We hope that by planting maize, they will also take care of the cajuput. Because if it is only cajuput, they do not want. They want quick results. (Head of Agriculture Agency Sumbawa District, 2016).

The quotes above show the community's dilemma in trusting the government, because it is difficult to differentiate if a program is a personal idea or if it is an official

program from the government taken with proper coordination and policy to ensure sustainability. Government programs in the upper watershed are often sporadic or random, depending on the local government officer in power, without adequate policy support to guarantee that 5 – 10 years ahead, a market will be secured and the policy to sell timber is clear and will not be changed. Moreover, government officers often are reassigned to other agencies depending on the local political situation. Their assignment is decided by the head of the district who will assign and reassign positions based on whether someone supports him/her during the election. Hence, certain programs promoted to the smallholders can suddenly stop or become unclear in the future with the changing of personnel in the government agency.

2.8.3 Tree planting program

Tree planting is one of the government's priority programs in the upper watershed, intended to rehabilitate critical land after forest conversion into arable land. Critical land perceived by the government is land of smallholders acquired mostly from forest conversion. The government program so far is to rehabilitate the area by planting trees and provisioning of seedlings as shown in Table 2.13. The smallholders considered this program to not produce any economic benefit. The government hopes that smallholders will be willing to plant the seedlings they have provided in the smallholders' land to increase land cover. Even if the government provides seedlings, smallholders are reluctant to plant them because their land is limited. When the trees are three to four years old, the land can no longer be planted with other crops. Thus, the smallholders prefer to use their land for planting commodity which can bring in immediate cash such as corn or for food security such as paddy. The government's

program to plant trees, specifically fruit trees considered to be able to provide future income is also difficult to be done in upper-watershed because the area lacks water. Some smallholders who tried to plant fruit trees stated that the trees they planted could not survive the dry season particularly during early stage of planting.

TABLE 2.13: Government conservation programs in the upper watershed

Location	Time	Activities	Observation
Batudulang Village - Dara River (Brang Dara)	2004	Agarwood tree planting (5 ha)	Poor tree growth. The living trees are only in 20 % of the total 5 hectares of the planting areas due to fact that the planting areas are in the dense vegetation forest.
Kelungkung Village - Semongkat River	2004	Agarwood tree planting	-
Kelungkung Village - Setongo River	2008	Teak and Rosewood tree planting	Poor tree growth. There are very few living trees due to poor maintenance.
Kelungkung Village - Kokar Ai Barat	2009	Toona sureni tree planting (50 hectares)	Healthy tree growth. The planting area is in limited production forest. In the same area, smallholders also planted candlenut and rosewood.
Kelungkung Village - Ai Panan	2004	Teak tree planting (50 ha)	Poor maintenance. Teak tree planting is at smallholders' land. Smallholders' plan to convert the teak tree planting area to be a maize plantation.
Batudulang Village - Lenang Belo		Mahoni dan Gamelina tree (30 ha)	The tree planting area is at smallholders' land.
Batudulang Village - Padea		Toona sureni, banyan, durian, sorea (50 ha)	Protected forest
Batudulang Village - Sampar Nunang		Coffee plantation for (30 ha)	The coffee planting area is in smallholders land.
Batudulang Village - Kokar Eta	2014	Avocado tree planting (10 ha)	The avocado tree planting area is in smallholders' land.
Batudulang Village - Kokar Eta	2014	Snake fruit (Salacca edulis) (10 are)	The land for snake fruit planting is in smallholders' land.

Source: Samawa Center (2017)

An interview with the Head of KPH Batulanteh revealed that tree planting program conducted in the upper watershed of Batulanteh was conducted based on a critical land map from Watershed Management Unit.

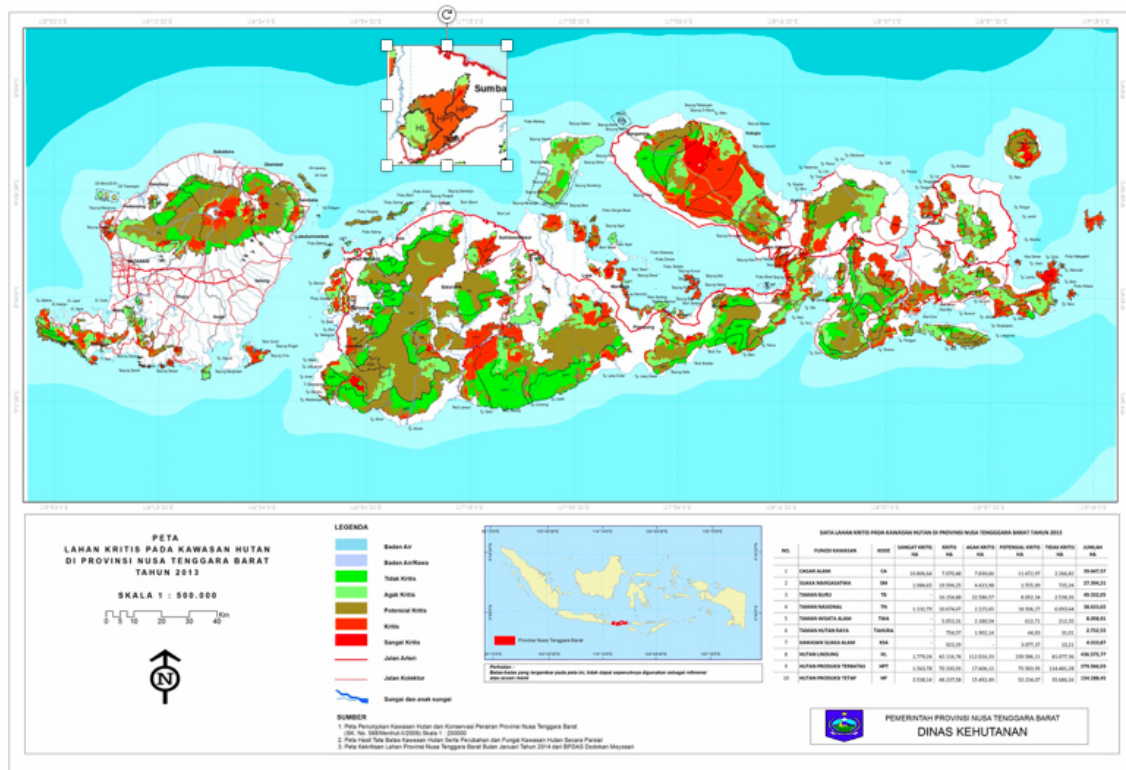


FIGURE 2.10: Map of Critical Land in NTB Province
(www.dishk.ntbprov.go.id/peta-kehutanan)

The critical land for tree planting is the land that has been cleared by smallholders, and the government also promotes tree planting in smallholders' land. The government targeted the tree planting program in Batudulang Village for 25 ha in 2009, with an additional 10 ha of critical land to be planted in 2017. For example, in December 2017, the government provided fruit 6000 trees to be planted in Batudulang Village. In Kelungkung Village, the government targets the tree planting

program for 20 ha consisting of 15 ha of critical land within the state forest and 5 ha of smallholders' lands, providing cajuput trees and lemongrass to be planted. The tree planting program is absent in Sampak Village. The government acknowledges that the tree planting program is challenging because smallholders do not want plant the tree due to limited land: *"This program is quite challenging. Smallholders who cleared the forest will not move from forest areas due to limited land."* (Head of Forest Management Unit of Batulanteh, 2017).

Overall, the smallholders considered this program to not produce any economic benefit. The government hopes that smallholders will be willing to plant the seedlings they have provided in the smallholders' land to increase land cover. Even if the government provides seedlings, smallholders are reluctant to plant them because their land is limited. When the trees are 3 to 4 years old, the land can no longer be planted with other crops. Thus, the smallholders prefer to use their land for planting commodities that can bring in immediate cash, such as maize, or for food security, such as paddy. The government's program to plant trees, specifically fruit trees considered to be able to provide future income, is also difficult because the area lacks water. Some smallholders who tried to plant fruit trees stated that the trees they planted could not survive the dry season, particularly during early stage of planting.

2.8.4 Animal Husbandry

The government does not consider animal husbandry as a priority in the upper watershed, while livestock is smallholders' aspiration as a source of income. The government does not oppose the idea of animal husbandry in the upper watershed, but the government criticizes the smallholders' current way of carrying it out. The animal

husbandry suggested by the government is an intensive modern form where raising cattle is the main and only job for smallholders, and this kind of animal husbandry requires a lot of livestock. Smallholders currently cannot even afford to buy one cow, let alone have a lot of livestock as required by the government. In addition to lack of financial capacity to fulfill this government aspiration, modern animal husbandry cannot be practiced in the upper watershed due to water accessibility. It is already difficult to meet domestic daily needs for water, and it will be even more difficult with cattle. Smallholders land is also limited, making it difficult to source cattle feed.

2.9 The Causes of Conflicting Goals

2.9.1 Land or Forest: the Center of Conflicting Goals

The different goals of the smallholders and the government are centered around the same asset: land or forest. Smallholders' livelihood strategies to achieve their income pursuits are mostly land-based livelihoods, thus to increase their income, they try to improve production. Because smallholders' land is dry land, the only way to increase production from this land-based livelihood is by expanding the land by converting forests. Thus, for smallholders, the forest is seen as a potential asset, which when converted to arable land, will increase yield and consequently their income. For the government however, the forest in the upper watershed is important for environmental services such as water and biodiversity and also to mitigate climate change, thus, forest must be conserved and if possible, to be increased. The government thinks that smallholders' land, seen as critical land which originally was a forested area,

needs to be rehabilitated, while sustainable environment is not a livelihood goal of smallholders.

Smallholders in the upper watershed of Batulanteh oppose the forest protection policy of allocating most of the land in the upper watershed, as the state forest limits their livelihoods, especially the slash and burn practices for planting paddy and maize. They feel that the land available is very limited and thus cannot fulfill their needs, and that in order to improve their livelihood, they need to have more land. Yet they are prohibited to expand their land in the state forest, and conflict over forest utilization has been ongoing in the three villages. This is a common problem in Indonesia; Li, 2002 states that the factor that almost all smallholders have in common in the upland area of the country is that they occupy land defined as public domain to which they have no legally recognized title.

The government considers slash and burn agriculture as a major threat for forests in the upper watershed, while the government's concern that shifting cultivation will lead to deforestation and critical land is considered as unreasonable by the smallholders. According to the smallholders, after the forests are cut down and cleared for agriculture, the succession of the land is quite fast as seen by the rapid growth of grass and bushes, and the trees will grow again. They do not perceive practicing shifting cultivation as violating any laws. They perceive that they have never opened the state-owned forests, and instead they practiced shifting cultivation in community forests. They perceive that they know the boundary of state forests and that according to them, on the contrary, it is the state that takes large portions of community forests.

Boundary marking of state forests is a problem in Kelungkung and Batudulang

villages. The communities think that the State has moved the boundary markers and now the boundaries are placed within the community forests. In Batudulang Village, when the government official determined the boundaries, the village population was not as high as now and there were enough lands for everyone. They agreed at that time with the boundaries being moved forward toward the village because the government official promised to give the land back if one day it would be needed by the local people. Now the local people feel that they need more land, but they do not know the procedure to claim it back and whether it will be approved. The smallholders also feel that the boundaries set by the government lately is different than what has been agreed upon with the local people. The local people recognize specific marks as the boundary of the state forest, while they are not familiar with the forest classification as stipulated by the government. For example, they know the boundaries of the state forest since it was historically marked by a big stone called “Batu Kuta”. But lately the government does not acknowledge that boundary and has in effect set new boundaries. The local people think that the government official who came from outside of the village does not have any knowledge of the correct boundaries, since that official simply arrived with a map, changed the boundaries of the land, and caused disadvantages to the local community in limiting the access of smallholders to forested land.

For the forestry officer, forest boundaries enforcement is a part of the policy from the central government that they must implement. Field officers oftentimes are in a dilemma, since they usually go to the field with a map provided by the central government, and when they are to put the boundaries, they are protested against by smallholders who have their own perception on where the boundaries should be. The

field officers, who are mostly newly placed in the upper watershed, do not know the conflict history between the government and smallholders, while for smallholders, the fact that they are new officers in that area is considered as one of the factors that make the establishment of the boundaries incorrect.

“If this forest belongs to the State, there should be a sign. There are many names, I don’t really know. There are this forest and that forest. Since a long time ago, there are signs in the form of stone that we called as ‘batu kuta’. That sign has been there long before our mother and father were born and it is always called ‘batu kuta’. Only recently there are some changes. The forest boundaries are moved toward here [to the smallholders’ land]. Although we never cultivate any areas beyond the ‘batu kuta’, we are not allowed to do slash and burn. Everyone in the village knows about it. They know exactly where the batu kuta is located. The officers do not know. They come from Jakarta [Capital of Indonesia] only bring some maps. They do not know about ‘batu kuta’, not like us, we all know it by heart.” (FGD Older generation, Batudulang Village, 2016)

“This is the truth. There was a forestry officer. We followed him when he put the markers of the forest boundaries. The markers were placed far from the village, around more than 10 km. They were far in the forest. But recently, some forestry officers came to put the markers of the forest boundaries differently from where they have been placed before. The areas, which have been opened by the local people, now become within the border of the forest. So we are getting less and less land.” (FGD older generation, Kelungkung Village, 2016)

“On Sekunyit Hill, there is a cliff, and there is small savanna. There is the boundary previously. The previous boundary is far from the village. Pangkit Hill, which is seen from Sekunyit, is where the marker of the boundary was previously. Now the marker is in the Telkomsel tower. The other marker is where we took some guavas yesterday when you came, where there were horses. There is where the last marker was placed. Just compare it with the marker in Sekunyit, so far. Markers in the past were made of wood, not concrete like nowadays, so they are probably rotten. If only the officers that came yesterday brought us along with them to the forests, we would have shown them where the previous marks were.” (FGD older generation, Kelungkung Village, 2016)

“For us, the previous markers cannot be changed. They have been placed in batu kuta. Everyone in this village knows batu kuta. Therefore, those officers did not need to put the new ones incorrectly using that tool [GPS]. There was almost a fight due to it. The latest markers were installed five years ago, while the previous markers were installed almost 20 years ago. They control the new

markers. They always come every year to control the new markers. This makes us more miserable.” (FGD older generation, Kelungkung Village, 2016)

In Kelungkung Village, smallholders also think that there are many forested areas which were previously accessible and which have now been restricted. They perceive that the local people who guide the government officials to put the forest boundaries are not knowledgeable about the forests in Kelungkung and are not the persons who know where the original boundaries were placed. As a result, the guides only brought the government official to areas easily accessed, which are actually the local people's land. Thus, the smallholders hope that this policy can be changed to accommodate their needs for more access to land: Allow me to add a bit more. I am a farmer and a father of three. My priority is these three children. I only have land around 2 ha, so how about my third child? That is what I need to consider. We really hope that there is a possibility to expand our land by moving the boundaries. And our land is dryland. So we can only plant once in a year, only in the rainy season. We cannot plant in the dry season. These lands have many big stones, we cannot plough them. So that is our wish. Please move the boundaries of the state-owned land backward into the forest so we can have more lands to work on.” (Pak Ustad, Male, Kelungkung).

Sampak village also has the problem of lack of access to land. Currently, smallholders' main priority in Sampak Village is planting maize, but this has become an issue which is conflicting with forestry policy. Therefore, the district forestry agency has encouraged the local people to stop expanding maize fields and even asked the local people to reduce their current maize fields. But the local people want to expand their land for maize, and the only way to have more land is to encroach into forests. They do not have any other choice to increase maize production other than having

more lands because the land can only be planted once a year. They think that they would not need to expand their lands if there was a dam and irrigation channel running on their currently rain-fed maize field, as a dam will make it possible to plant two to three times in a year.

“...So if water is available, we do not need to cut the forests. But now we have to cut the forest to expand arable land because we can only harvest once a year (water will change the agricultural scheme and land can be cultivated more intensively). Because then we can work on the same lands more than once in a year”. (Manesh, Sampak Village).

The problem of limited land is not a problem merely caused by the forest protection policy in the upper watershed, but it is also caused by the extensive form of agriculture passed on generation to generation in the upper watershed. Li, 2002 has noted that temporary or permanent conversion of forest to agricultural uses has long been part of the livelihood repertoire of upland peoples, and rural people who live in or near forest do not necessarily wish to sustain them as forest. Thus the problem of limited land can also be seen as a result of smallholders' livelihoods that are too dependent on land-based livelihoods, such as agriculture and agroforestry. The more land that smallholders have, the more yield they could get and the more options they could have for crops diversification and combination. Therefore, limited land is also the outcome of the absence of non-land based livelihood options for smallholders. High end agriculture commodities and processing of products for a better price in the market are also absent. Smallholders sell low priced raw agricultural and agroforestry products such as hard shelled candlenut instead of peeled candlenut. They are thus dependent on higher quantities to get enough income instead of selling high quality products with a better price.

Certain livelihood choices such as planting candlenut also makes it difficult to

plant other crops in the same land. While smallholders can still plant paddy when the candlenut is still one to three years old, in the fourth year, smallholders can no longer plant paddy. Most of the smallholders in Batudulang Village whose land is full with candlenuts are no longer practicing shifting cultivation. For them, candlenut is a compromise livelihood that can make the upper watershed green as required by the government, while at the same time the smallholders can maintain their land tenure. Smallholders perceive that planting candlenut is sustainable for the environment because after they converted the forest into agriculture land, the land will be green again and by planting candlenut, they have already taken the responsibility to protect the water for downstream population. This may be a misleading conception because a candlenut landscape is different than a forested landscape in terms of the biodiversity richness or other ecosystem services. Therefore, further study on the environmental impacts of candlenut in the upper watershed would be needed before determining this to be more sustainable livelihood.

Population growth will aggravate the land scarcity problems and intensify the conflict between government and smallholders. In addition, land grabbing is occurring significantly in the upland watershed, particularly in Kelungkung Village, made possible by good road access and beautiful upland scenery. Land grabbing occurred because the local people sell their lands located by the road with beautiful scenery in the hope that they can still get new land by opening forests like they used to do.

The problem of lack of land is also strongly related to soil fertility and availability of and access to chemical fertilizers. Decreasing agricultural yields are perceived as the outcome of lack of fertilizer, a major problem for smallholders particularly in Kelungkung and Sampak villages dependent on paddy and maize which need chemical

fertilizers. In the past, farmers planted local paddy seeds that could grow well without chemical fertilizer, but farmers stopped planting the local paddy variety when the government introduced new ones. The new variety only needs 3 -4 months to harvest, compared with the local variety which needs 5-6 months to harvest. Moreover, the new variety is also considered to be more practical and easier to harvest. But the new seeds cannot grow well without fertilizers. This might due to the fact that the variety was developed in Java, which has better soil nutrients than Sumbawa. Maize seeds were also introduced from outside of Sumbawa that can only grow well with fertilizers. Smallholders perceive the increasing need for fertilizer for maize over time, as the same amount of fertilizer that produced good yields in the past is not enough now.

Government policy is one of the reasons why farmers have become too dependent on chemical fertilizers. The government implemented their policy to introduce modern corn and rice seeds without paying attention as to whether the seeds were appropriate or not with the soil and environment conditions locally. Generally, seeds are developed by the Indonesia Institute of Science located in Bogor where the soil and climate is different from Sumbawa or other places in Indonesia. The new seed varieties require high soil fertility; thus it is unrealistic to be implemented in the upper watershed setting which force the farmers to use fertilizers so the crops can grow well. Policy to introduce these varieties is accompanied with subsidies for seeds and fertilizers which made farmers attracted to plant the new varieties. At that time, the yields were satisfactory because when introduced with the seeds, the farmers also received the subsidized fertilizers and the soil was still fertile because it had not been exposed to synthetic fertilizers. Later on, the government removed the subsidy for seeds and the

fertilizers. As a result, farmers now have to buy chemical fertilizers to get good yields. On the other hand, farmers can no longer plant the local rice seeds because they no longer preserve their local seeds. Even if the local seeds were available, they cannot grow well because the soil fertility has changed due to the accumulated use of chemical fertilizers. The local government during the past years has prioritized their policies to increase the production of maize through subsidies for fertilizers and seeds, which put more pressure on the forest, leading to conflicts with other government policies for forest conservation. This is what has happened in almost all parts of Sumbawa in the last couple of years, worsening the soil fertility problems and leading to increased floods.

2.9.2 It is All about Forest: Narrow Interpretation of Environmental Sustainability

Conserving the forest is the only means for the government to achieve their goal to sustain the environmental services provided by the upper watershed ecosystem. The government considers conservation as needing to maintain or increase forest cover, without considering that there are other factors causing environmental degradation in the upper watershed such as agricultural practices with high inputs of chemical fertilizer, no tillage systems, or merely due to the physical characteristic of the watershed morphology which is a sloping area and is prone to soil erosion regardless of the livelihood of smallholders. Increasing forest cover or land intensification as perceived to be sustainable for the environment by the government does not mean that environmental degradation does not happen. But the government does not focus on other elements of conservation such as soil conservation or conservation agriculture:

the upper watershed is all about forest conservation. This determination is not based on adequate research on the environment having a capacity to support the goals of smallholders and also to maintain the environmental function. So far, the amount of forests that need to be conserved was not decided based on research on carrying capacity, and the impacts of increasing or decreasing forest remain unclear until now. The amount of forest to be conserved was decided by the government, without a clear basis on how they came up with the figure. Due to this lack of clarity, the government then one-sidedly can expand the amount of forest they want to conserve simply by arguing that forest is important for environmental services.

2.9.3 Sacrificing other for the Benefit of Others

Environmental sustainability through forest conservation, the main policy priority for the government in the upper watershed, is centered around other populations who do not live in the upper watershed, such as downstream populations (in terms of water supplies) or the international community (in terms of carbon mitigation). With the narrative regarding forest conservation never built to benefit smallholders where the policy takes place, it is not surprisingly that government policy fails to address smallholders' livelihood goals. The conservation narration is not linked to how it will increase smallholders' income and well-nor does it acknowledge that smallholders who live close to the forest are poor. There are insufficient policies to develop off-farm based livelihoods or policies that will permit smallholders to do more intensification on their land rather than land extensification, such as policies to build dam structures. The government does not address smallholders needs through their programs: instead they push their own goals aimed at other beneficiaries.

2.9.4 Deliberate Smallholders' Choice to do Land Extensification

There is always a possibility that land extensification is a deliberate choice of smallholders regardless of the structural barriers. My research shows that the extensive form of agriculture has become a part of their livelihood portfolio from generation to generation which is strongly linked to their traditional knowledge that includes cultural and belief system which will be explained more detail in Chapter 3. Therefore, smallholders themselves are keen to do this type of livelihood. For example, smallholders feel fulfilled to plant paddy because they like the work that permits them to be together as community for traditions related to it of which they feel proud:

“You should come here when we do the rituals during paddy planting or harvesting, it is so joyful. Everyone gathers together, we have lots of food, we sing happily, we work happily on the farm, and many unique things that you can see, such as how our elder stewards watering the land with certain type of water, or how we make formation and produce certain sounds when we plant the paddy.” (Anjes, Kelungkung Village, male).

“Oh, I am the champion in “ngasak” a traditional way to plant paddy using a long bamboo and sharp metal. I can make so many holes for paddy seeds in a minute. I even go and join the ngasak competition in different villages. I really like this. I can even sleep on the road at night on my way to join the competition in other villages.” (Jahuri, male, Sampak Village).

In the past, opening new rain-fed land is not considered detrimental to the environment due to several reasons. Smallholders practiced the slash and burn with long enough fallow period and the land was also still abundant. But now, due to the increased population, fallow periods becomes shorter and demand for land is higher. Hence, it is impossible to do it without converting the forest. Thus, when the government prohibits them in doing slash and burn, a practice which they have done for generations, smallholders disregard the prohibition and keep doing it as before. They

keep doing it not only because it is a necessity for them in terms of sources of income and food security, but also because they like doing it. They may also keep doing it as a form of resistance to the government's policy. Not only because it is strongly linked to their culture, smallholders also deliberately perform livelihoods for which there are open markets for them, such as maize. Therefore, there is no guarantee that smallholders will not expand their farm land regardless of government policy due to economic pressure and population growth. The implication of this deliberate choice is that smallholders should not be seen as merely as the victim of policy, because it could be a deliberate choice rather than a structural constraint. Even though the government does not build their argument on how their conservation policy benefits the smallholders in the upper watershed, livelihood choices of the smallholders have created environmental degradation such as in the disappearance of guava and fern and soil fertility depletion shown by increasing need for chemical fertilizer.

This shows that the goal of the government is not always bad for the smallholders. Likewise, the deliberate action of smallholders is not always good for the environment and could be detrimental for the sustainability of their own livelihoods and future adaptation to climate change as shown in my research. Moreover, smallholders' livelihood in the upper watershed of Batulanteh Watershed is highly dependent on forest-based livelihood such as forest honey, candlenut, and other NTFPs. Hence, the government's goal to conserve forest actually protects smallholders' livelihoods that depend on the forest. This shows that the government actually can build an argument on environmental sustainability related to their conservation policy that will benefit smallholders in the upper watershed in the long run and not only focus on the benefit of conservation for the downstream population or international population.

This needs to be done to gain support from the smallholders, which is currently not happening.

2.10 Conclusions

In the upper part of Batulante watershed, livelihoods rely heavily on income pursuits, considered more important in comparison with subsistence goals. In contrast, environmental conservation is not a part of their livelihood goals. In order to achieve their income pursuit goal, smallholders rely heavily on land-based and forest-based assets, which are also the sources of conflict with the government. Such conflicts arise as the income pursuit activities are in friction with the government's conservation goals, centered on the same asset of land or forest. For smallholders, the forest is seen as a potential resource that can be converted into land in order to increase their income. For the government, however, the forest in the upper watershed is seen as an important ecosystem to sustain environmental services, such as water and biodiversity and also to mitigate climate change, consequently, forest must be conserved.

As a result, conflicts over forest utilization have been ongoing in the three villages for the last years. On one hand, the government perceives that smallholders' livelihood increases forest degradation causing negative impacts, and in particular downstream water problems. The government accuses smallholders carrying out their livelihood, of causing environmental problems in the watershed and forest degradation. The government believes that smallholders exhibit a lack of knowledge, laziness, a lack of agency, an opportunistic behavior, and greediness. They also perceive that the open access nature to the forest in the upper watershed with unclear property rights is one

of the major causes of deforestation.

On the other hand, smallholders perceive that the government's forest conservation policy reduces their access to expand their land, preventing them from achieving their income pursuit: because their major livelihoods that are land-based livelihoods are carried out under conditions of limited land due to restricted access to the forest compounded by the condition that the limited land available is low-productivity dry land. In contrast, smallholders do not perceive that their own livelihoods are degrading the state forest.

The government has asserted that making terraces in sloped areas, planting trees, and land intensification could become the basis for sustainable livelihoods in the upper watershed. However, the reality is that such activities yield reduced profit, and the programs introduced by the government believed to be sustainable for the environment were not feasible for smallholders and did not help them to increase their income. Smallholders, consequently, remain dependent on trying to exploit the forest to survive. As a result, the government's aspiration and the smallholders' goals continue to conflict. Moreover, climate change will further affect the smallholders as I will explain further in the next chapter.

Chapter 3

Smallholder and Governmental Knowledge in a Changing Climate

3.1 Introduction

It was December when I undertook my fieldwork in the three villages in the upper part of Batulanteh Watershed in Sumbawa, Indonesia. There was not a single drop of rain despite the fact that it is normally supposed to rain since late August; smallholders put strong emphasis on how abnormal the climate was and how it caught them off guard. Dealing with the impacts of climate change brings attention to the existence of local traditional ecological knowledge (TEK) systems that have persisted from generation to generation, contributing to building their culture, guiding livelihoods, and being a part of everyday life. Climate change will be a test for a TEK system: whether knowledge about climate changes have been included in TEK, and whether TEK can be developed as fast as the climate is changing.

This chapter will explore climate change phenomena in the upper part of Batulanteh watershed, smallholders' knowledge on climate change and the use of climate

change knowledge in smallholders' livelihoods. I will also discuss the barriers to developing climate change knowledge. Furthermore, this chapter discusses the government's climate change knowledge and the interface between government and TEK. There are three key points in this chapter. First, smallholders are able to observe the climate change phenomena happening in the upper watershed of Batulanteh, such as strong winds and decreasing and erratic rainfall. However, their knowledge about those phenomena is limited, due both to the nature of climate change and beliefs that people have about it. Second, while smallholders' climate change knowledge is incomplete, the climate change knowledge posed by the government is also unable to help smallholders because (i) the characteristics of the information does not suit smallholders' preferences, (ii) the communication of this knowledge is poor, and (iii) the community's acceptance of the information is viewed through the lenses of the relationship between the government and smallholders, which is often conflictual. Third, my research also finds that TEK is declining due to changes in rural livelihood and smallholders' aspirations such that they do not always want to sustain their TEK.

3.2 Literature Review

Berkes, 2012 defines TEK as: “a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (p. 7)”. Some scholars believe that TEK is very relevant and adaptive to climate change (Berkes, 2012; McNeeley and Huntington, 2007; Adger et al., 2003; Leonard et al., 2013, Egeru, 2012). They believe that

TEK should be incorporated in climate change policy in order to develop effective adaptation strategies that are cost effective, participatory, and sustainable (Egeru, 2012).

There are several reasons why TEK is believed to be important for smallholders to adapt to climate change. One of them is that TEK's existence is undeniable; it is already a strong basis for the life of smallholders' in developing countries (Berkes, 2012). For the local community, TEK is often a rule of thumb to be followed by community members that maintains security, assurance or risk management and which also provides them with a sense of community, belonging, and stability in an uncertain world (Nyong, Adesina, and Elasha, 2007). Thus, when climate change hits, TEK will shape the process and outcome. Thus, when climate change hits, TEK can shape the process and outcomes of adaptation because it is a part of existing social, economic, and cultural systems, and influences individuals' preferences, beliefs, daily practice, perception and response to climate change (Leonard et al., 2013). Moreover, TEK is believed to be valid and an essential source of information about the natural environment and its resources, and the relationship of people to land (Berkes, 2012). Thus, TEK can offer an improved understanding of the dynamic interaction between nature and society situated in particular places and cultures in the context of climate change (Berkes, 2012) especially both for observations of directions and degrees of change experienced locally (Kelman, Mercer, and Gaillard, 2012).

The proponents of TEK believe that smallholders have developed knowledge on climate change or that they will be able to develop it. Climate change is not something new for smallholders since it has happened in the past. Smallholders are sensitive to the sign and signal of change and they have accumulated information and developed

their knowledge and created strategies to cope with climate variability and weather extremes (Adger et al., 2003; Berkes, 2012; Leonard et al., 2013). Some local populations have developed and implemented extensive mitigation and adaptation strategies that have helped them reduce their vulnerability to past climate change through the use of TEK is used for coping and adapting to climate change (Egeru, 2012).

The proponents of TEK also argue that scientific knowledge about climate change is not sufficient for local adaptation, as local knowledge specific to the ecosystems and social conditions of a place are most needed (Lebel, 2013). TEK is more specific to the geographical and cultural features of place that reflect a longer history at finer spatial scale than instrumental observation, and TEK is better integrated with social experience (Lebel, 2013). The acknowledgement of TEK in adaptation to climate change will increase the success rate of the adaptation projects, because it is deemed relevant to the local culture, reflects community members' perception and world-view, and it is more participative (Nyong, Adesina, and Elasha, 2007; Lazrus, 2015). Climate change adaptation policy that does not recognize and prioritize community values, such as through validation of TEK, is believed to present a potential problem (Lazrus, 2015).

Despite the necessity to acknowledge TEK in adaptation to climate change, some researchers also acknowledge that community observations, priorities, past experience, and ways of learning may not be sufficient for climate adaptation planning (Lazrus, 2015; Linden, 2016; Vlek, 2000; Adger et al., 2003; McNeeley and Huntington, 2007; Berkes, 2012). Climate change poses novel and different challenges that could go beyond the capacity of the TEK system to adapt. Recent climate changes are large in scale and magnitude, unpredictable, multifaceted, and they occur at a rapid rate

and at a drastic timeline such that the change may turn out to be unprecedented in human history; this rapid pace of change does not give sufficient time to TEK to accumulate a depth of knowledge, store in social-ecological memory, and provide adequate time to adapt (Adger et al., 2003; Linden, 2016). People may rely on past experience to adapt to climate change that will not be sufficient to cope with new circumstances (Adger et al., 2003). Local knowledge is also considered to be prone to confirmation bias and some inaccuracies, and it may be contested (Lebel, 2013). Hence, for some scholars, TEK cannot be a panacea for adaptation (Kelman and West, 2009).

In order to be improved, strengthened and be more effective for adaptation actions in a time of change and uncertainty, some scholars suggest that TEK should be able to learn from within and elsewhere and must be combined with scientific knowledge (Lebel, 2013). Adger, Arnell, and Tompkins, 2005 have stated that communicating climate change information is one of the most important points in building adaptive capacity. Local knowledge can change rapidly as a result of experiences and interactions with external knowledge (Wisner, 2010). Despite the fact that smallholders have actively developed their traditional climate knowledge, to date, it is the government who is considered as the main actor in climate change awareness raising efforts by providing scientific information on climate change to be in line with the state adaptation strategy or aid programs (e.g. Petheram et al., 2010). Some studies have shown that in the context of successful adaptation, traditional climate knowledge systems may be counterproductive to scientific information about climate change. Raising awareness by providing scientific information about climate change may have no significant effect on changing public perception and affecting cognitive

and risk judgement because people already have existing knowledge about climate change (Nicholls, 1999; Sundblad, Biel, and Garling, 2007). Some studies also have shown that scientific information such as climate forecasts transferred to the public may not be taken seriously (Patt and Schroter, 2008), nor incorporated into people's decision making processes (Nicholls, 1999). This raises questions about what factors act as barriers to the communication of climate change knowledge between smallholders and the government.

While the literature on TEK focuses mostly on the debate of whether smallholders are able to develop their climate change knowledge for adaptation, it does not give proper attention to the factors that could act as a barrier limiting the potential development and the use of climate change knowledge. Thus, this chapter extends the question of climate change knowledge beyond the judgment of its adaptiveness but also assesses barrier to its development. Moreover, some of the debate on the adaptive power of TEK to climate change seems to be based on the belief that TEK has existed, is existing, and will exist in the future. Hence, this chapter addresses the question of TEK pathways and future existence under climate change and other stressors that have not been investigated yet in the literature.

3.3 Climate change in the upper watershed of Batulanteh

Smallholders in the upper watershed of Batulanteh perceive that climate change is happening and that they are able to observe the new phenomena. Changes that

are noticeable or perceived by smallholders are changes in wind patterns, decreases in rainfall, and erratic rainfall patterns as shown in Table 3.1.

TABLE 3.1: Climate change phenomena and perceived changes over time

Climate change phenomena	Perceived Changes
Strong wind	Strong wind is less severe for the last 5-6 years
Decreasing of rainfall/erratic rainfall	Decreasing of rainfall starting around 5-6 years ago

Source: interview

Strong winds are considered to be less intensive compared to the past, and have occurred for the past 5-6 years. In the past, smallholders felt that strong winds occurred more frequently and were more certain (i.e. at least once a year). Smallholders usually named the strong wind with names like West 1, 3, 7 and 9, which correlate to the intensity of the strong wind. West 1 and 3, which usually occur in November – December, are considered as wind that will bring good fortune because the wind helps plants to produce more fruits. West 9 is a local name for a strong wind with the highest intensity usually occurring around March or April. The latest wind considered as strong wind occurred in 2008 and 2009.

“In the past, strong wind occurs once a year. But since 5-6 years ago, there’s no more strong wind. We usually mark them. There is West 3, the wind comes three days and nights. This is considered as fortune wind. There is West 7 when the wind occurs 7 days and nights, and then West 9 when the wind occurs 9 days and nights. But since 5 – 6 years ago, it never happened again. In the past, it even caused harvest failure” (Nurdin, Male, Kelungkung Village, 2016)”

Smallholders also feel that the rain intensity and pattern are changing. Smallholders consider that in the past, the pattern and intensity are more stable compared to nowadays. They feel that currently the rain intensity is less and the pattern is erratic, particularly in the last 5 – 6 years.

“Yes, the rain nowadays is different. In the past, we had 6 months of rainy season and 6 months of dry season, right? Now, it is no longer like that. Now, we have less rain. In the past, the rainy season usually lasted for six months or sometimes more. Now, oftentimes, even though the prediction shows rainy months, the rain suddenly stops. This oftentimes causes harvest failure”(Nurdin, Male, Kehungkung Village, 2016).

These smallholders’ observations and perceptions of climate change are in line with the scientific assessment that the change in the average rainfall value and the chance of daily extreme rainfall are increasing in most parts of Indonesia (Bappenas, 2014). This shows that people notice changes during their lives, even without meteorological forecast information, and that perceived changes in local climate variability can fit well with the scientific records (Jones and Boyd, 2011; Kuruppu and Liverman, 2011). Moreover, smallholders’ perception can complement scientific climate knowledge. Climate scientists acknowledge that projections on weather and climate extreme events in Indonesia are still deficient due to the lack of data and time analyses (Bappenas, 2014). For example, weather stations mostly record rainfall parameters but rarely record the strong wind phenomenon noted by smallholders. Thus smallholders’ climate change knowledge can help to understand the more detailed climate change phenomena at the local level that can be hard to apprehend in a larger scale of analysis normally used by the government. Lack of data and attention to finer and more diverse climate change phenomena that happen in a local context will make it difficult to take appropriate vulnerability reduction or adaptation actions, which gives value to the need to combine multiple sources of knowledge.

Despite the strength of smallholders’ perception of climate change, there is a bias that hinders them to perceive certain climate change phenomena. Smallholders mostly perceive climate change phenomena that have negative impacts on their livelihoods

(discussed further in ch 4) while they tend to ignore the climate change phenomena that are positive for them. For example, climate change in the form of a long period of rain or increasing rainfall has also been noted in the upper watershed of Batulanteh. However, a long period of rain is not perceived as one of the climate change phenomena in the upper watershed because a prolonged rainy season is beneficial for smallholders. This confirms what Kuruppu and Liverman, 2011 have noted in that people mainly perceive changes which have consequences to their livelihood. The absence of some climate change phenomena in smallholders' perceptions shows that we cannot rely solely on local perception to understand the climate change phenomena in the upper watershed, but should consider multiple sources.

3.4 Factual Observation of Climate

TEK is a strong basis for smallholders' livelihoods in the Upper Batulanteh Watershed. Their main livelihood is agriculture that is sensitive to climate variability and change. Thus to be able to sustain their livelihoods, TEK systems about the local climate have developed in all three villages. Smallholders build their knowledge by observing local natural phenomena such as the sun, clouds, stars, plants, animals, water levels, and also observing the human body. In this section, I differentiate between climate and climate change knowledge.

Smallholders in the three villages use climate knowledge to predict the start of a rainy season and to guide smallholders to perform certain rituals and livelihood practices. Climate knowledge is the anticipated "default" knowledge and the situation that smallholders expect to happen to make their livelihood as "usual" every year.

Smallholders consider climate knowledge as the baseline of normality to define unusual climate change phenomena. Smallholders use climate change knowledge to predict the deviation from the expected normal climate, such as the potential for drought to happen (see Table 3.2).

3.4.1 Sign from the Sky

Cloud. A big cloud that covers the morning sun indicates the start of rainy season, and this climate knowledge exists in all the three villages. It is such a frequent phenomenon in the upper watershed that smallholders' observation of it has always proven to be right. Therefore, they are highly confident about the accuracy of this local knowledge to predict the rain and the start of the rainy season. This sign is a natural phenomenon occurring in the upper watershed due to its high altitude and also the nature of it as a catchment area where the orographic rainfall is common. Orographic rainfall is rain that is produced from the lifting of moist air over a mountain. Most orographic rain falls upwind of the mountain range, with some also falling a short distance downwind. This phenomenon occurs notably more often in Batudulang Village, which is located at higher altitude compared to the other two villages. In the other two villages, a big cloud suddenly appearing and turning to rain oftentimes occurs around the forest. Some smallholders believe that they must not be too noisy when they are in the forest especially when gathering honey because it will invite big a cloud which then will bring rain.

“Yes, once we were chased by a cloud when we were looking for honey. It was because one of our friends made loud noises in the forest. Suddenly big black cloud came and then it rained. We were all wet. Sometimes we did that just for fun so that we are all get wet. Hahahaha” (Manesh, Male, Sampak Village, 2016).

Sun. The changing position of the sun when it rises also indicates the start of the rainy season. Smallholders observe the changing sun position by orienting themselves toward certain landmarks. In Kelungkung Village, the sun rises from the position of Tambora Volcano during the dry season, while the sun rises from the position of Bukit Lesung located in the west of Tambora Volcano during the rainy season.

Stars. The appearance of star constellations early in the night that smallholders perceived as resembling local tools *rengala* and *roat* forms early in the night indicates the start of a rainy season. Rengala is a plowing tool operated by using buffalo, whereas roat is a tool for harvesting. indicates the start of a rainy season. Rengala is a plowing tool operated by using buffalo, whereas roat is a tool for harvesting. Therefore, when local people see a star constellation resembling “rengala”, they will start to prepare their land because they believe it is a sign that the planting season and rainy season is about to start. This knowledge only exists in Kelungkung Village and not in the other two.

Moon. The shape of the moon indicates the amount of rainfall. Smallholders relate the shape of the moon with the ability of the shape to retain water, i.e. a crescent with its concave facing up signifies the ability to retain a lot of water. Thus, it is the sign that rain is still abundant. The crescent with concave facing down signifies inability to hold water, and is thus a sign of less rain. The moon shape is also related with the abundance of honey in the forest. The crescent moon implies a shortage of forest honey, while forest honey is more abundant during the full moon. Scientifically, this is related with the sensitivity of *Avis dorsata*, the bees that produce the forest honey in Sumbawa, toward light. During a full moon, *Avis dorsata* become more active because their eyes can see better and they can search for food in a wider

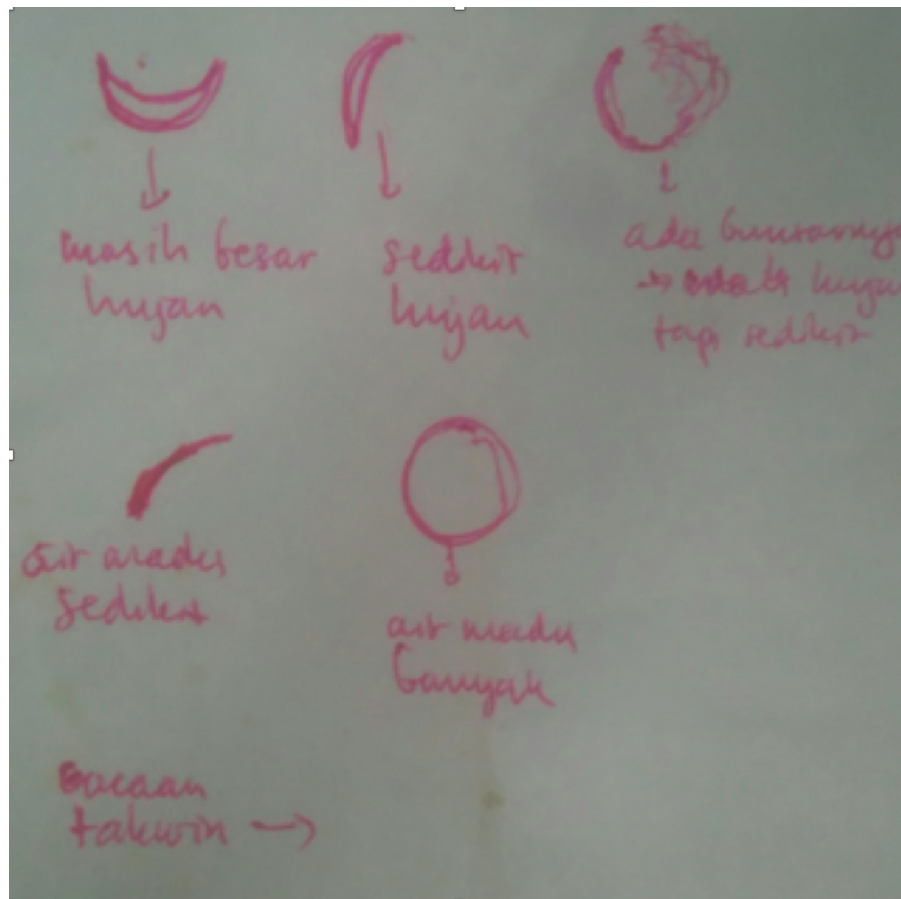


FIGURE 3.1: Smallholders' knowledge on moon, rainfall, and forest honey

area of the forest. On the other hand, they are less active during the crescent or half-moon and the production of honey falls (Dyer, 1985).

3.4.2 Plants / Tree Phenology

Certain plants and animals change their behavior as a response to the changing seasons. The flowering time for *turen tawir* and *lita*, the color changing leaves of “bunga balet”, and the longer stem of *gadung*, a local name for *Dioscorea hispida*, indicate the start of the rainy season as noted by one respondent: “Ah, when we

observe that lita tree has started to flowering, people in our village start to clean their farm field.” (Head of Sampak Village, 2016).

Knowledge on climate from observation of the trees in the forest is very strong in the three villages due to proximity to the forest. In addition, their livelihood activity as honey gatherers makes them sensitive to any signal of change from trees in the forest because honey production depends on the flowers of the trees. Smallholders will mark some trees to see whether bees have come to the trees when the trees are flowering. The arrival of bees to those marked trees will indicate the right time to get into the forest to gather honey.

3.4.3 Animal Behavior

In addition to plants, smallholders also develop their climate knowledge by observing animal behavior. When termites start making nests in higher places than before, it indicates the start of the rainy season. Termites make their nests under the ground during the dry season to protect themselves from the hot and dry surface temperature. When the termites start to move higher, it is a sign that the groundwater is raising and the surface temperature has become cooler. Climate knowledge gained from observing animal behavior only occurs in Kelungkung village. Climate knowledge acquired from termites' behavior is absent in Batudulang because termites do not live in Batudulang village, which is colder than Kelungkung village. *“Oh, there is no termite here. They can be found in Kelungkung or other places because it is cold here.” (Jalalluddin, elder steward, Batudulang, 2016).*

Some older people are sensitive to the signs given by their body to predict the climate. They feel like they will sweat more because the weather is more humid due to

the confluence of summer and the rainy season that is about to come. This knowledge is only possessed by smallholders in Kelungkung village.

3.4.4 Physical Environment

Smallholders in the three villages strongly believe that when the rainy season is about to start, the groundwater will start to rise even before the rain starts to fall. That is the reason they believe why some trees start to flowering and some plants such as *Dioscorea hispida* are sticking out longer even though the rain has not fallen. Smallholders perceive strong connection between groundwater and rainfall. The level of water increasing in the wells is a sign of rising groundwater which indicates the start of the rainy season. The smallholders in Kelungkung Village who experience dire water problems in their village are very sensitive to this sign. Furthermore, in Sampak Village, smallholders will look for the sign of the rising of groundwater by turning up some stones. When they find some moisture like dew under the stones, then it is a sign of the start of the rainy season.

3.4.5 Rain Changes

In all of the three villages, smallholders predict deviation in normal rain precipitation by observing the rain in Muharram month. Muharram is the first month of the Islamic calendar that is based on the lunar calendar, and is one of the sacred months for the local people. Muharram moves from year to year when compared to the Gregorian or solar calendar. When I was in the field, the Muharram was in October. Elder stewards predicted that there will be a drought or lack of rain this year due to the fact that the rainfall in Muharram was little. The amount of rainfall



FIGURE 3.2: *Biso tian pade* ritual in Kelungkung village

on the 1st day of Muharram is a hint to know the amount of rainfall for the future planting season: high rainfall during Muharram is a sign that the rainfall will be abundant for the next planting season, and is a good sign for smallholders that they will get a good yield.

Elder stewards predict that there will be a drought or lack of rain this year due to the fact that the rainfall in Muharram was little. The amount of rainfall on the 1st day of Muharram is a hint to know the amount of rainfall for the near future planting season. The high rainfall during Muharram is a sign that the rainfall will be abundant for the next planting season, thus it is a good sign for smallholders that they will get good yield.

“This is how our elder generation calculated it. On the 1st of Muharram, even until the end of Muharram, if there is a lot of rain, then for sure there will be a lot of rain for the coming months even in the dry season. But if there is

no rain on 1st of Muharram, then be careful and start planting soon. This has been proven.” (Budin, Male, Kelungkung, 2016).

“If we ask the elder people what are their reasonings in using rain in Muharram as the basis for predicting rain for the months to come, maybe they are not allowed to tell us why. But if we use this way, it is very rarely missed.” (Karim, male, Kelungkung, 2016).

3.5 The Use of Climate Knowledge in Livelihood Practices

Traditional climate knowledge preserves itself through practices of rituals. In my research area, smallholders have rituals that are based on their TEK. Smallholders in the three villages still practice these rituals as they strongly believe ritual will affect the productivity of agriculture. In this subsection, I differentiate between climate and climate change related rituals. Climate related rituals are a series of rituals that people practice from the start of the rainy season to the harvest time, while climate change rituals are those practiced by smallholders when climate deviates from perceived normality.

Practices related to climate knowledge. There are three major rituals related to climate in my research areas: *buka tana* (the land opening ritual), *biso tian pade* (the paddy baby shower ritual), and the harvest ritual. After the elder stewards observe and collect the signs and signals from their local environment that the rainy season is about to come, they will gather in the mosque and decide when to perform the land opening ritual. Smallholders will gather in the mosque to pray for the good planting season and eat together, signalling the start of the paddy planting season. When the paddy is in the phase of panicle development, which is around the 2.5th – 3rd

month after planting, smallholders will perform the *biso tian pade* ritual. Smallholders gather in the mosque to pray for god to give them a good harvest, and elder stewards also pray on some water brought by the smallholders. The smallholders bring back the blessed water and use it to water their land symbolically. When the paddy is ready to be harvested, smallholders perform the harvest ritual, around the 3.5 – 4th month of the planting. They bring food to the mosque and share it with other villagers. Smallholders generally donate around one sack of paddy for every ten sacks of harvest they gained.

When I was in the field, it was already the end of November and smallholders had begun to fret as the rains had not yet begun. The elder stewards were discussing in the mosque about what they would do in response to their situation. Once they decided to perform the rain prayer ritual, they reported their decision to the village officials, and they announced when they would perform the ritual through the mosque loudspeaker. The rain prayer ritual is rooted in the Islamic religion, the majority religious belief of smallholders in my research area, although it is believed that this ritual has existed long before Islam arrived. *Salatul Istisqa* is a prayer performed to seek rain from Allah Ta'ala during times of drought. Batudulang village performed the rain prayer on November 23, 2015, during my fieldwork. Smallholders chose to perform it at the Suwer River, one of the biggest rivers in their village. The religious leader led the rain prayer. After the prayer ended, elder stewards soaked their skull cap in the running water to signify the anticipated change from drought to rainy season. The younger generation threw plastic water bottles to each other to create a joyful atmosphere that signifies the anticipated prosperity that the rain will soon bring. The prayer and ritual ended with the eating of the food prepared by the women.

During my time in the field, while Batudulang Village performed the rain prayer, elder stewards in Kelungkung Village and Sampak Village were still contemplating whether they would perform the ritual or not, and they were still waiting and hoping for the rain to come soon. In Kelungkung Village and Sampak Village, smallholders had performed their last rain prayer ritual in 2010. In Kelungkung Village, the rain prayer ritual is also known as *turen brang* (down to the river ritual). Smallholders typically bring porridge, rice, coconut, fish, spices and cooking utensils, and cook traditional local food and eat together in the river after praying and splashing the water toward each other. Smallholders will do this ritual more than once if the rain has not fallen yet, and will move to other rivers to perform the same ritual until the rain falls.

3.6 Barriers for the Development of Climate Change Knowledge

Table 3.1 showed that climate change knowledge of smallholders is very limited. While smallholders have extensive knowledge to predict the start of the rainy season through the signs they gathered from their local environment (11 signs), they only have one sign to predict erratic and decreasing rainfall. Moreover, there is no sign that smallholders can use from their local environment to predict strong winds. Thus their limited climate change knowledge has little use to guide smallholders to navigate their livelihoods when climate change hits. While “normal” climate knowledge serves as guidance for smallholders to do their livelihood activities such as when to start the planting season and harvesting, climate change knowledge that smallholders have has

lead only to ritual performance. Once the ritual is performed, smallholders wait for the rain to fall so that they can resume their normal planting to harvesting. There is no particular livelihood activity that follows the rain prayer ritual that could be considered as an adaptation strategy to climate change. The fact that climate change knowledge is limited in terms of its type and use compared to “normal” climate knowledge raises the question of what factors act as barriers for the development of climate change knowledge, given changes that are highly uncertain, new and complicated.

3.6.1 Climate change is Beyond the Capacity of TEK Development of Smallholders

While some scholars believe that smallholders are in on-going learning to develop their climate change knowledge, there is always a possibility that smallholders’ TEK systems will not be able to adapt. In my research area, smallholders felt that it was difficult to predict strong wind and to understand changes in rain intensity. As one informant noted, *“Changes also occurred in the past. There is always a change. But we cannot yet figure out the changes nowadays. Is this because the moon above has shifted or the calendar?”* (Nurdin, Male, Kelungkung Village, 2016).

Smallholders in the past believed they were able to reduce or avoid the impacts of strong wind by making *lonong angin* or wind channel. *Lonong angin* is a hollow made from bamboos, installed in the smallholders’ farmfield. It is considered to be able to attract the strong wind and channel it so that the wind would not affect their farm field.

“For the wind problem, it is difficult for us to know. The elder in the past even made lonong angin, maybe because they ran out of ideas. Usually, even if there



FIGURE 3.3: Harvest celebration ritual in Kelungkung Village

was a strong wind in the village, if there was lonong angin made from bamboos, the farm field would not be destroyed. The farm fields next to or near it would be affected by the strong wind. It does not make any sense compared to BMKG's (Indonesian Agency for Meteorological, Climatological and Geophysics) ways.” (Nurdin, Male, Kelungkung Village, 2016).

There is a tendency for locals to think that climate change is beyond their capacity to understand. This may be due to the fact that recent climate changes are large in scale and magnitude, unpredictable, multifaceted, and rapidly occurring, thus there has not been enough time to accumulate TEK and get it stored in social-ecological memory for adaptation (Adger et al., 2003; Linden, 2016).

3.6.2 Climate Change is New

However, I would contend that it is perhaps too early to conclude that climate change is beyond the capacity of smallholders' TEK. The fact that their knowledge

on climate change is very limited compared to “normal” climate knowledge shows that climate change is something new to smallholders. Table ?? shows that smallholders perceive climate changes only started to happen around 5-6 years ago, but it may take considerable time for them to develop a new climate change knowledge base from their local environment and to integrate the knowledge into their livelihood practices.

Smallholders may be in the process of observing the environmental phenomena related to climate change and accumulating this knowledge. This is well-founded in my research as shown by the ability of smallholders to observe changes as accurately as climate scientists, such as predictions on rain changes in the Muharram month. Smallholders’ efforts to learn and develop their climate change knowledge were also observed. They had started to use information about climate change from outside and to interpret it within their local context. For example, they observed climate change phenomena in other places, such as floods in Jakarta, and, based on that pattern of floods, they started to relate it with the frequency of rain that fell in their areas:

“Because we often see it on TV. When rain often falls in Jakarta and then followed by floodings, then there is no rain in our place. We read it as if there is rain in Jakarta, it means that the rain has not come to our place. That is true. Because weather is swapped. We see that when there is flooding in Jakarta, then the rain in our place is decreasing, if it is dry in Jakarta, then there will be a lot of rain in our place. When we match it with the moon above or with our traditional way, then both of these pieces of information complement each other.” (Hamid, Male, Kelungkung Village, 2016).

Smallholders have also made some predictions related to climate change based on what happened in the past, and they have determined what they will do based on the pattern that occurred for the last few years. *“So, if this year we start planting in November, it means that next year we will start in December. It means that there are always some shifts. We rely on our prediction, however, our calculation is oftentimes*

missed." (Hamid, Male, Kelungkung Village, 2016). For example, smallholders also predict that strong winds will still occur in the future. This prediction is based on the smallholders' awareness on the topography of their areas, which lies in high altitude as well as from their experiences to strong winds before. They also predict strong wind based on their knowledge on how elder people predicted strong wind in the past.

"Prediction from elder people in the past said that if strong wind occurs this year, then it will not occur next year again . Wind will always occur because we are in peak areas, meaning that floods will not happen but our enemy is the wind. Therefore, our prediction is that wind will occur every year, but we cannot guarantee." (Hamid, Male, Kelungkung Village, 2016).

3.6.3 The Belief System: Perceived Causes of Climate Change

Belief includes how smallholders explain facts and cultural practices. One of the biggest smallholders' beliefs in the upper watershed of Batulanteh is rooted in spirituality, notably that climate change is the domain of God, and, thus, it is beyond human power. This finding confirms that climate variability and change is often present in religious texts and narratives of many traditional belief systems Donner, 2007. Extreme meteorological phenomena can be considered as a warning sign or punishment from God, because people were against the command of Allah Ta'ala. Therefore, when climate change hits, local people invoke Allah Ta'ala's mercy for rain and engage in abundant Istighfar. Istighfar is considered one of the essential parts of worship in Islam; the man who constantly recurs to Istighfar feels his own dependency and turns to God for help and aid by admitting the weakness of his nature and dreads the power and glory of the Creator (Abdul, 1993). Performing rituals, praying, giving alms, and promising God to do other noble things or other

rituals if the rain falls are among the things that people do to surrender to God and hope that their efforts will please God.

The belief system that climate change is the domain of God can make smallholders become more passive, in the sense that they do not force themselves to develop their own knowledge on climate change through the obvious signs in their local environment. This belief can also hinder them to accept climate change information or predictions of the climate scientists. Some other studies have found that the belief systems and worldviews can be barriers for adaptation to climate change despite the fact that people perceived climate change to be happening (Donner, 2007; Petheram et al., 2010). The existing belief system is one of the major barriers for adaptation to climate change in my research area and I return to it in Chapter 5.

Smallholders also relate the cause of climate change with the existence of Newmont Nusa Tenggara Mining Company, the second biggest copper and gold mining company in the nearby upper watershed of Sejorong in West Sumbawa District. Smallholders particularly relate climate change with use of heavy equipment for road construction, which is considered as a cause for loss of rain clouds:

“This climate changed ever since Newmont operationalized. We do not understand the advanced tools they use. We heard that they installed radars. There are clouds bringing rain which are supposed to fall around here, but because it will cause some damage to Newmont, these clouds then moved to other places by Newmont. They use modern tools which affect farmers’ yield. Why do I believe that these modern tools can move rain clouds? Because I have seen it myself when there was a road repair in this village, I forgot what year, we suffered harvest failure at that time. It was because the road repair used heavy equipment. I saw at that time there where dark clouds in Jompang and it was raining there. But the rain never reached here due to the heavy equipment.” (M. Nurdin, Male, Kelungkung, 2016).

Smallholders mostly do not relate the causes of climate change with greenhouse

gases (GHG) as understood by climate science. This confirms what Kuruppu and Liverman, 2011; Petheram et al. (2010) noted, which is that people are aware of local climate change, but often cannot explain the causes of it in a way climate science understands. However, even if smallholders make a different rationalization out of the causes of climate change, in fact, mining and forest conversion are indeed sources of increasing GHGs that contribute to global climate change.

3.7 The decline of TEK

The barriers for climate change knowledge development are not just related with to the nature of climate change and the internal capacity of smallholders' beliefs. The fact that TEK is in decline was also obvious in my research area, caused primarily by other factors. These include livelihood changes under pressures of globalization and loss of communication and trust in TEK. This will not only affect the development of TEK knowledge specific to climate change, but also the direction of the use of TEK for climate change adaptation.

3.7.1 The Decline of Trust to TEK

Traditional climate and climate change knowledge of smallholders is generally held by the elderly. Elder stewards' also do not talk about their climate change knowledge with other people due to their belief that talking about the climate change is a taboo, as shown in this excerpt from my interview below: *Researcher: "If the climate change happens in the future, will you prepare something?" An older woman in Sampak Village: "I will hit the mouth of the people who say that kind of stupid thing!"* Talking

about predicted climate extremes means that projected bad things will actually happen. This is certainly a barrier for communicating and disseminating knowledge of climate change in the community. However, not talking about climate change does not mean that the climate change knowledge is not being transmitted. According to Berkes, 2009, what is important for climate change knowledge transmission is not its contents but its process. In my research area, despite the lack of a deliberate effort to pass on TEK, local people still practice rituals strongly. Berkes, 2009 argues that when tradition remains strong due to the routine practices of ritual and culture, people see no need to make special effort to preserve knowledge:

"The young people also join it. What can they say? We ask them to join because if they do not, who will follow them? So, this tradition will be maintained and be continued by our younger generation who joins it now. It is impossible that this knowledge and tradition will disappear. They will believe it and they will follow the tradition. If it does not cause them any disadvantage, then there is no reason for them not to follow the tradition." (Alimuddin, elder steward, Batudulang Village, 2016).

Nonetheless, there remain challenges in passing on climate TEK, namely that the younger generation does not always believe the older stewards' TEK. *"Traditional ecological knowledge of older people? They are out of date,"* said young people during a focus group discussion in Kelungkung Village. Younger generations perceive that climate TEK held by the older generation is no longer sufficient to deal with the complexity of the modern world. Their hesitation is felt by the elder stewards: *"But among those young generations, there are some who do not believe it. Maybe, they think it is just a fairytale. Maybe it is. But, that is the reality that we experience."* (Hasan, elder stewards, Batudulang Village, 2016). The older generations in the village acknowledge the low level of trust of their younger generation to their traditional climate change knowledge, and are concerned that the traditions will be

lost. Rapid changes in technology are also believed to divert the interest of young people in sustaining their traditions.

However, the decline of trust toward TEK among the younger generation is not only due to their exposure to modern lifestyles, but also to other existing conflicts between older and younger generations. The younger ones stated that they feel irritated with the way elders make sense of climate change by putting the blame more on younger generations. The older generations deem that climate change is God's punishment to the village because young people become less religious and do things forbidden by both religion and culture, such as wearing more revealing clothes, stealing, and drinking alcohol. Younger generations also feel that the older ones take advantage from them by asking for contributions of hard labor, while they are rarely involved in decision-making processes in the village:

"We are powerless. All governmental aid is managed by the village officials. All funding for water related project are managed by the village officials. They have never involved young people, like us, except for something that requires free labor. They do not trust us and will never trust us for more important decision making in the village." (Joni, Youth, Kelungkung Village).

Due to the high intra-generational social friction, elder stewards in Kelungkung Village have become less confident in their own climate knowledge, because they know that it will be challenged by the youth. This can reduce the cultural practices of TEK transmission (for example, the ritual for asking rain was not conducted in 2016 in Kelungkung).

Smallholders themselves have noted the decline in both transmission and practice. Some climate TEK is already no longer practiced. For example, smallholders feel that it is getting difficult to face strong winds because in the past elders could predict it and warn the community about its arrival. Now, there is no one who can predict the

strong wind, so they can only be submissive in facing it:

“Oh! In the past, there was a notion petua (knowledgeable elder people), people who really knew the village. Usually, they said be careful this year because the wind will come. They knew it because of his closeness to Allah and strong faith. But now, there is no more petua. Now every one determines their own way.” (Nurdin, Male, Kelungkung Village, 2016).

The relationship between younger and older generation is critical for the sustainability of TEK (Lebel, 2013). However, the relationship between younger and older generations is also breaking down with shifts in occupation, migration for work, and new cultural introductions. Moreover, given the fact that there are different livelihoods goals and vulnerability perceptions between older and younger generations, as shown in the previous chapter and later chapter, TEK is likely to become more challenging to sustain under the context of both climate change and the strong force of globalization, as I discuss below.

3.7.2 Changes of Livelihood

Even though the proponents of TEK stated that TEK is very important for the livelihood of smallholders in Bantulateh, this is not entirely true. From the wide range of livelihood portfolios of smallholders as noted previously, not all livelihoods are related to TEK. Paddy is a livelihood that is strongly related to the TEK system, but overall, paddy has declined and been substituted by other livelihoods that do not relate to the TEK system. TEK becomes more irrelevant when smallholders change their livelihoods for economic reasons and do not prioritize the preservation of TEK. The income-driven goals of livelihoods makes them open to other cash crops that are more profitable than livelihoods that preserve culture and tradition, such as paddy. Therefore, it can be stated that globalization is a major force that influences

the existence of TEK and influences vulnerability as well (discussed in more detail in Chapter 4).

Livelihood changes in rural areas are occurring rapidly, and it is difficult for TEK to catch up. New livelihoods often emerge due to the opening of the market influenced by globalization in to crops such as planting hybrid corn or soya that had never been used before. Consequently, smallholders do not have much knowledge about those livelihoods and cannot relate them with the signs from their local environment. This is different from the livelihood that emerges locally and which is strongly related to the local environment, such as candlenut and forest honey.

For candlenut, their TEK focuses on how to collect good candlenut seedlings in the forest and how to plant them in their fields. For honey, smallholders have use TEK to identify times and places for gathering; they know they must go to the forest when they see certain trees start to flower or when they see some spots on stones in the river, which they consider as the excrement of bees, indicating that bees have started to look for food. They also go to certain trees which are bees' favourites and observe if they have started to come to collect food; if bees can be observed, then they go into the forest to look for honey. The local shaman does some rituals to make it safe for them to do the dangerous process of getting honey; smallholders' believe that the ritual makes them strong enough to climb the tall trees, reduces their fear, and tames the bees so that they will not sting them when they are taking the honey from the comb. Sometimes smallholders are really proud of such TEK: *"The people of this village rarely got stung by bees. There is no doubt on the magical power of the shaman of this village. In other villages, all honey gatherers oftentimes got stung. We know what to do."* (Anjes, Honey gatherer, Kelungkung Village, 2016).

New livelihoods are more dependent on other systems rather than TEK, including factors such as loans from banks or moneylenders, improved and popular seeds, herbicides and pesticides, or laborers from outside of the village. Livelihoods that usually have used the TEK system may now follow the system of the new livelihoods; for instance, the decline of the *besiru* labor-sharing system in planting paddy because smallholders now prefer to hire labor instead. The fact that the government also opposes paddy being cultivated in the upper watershed because it conflicts with their conservation goals had made TEK decline faster as well.

TEK has long had an important role for the building up and preservation of social capital, and so the decline of TEK also may signal a decline in social capital. The practice of TEK in certain livelihoods and tradition as well as rituals gave identity to smallholders and pride as a community, serving as a glue for social capital. The decline of TEK, therefore, may result in negative impacts to social capital, which is an important aspect for adaptation to climate change (explained further in Chapter 5).

3.8 Climate Change Knowledge of the Government

Due to the smallholders' limited climate change knowledge, climate change information from others, such as the government, has become more important for smallholders. Not only is government climate change knowledge important to complement the smallholders' TEK, but also it is critical for successful adaptation, because decisions on resource allocation for smallholders under the context of climate change are also made by the local government (discussed in more detail in Chapter 5). Therefore,

is it critical to understand if knowledge other than TEK is available and accessible for smallholders. What is the local government knowledge on climate change, and how does the government develop and use their climate change knowledge?

3.8.1 Type of and Access to Climate Change Knowledge

The Indonesian government has one agency, *Badan Meteorologi, Klimatologi, dan Geofisika*, *BMKG*, (Meteorology, Climatology and Geophysics Agency in English). CClimite change information falls under the purview of BMKG as reflected in their vision and mission published on their website:

“Reliable information on meteorology, climatology, air quality and geophysics in BMKG’s service is given through data presentation which is accurate, right on target, efficient, quick, complete and can be accounted for.”

*“Responsive and capable BMKG means that BMKG can catch and summarize stakeholders’ needs on data, information and service on meteorology, climatology, air quality and geophysics as well as able to provide services responsive to the users’ needs.”*¹

BMKG has branch offices at the provincial and district levels. For Sumbawa, climate data and climate change information are available at provincial level and managed by the BMKG Station Class 1 in West Lombok. Data is collected at local levels and then compiled and presented into national large-scale maps that can be accessed at the BMKG website. Information on climate at the BMKG website is quite numerous as shown in Table 3.3. But the scale of the information available is mostly for the whole of Indonesia (see Figure 3.5 for a map with 1:19,000,000 scale). This will be a problem for smallholders who want more specific information relevant for their areas or even for their village.

¹<http://www.bmkg.go.id/profil/?p=visi-misi>

For example, when I wanted to acquire data on climate change specifically for Sumbawa, I tried to access it via BMKG's website, and there was no data or information on rainfall or temperature through time available on the website. In order to get the data, I had to contact friends working in the central BMKG in Jakarta, who then gave me the contact person at provincial BMKG offices. When I requested some data and information on climate change, I was asked to provide a stamped letter from an institution. Eventually, I was given the data in an excel format, containing raw data from field stations with no interpretation. This shows that it is not easy to get meaningful data and information on climate change within Indonesia. For me, as a researcher with easy access to the Internet and good network at the government, it was quite difficult, let alone for smallholders without Internet access or an extended network. This is also in line with smallholders' complaints on how they get climate change information, which is mostly from national TV when there are floods or droughts in other areas of Indonesia. As a consequence, they think that the information is too general and not specific for their areas, which has caused reluctance and distrust from the smallholders to use scientific climate change information from the government. *"We heard some from the television, but there is nothing specific about our place. For example, there is no information on what will happen in our place."* (Khaeruddin, Batudulang Village, 2016).

Furthermore, the information provided is often very technical, which makes it difficult for lay people to understand some terms, including atmosphere dynamics, standardized precipitation index, El Niño Information Index, and Pacific subsurface temperature information. Often figures and numbers presented do not have sufficient explanation of their relevance.



FIGURE 3.4: Rainprayer ritual in Batudulang Village, December 2016

There is a challenge to bridge and synchronize scientific climate change data and information with local climate reality, so that the local community can benefit. In order for the data to be useful for smallholders for adaptation to climate change, a dialogue is needed among climate scientists and smallholders about what kind of information the smallholders need, how they understand it, and what communication platform can reach the smallholders. It is also important for climate scientists to understand the smallholders' interpretation of climate change phenomenon and the manifestation of the phenomenon at local level. To date, however, such dialogues have been absent in Indonesia.

3.8.2 Local Government's Climate Change Knowledge

The local government that directly interacts with smallholders also faces the same difficulties. They too find it difficult to use climate change data available at BMKG due to the scale and way data is presented. Interviews with a number of heads of relevant government institutions such as the Agricultural Agency, the Forest Management Unit, the Environment Agency, and the Regional Planning Agency revealed

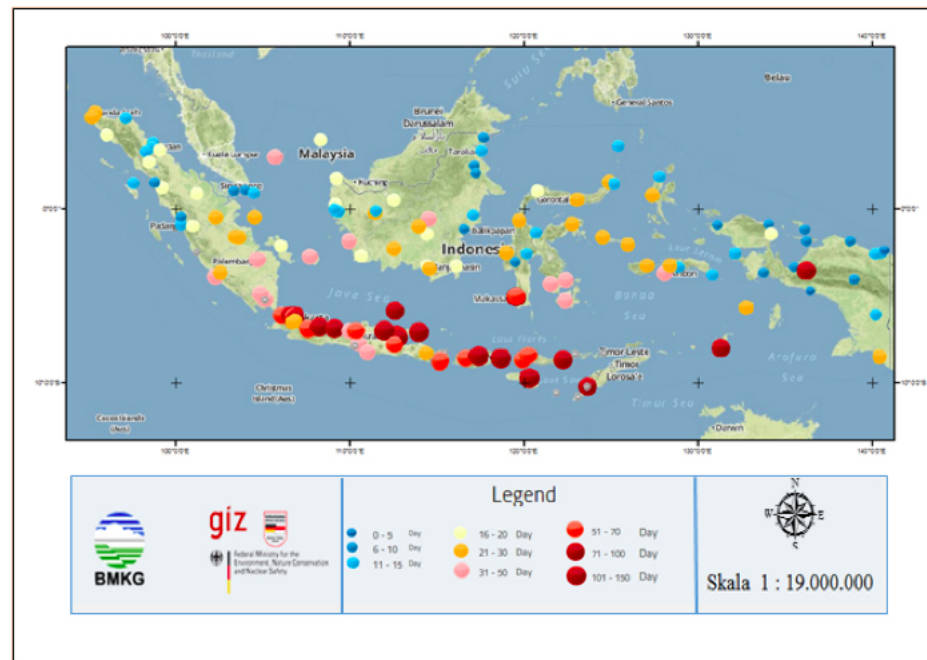


FIGURE 3.5: Dry spell map, <http://www.bmkg.go.id/iklim/trend-curah-hujan.bmkg>, last accessed June 9, 2017

that the local government is familiar with climate change issues, and consider them important mainly because of the occurrence of droughts and floods with increasing intensity and frequency, as the following quotes show.

“In the past years, groundwater was always available. Now, there are times where there is no water available for planting onions! This has never happened in the past years. So, it [the drought] must be severe this year. More severe than before.” (The Head of Agricultural Agency of Sumbawa District, 2016).

“Climate change affected Batulanteh Watershed, even though it was due to global influence. For example, in 2010 the dry season was relatively wet. There was rain throughout the year. It has caused a reduction in honey products as shown by the data.” (Head of Forest Management Unit of Batulanteh Watershed, 2016).

“We are actually vulnerable to climate related disasters. Moreover, the issue now is food security which is strongly linked with climate change.” (Regional Planning Agency of Sumbawa District, 2016).

Yet even though the local government has climate change knowledge, it is still

limited, primarily because they consider climate change mostly related to deforestation, carbon markets and greenhouse gases. For the local government, climate change is an issue that is centered around forest conservation instead of an issue that mostly affects smallholders' social and economic life. The local government does not have climate change information that is ready to be transferred to smallholders. The climate change knowledge that they possess is normative, only held by some personnel in particular agencies, and is general and limited, particularly on prediction and forecasting. When smallholders want to know about climate change, there is no local agency that has the information on it that can be transferred to them for any adaptation, as one informant noted: *"So far, there is no information given about climate change. We want to get some information about it but we do not know where to go and how to get it. If we get it, it would be much better for us."* (Monte, male, Kelungkung Village, 2016). Therefore, even if smallholders are interested and need to know climate change related knowledge, it is difficult to get it because they do not know where to go and ask for such knowledge. What has caused the limited knowledge of the local government?

Indirect impact of climate change. Unlike smallholders who have an active TEK system toward climate change because their livelihoods rely heavily on natural resources, which are sensitive to climate change, it is not easy for the local government officers to acquire climate change knowledge. It is widely accepted that government officials mostly work behind the desk, in front of a computer in an air-conditioned room. Their salary is not affected by climate change, and climate change is not directly related to any impact on the government. This has prevented the local government officials from automatically developing climate change knowledge, unlike the

active system possessed by the smallholders.

High dependency on central government. Currently, the only source of local officials' climate change knowledge comes from the central government through training programs or planning and guidebooks from the National Development Planning Board. This mechanism only allows some of local government officials to have knowledge: namely, officials representing their agencies related to climate change, which tend to be always the same persons. Besides, not all governmental agencies get the training at the local level, as climate change is considered relevant only for some agencies such as the Forest Management Unit, Fisheries Agency, Environment Agency, Disaster, and Regional Planning Agency.

The training and the books provided by the national government, which are the major tools to raise local climate change knowledge, are still insufficient to make informed decisions for climate change adaptation. For example, adaptation ideas such as bike to work and car free days, which were suggested by my informants, are very urban-centric, perhaps because the training is centralized in big cities in Indonesia, and are not relevant to rural and agricultural areas such as Sumbawa. A lack of communication between the local government representatives who attend the trainings with other officials who did not attend also occurs: *"Yesterday, I attended a training on climate change in Yogyakarta then Surabaya. But it is indeed difficult to transfer it. If we talk about it here, the people surely will say what is climate change?" (Regional Planning Agency, 2016).*

A lack of communication between sectors is also problematic. Climate change is being discussed in sectors without synergy as sectoral actors are reluctant to sit down together. There is no platform available to discuss together among the local

government agencies. Regional Planning Agency has the mandate to coordinate other government agencies/institutions to discuss about climate change and to come up with a cross-sectoral adaptation strategy to climate change, but it appears to be ineffective as the quotes below note.

“We have never been invited to discuss about climate change. Other sectors blame agriculture because farmers clear the forest to plant corn. Sometimes these farmers are beyond our control. They just open the forest as they wish. Yes, we need to discuss together.” (Head of Agriculture Agency, 2016).

“Policies from central government will go down to each relevant institution. Regional Planning Agency is only a coordinator. We admit that the activities/programs of government institutions are not coordinated and synergized due to sectoral ego. Even if we enjoin them to work and coordinate together, they are still reluctant to do it.” (Regional Planning Agency, 2016).

“Actually, the Medium-Term Development Planning (RPJM) has included climate change issues and mission. RPJM is developed once in five years. It is mentioned there. But then, I don’t know why it is not addressed by Regional Planning Agency.” (Head of Forest Management Unit of Batulanteh, 2016).

“No, we have not adopted climate change. If we look by institution, there are activities which can reduce the impacts of climate change, but they are not coordinated and synergized.” (Regional Planning Agency, 2016).

3.9 Smallholders’ interest in government climate knowledge

The local government’s difficulty to develop climate information that is relevant for the local level indicates the importance of combining and complementing local government knowledge with smallholders’ TEK system. TEK can bring the local government closer to the reality of climate change occurring in their areas, given that TEK is often contextual, locally specific, rich, and up to date, while climate change information presented by the government can also help smallholders develop climate

change knowledge where their TEK is limited. However, the co-production of such knowledge does not occur in the upper watershed of Batulanteh mainly due to the lack of trust and the lack of acceptance on the part of smallholders to the government's climate change knowledge, and the existing TEK does not have the power to influence the government's knowledge and their policy.

There were considerable differences among the villages on climate change information needs, which indicates the difficulties of developing appropriate co-production models. Smallholders in Batudulang Village said that they did not need any information from the government about climate change. Smallholders in Kelungkung Village had mixed opinions about their needs, while smallholders in Sampak Village think that they really need climate change information from the government. Given the same base of TEK, rituals, and belief, then why do they have different answers to the need for climate change knowledge from the outside? Their different answers gave me a hint about their level of confidence and trust in their TEK and also on relationships with local government in influencing acceptance of climate change knowledge.

Batudulang Village. “No, we will not believe any information from the government” is the response from from all the participants –older, women, and youth– in Batudulang Village during focus group discussions. They believed that the elder stewards' climate knowledge is accurate and highly specific and relevant for their local area. Furthermore, climate change information from the government was considered too general and not specific to their village. Smallholders noted that climate change is highly uncertain, which is what makes it difficult to predict, thus there is no guarantee that the government could predict it accurately either:

“We do not really care about the climate change information from BMKG. I can say that I believe it and also do not believe it. Climate is uncertain. There is

no guarantee that they will be right. That's why, here, long before the existence of BMKG or whatever it is called, we have always been using our traditional knowledge system. Well, it is not always really accurate, but even if it is not really accurate, it is only slightly inaccurate." (Jalalluddin, an elder steward, Batudulang Village, 2016).

Smallholders, therefore, prefer to confide in their elder stewards' local climate knowledge. Smallholders' high level of confidence and trust in their local climate knowledge and their resistance to climate change information from outsiders, especially from the government, is also likely linked to the conflict over forest utilization between local people and government (explained in more detail in Chapter 4). The high level of trust and confidence to their traditional climate knowledge is a way to show their intact social fabric and independence, and having strong trust on traditional climate knowledge is also a form of resistance to the government. For the local people, accepting knowledge and information from the government including climate change information implies that they also agree with the government claims on forest boundaries that have been contested for years.

Kelungkung Village. Younger generations do not respect the older generations' TEK, because they feel that they are blamed as the culprit of climate change, and feel that they are regarded as unimportant by the elder generations (as noted previously). This renders low levels of trust towards TEK knowledge in Kelungkung village. This low level of trust also has a strong link with long-standing internal conflicts over water resources and local politics in the community. Kelungkung village has a significant water problem due to its geographical location in the hilly upper watershed, and climate extremes have exacerbated the dire water problems. Smallholders perceive the escalation of conflicts is related to extreme events linked to El Nino in 2015 when I did my fieldwork. Fights occur more often when local people need to queue for water.

Owners of wells also lock them, otherwise, there would be no water for them left. Some conflicts also emerge when the government supplies emergency water, but the water is limited so that only certain people have access to it. Smallholders reported increasing theft during extreme weather conditions, particularly against livestock and candle nut (explained further in Chapter 4).

Sampak Village. “We really need climate change information from the government”, all people interviewed in Sampak Village said. Despite their ability to predict the likelihood of extreme weather conditions, smallholders in Sampak Village realized that they cannot predict how long drought spells will last, and for this, climate change information from the government is highly needed. The need for it in Sampak Village does not necessarily correlate with low level of trust and confidence to their own local climate knowledge, but rather, their need for climate change information is more related to the marginality of their village. The government rarely visits Sampak Village due to the bad road conditions, and the need for climate change information from the government can be seen as a hope for the government to be more present in their village. They expect their marginality problems, such as improving their access road or building a dam, which are beyond their capacity, might be alleviated. For this village, the government is a very powerful actor that can make changes, and is very capable in predicting climate change, and in consequence people believe in the government’s information.

3.10 Conclusions

Smallholders in the upper watershed of Batulanteh perceive that climate change is happening, particularly for the last 5 or 6 years, as they have been observing and suffering from a number of climate change phenomena, such as strong winds, decreases in rainfall and erratic rainfall patterns. Yet despite their observations in changes in climate, their TEK related to climate change is limited. Smallholders' belief that the effects of climate change are derived from God's will is one of the major barriers to TEK development, inducing them to be passive in their climate change learning process (based primarily on conducting rituals) and, as a consequence, their climate change knowledge base does not improve. Furthermore, smallholders also relate the cause of climate change with the existence of a mining company in the adjacent part of the watershed.

The fact that smallholders' climate change knowledge is still limited may be a sign that the recent climate changes are large enough in scale, magnitude and rate that TEK cannot keep up. Thus, smallholders have not been exposed enough to the new phenomena in order to accumulate and develop their TEK. However, it is maybe too early to conclude that climate change is beyond smallholders' capacity to develop their TEK system specific to climate change, because smallholders may still be in the process of observing environmental phenomena related to it and accumulating their knowledge.

Furthermore, smallholders also relate the cause of climate change with the existence of a mining company in the adjacent part of the watershed. The fact that smallholders' climate change knowledge is still limited might be the sign that the recent climate changes are large in scale and magnitude, rapid rate, unpredictable,

multifaceted, and drastic. Thus, smallholders have not been exposed enough to the new phenomena in order to accumulate and develop their TEK. However, it is maybe too early to conclude that climate change is beyond smallholders' capacity to develop their TEK system, specific to climate change, because climate change has been manifesting recently and smallholders maybe still in the process of observing the environmental phenomena related to it and accumulating the knowledge.

In addition to the limitation of TEK to develop the climate change knowledge base for smallholders and the lack of scientific climate change information from the government, the use and the importance of TEK for smallholders' livelihood is also declining. Rural livelihoods related with the TEK system are declining, as they are more integrated into the global market. As a result, smallholders deliberately tend to abandon the practices of their TEK system. The decline of TEK will complicate future attempts at climate change adaptation, especially for on-going efforts that advocates TEK to be integrated in adaptation policy. The fact that climate change is a reality for smallholders in the upper watershed, while they have limited knowledge on climate change itself, raises questions regarding their specific vulnerabilities, which is further explained in the next chapter.

TABLE 3.2: Traditional climate knowledge of smallholders

Sign	Detailed Sign	Local sign	Climate Phenomena	Batudulang	Kelungkung	Sampak
Sky	Cloud	Big cloud covers the morning sun	The start of rainy season	X	X	X
	Sun	The sun raises in the relatively west position	The start of rainy season		X	
	Moon	The shape of the moon will tell about the abundance of rain and also the abundance of honey in the forest				X
	Star	The appearance of star constellation in local name “Roat” and “Rengala” early in the night	The start of rainy season		X	
Plant/tree phenology	Bunga Balet	A plant called “bunga balet” changes its leave from red to green	The start of rainy season	X	X	X
	Gadung	The stem of a plant called “gadung” starts to creep	The start of rainy season		X	X
	Turen tawer	A tree in the local forest called “Turen tawir” starts flowering	The start of rainy season	X	X	X
	Lita	A tree called “Lita” starts flowering	The start of rainy season			X
Animal behavior	Termite	Termites start making a nest in a higher place than before	The start of rainy season		X	
Human body	Human body reaction	Increasing humidity makes people sweat more	The start of rainy season		X	
Physical environment	Water level	The increasing water level in the wells	The start of rainy season		X	
	Rock/Stone	When they turn up stones and see some moisture	The start of rainy season			X
Rain changes	Rainfall amount	Rain in Muharam’s month	Erratic rainfall lack of rainfall	X	X	X
No sign	No detailed sign	No local sign	Strong winds	No knowledge	No Knowledge	No Knowledge

Source: interview

TABLE 3.3: Climate information at BMKG website

Climate Information	Detailed climate variables
Climate Forecast	Monthly rain forecast
	Season forecast
	Floods potentials
	Climate bulletin
Climate Analysis	Monthly rain information
	Atmospheric dynamics
	Standardized precipitation index
	Water balance
Climate Information	Information on day without rain
	Information on sea surface temperature
	Information on El Niño Index
	Information on pacific subsurface temperature
Climate Change	Rainfall trend
	Temperature trend
	Rainfall normal change
	Extreme climate change
	Climate change projection
	Climate change book

Source: <http://www.bmkg.go.id>

Chapter 4

Vulnerability from the View of the Vulnerable

4.1 Introduction

“We are smallholders. Our lives are always tough and miserable. We do not have serious problems. The only thing that we think really hard is how to eat day by day.” (Women’s FGD, Sampak Village, 2016).

Climate change is a reality for smallholders in the upper watershed who rely heavily on natural resource-based livelihoods hit the most by the impact of climate change. However, the quote above gives a hint that smallholders do not always perceive climate change as the most significant factor influencing their vulnerability: it seems easier for them to define their vulnerability by describing that their life is always tough and miserable in general. Their statement shows a potential perception problem: how can vulnerability be reduced when vulnerability populations may have conflicting perceptions of underlying causes?

The first point of this chapter is that despite the fact that smallholders in the upper watershed of Batulante are vulnerable to stressors of climate change and

globalization, smallholders' themselves say their biggest concern is a lack of land. This concern overshadows other elements of vulnerability, such as the critical water scarcity problems that have emerged. Thus the second key point of this chapter is that smallholders' perception on their vulnerability is oftentimes biased in that they are likely more vulnerable than they actually perceive they are, and there are some hidden vulnerabilities that cannot be captured by smallholders' perception alone. The final emphasis of this chapter is that different groups of smallholders' experience and perceive vulnerability differently, influenced by culture, belief, experience, marginality, and on-going conflicts with the government. This chapter overall serves to give a better understanding of how smallholders' exposure and vulnerability to climate change is intertwined with other non-climatic stressors.

4.2 Literature Review

Adger, 2006 defines vulnerability as the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. Furthermore, the stress encompasses disruption and unexpected changes to groups or individuals' livelihoods (Chambers and Conway, 1992). Thus, vulnerability can be explained by a combination of risks by incorporating the physical aspects of climate change related hazards exogenous to the social system and social factors (Adger, 1999).

A smallholder whose livelihood relies heavily on the agricultural sector is one of the most vulnerable populations affected by climate change, mostly due to the changes in rainfall especially in areas that are prone to water stress (O'Brien et al., 2004;

Hallegatte et al., 2015). High temperature also increases the rate of evapotranspiration leading to negative impact on soil moisture (O'Brien et al., 2004). Smallholders would directly suffer from the production shocks resulting in lower crop yields, thus triggering the changes in their income level and food availability. On the other hand, climate change could increase food prices which may benefit some producers. Along with local stressors, climate change stressors, such as pollution and overuse of natural resources, threaten the ecosystems that provide subsistence production and safety nets for smallholders (Hallegatte et al., 2015). Moreover, despite being affected the most by the impact of climate change, smallholders receive more limited support from social safety nets (Hallegatte et al., 2015).

Several studies emphasize the fact that smallholders livelihood are being hit by climate and non-climate stressors such as market shocks, enclosure of land by outsiders, and population growth (Morton, 2006; Bebbington, 1999; O'Brien and Leichenko, 2000). Other stressors and climate change are often superimposed on one another (O'Brien et al., 2004). O'Brien and Leichenko, 2000 emphasize the importance of incorporating globalization stressors in the analysis of vulnerability to the climate change, which they label "double exposure." They define economic globalization as a set of production and consumption activities that shift from the local or national scale to the global scale, and smallholders in rural areas are affected significantly by globalization through integration of smallholders' livelihood activities and their products to global markets. Smallholders experience technological changes, especially in communications and transportation technology, the increasing use of information technology, and the shift from large-scale, mass production to more flexible production methods.

Globalization can also benefit smallholders by increasing their income level. However, globalization also poses a negative consequence for smallholders in that their agricultural livelihood becomes more temporary and highly dependent on consumers, investors and trade policy O'Brien and Leichenko, 2000. By acknowledging these two big stressors in smallholders' livelihood, my vulnerability analysis will produce a different set of outcomes when compared with other analysis conducted with the respectively separated stressors O'Brien and Leichenko, 2000.

Different people have different sensitivity to climate change (O'Brien et al., 2007) because local communities are differentiated and social actors' natural resource claims are positioned differently in power relations (Leach, Mearns, and Scoones, 1999; Li, 2002). Thus, the consequences of climate change and other stressors are also socially differentiated (Leach, Mearns, and Scoones, 1999). While many researchers focus on the differentiation of smallholders in their livelihood assets and power relations, there is a limited understanding of how the perception of vulnerability varies among certain groups. Despite some efforts to set standardized variables of vulnerability to make it easier to compare vulnerability across different places and communities, it is almost impossible to compare the differences because of the fact that vulnerability is a situation that is specific to certain people and places (Füssel, 2007).

For vulnerability reduction, some scholars emphasize the importance to focus on perception of the vulnerable population, as perception are the precursors of attitudes and individual and group actions (O'Riordan, 1971; (Ervin and Ervin, 1982; Rogers, 2003); Bayard and Jolly, 2007. Increasing risk perception is believed to be important for adaptation to climate change that the vulnerable could promptly respond to the

risks or to support adaptation measures from the government or donors (Sullivan-Wiley and Gianotti, 2017). Under the context of climate change, perception of the vulnerable has been widely explored by risk perception literature. Risk perception of the vulnerable has been studied in a way that the focus is on specific hazard considered as a major hazard by the government such as in the case of understanding everyday's risk in the flood plain of Puerto Rico (López-Marrero and Yarnal, 2010), and the hazards that are external to community is a starting point in risk perception research and very central to the concept. However, there is a gap to approach vulnerability reduction by using the existing risk perception conception that centered around hazard considered as major by the outsider because Adger, 1999), mentioned that vulnerability of people is something that is internal to community as their characteristics. Thus, it implies, regardless the hazards, people will have their perception on themselves and to reflect on their life situation in general. However, the study on how poor people perceive their vulnerability regardless the hazard is still limited. Thus, this chapter explore perception specific for vulnerability that will help to understand more about the vulnerability of the vulnerable population and to position their perception in vulnerability reduction.

4.3 Climate Change Impact

As noted in the previous chapter, smallholders' livelihoods in the upper watershed of Batulante are sensitive to strong winds and changes in rainfall patterns. These have resulted in impacts on livelihoods, including decreasing income levels, food insecurity, a lack of water and health-related problems, as explored below.

4.3.1 Decreasing of Income and Food Insecurity

The higher altitude and hilly morphology of the upper watershed exposes it to strong winds that destroy paddy by toppling the flowers, and break the branches of candlenut trees, leading to decreased yields and harvest failures. Paddy harvest failure due to strong winds occurred in 2010 in Kelungkung and Sampak Villages, leading to food insecurity. During my fieldwork, smallholders reduced their daily food intake due to lack of food supplies caused by a long drought:

“In normal days, we cook 2 cups, but now we have to cook 1 cup of rice. In normal days we buy fish and vegetable for around IDR 10.000 and now we rarely buy it. We should really reduce our spending. Yes, the fish seller is always around every day, but we cannot buy it. We do not have money because we only have once in a year income.” (Women FGD, Sampak Village, 2016).

In addition to the destruction of crops and trees by strong wind, it also affects the soil quality in the upper watershed, which are dominated by Brown Andosol Latosol and Reddish Brown Latosol (62% of the area). In general, the top soil fraction here is clay and rich in organic matter (C, N, P, but the soil is fragile and highly erodible (Julmansyah et al., 2008). Strong wind erodes top soil in hilly areas, and projected higher temperatures that will increase the rate of evapotranspiration, leading to decreasing soil moisture, will likely to increase the problem of soil erosion as well.

Long spells of no rain strongly disrupt smallholders' livelihoods when they are reliant on rain-fed agriculture, such as paddy and maize. Moreover, in the upper watershed, rising temperature burns the coffee flower and disrupts candlenut and other trees' flowering process, leading to decreased yields, including for forest honey production, which depends on flowering as bees' food sources. The increasing temperature also becomes a challenge for smallholders whose livelihoods require intensive human

labor, such as walking in the forest to gather honey and agricultural products.

In addition to the decreasing rainfall, erratic rainfall pattern also impacts smallholders' livelihood upper watershed:

“Even more, there was no rain at all during this dry season. No wonder why our coffee trees die. When our coffee trees die, our candlenuts are also decreasing. Candlenut is more resilient. From my observation, candlenut has lots of flowers in this prolonged dry season. It seems that candlenut likes it. Well, I do not know if it will survive or not. But I have a strong feeling that those kind of candlenut flowers will survive and candlenut yield will be abundant. The coffee dies. They do not have leaves but the flowers still come out. Well, we hope they will not die, just in case that the rain will fall this upcoming Friday. If it happens, then the coffee will survive.” (older generation FGD, Batudulang Village, 2016).

The sudden stop of rain can keep planted crops from growing further, thus, money and energy spent by smallholders will be in vain. When the rain falls again, sometimes farmers must replant crops and spend more money and human labor. Some farmers do not replant because they used up their assets in the previous attempt. To cover production costs, farmers who decide to replant crops often sell their livelihood assets, such as their livestock. Occasionally, farmers also borrow money, which puts them into debt. Mung bean is an extreme case that entire smallholders' livelihood portfolio disappeared because of erratic rainfall. Smallholders used to plant mung bean after paddy with a hope that beans will grow with the last days of rainy season and will be ready for harvest when the rains stop. For the last few years, however, the harvest has not been successful because of the bad timing of the rainfall right before the mung bean was about to be harvested. This has discouraged smallholders from planting mung bean. Furthermore, another major livelihood challenge is increasing pest outbreaks and plant diseases in paddy and maize, which could be highly related with climate change.

4.3.2 Water Scarcity

The lack of water is a persistent problem in the upper watershed due to its hilly areas. The lack of water for domestic and agricultural uses is a major problem perceived by smallholders, happening throughout all three villages to different degrees of severity. Smallholders in Batudulang are better off in terms of their access to the water because they have a pipe installation to channel the water from springs to their houses, whereas in Kelungkung Village smallholders walk to get the water in wells or springs, while in Sampak Village, smallholders collect water in a public water tank collected from springs channeled through pipes.

Climate change exacerbates the issue of insufficient water supply. Many wells and springs go dry due to a prolonged dry season. Smallholders must walk further to reach far-away springs and wells to bring the water to their homes, or they should queue in long line from 4 am to 6 am. Queuing for the water is perceived as a very miserable condition. Moreover, not only for the domestic water supply, smallholders also have to queue for the water for their cattle.

“The thing that we find the most miserable in the whole of our life is this: lack of land and water. So, you observe it, all the wells and springs are dry. Thus, everyone is queuing for water now. Even further, we have to buy water from our friends who took it from Semongkat (river). That’s how tough this situation is.” (Pak Monte, Kelungkung, 2016).

“All the time, we are lacking of water. Smallholders in our village are already queueing for water before 4 am. The wells and springs are full with people. Imagine, from 4 am until 6 am. There will be no water left at 6 am. That’s why at 4 am we should be there in the springs or wells. 4 am, the time where we were supposed to sleep well. But if we sleep, we don’t get the water. So we have to wake up. That’s how miserable our life is because of lack of water.” (Jamali, Kelungkung Village, 2016).

Beside aggravating the problem of lack of water, climate change is also a major

setback for the effort to solve the water problems. Actions that used to be a successful remedy to water problems are not effective anymore. For example, in the past, smallholders in Batudulang had to walk to the springs or wells. Installation of water pipes solved the problem of a water shortage. However, when I conducted my field work in this village, I observed many smallholders still walked to water wells to get water because the water was no longer running to their house. The prolonged dry season at that time caused low levels of springs that made it no longer able to pipe water from them. The same problem happened in Sampak Village during the prolonged dry season, as the public water tank had no water due to the low level in the springs.

Climate change impacts on water resources have also caused diminishing economic capital and livelihood assets. Smallholders must spend additional money to buy water and gasoline for their motorcycle to collect water. Moreover, the lack of water also diminishes their livelihood assets such as cattle. Cows and goats become skinnier due to lack of water and food, which reduces their selling price. The dire problem of water shortages also generates conflicts in the community, particularly when people queue for water or when the owners of the wells lock them:

“Oh my god, yesterday, Pak Lebei (an older steward) brought machete to the house of Mr. Muin. Pak Lebei was so angry because Pak Muin locked his well. Pak Lebei said that there is no history of people locking their wells in this village, ever. Then he destroyed the lock so that people can take the water again from that well.” (FGD young people, Kelungkung Village, 2016).

“Currently, people lock their water well, because they are waiting for the water to accumulate in their well. If we do not lock it, we do not get the water. This dry season, we are so miserable. For example, yesterday, I went back home from a wedding ceremony in other village. I wanted to take a bath because it was so hot. There is no water left. Whereas, we are the owner of the well. We are supposed to have water but we do not get it. I am so sad for this.” (Jamali, the well owner, Kelungkung Village, 2016).

Cases of theft of livestock, candlenut and guava appear to increase during the

prolonged dry season, especially in Kelungkung Village, further intensifying the social friction in the communities:

“So now, during the harvest time of candlenut, guava, there are many thieves. They do not plant it but they go to the land of the people who planted it and take it. We really concern about this issue because if this continues to happen, there will be a major conflict. This is our biggest fear for the future. There will be an open conflict. Smallholders who own land will suffer decreasing yield because of the thieves who do not have land and do not own a job. For sure, we will have to fight one another. There will be conflicts eventually.” (Jamali, Kelungkung Village, 2016).

4.3.3 Health Problem

The increasing temperature during a prolonged dry season has caused smallholders to be more prone to many health problems, including respiratory illnesses such as coughing and asphyxiate problems due to the dust. Ill-health is often at its peak in rural populations during the wet season (related to high workloads and low food availability) at precisely the time when travel conditions, even for pedestrians, are at their worst. The health problem is exacerbated by the high travel cost to medical facilities and also by the cost of medical treatment (Porter, 2002). The changing from hot and rainy weather in an erratic way also makes smallholders get sick easily, as one informant noted:

“There are many smallholders who get sick, many kind of illness. This is the impact of drought. We become very sensitive. We can get sick easily just because of taking a bath in the wrong time. Me, for example, I have just gotten better. I was sick for quite long time. Many times I had to go to the doctor. It is because of the dust due to the lack of rain. Everyone gets sick, not only us older people, but also children and adults. It is because of the climate, lack of rain, [it is] too hot.” (FGD older people, Kelungkung Village, 2016).

All the livelihood problems become a burden for smallholders which make them feel stressed easily. Smallholders have to think hard on when the rain will fall, whether or not they will get the water the next day, whether or not their action to lock the well will bring negative outcomes and conflict and whether or not their food stocks will be enough.

4.4 Double Exposure: Interplay Among the Stressors of Climate Change and Globalization

There is a tendency to highlight climate change as the biggest stressor for smallholders due to their natural-resource based livelihoods. This conception comes from a thought that smallholders are traditional and subsistence-oriented communities, and are directly affected by the low yield of “consumption” crops. Smallholders once were also thought to be isolated from globalization, therefore, this issue was downplayed in discussions of smallholders’ vulnerability to climate change. However, my research confirms the importance of globalization in the discussion of vulnerability to climate change: double exposure is real for smallholders.

Climate change stressors are strongly intertwined with globalization related stressors, especially price fluctuation and access to market and are felt significantly by smallholders in the upper watershed of Batulanteh. This is mostly due to smallholders’ livelihood goal for higher incomes (as explained in chapter 2) such that their natural resource based livelihoods that are sensitive to climate change are also fully integrated into the market. Climate change decreases the yield and the quality of smallholders’ products that the market responds to: the price goes down when honey

contains more water, when cashew and guava change their color and quality due to prolonged rains, and when candlenut is sold wet.

Globalization is undeniably an important factor that influence smallholders' livelihoods that even stronger than climate change and other stressors. Even though the yield is plenty due to the positive impact of climate change, if the market price is down, then smallholders will not be able to gain a lot of profit. This happened in the case of corn in Sampak Village. Despite the increasing yield, farmers in Sampak Village complained about the price of the maize dropping down to US\$ 0.13 — 0.14/kg in 2016. The original price was US\$ 1.6/kg when they first planted the maize five years ago. Smallholders relate the problem of price and access to markets with the problem of bad roads. Due to the poor road access, it is difficult for buyers to reach the village and for smallholders to reach the market, and diminishes the bargaining power of smallholders. For example, the price of maize in Sampak Village is around US\$ 0.13 — 0.15 per kg, whereas the price of maize in other villages is around US\$ 1.6 — 1.8 per kg. Due to the lack of buyers thanks to bad road conditions, smallholders often have no other choice but to accept the lowprice offered. Smallholders in Sampak Village also gain less profit from honey compared with the other two villages due to high costs of transportation and also higher risk. For example, because there is no public transportations coming to the village, they pay a motor taxi US\$ 4.4 for round trip whereas in the other two villages, it costs US\$ 1.5 — 2.2 for a round trip. Transporting the honey on the bad road is also very risky as honey is often spilled out on the road.

Due to its importance for accessing markets, the impact of climate change on rural roads will potentially increase the vulnerability of smallholders (see Figure 4.3).

Rural roads in developing countries will be easily damaged by warmer and fewer cold days and nights, warmer and more frequent hot days and nights, heavy precipitation events, drought, and increasing intense tropical cyclone activity (IPCC, 2007). Rainfall intensity can change the physical property of the soil surface and the slope materials of the unpaved road (Martinez-Zavala, Lopez, and Bellinfante, 2008).

Furthermore, despite the paved road in Kelungkung Village and Batudulang Village, climate change still brings a major risk due to the slope and steep topography of the upper watershed. The erosion of the road surface is accelerated in locations where slopes are steep, the overland flow distances are long, and the vehicle usage is high (Martinez-Zavala, Lopez, and Bellinfante, 2008). Sometimes, the road surface may have totally disappeared (see Porter, 2002; Dahal and Hasegawa, 2008; Borga et al., 2005). Especially during monsoon rains, the higher intensity and duration of rainfall can trigger landslides in mountainous areas (Dahal and Hasegawa, 2008) (Figure ??).

In an era of decentralization in Indonesia, the allocation of limited budgets for building roads are also shared among provinces, districts, and local governments (Walle, 2002). One result is too many roads competing for too few funds - each one gets funded but at a very low level – as a result road construction literally ‘inches’ ahead. Local administration tends to prioritize areas which give more economic benefit and are politically significant, while poverty is concentrated in poor rural areas without roads and with low economic potential (Walle, 2002). Furthermore, poor rural people often cannot influence decision-making process in rural road building and maintenance due to their difficult access to lobby policy makers (Porter, 2002).

The emergence and disappearance of livelihoods in the upper watershed also shows that globalization is the main driver of livelihood decision-making, as much as or even

more than climate change. Even though smallholders' livelihoods are sensitive to climate change, they choose livelihood strategies that are more integrated to the market and more profitable than the livelihood that are less sensitive to climate change. Smallholders' also choose livelihoods which have economic value than for subsistence, reflected in changes in smallholders' livelihoods from paddy for subsistence to maize, candlenut and other commodities to be sold. In Batudulang Village, candlenut has almost completely substituted for paddy. The same trend also occurred in Sampak Village where the smallholders do not prioritize planting paddy anymore and have replaced it with maize. Thus, in this regard, food security issue in the upper watershed is highly influenced by globalization because the lack of food is not only about the decreasing yield but also the decreasing purchasing power. Oftentimes, climate change and certain government policies will inflate the staple food price which then exacerbate the food security problem. The fact that the smallholders choose livelihoods such as maize, even though it is discouraged by the government, also shows that globalization forces are potentially stronger than local policies.

The emergence and disappearance of livelihoods in the upper watershed also show that globalization is the main driver of livelihood as much as or even more than climate change. Even though smallholders' livelihoods are sensitive to climate change, they choose livelihood strategies that are more integrated to market and more profitable than the livelihood that are less sensitive to climate change. Smallholders' also choose livelihoods which have economic value than for subsistence. This is shown by the changes in smallholders' livelihood, that in the past they planted paddy for subsistence, but now they plant maize, candle nut and other commodities to be sold. In Batudulang Village, candlenut almost completely substituted paddy. The same

trend also occurred in Sampak Village where the smallholders do not prioritize planting paddy anymore and replaced it with maize. Thus, in this regards, food security issue in the upper watershed is highly influenced by globalization because the lack of food is not only about the decreasing yield but also the decreasing purchase power. With the decreasing income, their purchase power will be low even though foods are available in the market. Oftentimes, climate change and certain government's policies will inflate the staple food price which will then, exacerbate the food security problem. The fact that the smallholders choose livelihood for their income pursuit such as maize even though it is against the government interest and goal also proves that globalization force is potentially stronger than structural constraint that will increase the conflict over forest utilization between smallholders and the government.

4.5 Risk Perception: the Bias of Everyday Risk

Table 4.1 presents the ranking of the problems of risk as perceived by smallholders, organized based on location (B, S and K villages) and gender and age. This ranking of perceived problems helps illuminate the concern of smallholders in terms of their priorities and how those concerns relate with climate change.

Table 4.1 shows that even if smallholder do perceive that climate change is happening and they experience the negative impact of climate change, the lack of land is the biggest concern of smallholders in all three villages for male adults. Smallholders perceive the need to address the problem of lack of land as a solution to overcome the problem of low income, but consider less about how low incomes may be a result of other factors, like climate change. This confirms what Patt and Schroter, 2008

TABLE 4.1: Smallholders' perceived livelihood problems. Numbers 1, 2, 3 etc. are the ranking of the perceived problems. B = Batudulang, K = Kelungkung, S = Sampa

Vulnerability	Perceived problems	CC related	Female			Male			Young People		
			B	K	S	B	K	S	B	K	S
Decreased income	Lack of income/ lack of money	X	1	1	2				1	1	
	Once in a year income	X			5						
	Decrease in candlenut price	X							2		
	Harvest failure	X								3	
	Decrease in coffee production	X							4		
	Decrease in candlenut production	X			6						
	Loan								3		
	Lack of land			5		1	1	2			
	Low agricultural productivity	X		3			4				
	Population growth						3				
	Bad road access	X						1			
Food insecurity	Lack of food	X	2	2	1						3
Lack of water	Water scarcity	X		4	3		2			2	2
	Erratic rainfall pattern	X	3	7							
Other	Lack of sanitation facilities				4						4
	Traditional mind set of people									4	
	Forest degradation									5	
	Single									6	

Source: focus group discussion

have found, which is that even though people are aware of climate change, they may not consider impacts of climate change as their central problem. López-Marrero and Yarnal, 2010 have also noted that people perceive other risks in their lives, and that smallholders are concerned more on everyday risks rather than infrequent or severe risks that is considered important by outsiders such as the government. However, the literature on risk perception is not clear on whether smallholders' risk perception is a guarantee for them to be able to reduce their vulnerability or not. My research shows that the perceptions of smallholders on everyday risks brings some complications for vulnerability reduction.

As an example, although smallholders perceive that the lack of land is their biggest livelihood problem that leads to low productivity and incomes, smallholders' vulnerable conditions are also coming from the problem of a lack of water. Lack of water has direct impacts on low land productivity in the upper watershed, limiting agriculture to the rainy season. Not being able to plant during the dry season makes it difficult to diversify income, due to labor allocation to queue for water. Addressing the lack of water problem can even solve the problem of lack of land, as acknowledged by a smallholder in Sampak:

“If we have good road access, we will just plant maize. However, the forestry agency, they want us to reduce the size of land for maize. They want us to only plant half of it with maize. It is impossible. Commonly, we only have 2 hectares dryland for each household. We want bigger land to increase our yield because we can only plant it once in a year. So, to get bigger land, we have to convert the forest. If the government built a dam for us, [then] we do not have to convert the forest because we can plant the maize in our land three times in a year instead of once a year.” (Manesh, male, Sampak, 2016).

With a better access to water, smallholders could intensify their land and diversify their livelihoods without having to extensify their land holdings. Lack of land may

no longer be perceived to be an issue anymore if smallholders are supported with programs that enable them to diversify their incomes. But rather than invest in water management infrastructure, smallholders have prioritized their income for buying motorcycles, cellular phones, building houses, and buying kitchen ware and furniture rather than to dig more wells to solve water scarcity problems or to increase their assets.

The everyday risks that smallholders perceive are thus potentially a “wicked problem” that is very difficult to solve. In the upper watershed of Batulanteh, the battle that smallholders choose by saying that their biggest problem is lack of land is a battle that is impossible to win for them. The fact that most of land in upper watershed is allocated as state forest is a policy that will be hard to change, as the government has put strong importance in conserving the forest in the upper watershed to sustain environmental services for the whole population. Conflicts over forests between smallholders and government have been ongoing for many years, and the forest boundary has never been changed as aspired by smallholders. Instead, the government plan to add even more conservation forest. This prolonged conflict drains the energy of smallholders that at some point increases smallholders’ vulnerability. When smallholders tried to show their resistance toward government policy by converting forest into agricultural land, they often ended up in jail. Focusing on the wrong underlying causes of vulnerability can hamper the vulnerability reduction efforts; it would be easier to find compromises between the government and smallholders if they are more focused on other problems such as the lack of water or lack of access to markets.

Too much emphasis on the problem of lack of land also shifts the focus away from the problem of lack of water. Water has been the issue that connects the

upper watershed with downstream and also an issue that puts the upper watershed in a “special” place in terms of policy. Water is also an issue that will change the whole vulnerability picture of smallholders in the upper watershed. The problem of lack of water has been portrayed mostly as the normal problems resulting from the topographical location of the upper watershed. Therefore, most people think that the solution is to move the water from downstream to the villages with trucks. Another solution is to build pipe systems that connects springs to the villages. But for some reason, building dams and irrigation has been out of the equation for smallholders and government. In other word, they take for granted the problem of lack of water in the upper watershed and thus they do not relate it to their livelihood problems as something to overcome and fight for as much as they fight for the lack of land issue. Smallholders seem to agree to bear the responsibility to provide the water for the downstream population without questioning it further in terms of their own access. Smallholders perceive the lack of water is caused by the natural characteristic of the upper watershed rather than blame it as a policy failure of the government. Focusing on lack of land as their biggest underlying causes of vulnerability also shifts attention from the fact that climate change is also a major underlying causes of vulnerability.

The fact that smallholders are concerned more about certain risks, such as lack of land, than on other risks is an important problem, showing potential bias is inherent in people’s risk perception. In this research, the persistent land conflict hinders smallholders from focusing on other issues that are also critical and potentially more solvable. This focus on land is likely a fight back and form of resistance to the government, who point their fingers to smallholders as the culprit behind the environmental degradation such as soil erosion, floods in downstream, and forest degradation. By

blaming that the lack of land as their biggest problems so far, smallholders present a counter attack to the government and also a strategy to move the blame from themselves to the government. Thus focusing policy on only perceived risks of the vulnerable is not necessarily able to reduce their vulnerability if such risks are perceived through cultural frameworks that might reflect cognitive biases.

4.6 Perception of Vulnerability

Earlier sections have shown that smallholders in the upper watershed are vulnerable to both the stressors of climate change and the market which decrease their income, threaten their food security, exacerbate the existing water scarcity problem, and expose them to health problems. However, those vulnerable conditions are experienced and perceived differently by different smallholders, confirming Kasperson et al., 2005 who noted that vulnerability may be differently perceived or experienced by the vulnerable themselves. My research shows strong evidence that the same vulnerable situation is perceived differently by different groups of people, such as those differentiated by gender and age as shown in Table 4.2.

4.6.1 Gendered Perception of Vulnerability

Earlier sections show that smallholders in the upper watershed are mostly vulnerable to the stressors of climate change and market which decrease their income, threatened their food security, exacerbate the existing water scarcity problem and expose them to some health problems. However, those vulnerable conditions are experienced and perceived differently by smallholders which confirms what Kasperson

et al., 2005 assumed that vulnerability maybe differently perceived or experienced by the vulnerable themselves. My research shows strong evidence that the same vulnerable situation is perceived differently by different group of people mostly based on gender and age as shown in Table 4.2.

4.6.2 Gendered Perception of Vulnerability

Smallholders feel vulnerable from a wide range of issues, ranging from lack of basic needs such as food and water to having goods to satisfy their desires for modern life such as mobile phones, motorcycles, refrigerators, or TVs. Smallholders of all ages and genders in the upper watershed feel noted vulnerability when their level of education is low. Education is highly valued because smallholders believe that by having good education, their children will not have to work as farmers, and thus they will have better life than their parents. Being a farmer signifies a miserable life due to the hard work and poverty, while having good education will give them opportunities for non-farm based livelihoods such as being lawyer, teacher, etc., that are viewed as decent jobs. Having a good education will also raise their status in society thus their power to be heard and counted in decision-making processes in the community.

There is a significant difference in the perceived vulnerabilities between men and women. Among many vulnerable conditions mentioned, men only focused on one vulnerable condition, which is the low level of education of their children. On the other hand, women and young people feel vulnerable in a wider range of situations. Women mostly feel vulnerable concerned with domestic issues such as food security and lack of income, or if they are not able to buy dresses for big occasions, furniture,

TABLE 4.2: Smallholders' perceived vulnerable conditions

Vulnerability	Perceived vulnerable condition	Men	Women	Young people	Older generation
Decrease in income	Drop out of school, low level of education.	X	X	X	
	Cannot build and repair the house.		X	X	
	No money for buying things.		X		
	Cannot do shopping in the city.		X		
	Cannot buy furniture and house appliances such as refrigerator, TV, cupboard, Tupperware, etc.).		X		
	Cannot buy motorcycle which they need help them to get the water, carry the candlenut from the farmland, to go to school for the kids, to go somewhere for recreation.		X		
	Cannot buy proper clothes for social events.		X		
	Cannot eat delicious food.		X		
	Cannot buy hand phone and phone credit.			X	
	Lack of money to start a new venture.			X	
	In debt.			X	
	Cannot go for recreation.		X		
Food insecurity	Lack of food.		X	X	
Lack of water	Lack of water for domestic supply.		X		
	Lack of water for bathing and washing clothes.			X	
	Late for social gathering because of queuing for water.			X	
	Lack of water for agriculture makes it difficult to plant vegetable and other crops.		X	X	
	Unhealthy livestock due to lack of grass and water.		X		
Health problem	Anxiety because they are still single.			X	
	19	1	13	10	0

Source: focus group discussion

house appliances, or good food. The significant difference of perception between men and women raises question of what accounts for those differences? What factors influence their perception on vulnerability?

The different vulnerability perception between men and women shows that gender roles in the household and community affects vulnerability perceptions. Women perceive that the most vulnerable condition is highly centered around domestic issues such as food insecurity and lack of income because of their role in the family to ensure sufficient food on the table for the whole family. Men are often assigned to have a role as the breadwinner in the family, and will give money to their wife to be managed. Therefore, when climate change hits, the one who should make the both ends meet are the women. Men may perceive that their income is decreasing, but the ones who really must manage those situations are women. Patriarchy also puts men above women, resulting in women trying hard to serve other members of their family with food first. Thus, when the men mention that food supplies are normal, it may mean that the woman is sacrificing herself to eat less so their family could eat normally. This explains why women feel vulnerable on issues related to food security and low income, while men do not perceive such vulnerability to exist, as noted below.

“We are lacking of food. That is the most vulnerable thing for us and hits us the most. We have to really economize our food stock. If in normal days we cook two cups, now we are cooking only one cup” (FGD women, Sampak Village, 2016)

“Food? It is normal.” (FGD men, Batudulang Village, 2016).

“For rice and food, it is stable. We can still eat normally.” (FGD adult men, Kelungkung, 2016)

4.6.3 Different Cognitive Baseline of Vulnerability

My research also finds significant difference in perceptions of older generations and the rest of the population. The vulnerable conditions perceived by the younger generation are not considered as vulnerable by the older people. While young people perceive a lack of food, income, education, road access, knowledge and information, access to market, and water, the older generation perceives significant improvement in the upper watershed in comparison with the past. This shows that vulnerability perception is highly influenced by experience through time Tables 4.3, 4.4, 4.5, and 4.6.

TABLE 4.3: Vulnerability perception of older and younger generations:
Food security and income

Element of vulnerability	General population	Older generation	
	Present	Past	Present
Food security	Lack of food (means lack of quantity of rice)	- Lack of food (means lack of quantity of rice that they should add it with eaves, tubes, fruits in the forest, etc. They also should eat less).	Abundant food. More yield of paddy. Easy to get food.
Income	- Low income	- No access to market	- Easy to sell their products
		- No buyers come to the villages.	- Buyers are coming to the village

Source: focus group discussion and interviews

TABLE 4.4: Vulnerability perception of older and younger generation:
Assets and education

Element of vulnerability	General population	Older generation	
	Present	Past	Present
Assets	- Lack of clothes (they cannot buy the latest models)	- Lack of clothes (they have to make the clothes from the scratch. They only had very few clothes)	- More clothes available in abundance and style
	- Traditional wooden house		- Easy access to buy clothes
Education	- Low level of education (they can only study until Senior high school)	- No or low level of education (their highest level of education was elementary school)	- Better level of education (people can study until senior high school or even go to university)

Source: focus group discussion and interviews

Tables 4.3, 4.4, 4.5, and 4.6 shows that the older generation has different vulnerability experiences from the younger generation. The present vulnerability of the younger generation is considered an improvement on past vulnerability for the older generation. They consider that the younger generation does not have enough past experience to compare with the present situation. For older generation, the present situation, even with the impact of climate change, is far better than the vulnerable conditions in the past. Thus, instead of complaining about the impact of climate change and perceiving it as vulnerability, they are grateful for the present situation: present situation by making a comparison to the past vulnerability.

“The life in the past and present are very different. That is why we are so grateful now.” (FGD older generation Kelungkung Village, 2016).

TABLE 4.5: Vulnerability perception of older and younger generation:
Well-being and technology

Element of vulnerability	General population	Older generation	
	Present	Past	Present
Well being	- Lack of recreation		
	- Difficult to get boyfriend or girlfriend		
	- Lack of money to buy delicious food and shopping		
Technology	- Lack of money to buy the latest model of motorcycle, mobile phone, furniture, home appliance (Tupperware, refrigerator, rice cooker, TV, etc.).	- No technology. People would walk from their village for days carrying heavy stuff on their shoulder to barter or sell their product in Sumbawa City.	- Motorcycle make people more mobile that safe times and human labor.
			- Mobile phone.

Source: focus group discussion and interviews

“Oh now, there is no such miserable condition because the life is getting more modern. The things that did not exist in the past, we can see it now. The things in the past that were limited in number, and now become abundance. There are a lot of ways to get money. Everything is so modern. In the past people walked, now we ride motorcycle. In the past no information about anything, now we get information about many things. We thank God for that. Well, there are still vulnerable conditions, but not much.” (FGD Older generation Batudulang Village, 2016).

“The life of smallholders now is not miserable anymore. As long as they want to work, they will be fine. We do not feel that this situation is miserable because we have experienced the more dismal situation in the past.” (FGD older generation, Sampak Village, 2016).

“If we compare the life in the past and now, it is far better now. There was no merchant that came to our village. In the past, we could not live in our village. We had to walk for days to bring fern, guava, to the city to be exchanged with rice. We carried it in our shoulder. We left the village in the afternoon. We walked through the forest, we called it Sampar Jati. There was a place we called Kuang Bukal. We took a break there. We often slept there, waiting there until 4 am. Then we woke up, carrying our stuff again in our shoulders to the city. Nowadays, no young people would do that. They do not even want to buy fish in the market now! They feel ashamed.” (Salahuddin, male, Sampak Village,

TABLE 4.6: Vulnerability perceptions of older and younger generation:
Health, human labor, and knowledge and information

Element of vulnerability	General population	Older generation	
	Present	Past	Present
Health	Get sick easily because of the dust and climate extreme	Lots of people got sick for months and died. There was no health facilities and doctors. There were only local shamans.	- Access to health facilities, doctors, and medicines.
Human labor	Long walk during honey gathering	- They would carry candlenut, fern, guava on their shoulders and walks for long hours to reach the city.	- Motorcycle or truck make it easier.
Knowledge and information	- Limited information on climate change	- No information about anything	- More knowledge and information from extension officers about agriculture

Source: focus group discussion and interviews

2016).

“We did not wear pants in the past. We only wore short made by our mother. It was handmade. They made it from scratch. They wove it. Now it is very easy to get clothes. If we have the bad one, we can just throw it out. In the past, we had to use clothes for years that the clothes were patched everywhere. You know how rare clothes were in the past? If we saw people wearing trouser, we would think that he is a policeman. No one will dare to confront him because no one wore trousers in the village.” (Salahuddin, male, Sampak Village, 2016).

“Oh my god, our food in the past? It is so different now. In the past, we had to put other thing in the rice. We put leaves, fruit of “ara”, “suir”, candlenut, the skin of banana, fern, etc. to make the rice enough for everybody. I have 11 siblings because there was no contraception in the past. Contraception is quite new. Thus we only got few rice in our plate. Now people eat as much as they want until they are really full.” (Jalal, Sampak Village, 2016).

Perception of vulnerability is also influenced by the role of certain groups in the community, as shown by the perception of older generation. They are the ones who have a role in the community to lead in the TEK system, and to guide the community during climate change. Their role is to keep the stability in community, thus they may downplay the vulnerable situation and emphasize that things are under control.

Low perception on vulnerability can also be caused by the fact that older generations are also religious leaders. They are more receptive towards their vulnerable conditions because complaining is also considered as being ungrateful to God. They also consider materialism as shown in the objective well-being of other groups of smallholders as hedonism and should not be the main purpose of life.

The experiences of older people through time helps us to understand better what factors have been important for vulnerability reduction so far in the upper watershed. Tables 4.3, 4.4, 4.5, and 4.6 (column 4) show that access to the market for selling and buying enabled by the better road conditions; research and technology; access to information; and policy in education, health, and reproduction are all important factors reducing present vulnerability significantly. For example, the development of roads in rural areas has proven to be very crucial for vulnerability reduction. The life of smallholders started to improve along with the improvement of road access, as it enables better access to markets resulting in increased incomes:

“With the construction of rural roads, the first thing that happened was the selling of coffee, candlenut, and forest honey. In the past, there was no price for coffee, candlenut and honey. Candlenuts were everywhere in the village and no one really cared. We just utilized it for shampooing our hair.” (FGD Older Generation Batudulang Village, 2016).

Rural roads made it easier for smallholders to sell their agricultural and forest products, as buyers started to come to the villages from the city. With the increases in income, smallholders can buy food, clothes, and other things, and roads ease access to buying food in the market when smallholders suffer from a harvest failure. Rural roads also opened access to technology such as motorcycles that have changed smallholders’ vulnerability outlook. Before road construction, smallholders had to walk for days to carry fern or candlenut, while now it has become easier for them to

reach the city by motorcycle:

“In the past, we walked. There was no asphalt road. We had to stay overnight in the forest for two nights. Motorcycle has made our life so much easier. Rural road also made our life easier. What we could not bring in the past due to the limitation of our human power, now we can bring it with motorcycle and truck. Everything can be sold. Even if it is not big amount of money, at least, we get money. So, we are so grateful.” (FGD older generation, Sampak Village, 2016).

Rural roads also help smallholders to activate their social capital, especially through kinship. When hit by harvest failures, smallholders bring candlenut and fern to their families in towns or in other villages to be exchanged for rice. It is a part of tradition that smallholders’ family, in other places, help them during hard times and better roads facilitate these exchanges, while in the past, the lack of road access forced smallholders to survive on their own in isolation during hardships.

Research and technology also play an important role in reducing vulnerability in the upper watershed. Motorcycles have changed smallholders’ lives as they become more mobile. They are able to save their time and energy in accessing the market by not having to spend days to walk to reach it. When droughts hit, motorcycles make it easier for smallholders to access water springs located far from the village.

The invention of paddy seeds resilient to droughts, that are easy to harvest, and that are short-lived and can grow well under tree shade has changed smallholders’ vulnerability as well, . contributing significantly to smallholders’ food security. In the past, they had to wait for six months to harvest their local paddy seeds, while the new seeds only need 3-4 months. Therefore, smallholders always plant this new seed, because they have learned from experience that this type of paddy is the most suitable with their local environment.

“The red paddy, this type of paddy is superior. I wish you could come here to see it when we harvest it. They yield of this paddy is abundant. Other types of

paddy are not as good as this one. This red paddy is really a success. The only flaw is that we do not have irrigation here.” (FGD men, Kelungkung Village, 2016).

“There is no doubt about the red paddy. It has been here for long. It came from abroad, I guess. Maybe after some researches on what kind of paddy that are more resistant toward diseases and short-lived, the paddy then being released to the farmers. This paddy does not grow well in the paddy field “sawah”. Due to its thin straw, this paddy will fall down with lots of water. So, this paddy is not a local seed. This paddy was planted the first time in Sebasang Village. Jala was the name of the person who introduce it. It was planted by one person, named Bonong. He just tried it. After the harvest, we asked him to give us the seeds. We planted it here. It was good. Since then, we have never planted our local paddy any longer. There were some other new paddy seeds being introduced by the government such as 64. But in comparison with the red paddy, the 64 was defeated. Therefore, we keep on planting the red paddy. It is very sturdy. It grows well under the candlenut and guava. In short, this paddy is stubborn to the disease. We call the paddy Iraq. Why Iraq? Because it defeated all type of paddies. Iraq is a country that are always in war. It suits this paddy. The grain of this paddy is red. We like this paddy.” (FGD older people, Kelungkung, 2016).

Technology also helps smallholders to get easier access to information, such as from the television. They can also exchange their knowledge and information easily by using mobile phones. However, there is a vulnerability paradox. On one hand, technology can reduce vulnerability. On the other hand, wanting technology is an important factor that makes people feel vulnerable. Smallholders perceived that owning the most up-to-date technological device is a symbol of the good life. Therefore, not having things such as mobile phones, TVs, refrigerators, etc. makes them feel vulnerable.

4.6.4 Hidden Vulnerability

The different vulnerability perceptions of different groups of people such as males, female, the elderly and youth raises a question of whether their vulnerabilities are really different from one another, or do they have perception biases? Which factors might lead to the biases? In order to discuss the potential bias in vulnerability perception of smallholders, I use my analysis as a researcher based on the information I gathered from the smallholders as well as my own observation on their lives. I discuss the potential biases of vulnerability perception for each group below:

Male adult

Table 4.2 shows that male smallholders perceive only one vulnerable condition (out of 19), low levels of education as the outcome of the decreasing income level, while other groups mentioned a wider range of vulnerable situations. The low level of vulnerability perception of male adults raises a question of whether male adults are in fact less vulnerable than other groups or it is a sign of perception bias? My research finds that male adults are more vulnerable than they perceive. In particular, they are mostly vulnerable physically due to the nature of smallholders' livelihoods that rely on male labor.

Male adult smallholders are exposed to higher physical risks compared with other groups. The intensive human labor-based livelihoods in the upper watershed are mostly managed by adult males. Adult males are involved in all stages of agricultural-based livelihoods, especially those that need intensive human labor, such as cleaning and fencing land, taking care of the cattle, etc. They also undertake work which is highly risky, such as spraying herbicides to grass and pesticides to plants. Adult male

smallholders who gather honey in the forest are also exposed to physical vulnerability such as strenuous walks in the forest, risk of falling from trees, and getting stung by the bees. Adult male smallholders also have to clear forest lands and confront directly the risks of punishment from the government. The increasing temperatures may make male adults suffer more physically because they must conduct hard labor under the extreme weather. This will make them become more vulnerable to illness that will disrupt their livelihoods, and thus will increase their own and their families' vulnerability.

I would argue that culture is the most important factor that acts as barrier for men to really see their vulnerability. Men are expected to be strong in that they should not complain about their own situation. As the breadwinner, adult men in the family carry a burden to make sure of the survival and well-being of their family. Complaining and feeling vulnerable are signs of weakness, thus instead of articulating their vulnerability, they prefer to hide it to keep their strong image intact. Another possible reason for their low perception of vulnerability is also related to women's vulnerability that I will discuss below. It is possible that men do not feel vulnerable because there is other group, namely women, that act as the buffer who absorbs the other's group vulnerability.

Women

Table 4.2 shows that women perceive a wider range of vulnerable conditions (13 out of 19) compared with other groups. This shows that women are capable of articulating their vulnerability better than men if given a chance, such as in the focus groups that I held for women. Even though it seems that we can get better picture of

vulnerability through women's eyes, there are always a risk in missing the hidden vulnerabilities that are not easily to articulate by the vulnerable themselves. My research strongly confirms that vulnerability is deeper than just the perceived vulnerability. The vulnerable themselves do not even realize some elements of their vulnerability, such as shown in the case of women's perception and objective vulnerability.

Powerlessness. One of the striking elements of vulnerability in my research area is the powerlessness of women before and during climate change events. Women in the upper watershed are mostly vulnerable due to the very limited livelihood options available for them. They feel hopeless because they are unable to contribute to their households and community to improve the situation. Climate change further reinforces their powerlessness that lead them to justify their miserable conditions as something that they deserve because they cannot do anything. I would argue that climate change also reinforces the subordination of women and a major setback for women empowerment in patriarchal society. Even further climate change could put women into the risk of domestic violence, as many studies have shown. *"We are truly lucky that our husbands do not hit us in this hard time, because we can only sit waiting for them at home."* (FGD women, Kelungkung, 2016). It is not easy to know the correlation between climate change and domestic violence in rural households. Domestic violence is a taboo that no one really wants to share and discuss. However, the above quote gives a strong hint that there is potential for climate change to increase the likelihood of domestic violence that puts women into more vulnerable condition. Climate change reinforces the powerlessness of women that make them justify the domestic violence as something they deserve.

Another evidence that supports how powerless women are during climate change

is that women become the last resort to overcome the accumulated negative impacts. When climate change significantly diminishes livelihood assets and disrupt livelihoods, it is often women who will go to work as transnational migrant workers (TKW) in the Middle East, Singapore, or Hong Kong. TKW is often the only work available for women from the upper watershed, but being a TKW is not a freedom of choice for the women. It is rather imposed upon them by others, as shown by the quote from one group: *“So, when we lose everything (livelihood assets), it is the time to take our women to the airport (to work as TKW)” (FGD young people, Kelungkung, 2016).*)

The quote above implies that being a TKW is more or less because of the pressure from society and family, rather than an idea from the woman herself. Instead of women going abroad as housemaid, why are men not working abroad as farm labor in Malaysia when the opportunity is also open for men? It shows that women are more vulnerable in that there are markets for people that capitalize on the precarious situation of women for their benefit as a cheap labor. Women do not have an aspiration to be TKW; thus TKW is a form of self-sacrifice by women.

Climate change may force women more to work as TKW. From many other livelihoods, TKW is considered the last option. In patriarchal society where the bread winner in the family is supposed to be a man, the head of household, the decision to have a wife or a daughter work abroad as TKW has never been easy. It signifies a failure for a man to provide for the family. It is a sign of crisis, a cry of survival, where women that are supposed to be home close to their family have to leave, confronting higher risk, to save their family. The risk embedded in TKW is remarkably high, as TKW has never been thought of as a decent work. It is the only work available for women who do not have other skills or who are uneducated (Nurchayati, 2011;

Wiratri, 2016). Women working as TKW note their emotional insecurity despite the increased economic security; they cannot meet the ideal concept of ‘women/mothers’ where they are obliged to be present at home for their husbands and children and responsible for all domestic work (Nurchayati, 2011; Wiratri, 2016). They are emotionally vulnerable in enduring long physical separation from their families that evokes longing and sadness for many migrants (Silvey, 2006). Their long absence oftentimes threatens their own relationships inside the family and with their children (Silvey, 2006).

“It is hard to make my son Bayu (5 years old boy) close again to me after I came back from Jordan. He does not really want to be with me. He maybe gets used to not to have me as his mother or maybe he is still angry that I leave him for two years.” (Buniyati, female, 23 years old).

Women are vulnerability from the beginning of the process of becoming TKW, when they are working abroad, and when they return to Indonesia. They are not legally protected and more vulnerable to exploitation and maltreatment. They must deal with panderers who ask them to pay more for their documents needed to go abroad such as passport, medical check-up, etc. When they are in Jakarta to get some training and wait for their placement, they are given very sparse facilities and food. When they are abroad, their passports are held by their employer, they live in employers’ houses, and most of them are not allowed to leave those houses. They are in isolation that exposes them to higher risks of abuse, exploitation, and sexual harassment, and makes it harder for them to seek help from the police and other authorities (Nurchayati, 2011). Some Indonesian TKW in the Middle East sustained serious injuries and died on the run from abusive employers who confined them (Nurchayati, 2011). They are subjected to long hours of work work (16-20 hours per day,

seven days a week, with no holidays), non-payment of wages, physical abuse, or sexual harassment. Upon returning home in Indonesia, they also become a target; when on their way to their hometown, sometimes hoodlums get in the bus just to look for TKWs and coerce them to give money. The latest case from Nusa Tenggara Province was a TKW who was brought to a hospital by her employer where an organ was taken without her consent. In the upper part of Batulanteh watershed, some known cases are TKW sprayed with hot water and impregnated by her employer. TKW are also very vulnerable to trauma and suffer from mental disorders. In some cases, TKW returning home become very stressed and suffered mental disorder when they find out that the money they sent to home while working abroad was used by their husband to get a second wife or spent by her families. TKW also suffer from high social expectations that when they return, they will bring large amounts of money, and the inability to fulfil these social expectations creates further difficulties for reintegration when returning.

It is not easy to know certain vulnerabilities that are hidden deeper, such as the potential of increasing domestic violence in rural households due to climate change. This type of vulnerability is hidden because domestic violence is a taboo: talking about domestic violence puts men in jeopardy and tarnishes their reputation, while women feel ashamed and strictly forbidden to talk about the “dirty laundry” of their family. Thus the vulnerability of women that we can gather from their stated perceptions may just be a tip of the iceberg of their “real” vulnerability. Being in powerlessness situation in such a long time can also make women normalize their vulnerability, thus they do not feel that they are vulnerable.

Elder Generations

The older generation perceives that they are becoming less vulnerable over time, as they perceive that they were more miserable in the past. Despite their low vulnerability perceptions, the older generation is still vulnerable to climate change. Older people have limited livelihood options, due to their decreasing physical power, while the majority of livelihoods in the upper watershed are natural resource-based livelihoods that require intensive or heavy human labor. For example, due to the high risk in gathering forest honey, the older generation is no longer able to go into the forest due to their decreasing physical strength:

“We are already old. We cannot longer do the physical work as much as we did when we were young. Thus we cannot go to the forest gathering honey. This is a tough situation for us. It would be great if we get venture capital to start something that does not require intensive human labor.” (FGD, older people, Kelungkung, 2016).

The older generation, then, relies more on their children for their well-being. The fact that younger generations will act as the buffer who should take care their older generations is also a possible factors why older generations do not feel too vulnerable. This shows that the vulnerability of certain groups of people interactively influences the vulnerability of other groups. In this case, the vulnerability of older people puts more pressure or burden on the younger generation that are already struggling with their own life. Older people also get sick easily, as hot weather and drought make people cough from dust and suffer respiratory problems. Older people are also more stressed during the climate change because they have a specific role in their community when climate change hit. They should show that they are knowledgeable enough about it to give guidance to their community. They are also the ones who are

responsible to keep the family intact and calm during a hard time: *“Yes, it burdens us. We keep on thinking about our water, when the rain to come, etc.”* (FGD older people, Kelungkung Village, 2016).

Older people’s perception on vulnerability may be a bias coming from their role in the community, which is to maintain a sense of stability and normality. The older generation is seen as the wisest so that others look upon them for examples on how to lead a happy life despite the challenge of multiple stressors. Thus older generations value grateful attitudes instead of complaining about their vulnerability, regarded as an ungrateful attitude toward God. Elderly people also have low vulnerability perception due to their cognitive baseline that they have experienced the worse conditions in the past. In the context of environmental hazards, direct personal experience has consistently been shown to be positively associated with risk perception (Grothmann and Reusswig, 2006; Terpstra, 2011). My research shows the opposite: that experience does not always increase risk perception. In my research area, older people who experience more risk in their life have low perception compared to younger generation.

Youth and Children

Most of the time, in order to apprehend young people and children’s vulnerability, it needs to be accomplished through the eyes of a third person, such as an adult that it is close to them. In this research, the vulnerability of children exists, but is hidden from a general discussion and thus is based from my own observation and experience encountering them in my everyday life. I was born and raised in Sumbawa and some of my relatives and neighbors are working as a TKW, thus, I am familiar with many stories of children’s miserable life resulting from TKW. It helps me to be aware of the

hidden vulnerability of youth and children that I observe is missing when discussing vulnerability with adult populations. Besides being vulnerable by the direct impacts of climate change to their health such as coughing, asthma, and flu, children are also more vulnerable due to the emotional struggle they are being left by their mothers who work as TKW. These can be long term effects for the children. I relate several stories below:

Bob's Story

Bob is his nickname, and he is a friend of my younger brother. Three years ago my brother told me that Bob died by suicide through electric shock. My brother told me that Bob had never overcome the lonely feeling since his mother left him when he was a kid to work as TKW. The day his mother left, he moved to the basement of his grandparents, a place that is supposed to be a place for his grandparent's dog. He stayed there with the dog and refused to talk for many days. After many years passed, Bob was able to enter university with his mom's money, and he seemed like a normal and happy young man. His mother has never returned again. For no apparent reason, Bob suddenly came back to our island, staying again at the basement, and refused to leave for days until one day someone found that he had killed himself there.

Buton's Story

Buton is also a nickname. He is 22 years old. His mother left him to work as a TKW, since he was 7 years old. There was no one who really cared and made sure that he would wake up every morning to go to school, and Buton dropped out school at the age of 10. He works now as a freelance driver. He has a punk hairstyle and always looks happy. One day, I asked him to be my driver to my research areas. On the way back home, I played a traditional Sumbawa song. All of a sudden, Buton cried. He pulled the car to the side of the road, stopped and cried really hard. After sometimes, he said: "sorry boss, I cannot stand to hear that song. That song always reminds me to my mother who never returned again from the Middle East since I was a small kid." Since then, I removed all the sad songs from the car. We only have happy songs for Buton.

Young people in the upper watershed are also forced to undertake certain livelihoods, which are considered as indecent by the wider society, such as being waste-pickers, farm workers, or frog hunters to earn income. They are vulnerable from

society shaming and bullying because of the livelihood choices they must take, and they have low perceptions toward themselves. For youth, water shortage problems, which makes it difficult for them to take a bath and wash their clothes, has hampered their social life with their peers that do not face the same problem, and they easily become anxious about their social life and future.

It is not easy to understand the vulnerability of young people and children to climate change because they often do not articulate their vulnerability as adults do. Thus our understanding of their vulnerable situation is still too general and limited. There is a risk of bias from the third person's point of view which may not always reveal the real vulnerability that they experience, such as the loneliness and depressed feeling being left by their mothers who work as a TKW. There is a tendency to put this group's vulnerability in the last priority of our investigations with less urgency. However, my focus group discussion with young people reveals their vulnerabilities to climate change are very specific to their age, and young people and children's vulnerability should be given the equal attention with other groups'.

4.7 Conclusions

Climate change decreases smallholders' income, increases food insecurity, exacerbates water scarcity problems, and aggravates health problems. Smallholders who rely heavily on land and forest-based livelihood and whose livelihoods are integrated into the market are being hit the most by climate change related and market stressors. Being intertwined with market stressors, not only does climate change decrease the revenue and increase the harvest failure risk, but also it reduces smallholders' product

prices, increases the price of staple food, and destroys rural infrastructures, such as important roads for accessing the market.

However, even though smallholders are aware of climate change stressors, they do not consider climate change as the central problem and they are more concerned about other issues, such as a lack of land. This shows the tendency of bias in perceptions related to vulnerability. Smallholders' focus more on lack of land, while they ignore water scarcity, climate change, or market issues, which are actually more important and significant as the underlying causes of their vulnerability. Smallholders' focus on less influential factors that affect their vulnerability and adaptation to climate change could be misleading for vulnerability reduction efforts. In this regard, solving everyday risks that people perceive will not always reduce their vulnerability.

On the other hand, vulnerable conditions are experienced differently by distinct groups of people. Women are more concerned about domestic issues such as food security and the lack of income, whereas men are concerned about the lack of land and education. Vulnerability perception is highly influenced by both gender and experience through time. Older generations do not feel vulnerable, as a result of perception bias coming from their role to maintain a sense of stability and normality in the community, while younger generations tend to perceive that their well-being is far from satisfying. The different perception of vulnerability from different groups of people raises the question of whose and what vulnerability counts in vulnerability reduction policies and projects, especially if implemented under limited adaptation funds. The hidden vulnerability that cannot be captured by the perception of the vulnerable themselves shown in this research also shows the need for complementing smallholders' risk appraisal with a vulnerability analysis from a researcher or an

outsider.

Smallholders are potentially more vulnerable than they think they are, because vulnerability is also not always easy to articulate. Oftentimes, they do not even realize about their vulnerability. Clearly, culture is the most important factor that acts as a barrier for males to discern their vulnerability. Men are expected to play a forceful role in society, and they prefer to hide their vulnerability to keep their strong image intact. Certain vulnerabilities are also hidden due to the marginality of certain groups, such as women or children. The vulnerability that they experience is taboo and shameful, not to be shared or discussed. Being in a powerlessness situation for a significantly prolonged period of time can also induce women to normalize their vulnerability. Thus, they do not feel that they are vulnerable. On the other hand, belief also causes vulnerability bias, as people appreciate more a grateful attitude instead of a complaining one, and articulating about vulnerability will be regarded as an ungrateful attitude toward God.

The vulnerability perception is also highly influenced by experience across time, as the older generations perceive significant improvement in their life in comparison with the past. Thus, their vulnerability perception is not just an outcome of a series of negative experiences, but a result of their positive experiences through their life. This shows that cognitive baseline of vulnerability is different for distinct groups of people in different times. Smallholders' vulnerability perceptions are closely related with globalization trends, and they feel vulnerable if they do not have money to enjoy the comforts that the economic openness can offer. Thus, cognitive baseline of vulnerability will be highly dynamic through time depending on the rate of globalization.

The fact that smallholders are vulnerable to the impact of climate change and market stressors, while their focus is on the problem of the lack of land, raises a question on their adaptation to climate change. Will they be able to adapt to the changing climate and reduce their vulnerability? In addition to climate change, the bias in their vulnerability perceptions and their existing vulnerability as the outcome of prolonged conflict over forest utilization will further complicate their adaptation to climate change, which I explain further in the next chapter.



FIGURE 4.1: Dry well in Kelungkung Village



FIGURE 4.2: Queue at water well



FIGURE 4.3: Unpaved Road in Sampak Village

Chapter 5

Adapting to Climate Change in the Context of Forest Conflict

5.1 Introduction

After waiting some time for the rain that never falls, smallholders have to face the reality of the impact of drought that reduces their yield, income, and food stock. They must deal with the last months of their diminishing food stock, while at the same time this time of the year requires the biggest spending and labor for preparing the land, buying the seeds and fertilizer, paying for human labor, etc. It is the time for them to take actions not only to overcome the deficit of their normal yield and income due to climate change impact, but also to add their food stock and to cover the cost of the new planting season. Will it be possible for them to adapt to climate change under their existing vulnerability and to reduce those vulnerabilities to adapt to future climate change?

Being hit by climate change and other stressors, smallholders in the upper watershed of Batulante do not stay silent; they take actions to respond to climate changes

impacts. The first point of this chapter is that forest is central for climate change adaptation of smallholders in the upper watershed context. However, the outcome of smallholders' adaptation actions is potentially maladaptive in that their actions manifest in the form of increasing vulnerability of smallholders, underlying vulnerability is not addressed, and it has negative impact for the environment. Another key point of this chapter is that conflict over forest utilization between smallholders and the government strongly influences adaptation to climate change. However, a combination of increased climate change awareness and aspiration appraisal can help to remove barriers to adaptation. My research finds that smallholders need specific climate change knowledge to make better adaptation plans, namely climate change projections brought by actors who have good relationships with smallholders.

This chapter aims to understand the specific characteristics of adaptation to climate of smallholders in the upper watershed, the outcome of adaptation strategies, and the barriers for adaptation to climate change. I present smallholders' coping strategies and their adaptation aspirations. In order to understand whether the actions and aspirations are maladaptive or successful, those strategies and aspirations are analyzed against smallholders' vulnerability, taken from the previous chapter. The maladaptation outcome of those actions and aspirations is analyzed further to understand the barriers to adaptation. I conclude by discussing in what ways aspirations can remove barriers to adaptation.

5.2 Literature Review

Some scholars believe that when climate change hits, rural poor populations end up just coping, due to their existing vulnerability, instead of doing planned adaptation. Despite the fact that coping strategies are also a form of adaptation to climate change, they are considered as reactive adaptations (the opposite of planned adaptation) that tend to exacerbate vulnerabilities of the poor (Adger, Arnell, and Tompkins, 2005), and which are referred to as poverty traps by economists (Ray, 2006). Planned adaptations to climate change are actions taken in present time as an anticipation for future climate change that aims to reduce or alleviate its negative impacts, and scholars strongly suggest that planned adaptation has an advantage over reactive adaptation (Füssel, 2007; Adger, Arnell, and Tompkins, 2005).

An action taken as a response to climate change whose outcome increases vulnerability is known as maladaptation (Barnett and O'Neill, 2010). Maladaptation is not always the outcome of unplanned adaptation or coping strategies, but sometimes intentional adaptation can also be maladaptive in its outcomes (Juhola et al., 2016; Barnett and O'Neill, 2010). Juhola et al., 2016 distinguish three types of maladaptation outcomes – rebounding vulnerability, shifting vulnerability, and eroding sustainable development. Furthermore, Barnett and O'Neill, 2010 define five types of maladaptation: increasing GHG emissions, disproportionately burdening the most vulnerable, high opportunity costs, reducing incentives to adapt, and path dependency.

Factors that lead to maladaptation can be considered as a barrier or limit for successful adaptation. Adger et al., 2007 propose the concept of limits to adaptation as a set of immutable thresholds in biological, economic, or technological parameters.

Some researchers note that resource constraints with financial, technical, and institutional determinants are considered to be more important for adaptation than people's perception (Grothmann and Patt, 2005; Pelling, 2010; Kuruppu and Liverman, 2011). People's perception is often ignored because people are considered to have the perception that they are not able to control environmental problems and their individual level response to climate change is short-term; thus, individual response does not qualify as an adaptation (Grothmann and Patt, 2005). However, the importance of a cognitive aspect for adaptation to climate change has gained more attention lately. The IPCC, 2007 emphasizes that cognitive and behavioral factors constrain successful adaptation, along with other factors. Adger et al., 2007 emphasizes the endogenous aspects of the limits to adaptation for society that is influenced by ethics, knowledge, attitudes to risk, and culture. Furthermore, the limits to adaptation depend on the goals of adaptation that are underpinned by diverse values, uncertainty around future foresight of risk, and social and individual factors. Kuruppu and Liverman, 2011) emphasize that people's response toward climate change is a manifestation of their existing knowledge and understanding. Therefore, this chapter will try to give better understanding of the maladaptation outcome and factors that act as barriers that lead to maladaptation in the upper watershed context of Indonesia.

Climate change knowledge is believed to be one of the key elements of planned adaptation that is critical in the process of decision making for adaptation (Füssel, 2007; Adger, Arnell, and Tompkins, 2005). The most knowledgeable people about climate change are more willing to change their behavior (Scannell and Grouzet, 2010). Despite the fact that the literature mentions the importance of climate change knowledge for successful adaptation, the understanding on what kind of climate change

knowledge leads to successful adaptation is still lacking. Moreover, literature on risk perception shows that climate knowledge does not change the cognition of people to undertake adaptation actions (Kuruppu and Liverman, 2011; Petheram et al., 2010). Thus, this chapter will try to understand whether successful adaptation is influenced by climate change knowledge or other factors and in which way climate change knowledge can help smallholders adapt to climate change.

One of the most important aspects of adaptation to climate change is about breaking the poverty trap and preventing the further downward spiral caused by the negative impact of climate change. The capacity to aspire is very important to break the poverty trap (Appadurai, 2004), as poverty is believed to be a result of lack of aspiration, known as an aspiration failure (Ray, 2006). Aspiration is thought of as a resources for the poor to contest and alter the conditions of their own poverty (Appadurai, 2004), as aspiration contains motivations to change that trigger the effort to make it happen. Aspiration is also a form of voice and expression of views that are oftentimes lacking from the poor (Appadurai, 2004). Therefore, aspiration is a factor that could stimulate a positive adaptation or could reinforce vulnerability to climate change. However, the understanding on how aspiration can break the barriers of adaptation to climate change is still lacking. In this study, aspiration is used as a venue to understand the potential for vulnerability reduction.

5.3 Smallholders' Coping Strategies to Climate Change

Smallholders in the Upper Batulanteh Watershed have taken certain actions to overcome the impact of drought. In this study, I define coping strategies as responses

toward the negative impact of climate change in which the outcome is maladaptive. I define adaptation as actions taken that reduce vulnerability of smallholders. Thus, to define smallholders' action as coping strategies or adaptation, it is strongly related with the outcome of the response. Thus, defining whether the actions of smallholders are the act of coping or adapting can be made later. However, in this chapter, the use of the term of coping strategies from the beginning of the chapter is strongly linked to the potential maladaptation outcome of those strategies implied by the literature. In order to classify the type of smallholders' coping strategies, I modified the classification from Agrawal and Perrin Agrawal and Perrin, 2009, who classified adaptation into four classes: mobility, storage, diversification, and communal pooling. Any of the four classes can be substituted by market-based exchange. I add two classes of strategies based on my finding, which is extensive and lifestyle change.

Table 5.1 shows that smallholders in the upper watershed of Batulante often cope with the livelihood shocks brought by climate change through practicing a new livelihood that they do not normally practice, such as becoming a waste-picker, frog gathering, or birds poaching. However, such diversification in my research area happens when the major livelihoods are disrupted, while the notion of diversification in Agrawal and Perrin, 2009 is related to risk reduction across assets owned by households. Coping strategies are also conducted by changing habits or lifestyles, such as cutting spending by reducing cigarette consumption, reducing food portions, or reducing bathing to save water.

Smallholders also try to find other jobs, for example women can try to become a transnational migrant worker, or men can be hired for farm labor outside their village. I classified all these as forms of mobility. Agrawal and Perrin, 2009 mentioned

that mobility is the most common and seemingly natural response to environmental risk to pools or to avoid risks across space, such as by shifting grazing lands. Coping strategies are also performed by conducting livelihoods already existing in their portfolio more extensively, such as honey gathering in the forest and other agricultural based-livelihood. Smallholders also sell their stock of food and livestock to overcome the impact of climate change, which I classified as “storage” in the coping strategies classification. Rural people’s storage pools reduce risks experienced over time (Agrawal and Perrin, 2009). Communal pooling that refers to adaptation responses involving joint ownership of assets and resources during the times of scarcity (Agrawal and Perrin, 2009) does not occur in the upper watershed of Batulanteh.

Table 5.1 shows that smallholders prioritize responses to deal with income lost rather than the problem of water scarcity. This shows that income pursuit livelihood goal remains the major influence for smallholders’ response to climate change. Smallholders even make vulnerability tradeoffs to deal with the income lost by selling their food stocks and livelihood assets such as livestock and land, both of which are maladaptation that will increase food insecurity and diminish assets important for future adaptation to climate change.

5.4 Stages of Coping Strategies to Climate Change

Impact

In order to understand better the link between smallholders’ adaptation strategies, vulnerability, and the local environment, especially the forest, I classify the response into stages of response and resource needed. In order to respond to climate change,

there are several stages of actions that smallholders undertake, as shown in Table 5.2. They start with actions that do not require monetary and property resources, that is, mostly forest-based resource livelihoods, followed by absorbing the impact of climate change through their human body. If climate change impacts rise, they will then sell their livelihood assets.

Forest as a buffer. Under the impact of climate change that diminishes their livelihood assets, smallholders start their response by undertaking actions that require less economic assets (stage I). Honey gathering, candlenut picking, bird poaching, and vegetable and fruit gathering in the forest become their first major coping strategies. Not only is the forest resource used by smallholders to provide direct income, but also to reduce spending for fertilizers to start their production when their income is decreasing due to climate change, as smallholders get the benefit of fertile soil from the land they get from forest conversion. Forest is also used to offset the maladaptive outcomes of other non-forest based smallholders' response. Often times, smallholders have to sell their land to overcome the impact of climate change that hits during their biggest spending needs: the payment of children's education at the start of school year, the last months of their food stock, and the start of planting season that requires money and labor for preparing the land, buying the seeds and fertilizer, paying for human labors, etc.

This shows that forest is a very important resource for smallholders in the upper watershed to adapt to the impact of climate change, despite the fact that smallholders simultaneously aspire to have more land from converting forest into agricultural land. Thus there is a contradiction: smallholders have aspirations to increase their land by converting forest, yet they are most reliant on forests as their most important coping

strategies during hard times. While forests are critical for smallholders' survival when climate change hits, smallholders do not always appreciate the importance of forest as a safety net.

This raises a question on how to position smallholders' goals in relation to adaptation to climate change, because their livelihood goals are proven to be potentially negative. The importance of forest for smallholders' adaptation provides a leveraging opportunity to possibly reduce the conflicting goals over forest between smallholders and the government, as retention of forest can act as the common ground for both interests. Forests are important for smallholders to cope with the impact of climate change, while at the same time the government's goal supports forest sustainability. However, the reliance on forest for their coping strategies also brings another risk for smallholders that I will explain further in the maladaptation subsection later in this chapter.

Human as a buffer. When the impact of stressors is severe and the money gained from forest-based resources cannot make both ends meet, and they also have lack of assets, smallholders start to absorb the impact of climate change with their human labor by working harder in the farm, going deeper into the forest to gather honey, or working long hours as a TKW (Stage II). They also change their daily habits: spending less, eating less and showering less. Smallholders also undertake livelihoods that are less preferred, such as being a scavenger or TKW. This second stage of coping strategies also highlights the importance of forests, as smallholders will have to enter this second stage when their use of NTFP's is not sufficient to overcome the impact of climate change. While by entering the second stage of their coping strategies, smallholders start the phase of increasing their vulnerability and I will

discuss it further in the maladaptation section.

Selling livelihood assets. If the impact of climate change and other stressors is bigger and more accumulated, smallholders have to sell their important livelihood assets, such as land and livestock. Due to the lack of liquid assets, smallholders sell their land that has secure land tenure in order to get a better price. Oftentimes, smallholders sell their land when their children need to pay for education, their daughter or son gets married, or if one of the members of their family gets sick. Afterwards, they will convert more forest to compensate the loss of their land, and risk conflict with the government. The practice of selling land is becoming more common, especially in Kelungkung Village due to the increasing interest of buyers from the city to own land with beautiful landscapes. Smallholders also take the opportunity of both the increasing price of land and the increasing interest from urban people to acquire land in upland areas. This provokes a negative sentiment from the government, which puts the blame on smallholders for the lack of land, due to the increasing trend of land grabbing. I will discuss further the outcome of these actions for vulnerability reduction in the later part of this chapter.

5.5 The Outcome of the Coping Strategies: Maladaptation or Successful Adaptation?

In order to understand maladaptation or successful adaptation in my research areas, I examined smallholders' coping strategies by analyzing the outcome for smallholders' vulnerability taken from the vulnerability analysis in Chapter 3. Maladaptation or successful adaptation will be defined whether the actions reduce or increase

smallholders' vulnerability, create new vulnerability, or increase vulnerability of others. My research shows that coping strategies are the least preferred livelihood type taken under the situation of limited and diminished assets. Coping strategies do not help smallholders to get out completely from their vulnerability, as these responses are reactive, short-term and do not address the underlying problems. These responses will not make smallholders' become more resilient against future climate change, and these coping strategies to some extent tend to exacerbate smallholders' vulnerability. Therefore, I can conclude that smallholders in the upper watershed are maladaptive to climate change.

The maladaptation outcome of smallholders' coping strategies is noticeable in the upper watershed. Despite the fact that smallholders' coping strategies are mostly centered around overcoming income declines as shown in Table 5.1, most of their strategies rely on low income livelihoods, and these coping strategies cannot overcome their vulnerability. Even more, Table 5.1 shows that smallholders' coping strategies do not address other vulnerabilities brought by climate change impacts such as food security, water scarcity, and health problem. Smallholders' coping strategy to overcome water scarcity by showering less has no impact in addressing the long-term water scarcity problem. Furthermore, smallholders do not have any strategies to address health problems. Table 5.2. shows that smallholders are forced to take certain livelihoods seen as indecent work which may in turn create new vulnerability for smallholders. Smallholders also face the increasing risk of conflict among themselves, due to the increasing competition to get forest resources such as forest honey and candlenut that can trigger upheaval among villages, which will create, in turn, new vulnerability.

Adaptation is considered as successful if the action does not increase smallholders'

vulnerability. In my research area, smallholders' response to climate change tends to increase smallholders' vulnerability. Tables 5.1 and 5.2 show that most of smallholders' livelihood strategies rely heavily on a livelihood that forces them to use their human labor more extensively. They work for hours in their or others' lands, walking for hours to gather honey in hot weather, and risk falling from the tree or from getting stung by the bees. The combination of one of their coping strategies, which is to reduce their food consumption, while at the same time, they are forced to do coping actions that requires extra physical energy, makes smallholders easily sick and unable to conduct their livelihood activities.

Vulnerability of women is also increased due to fact that TKW is their main coping strategy to adapt to climate change. This adaptation strategy exposes the whole members of families into a new dimension of vulnerability, as explained earlier in Chapter 3. Smallholders' coping strategy to sell their food stocks to gain more money also increases smallholders' food insecurity problems. Smallholders are also forced to sell their livelihood assets such as land and livestock that reduce further their livelihood assets and trap them in the downward spiral of poverty and debt.

The increase of greenhouse gas emissions from forest degradation is also considered one of the outcomes of actions defined as maladaptation (Barnet and O'Neill, 2011). Smallholders' coping strategies that are based on forest will also potentially increase further the tension between smallholders and the government, given strategies oftentimes have negative effects for the environment, such as illegal logging and bird poaching. Moreover, most of the time there is no distinct separation between smallholders' coping strategies and their normal livelihoods. Under the climatic and

non-climatic stressors, smallholders prioritize their major livelihoods, which are agricultural based. In this case, they also convert forest into agricultural land to get fertile soil to overcome the decrease in income from the impact of climate change by reducing their spending to buy fertilizer. Forest conversion into agricultural land also will increase the vulnerability of other populations, such as those downstream, considering that the forest ecosystem in the upper watershed provides important environmental services like water. The increase in floods in the downstream and high rate of sedimentation deposits in coastal areas are among the examples of how environmental degradation in the upper watershed can affect other populations in different places. Moreover, environmental degradation will limit climate change adaptation options for future generations.

Water scarcity additionally affects smallholders' vulnerability in the upper watershed. Consequently, the lack of action to address water availability is one of the biggest maladaptation outcomes. Better water availability can overcome the problem of food security, economy, health, and other vulnerabilities. With water being available and accessible, smallholders will be able to increase their income, which is their main goal. Available water will enable smallholders to get more crop yields from their farm land, because they would be able to plant more than once a year. Water availability will also render livelihoods such as paddy less sensitive to climate change, particularly drought. Water availability will also make other livelihoods opportunities become possible. Thus, the lack of water in the upper watershed limits smallholders' options to diversify their livelihoods, such as planting more than once in a year in their land, and forces them to increase their production through land extensification, the major cause of disputes between smallholders and the government.

Water availability would make the upper watershed environment become sustainable, because smallholders could undertake intensification on their existing land and would not need to turn to extensification.

The reduced conflict between smallholders and the government would ease smallholders psychologically, because they would not have to illegally cut down forest to get arable land. They would no longer be perceived by the government as forest destroyers. It would also increase the trust between the two sides, which is important for climate change adaptation. The solution to the water problem could also reduce the internal conflict among smallholders that are mostly related to water scarcity. Reducing the conflict would help increase social capital essential for adaptation to climate change. Furthermore, the shortage of water makes it difficult to materialize smallholders' aspiration. Planting vegetable and fruit trees, applying improved animal husbandry and poultry are difficult without sufficient amounts of accessible water. Some farmers have tried to plant fruit trees on their land, but failed because it was difficult to get water during the dry season. The factors that cause the persistence of water scarcity problems in the upper watershed of Batulanteh are discussed below as barriers to adaptation.

5.6 Adaptation Barriers

The maladaptation outcome of actions taken by smallholders in the Upper Watershed of Batulanteh leads to the discussion about barriers to adaptation. There are two major impacts of climate change in the upper watershed of Batulanteh that need further explanation. First, the problem of low income that becomes the center

of focus of smallholders' response is not well addressed by smallholders' response. Second, the fact that smallholders' actions do not address the water scarcity problem is quite problematic for adaptation. Thus, I focus the discussion about adaptation barriers toward the issue of lack of income and water scarcity.

5.6.1 Lack of Natural Resources and Limited Livelihood Diversification

Smallholders coping strategies discussed earlier in this chapter lean heavily on natural resources considered “free”, despite the risk of conflict with the government. The limitation of dependence on natural resources is also obvious from smallholders' coping strategies; not only are natural resources limited in terms of the amount of land that people have, but also the land that they have is marginal and is only productive once in a year during the rainy season. The lack of natural resources limits smallholders' option to diversify their livelihoods and to generate higher profitability of livelihoods.

Ellis, 1998 has stated that livelihood diversification is an important component of sustainable livelihoods, while unsustainable livelihoods can be the reflection of the limited availability of alternative income sources (Vedeld et al., 2007). Where cultivation of marginal lands takes place in the absence of non-agricultural income potential, low agricultural productivity and profitability can force smallholders to mine natural resources as a livelihood strategy, leading to further encroachment on marginal lands (Reardon and Vosti, 1995). Thus, development of off-farm non-agricultural income diversification is crucial in limiting future forest clearing (Reardon and Vosti, 1995;

Vedeld et al., 2007). Thus, the limited off-farm livelihoods options in the upper watershed are a result of the lack of resources to make other livelihood options and also the result of the lack of government adaptation policy in the upper watershed that I will explain further in Chapter 6.

To certain degree, livelihood diversification is happening in the upper watershed of Batulanteh, mostly due to globalization. The disappearance of paddy and substitution by maize, because smallholders prioritize cash crops, shows that globalization can be one of the major factors causing rural livelihoods to be more diversified and less tied to land-based resources. Thus globalization plays a major role not only as a major stressor for livelihood as noted in Chapter 3, but also as an opportunity to adapt to climate change through livelihood diversification.

However, the use of globalization as a platform to adapt also brings another complication, as smallholders' vulnerability can be increased. My research shows that the income diversification that happened due to globalization is not always off-farm and it cannot reduce pressure on the environment. Income diversification due to globalization can be in the form of farm-based livelihoods, which potentially can increase environmental degradation, as has happened with the maize case.

Off-farm based livelihoods also bring complications to smallholders' adaptation to climate change. Off-farm based livelihoods can make smallholders more vulnerable to price fluctuations of the global market, which will be affected by climate change. In addition, if smallholders depend on off-farm based livelihoods and abandon farm-based livelihoods like paddy, the uncertainty of market and price fluctuation, especially the increase of food price, can swell smallholders' food insecurity. Moreover, oftentimes farm-based livelihoods such as paddy play a key role in preserving social

capital that is critical for successful adaption to climate change. Thus, by having paddy as a livelihood, smallholders activate their TEK system, including the practice of many traditions that can help increase social cohesion in the community. Therefore, successful adaptation to climate change in the upper watershed needs to acknowledge that certain livelihood practices that are considered negative for the environment have been long part of the livelihood repertoire of rural people (Li, 2002; (Vedeld et al., 2007), and they have an important role in increasing social capital as shown in this research. This research shows that the farm-based livelihood in the upper watershed cannot be written off without proper thinking on how social capital can be developed under new off-farm based livelihoods, and how to make sure that smallholders will not be more vulnerable under diversification considering the stressors of market uncertainty and price fluctuation.

5.6.2 Cross-scales and Different Level of Decision Making for Adaptation Actions

The fact that smallholders' coping actions do not address the water scarcity problem shows that the problem of water availability is considered beyond smallholders' capacity. The available options to solve water scarcity problems include making dam structures, groundwater boreholes, and pipes draining from springs requires lots of resources and expertise that is unavailable at individual or village levels. The decision-making on high cost solutions, such as dam structure or groundwater borehole, is in the hands of the national government, located at different scale from the local site where the vulnerability happens. Thus, it is important to understand the decision-making process that links the vulnerable with decision makers at different levels,

because as my research shown, the adaptation decision making to reduce vulnerability at local scale is oftentimes in the hands of a higher level (explained further in Chapter 6). The problem of water scarcity in the upper watershed is more complicated to solve, because the options to overcome water scarcity issues are thought to be a major threat for water availability in the downstream areas.

Moreover, in order to solve the water problem for certain populations, it requires cross-administrative agreements that go beyond the capacity of smallholders and even the community at village level to negotiate or decide. Thus, the decision-making to solve water scarcity problem cannot be undertaken at the village level where the problem occurs. For example, to solve the problem of water scarcity in Kelungkung Village, one of the options is to drain the water through pipes from the springs in Batudulang Village. Smallholders in Kelungkung Village cannot decide to drain the water from other villages, as only government is the one who can take such decisions. Therefore, in order to solve the problem of water scarcity, smallholders in Kelungkung Village depend on the goodwill of the government, while the goodwill of the government toward certain communities depends on the relationship between smallholders and the government. Thus, in this regard, long standing conflict between smallholders and government over forest utilization influences the options and policies for adaptation in the upper watershed and potentially increases smallholders' vulnerability.

5.6.3 Lack of Adaptation Funds and Experts

Actions needed to solve the underlying cause of vulnerability oftentimes require high cost that is beyond smallholders' capacity. Even though people believe in the

effectiveness of actions such as impoundments and boreholes, they are not able to implement them due to barriers of cost. These actions are expensive enough that even the local government does not have the resources needed, let alone the smallholders. The high cost of the adaptation actions requires the national level government to step in.

A lack of expertise is also one of the barriers to solve the water scarcity problems. For example, there is no local TEK that specifically addresses the problem of water scarcity. Even though some smallholders have tried to dig wells in the upper watershed, most of the times their efforts were in vain. The wells were often times dry due to the difficulties in knowing where the groundwater is in the hilly upper watershed setting. Thus, experts from outside of community are needed to help solve the water problems.

5.6.4 Lack of Agency

However, the lack of adaptation actions is not always due to the lack of funds. Smallholders in the upper watershed generate considerable amount of money from TKW and planting corn. However, the income gained is not generally used for adaptation to climate change. The money gained from TKW, for instance, is used to change their wooden house into a concrete house, to buy a motorcycle, house furniture, cellphone, refrigerator, etc. instead of allocating the money to dig a water well: *“Yes, if we had more money, we would change our wooden house little by little to become a stone house.” (FGD Youth, Batudulang Village, 2016).*

This shows that the lack of agency is a barrier for adaptation to climate change

that even if smallholders gain more income, there is no guarantee that they will address the water scarcity problem. Lack of agency in this context is a lack of intention to utilize the resources or income gained from livelihood activities to solve the underlying causes of vulnerability. The same also has been documented in Kiribati where sometimes people considered it was better to use funds for other priorities such as buying television, motorbike, or DVD player that could bestow social status (Kuruppu and Liverman, 2011). People in Kiribati also think that the cost for adaptation is expected to come from the government or external aid. Similarly, the government in Sumbawa also complains about the lack of initiative taken by the smallholders to solve their problems:

“The smallholders rely only on the government aid. They do not have initiative on their own to solve their own problems. They are only interested on the government aid. For example, even if we gave them some support such as hand tractors, or other agricultural machines, they do not take good care of it. Once the machine is broken, they do not bother themselves to try to fix it, because they know they can ask for the new support.” (Regional Planning Agency, 2016).

5.6.5 Lack of Social Capital

Although the government has programs to solve water scarcity problems in the upper watershed, the lack of social capital has become a barrier for the success of the programs. For example, one of the water projects in Kelungkung Village was to drain water from a spring in Sakedit (a hill about 4 km far from the village) through pipes. However, the water from the spring was not sufficient for all the population and sometimes the water does not reach the houses that are located farthest from the water source. Smallholders whose houses are the first to pass by the water pipe are the ones who can get the water. Smallholders who do not get the water then break

the pipes with the argument that no running water at all is much better and fair for everybody. Until now, no one has repaired the water pipes because people are afraid that it will add more conflict in the community.

Failure of government programs have also occurred in the project to drain water from Batudulang to Kelungkung Village. When the water does not flow because the pipe is filled with moss, or broken by a rock, there is no one cleaning the pipe because the government did not build a water management system along with the local people. There were unclear rules about who is responsible for cleaning and repairing the broken or dirty pipes:

“The drained water from the pipes from Batudulang will not last. Usually, it works for 2-3 months, and then it stops. It is because when the villagers have conflict and fight each other, then no one will want to fix the water pipe. Our men here, they are so annoying! They never go fixing the water pipe as soon as the problem happens. Moreover, fixing the water pipes requires some additional cost as well.” (FGD Women, Kelungkung Village, 2016).

Thus, any adaptation project will fail if it does not pay attention to the social capital where the project takes place and it also shows the importance of local water governance and strong social institution to be established before the implementation of any physical project for adaptation to climate change.

Trust is a part of social capital that is important for adaptation to climate change. The lack of trust in a community hampers the success of adaptation projects. For example, young people in Kelungkung Village do not want to be involved in the installation of pipes that will drain water to their village. They feel that they are only being used, while others such as local elites will take advantage of the project. Any adaptation projects carried by the government are suspected to benefit only certain groups of people in the village, especially local elites. Every government

project that requires in-kind contributions from the community becomes difficult to implement, because every time the local elite said that a particular project lacks operational funds, smallholders believe the opposite. They believe that the project is funded and the local elite is trying personally corrupt it by saying that the project has no operational fund.

Low level of social capital limits adaptation options in the upper watershed, because it will rule out other adaptation options that can be done in groups or as a community, rather than as individuals. For example, smallholders can dig additional wells in the village in groups to share the cost and human labor. Smallholders can also reduce the theft of livestock or crops if they can work together and make night watch schedules. The lack of social capital also makes smallholders discard some potential adaptation ideas, as they realize that the options will be difficult or even impossible to implement because of the existing conflict in the community. Moreover, people already have experience in the failed water projects in their village caused by low social capital.

The failure of government water projects elsewhere related to low social capital also occurs. When I worked as a farmer's group facilitator in for the FAO in Lombok, some deep groundwater wells, one of the government's projects, was no longer functioning. Even if it works, it turns out that the water from the borehole cannot be enjoyed by everyone: mostly the head of a local group or the local elite monopolize the use of the well. The operating costs of deep wells are also expensive, so only the already rich farmers can use the wells. Conspiracy between the group leader and the agricultural extension officers in determining where the groundwater well should be made also occurs, as usually the wells are made in the group leaders' land, and agricultural

extension workers usually get some kickback from the group leaders for that. Thus, strong social capital is very important for developing better water governance, which will ensure the fairness and transparency on who gets the water, how to make it fair for all community members, how to maintain pipes or wells, how to fund mechanisms for maintenance, and how to monitor them subsequently.

5.6.6 Cognitive Bias

Smallholders' actions that do not address vulnerability can also occur because of cognitive bias. Nicholls, 1999 stated that when the human mind is confronted with probability, uncertainty, and complex problems such as climate change, then cognitive illusion arises. To simplify complex things such as climate change in decision-making, people use heuristic rules (mental shortcuts) that could lead to biases. My previous chapter on vulnerability shows that smallholders tend to consider themselves less vulnerable than they actually are. Therefore, as their response to climate change, smallholders take some coping actions such as TKW and other intensive human labor livelihoods that increase the vulnerability of certain groups instead of actions that can reduce these vulnerabilities because they do not perceive that they are vulnerable by doing these livelihoods. They also do not address livelihood problems such as water scarcity, because they do not perceive they are vulnerable to those vulnerabilities. Older generations perceive significant improvement in the upper watershed in comparison with the past condition that they experienced. This finding is in contradiction with the literature noting that people who have past experience with risk think about adaptation more often and have adaptation intentions (Kuruppu and

Liverman, 2011). This shows how cognitive bias can act as barrier for climate change adaptation.

The persistent and even the increasing vulnerability of women in the upper watershed of Batulanteh shows that culture is also one of the barriers for adaptation. Women become more vulnerable, because they are culturally viewed as weaker than men, so there are not many livelihood options open for women other than being female migrant workers. Patriarchy also puts men above women, which makes women have to absorb most of the impact of climate change for example by eating less in order to serve the normal portion of food to the men in their family or by sacrificing themselves to work as TKW. Women are also excluded in decision-making, as in Indonesia, decision-making meetings from the lowest community unit level up to the village level are only attended by men. Meeting invitations to discuss community issues delivered to households only contain male adults or the heads of the household. Therefore, women can never voice their concern and opinion, thus their vulnerability never has the chance to be heard, acknowledged, and addressed. It also leads to the limited or even absence of adaptation programs from both local and national levels specific for women.

Belief is also one of the barriers of adaptation to climate change that leads to the lack of action or even inaction to response to climate change due to low perception of vulnerability. Older people in the upper watershed of Batulanteh perceive that there are major changes between their lives in the past and the present situation. Instead of complaining for the impact of climate change and perceive it as a vulnerable situation, they are more receptive towards their vulnerable conditions, because complaining is considered as being ungrateful to God. This shows that faith in God may enable

people to alleviate feelings of hopelessness and fears of threat (Kuruppu and Liverman, 2011). They also believe that the proper actions to deal with climate change is to increase the level of their belief to God, correct negative behaviors, do more prayers and perform rituals. For them, climate change is the domain of God, and they should wait for the mercy of God to divert the climate change which is beyond their human power. Such a faith in God, also known as avoidant behavior, also happens in floodplain communities in Mozambique (Patt and Schroter, 2008), coastal communities in Kiribati ((Kuruppu and Liverman, 2011), and Aboriginal tribes in Australia (Petheram et al., 2010).

5.6.7 Lack of and Limited Climate Change Knowledge

When asking smallholders about their preparation to adapt to the impact of climate change, all of them answered that they have no particular plan for adaptation, implying that planned adaptation is not happening in the upper watershed.

“We do not have any preparation at all, because we do not know (the drought). No one told us. Had we been told about it, we could have prepared something. As for now, we are helpless. This is the first time we encountered such a situation.”(FGD, Kelungkung, Older generation).

“We do not have special strategies to adapt to climate change. The only thing we can do is just to prepare our land. As a preparation, it is the same as it used to be. Nothing is special. We are only waiting for the rain to fall. That is all.” (FGD, Sampak, Older generation).

One of the biggest reasons why smallholders do not undertake planned adaptation is that their climate change knowledge is still limited (Adger et al., 2009). When climate change is new for smallholders, it takes time to learn to adapt: *“What to prepare? It’s already here and we are being caught in the middle of it. We look like a blind person and we know nothing about this.” (Jalaluddin, Male, Sampak Village,*

2016). Without better knowledge, smallholders do not know what to do for the time being. They do not know how to find information about climate change, as I noted in chapter 3. They are confused and shocked. They do not have any preparation for extreme climates or any specific strategies to adapt to climate change. They end up just coping instead, due to the lack of climate knowledge.

“So far, there is no information given about climate change except the existing knowledge that we know. We want to get some information about it, but we do not know where to go and how to get it. Had we known that climate change would happen, it would have been much better for us.” (Monte, Sampak Village).

5.6.8 Lack of Trust

The limited knowledge on climate change that smallholders currently have makes it clear that it is very important to provide information about climate change to them. The reality is that smallholders in the upper watershed of Batulante have different perspectives on the need for climate change information from the government or outsiders. The literature on psychology explains that the need for knowledge information correlates with the level of confidence and trust in knowledge. Scannell and Grouzet, 2010 note that “when confidence in knowledge is low, the information-seeking behavior is activated in an attempt to confirm or disconfirm existing knowledge, which ultimately serves to fulfill the need for accuracy.”

High confidence and trust on traditional climate knowledge can be an opportunity and a barrier for climate change adaptation, as noted previously. Smallholders are more resistant to accept information from outsiders if they have high level of confidence and trust to their own traditional climate knowledge. This brings particular challenges on how to integrate traditional climate knowledge and climate change

knowledge from the government or scientists.

However, high confidence and trust in TEK system can also be positive for adaptation to climate change, as it is often a reflection of strong social fabric. Smallholders in Batudulang village, who have high level of confidence and trust in their TEK, were able to perform their rain prayer tradition, while such a tradition was absent in the other two villages, who have lower levels of trust and confidence in their TEK system. In the case of Batudulang village, TEK can help smallholders speed up their climate change knowledge accumulation, to raise elder stewards' knowledge of potential adaptation strategies, and to encourage elder stewards to dig more into their belief system to find something to justify adaptation practices.

My findings on trust helps to understand better the cognitive bias in risk perception. High level of trust showed by smallholders in Batudulang in their TEK system risks them to have cognitive bias. (Nicholls, 1999) mentioned that over-confidence and over-optimism could lead to less willingness to take action. Increased confidence in risk judgment can also lead by hindsight bias, when people think they have hints about the event (Nicholls, 1999). Kuruppu and Liverman, 2011 stated that such over-confident beliefs may be a form of cognitive bias which makes people believe in their adaptation strategy and feel that they do not need any information or new strategies.

Low levels of confidence and trust in TEK, such as in my other two research villages, raises smallholders' need for additional climate change information, as the more knowledgeable people about are climate change, the more they are willing to change their behavior to adapt (Scannell and Grouzet, 2010). However, low-level of trust to TEK can be negative for adaptation as well as it may indicate social cohesion or friction in the community. This is one of the worst scenarios for adaptation to

climate change: smallholders who have low levels of trust and confidence in their TEK system, due to a deterioration of their social fabric, while there is no climate change information from the government to help them adapt to climate change.

5.7 Adaptation, Aspiration, and Climate Change Awareness

Adaptation to climate change is related to future-oriented behavior. Some economists theorize that the future-oriented behavior is determined by aspirations and such aspirations increase investment for the future (Ray, 2006; Appadurai, 2004). Aspiration is an idea about the future that helps us to better understand about how human beings engage their own future. Thus, aspiration is important for adaptation to climate change and capacity to aspire should be considered a form of adaptive capacity. As lack of aspirations is one of the causes of poverty, the more aspirations we have for adaptation to climate change, the better the chance to adapt successfully to it. Moreover, it is logical to put more focus on smallholders' aspiration, because they are the ones who feel the impact of climate change and know what works and does not work at their local context. They are also the end point and bear the outcome of the adaptation to climate change policy.

My research shows the importance of aspiration for climate change adaptation. I undertook aspiration appraisal using interview and focus group discussion methods by asking smallholders' general aspirations, using the interview method, while for the focus group discussion, I was specific to aspirations under the context of climate change. Thus, I started the focus group discussion with a discussion about climate

change followed then by the aspiration appraisal. Table 5.3 shows that there is a significant different between aspirations and coping strategies of smallholders (shown in Table 5.1 previously). Smallholders' aspirations in general reduce smallholders' vulnerability, shown by the fact that there are less farm-based livelihoods appearing in their aspiration, compared to coping strategies, which means that smallholders aspire to be less vulnerable physically. The absence of TKW also shows that smallholders view TKW as a livelihood that makes them vulnerable. Moreover, women in all three villages aspire to do small business, showing that aspiration is crucial for the most vulnerable populations as a form of voice and expression of views that oftentimes are lacking from the poor (Appadurai, 2004). Women and young people's aspiration in all three villages for small business also show that they aspire to an off-farm based livelihood diversification, which is different from the aspirations of adult men that are centered on farm-based livelihoods. Hence, the youth and women's aspirations can become key for successful adaptation to climate change. Gender sensitive adaptation approaches will be beneficial for successful adaptation. However, their aspirations are being obstructed by numbers of factors that I will explain in Chapter 6, especially in the section that explains how the weakly the voice of the vulnerable reaches the decision makers.

Another important aspect about climate change knowledge, awareness and aspiration that I should underline here is that by introducing climate change intentionally and specifically in the aspiration appraisals, it generates significantly different aspirations compared to the appraisal generated without being specific to climate change (see Table 5.3). When I asked smallholders whether they would do things differently

if they had information that the climate would be extreme that year, smallholders confessed that they would undertake different practices if they knew beforehand about the climate: *“If we knew that the climate is extreme this year, we would prepare something.” (Monte, Sampak Village).*

Table 5.3 shows that highlighting climate change in the discussion of aspirations is beneficial for the adaptation to climate change. It also expands further smallholders’ general aspirations into more detailed aspirations. The more specific the discussion on climate change, the higher the common points between smallholders and government aspirations, such as planting trees, crop diversification, and better livestock management that are missing in the more general discussions about smallholders’ aspirations.

Climate change awareness is thus crucial. My research shows that the raised awareness of climate change leads smallholders’ aspirations to address more vulnerability, which was previously not addressed in the coping strategies. Smallholders told about climate extremes are more likely to want to directly address food security issues, rather than assuming that food security will be addressed indirectly through the increasing of income:

“Researcher: So what would you prepare differently for the future, now that you know the future climate projection? FGD Women Kelungkung: We have to prepare something, especially our food stock. We will economize it and we will not sell our rice harvest. We will not sell our livestock now, so that we can still have it during the hard time, just in case if we really need the money, we can easily sell it. We have to dig water well, just in case that the water drained from the pipes stops working. We should dig the water well from now on.”

The quote above and Table ?? also show that smallholders given climate change data are more likely to directly address the problem of water scarcity, an underlying cause of their vulnerability, and an important aspect for smallholders’ adaptation that

previously they had not addressed. Although they still put the pursuit of income as a livelihood goal, they direct their gained income to solve the water scarcity problem, which is shown with their intention to save their money to dig new wells. Smallholders also intend to save their money gained in the bank as emergency money, to buy food, in order to increase their food stock before the price is increasing as a result of the impact of climate change. Smallholders also plan to add their food stock by not selling their harvest. This aspiration is the opposite of their actual coping strategy, which is to sell food stocks. Smallholders also wanted to become more independent and not wait for government assistance to solve their vulnerability, as shown in their intention to dig new wells with their own money.

Table 5.3 also shows that climate change issues bring the opportunity to reduce the conflict between smallholders and the government. Including climate change issues while discussing smallholders' aspirations produces a set of aspirations that have more common points with the government goals and interest in the upper watershed such as planting fruit trees, crop diversification, afforestation, and better livestock management. Although smallholders do not intentionally have a goal to preserve the environment, they do have interests in planting trees to protect them from the hot weather during extreme climate. Some previously non-existent livelihood practices also emerged, such as planting cassava or banana. Smallholders' aspirations are no longer centered on paddy and corn as their major livelihoods, which mean that they are more aware of the sensitivity of those livelihoods to climate change. They become more strategic to reduce their sensitivity to climate change by including other livelihoods in their portfolio that are less sensitive to it. By diversifying their livelihoods and reducing the extensive cultivation of paddy and maize, blamed by as the cause

of forest degradation in the upper watershed, smallholders would be able to reduce conflicts with the government. The government could also have better perception on smallholders' and could provide more positive circumstances for them to support and bring adaptation programs to them.

The explanation above shows the important finding of this research, which is that smallholders are able to come up with ideas of sustainable adaptation on their own, and those adaptation actions can be brought out by the increasing awareness of climate change, as an excerpt from my field-notes below highlights:

"It was a dry afternoon when I gathered smallholders' in one of the smallholder's houses. I asked Anjes, one of the smallholders in Kelungkung Village, for help to gather elderly people whom he thought were knowledgeable of the village, in his house. Among the were the religious leader (i.e. the Imam of the local mosque), the head of village cooperation, and local shamans. I felt a bit awkward to sit down in front of these "knowledgeable" community leaders as a woman that is much younger than them. I know that woman and young people do not really have a place in decision-making and they are not considered as important as men there. It was an awkward moment for us, as I should lead the FGD, especially when I had to introduce the purpose of our FGD and they were all in silence focusing on me. I could not stop thinking that they must be questioning who I thought I was to talk like this about their community or doubting my capacity for what I was doing. I tried hard to play the role as an outsider who does not know much about the village, thus I really appreciated if they could share their knowledge to help me understand more about the village. For the first few moment, I tried to avoid the trap of power struggle and clash of ego by acknowledging their important knowledge. I led the discussion by asking them about what were the problems in the village so far. I did not just stay passive to mine all their information. I also shared some observations from other places or my experience working in other dry areas with other smallholders that were relevant to people's discussion. Then, after making sure all the participants were really engaged in the discussion, I tried to bring up the climate change issue. I admitted that there was nothing special about the knowledge of climate change that I shared with them. When they discussed more about their perception on climate change and their experience with it in the past, I asked them if they knew beforehand that the climate change would happen and whether they would

do different things from what they did at that time? I also asked whether they perceived that climate change would happen more in the future. This was when the cognitive bias arose: They were not sure because it is the domain of God. Then, I just interrupted them with some information about the general projection of the likelihood of climate change in the future. Along with that, I shared my experience living in America when hurricane Sandy hit the US East coast, telling them how amazed I was at how precisely they could predict the time of the hurricane to hit and that I had been given some warnings a few days before to prepare myself. I honestly showed them how astonished I was at the advancement of science to predict the likelihood of climate change. Thus, without being too specific on when or where the climate change would hit in the future, the general prediction of climate change knowledge was as enough to raise smallholders' awareness, if they were convinced by the prediction. Thus, when I followed up with the question whether they would think differently in the future was based on that prediction, they came up with an affirmative response and made a list of their aspirations that were completely different from the general aspirations taken" (Researcher's experience, FGD in Kelungkung Village, 2016)

I would argue that climate change knowledge is different from climate change awareness. My research shows that smallholders do have climate change knowledge. However, such knowledge does not lead them to address their vulnerability as shown in their coping strategies and aspiration. Sundblad, Biel, and Garling, 2007 also acknowledges that knowledge of the present state of climate change has no effect on risk perception. However, my finding shows that it is not that climate change knowledge has no effect to drive successful adaptation, but which type of climate change knowledge can break the barrier of the cognitive bias that is lacking in the literature. From my research (as shown in the excerpt above), it is clear that smallholders prefer the climate change information to be given in a more participatory way, where they can sit down together with other actors, who have different climate change knowledge, such as through FGD, instead of the information given on television that is more one way and top down, without any chance for exchange with their existing climate

change knowledge. The trust toward the actors who have the knowledge is also important. In my case, smallholders have high trust on me, because they know I am a PhD student who studies abroad. Thus, they believe that I have extended knowledge about certain issues. They also trust me as a person who has a good intention for the community, because previously I ran a forest conservation education project for young people in Kelungkung village. I also helped a smallholder to be initiated on conservation agriculture (CA) in his land, based on my knowledge and experience working with the FAO project in Lombok Island. Moreover, smallholders could already see the result of the CA that we practiced there by making the square hole, filling it with manure and covering it with mulch. It turned out that the maize and chilly that we planted in that hole produced more yield and survived during the period of no rain. Thus, it is very important that actors who bring climate change knowledge build trust with smallholders. Smallholders should trust that the actor wants the best for them, instead of limiting their livelihood options without no alternatives, as shown by the existing government policy in the upper watershed.

Existing climate knowledge alone only makes smallholders aware of some phenomena that are used for the upcoming planting season, but it does not help them to predict long-term future climate change. Even more, the cognitive bias, including religious belief, tends to downplay climate change. However, when they get information that climate change will manifest more often and more severely in the future, they integrate that prediction into their adaptation aspirations. Therefore, not only is the knowledge of climate change what matters, but also what type of knowledge. Thus, considering that smallholders' climate change knowledge is still limited and it is unable to help them predict the future climate change, they need outsiders such

as the government to bring this kind of information. Therefore, trust becomes crucial to be built between the government and smallholders, because the information brought by the government is viewed through the lens of their relationship. In the upper watershed context, in spite of the limitation of TEK about climate change, the acceptance of climate change information from the government depends on the degree of conflict over forest utilization. For example, smallholders in Batudulang and Kelungkung Village oppose most climate change information from the government, since they have a history of conflicts including imprisoned smallholders. On the other hand, smallholders in the isolated Sampak Village are more willing to accept climate change information from the government, because they have no major conflict with the government, due to the lack of forest monitoring in the village. Therefore, in order to improve smallholders and the government's relationship, conflicts over forest utilization between smallholders and the government should be given more attention.

Despite the significant improvement of the aspiration of smallholders to adapt to climate change, awareness to it does not address certain vulnerabilities. For example, the raised awareness to climate change does not necessarily make TKW become reduced or absent from smallholders' livelihood portfolio, which means that women and children's vulnerability does not change with the awareness to climate change. Women's aspiration to have smallbusiness is also not being addressed. This shows that the underlying causes of women's vulnerability rooted deeply in the culture and marginality of certain group.

I would argue that the lack of climate change knowledge could also be extended to the lack of adaptation options. The fact that climate change is relatively new and smallholders' knowledge on climate change knowledge is limited, the adaptation

options can also be assumed to be limited. Moreover, the government does not give the climate change information needed as well as the feasible adaptation options. Thus, smallholders do not always have a sense of adaptation options. The uncertainty and futuristic nature of adaptation to climate change makes it difficult for anyone to really know and be certain about which adaptation actions to take and whether the actions will work in the future. Climate change is contextual and site specific, which implies that what has been successful in certain places, may not be successful in other places. Thus, incorporating aspirations is highly needed to increase the adaptation options in order to search for the best formula that will work for certain places and people. Moreover, it is logical to put more focus on smallholders' aspiration, because they are the ones who feel the impact of climate change and know what works and does not at their local context. Thus, with the fact that aspiration with climate change awareness is beneficial for climate change adaptation, smallholders' aspiration in the upper watershed should be encouraged to be heard by the policy maker, without the fear that their aspirations are destructive and counterproductive with the government goals in the upper watershed, as advocated Li, 2002. This is also in line with Li's statement (2012) that smallholders' aspiration should not be positioned as separation and opposition between community and the state, because my research shows that there are many points of commonality between smallholders' aspirations and the government's goals for the upper watershed. This indicates that there is a big opportunity to empower people, because their aspiration is also in line with the government aspiration (Li, 2002.)

Despite the positive side of aspirations, some actions that smallholders aspire cannot be done due to the unavailability of the resources needed; smallholders sometimes

have aspirations that are not realistic in terms of resource availability. For example, smallholders desperately want livestock as one of the livelihoods they consider ideal to reduce their vulnerability. However, the lack of water and land in the upper watershed make it difficult to feed livestock. Moreover, livestock may be more sensitive to climate change, and can adversely affect social capital, as it could conflict with other livelihoods such as agriculture. This once again shows the trap of perception in adaptation to climate change that what smallholders aspire to could potentially increase their vulnerability instead of decreasing it.

5.8 Conclusions

Forest is central for the adaptation of smallholders who live in the forest margin in the upper watershed, as they use forests for “free” resources as the first stage of their coping strategies. Thus, in this regard, smallholders in the margin forest undertake adaptation to climate change under a situation of conflicting goals over forest utilization. Such conflicting goals influence and limit the usage of forest resources for adaptation and this forces smallholders to enter the stage 2 (using human labor) and 3 (selling assets) of their coping strategies, increasing their vulnerability instead of reducing it, leading to maladaptation.

Smallholders’ maladaptive outcomes from coping strategies show that some of the critical aspects for adaptation to climate change in the upper watershed, including the water availability problem, is beyond smallholders’ capacity for its resolution. However, the ongoing forest conflicts will influence the government’s willingness to

assist the community to adapt to climate change. An ongoing and prolonged conflict over forest utilization leads to a negative perception of the government toward smallholders. Projects for adaptation to climate change can become an arena of rewards and punishment from the government to certain communities who oppose to or support their goals. The government will likely prefer to implement adaptation programs in other communities that are less conflicting. Moreover, the fact that the funds for adaptation are lacking, the government will be more selective to choose the communities where the adaptation programs will be implemented. Thus, the conflicting communities will become the last in their lists or even being excluded from the adaptation programs. Conflicts also reduce trust and influence smallholders' acceptance toward climate change knowledge of the government that will be beneficial to help smallholders to develop their knowledge base on climate change.

In addition to the conflicting goals that act as the major barrier for adaptation for the people who live in the margin forest in the upper watershed, the lack of resources to address the livelihood problems, to diversify incomes, and to undertake new off-farm livelihoods prevents smallholders from adapting to climate change. Another major barrier of adaptation to climate change is related to water scarcity problems, which have been the underlying causes of vulnerability. The barriers to solve the water scarcity problem in the upper watershed context are mostly due to the lack of funds, the lack of resources, the lack of experts, and the different level and scale of adaptation decision-making. Furthermore, social and individual factors also act as a barrier to solve the water problem; smallholders lack of agency, their limited TEK, their belief that climate change is the domain of God, and a lack of social capital all prevent water projects from succeeding.

My research shows the importance of mainstreaming the issue of climate change and providing the required climate change knowledge. Smallholders are able to aspire actions that reduce their vulnerability to climate change if they are being provided the information about climate change predictions. Smallholders' aspirations are strongly related to climate change adaptation and can address underlying vulnerabilities not solved by existing coping mechanisms, including addressing the water scarcity problem that is critical. This shows the importance of being specific on the climate change issue when talking about adaptation to climate change, rather than to assume that smallholders will automatically integrate it in their livelihood strategies or plan. My finding also shows that bringing the subject of climate change into talking about aspirations leads to more points of commonality between smallholders and the government's goals.

Considering that conflicts are a major barrier for adaptation in the upper watershed, this chapter shows that climate change will potentially increase the conflict over forest. Forest is so central for smallholders' adaptation to climate change, that even with the use of forest resource for adaptation along with other coping strategies, the smallholders cannot reduce their vulnerability. This shows that in the future, forest as the most convenient resource for smallholders will continue to play the central role in smallholders' adaptation to climate change, thus exacerbating the existing conflicts between smallholders and the government. The heavy reliance on forest for adaptation responses shows that adaptation policy is missing in the upper watershed, a problem that I will discuss further in the next chapter.

TABLE 5.1: Smallholders' coping strategies to climate change. M = men; W = women; Y = Youth

CC outcome	Coping strategies	Class of strategy	Batudulang			Kelungkung			Sampak		
			M	W	Y	M	W	Y	M	W	Y
Decreasing income	Forest Honey	Extensive	X			X			X		
	Farm labour (outside village)	Mobility-diversification				X					
	NTFP	Diversification				X					
	Illegal logging	Diversification				X					
	Selling livestock	Storage				X					
	Scavenger	Diversification						X			
	Catching and selling frogs	Diversification						X			
	Bird poaching	Diversification			X						
	Reduce spending (cigarette)	Lifestyle change			X			X			X
	Candlenut picking in the forest	Diversification				X	X	X	X	X	X
	Sell harvest (food stock)	Storage					X				
	Sell land					X					
	Being TKW	Mobility					X				
Water scarcity	Showering less	Lifestyle change					X	X			
Food security	Eating less	Lifestyle change					X	X		X	X
Health	-	-									

Source: focus group discussion and interviews

TABLE 5.2: Resources important for coping strategies

Stage of Response	Buffer / Resource needed	Response	Vulnerability
Stage I	Forest (natural resource)	Forest Honey	
		NTFP's	
		Candlenut picking in the forest	
		Illegal logging	Conflict with the government, jail, environmental degradation
		Catching and selling frog	
		Bird poaching	Conflict with the government, jail
Stage II	Human	Farm labour (outside village)	Tiring, health
		Being TKW	Violence, family disfunction, society shaming
		Reduce spending (cigarette)	
		Scavenger	Society shaming
		Showering less	Society shaming
		Eating less	Malnutrition
Stage III	Economic/ Livelihood Assets	Sell harvest (food stock)	Malnutrition
		Sell land	Poverty (downward spiral of vulnerability)
		Selling livestock	Poverty

Source: focus group discussion and interviews

TABLE 5.3: Smallholders' aspirations without and with climate change awareness

Vulnerability addressed	Aspiration without CC awareness	Aspirations with CC awareness
Income	Planting medicinal plants (spices such as turmeric and ginger)	
Income	Forest honey	
Income	Vegetable	
Income	Poultry	
Income	Agricultural	
Income	Office work	
Income	Small business	
Income - sustainable environment	Planting fruit trees	Planting fruit trees
Income - livelihood assets	Livestock	Livestock
Livelihood assets		Vaccinate their livestock to make them more resistant to disease
Livelihood assets		Plant grass and other plants as a source for feeding the animals
Livelihood assets		Accumulate hays to be used later to feed their livestock
Food security	Paddy	Economical to consume their food stock
Food security		Stock food instead of selling their harvest
Food security		Buying the food stock before the price is increasing due to extreme climate
Food security		Save their money in the bank to buy food when their harvest fails
Food security		Planting cassava, banana (alternative food stock)
Climate change sensitivity		Crop diversification
Climate change sensitivity-food security		Choose variety of paddy that is resistant to drought and disease
Water availability		Save their money to dig a new well
Water availability		Build water reservoirs
Water availability		Build small dams
Sustainable environment		Planting trees as protection from the hot weather during the climate extreme

Source: focus group discussion and interviews

Chapter 6

Policy Gaps on Adaptation to Climate Change

6.1 Introduction

As described in the previous chapters, smallholders in the upper watershed of Batulante are vulnerable to the impacts of climate change and their response to climate change is often maladaptive. This is compounded by the fact that the susceptibility to poverty and vulnerability resulting from climate change, which is faced by these communities, remains absent from both national and local level government planning policies, legislation and procedures.

In Indonesia in general and in the upper watershed of Batulante in particular, policies to adapt to climate change from both national and local government levels are limited or even absent, and attention to the vulnerability of smallholder populations is missing in what little adaptation policy there is. The second key point of this chapter is that at national level, the integration of climate change adaptation into existing development goals hinders these problems from being sufficiently addressed.

The third point of this chapter is that the absence of adaptation policy at the local level often arises due to local political structures, processes and traditions, whereby local policies are made to fulfill political promises of the elected local leader instead of addressing core issues related to poverty, environment and vulnerability. The last key point of this chapter is that smallholders' vulnerability is not captured in decision-making process, due to the marginality of the most vulnerable groups, domination of local elites, and local political intrigue.

This chapter will explain the development of climate change policy in Indonesia in general and in Sumbawa District in particular with a specific focus on adaptation policy. This chapter will present the gap between current adaptation policy and the vulnerability experienced by smallholders. This is then followed by a discussion regarding some of the factors influencing this gap. This chapter also discusses how existing decision-making process fail to link vulnerable communities with the decision-makers.

6.2 Literature Review

Adaptation policies are specifically aimed at helping people to adjust to climate change (Nightingale, 2017), and thus fit the definition of “planned adaption” (IPCC, 2007). Adaptation policy includes the means to act from the government including legislation, regulations, and incentives (Dovers and Hezri, 2010).

The need for the development of adaptation policy has become a focus of debate and negotiation at the international level (Schipper, 2006). UNFCCC has provided funding for developing countries to develop National Adaptation Plans of Actions

(NAPAs) that highlight the priorities of each country to cope with or capitalize upon changing resource bases (Eakin and Lemos, 2010). UNFCCC has also developed a template for adaptation policy development, which includes vulnerability assessments to define biophysical hazards and the evaluation of the populations who are most at risk from them (Ayers and Forsyth, 2009). Once vulnerability assessments are produced, technical measure and institutional design, including new national and regional level coordination bodies, and community-based environmental management groups are often followed (Biagini et al., 2014; Eakin and Patt, 2011). These internationally initiated and guided adaptation programs are among the factors that drives the development of climate change adaptation policy in developing countries (Nightingale, 2017). The development of climate change policy that originated as an international issue raises questions on how it is translated and developed at the country level under the influence of local context.

Despite international initiation, guidance and support, many developing countries have yet to develop effective and operational climate adaptation policy. Bretschger, 2017 suggests that the major reasons for low adoption in developing countries stem from a prevailing concern that implementing climate policy will have negative cumulative economic consequences for domestic economies, resulting from costs associated with implementation, administration and monitoring. Thus, the adoption of adaptation policy depends on the potential of climate change policies to address other development needs, also known as co-benefits (Adu-Boateng, 2015). To increase the adoption of adaptation policies, some researchers emphasize the importance of the integration of adaptation into already established policy sectors (Dupuis and Biesbroek, 2013; Adu-Boateng, 2015). Therefore, many climate change initiatives are tied

to pre-existing concerns (Adu-Boateng, 2015). Without these co-benefit, it is arduous to drive stand-alone “adaptation policy”, as it often has no value until linked to existing concerns in the local context (Adu-Boateng, 2015). Limited perceptions of development and political co-benefits is considered as one of the barriers of adaptation policy, along with weak external pressure, absence of normative mechanisms, and the tensions in negotiating national directives and local priorities. It must be recognized that co-benefits are not a panacea and there is a risk that the co-benefit will also be a barrier for adaptation instead of acting as the enabler. Co-benefit concerns make many policies intended to address climate change not entirely driven by the concern for climate impacts (Adu-Boateng, 2015). Thus, climate change adaptation policy risks losing its intention to really address the issue of climate change (Dupuis and Biesbroek, 2013). To many scholars, the specific outcomes and impacts of addressing climate change are paramount in designing contextualized policy to manage localized impacts of climate change, reduce vulnerability and enhance adaptive capacity. Therefore, climate change should be highlighted intentionally if its impacts are really considered as the problems that set the need for adaptation. Projected climate change impacts should be the starting point for policy development and decision-making for climate change adaptation (Dupuis and Biesbroek, 2013). Adaptation policy also should be substantially contributing to reducing climate change vulnerability or benefit from climate change opportunities (Dupuis and Biesbroek, 2013). In other words, adaptation policy should specifically target the effects of climate stimuli and the resulting vulnerability (Füssel, 2007).

Focusing on co-benefits in adaptation policy risks the issue of over complication and addition of other, less specific, policy objectives (Dupuis and Biesbroek, 2013).

Thus, climate change adaptation policy can become very limited in terms of its benefits and its impacts in reducing vulnerability. Climate change issues tied to other objectives of development can be a form of political agenda-setting to conform to pressures such as international demands under UNFCCC national communication rules (Dupuis and Biesbroek, 2013). Thus, most countries re-label their existing policies, programs and activities and re-frame them as “climate change adaptation strategies” in order to demonstrate their political progress. This has led to indirect and ineffective policy that has limited potential to provide solutions. Tying climate change adaptation to other existing development objectives also makes it difficult for radical policy transformation to occur (Kates, Travis, and Wilbanks, 2012). In some cases, the complexity surrounding the concept of adaptation has been used as a negotiating ploy to reinforce and exercise influence, social and political re-alignment, and ultimately used as a means to improve authoritarian and undemocratic actions. As a result, the inception and design of climate change adaptation objectives are often developed through a non-diplomatic and top down approach (Nightingale, 2017).

The change in climate and its impact needs to be managed at all levels of government (Füssel, 2007). Adu-Boateng, 2015 highlights the inherent complexity in managing adaptation policy across government sectors and between national and local levels. Oftentimes, long before the issue of climate change emerged, there have been tensions at various levels starting from the grassroots, local government and national government. What is considered as urgent by certain actors, such as aid donors or national government, is not always the case with the local government and local people. Moreover, climate change policy is relatively new and mostly originates from the external international pressure. Hence, adaptation policy is more directive

in nature and does not emerge from the awareness of the local government. Consequently, the success of adoption of adaptation policy depends on the degree to which the guidelines from national government are enforceable and the level of local government's autonomy (Adu-Boateng, 2015). Local government has varying degrees of autonomy and may resist, concede to these directives, or take their own initiatives outside national frameworks (Adu-Boateng, 2015). Thus, climate change adaptation can increase conflict that will exacerbate vulnerability instead of alleviating it (Adu-Boateng, 2015; Marino and Ribot, 2012).

This chapter tries to get a better understanding on whether the approach of developing adaption to climate change policy by tying it to the existing concern of development goals and policies will be beneficial for adaptation to climate change in Indonesia, or on the contrary become a challenge to adaptation. This chapter will also try to understand the local political influences impacting climate change adaptation policy at the local level.

6.3 Challenges for Climate Change Adaptation Policy Development at National Level

The GOI is struggling to develop effective climate change adaptation policy, mostly because of the integration of climate change adaptation to existing development goals in the co-benefit approach. Even though many have argued that this needs to be encouraged as one of the strategies for the adoption of climate change policy, my study shows that this co-benefit approach does not lead to effective adaptation policy in Indonesia. The co-benefit acts more as a challenge for adaptation policy that

leads to incoherence and unclear targets, lack of participation from stakeholders, lack of adaptation programs that directly address climate change, lack of funding, and missing vulnerability of the most vulnerable population. Each of the challenges will be explained further below.

6.3.1 Incoherence and Unclear Target of Adaptation to Climate Change

While the GOI builds the narrative for their needs to adapt to climate change based on their high exposure, risk, and their vulnerability to climate change, their adaptation goal is centered on the issue of development goals. Unlike mitigation to climate change policy that shows a clear and specific target in terms of greenhouse gas emissions, the amount to reduce (26%), and the timing to achieve the target (by 2020), adaptation policy does not have clear, specific targets, and certain time frames. The GOI's target of adaptation to achieve development goals and resilience to climate change is not specific, and is not directly linked to reducing exposure and vulnerability. This shows a more complexity in the development of adaptation policy than that of mitigation. What makes it more complex?

Unlike the mitigation to climate change that has one variable to focus on, which is the greenhouse gas emissions, climate change adaptation has a wide range of conceptions that could be related to adaptation, such as exposure, vulnerability, resilience, development goals, poverty, adaptive capacity, etc. Therefore, it is challenging to choose which variables to focus on in policy. Even at the international level, there is no agreement on the targets for adaptation.

The integration of adaptation and development goals could also be a way for the GOI to hide their unclear conception about adaptation. Conveniently, the GOI claims that climate change adaptation fits well with Indonesia's existing strategic development goals, known as the Nawacita (or Nine Agenda Priorities). Hence, they claim that they prioritize climate change adaptation by integrating it in the existing development goals instead of making climate change a separate priority. The GOI claims that adaptation and mitigation to climate change are integrated as cross-cutting priorities of the National Medium-Term Development Plan (Environment and Forestry, 2015). By integrating climate change issue into the existing strategic development goals, GOI does not have to set a different budget for climate change and also does not have to make new structures and policy instruments because climate change is considered as being integrated directly to existing development goals and programs.

“RAN-API is not a separate document (from the Indonesia's national development framework) which has formal legal power of its own, but it becomes the main input and an integral part of national development planning documents and Line Ministries planning. RAN-API is also a reference for local governments in developing local strategy/action plan for climate change adaptation.” (Bappenas, 2014).

Thus, by keeping on doing their development programs, there is no need to change the existing programs for adaptation to climate change or to make specific programs for climate change adaptation. Therefore, I would argue that the co-benefit is not always an “intentional” strategy to promote climate change adaptation. Instead, the co-benefit becomes a convenient way to claim that a country is doing adaptation, while they do not in fact have to do something new.

6.3.2 Poverty: the missing vulnerability

Adaptation to climate change for the GOI is a condition when a development goal is achieved and the climate change is not affecting to it, due to the increase in physical, economy, social and environmental resilience. The development goal of Indonesia is to reduce the poverty rate of approximately 11% of Indonesia's population below the poverty line to below 4% by 2025, by promoting economic development at least 5% per year (Environment and Forestry, 2015). However, despite the fact that the co-benefit of adaptation policy is to also achieve the development goal, eradicating poverty as a proxy for reducing vulnerability, the narrative of adaptation policy in Indonesia is centered around natural hazards and archipelagic place-based vulnerability rather than on poverty or social vulnerability. Poverty is mentioned in the general context of vulnerability as shown in the INDC RI (2009) p.3: *"As the Indonesian population grows, climate change-induced natural disaster will impact a greater number of people and their assets, making it more difficult for them to rise out poverty."*

The focus of vulnerability from the GOI is based on geographical locations that are prone to natural disasters as shown by their adaptation focus in coastal areas and small islands compared to vulnerability approach which focuses on social aspects such as poverty: *"The main objective of adaptation to climate change in the RAN-API is the implementation of a sustainable development system which has a high resilience to climate change impacts."* (Bappenas, 2014).

However, despite the fact that the co-benefit of adaptation policy is to also achieve the development goal, which is to eradicate poverty served as a proxy for the most vulnerable population, the narration of adaptation policy in Indonesia is centered around their natural hazards and archipelagic place-based vulnerability rather than on

poverty or social vulnerability. Poverty is mentioned slightly and in general context of vulnerability as shown in the INDC RI 2009 p.3: “The poorest and most marginalized population tend to live in high-risk areas that are prone to flooding, landslides, sea level rise, and water shortages during drought. Most of these areas have experienced rapid urbanization, reaching 50% in 2010.” (INDC, p.3). It is reasonable for the GOI to focus on flat lying areas, coastal and small island for adaptation to climate change, based on the existing scientific data, which show strong evidence of increasing sea level rise. However, this does not mean that other populations in other geographical settings are less vulnerable to climate change. The lack of data and analysis on other climate change indicators can lead to other vulnerable population being invisible and not exposed as much as the population in low flat lying areas. This is also recognized by the GOI: *“Analysis on weather and climate extreme events projection is not easy to do because it requires plenty of time for analysis and more detailed data. Therefore, it can be understood that a comprehensive study related to extreme events in Indonesia is still very limited.”* (Bappenas, 2014).

Therefore, the existing vulnerability assessment of the GOI as a basis of their adaptation programs is not complete yet due to the missing risk data and climate change indicators, which may lead other vulnerable populations to be missed. The GOI also risks downplaying other vulnerable populations that do not reside in the coastal areas, or small islands, and also those populations that do not have characteristics as prioritized by the GOI with its natural hazard-based approach (i.e. determining vulnerable areas based on number of population and infrastructure). In Indonesia, it is well-known that climate change will also hit the rural populations and marginal people who rely on natural resources and live in poverty due to limited

development, of which the majority of them most often live in highland areas, not coasts. However, adaptation strategies for rural areas are missing in the RAN-API compared with ones for small islands and cities.

Despite the fact that the GOI acknowledges that climate change impacts will disrupt their development goals, they do not make specific reference to objective reasons that support how climate change intersects with poverty. The topic of poverty is also limited or even absent in the vulnerability narrative. The missing of more analytical thinking about poverty, climate change, and development goals has caused incoherence between the narrative and goal adaptation. How can the goal of poverty eradication be achieved under the context of climate change, if the focus of adaptation is neither poverty nor climate change but something else? The topic of poverty actually can act as the common ground for the integration of development goals and adaptation to climate change, but it is currently not used this way.

The major implication of the lack of attention to poverty has caused the GOI to fail to address the underlying causes of vulnerability to climate change, which relates strongly to poverty (Adger et al., 2007). Addressing the underlying causes of poverty is crucial for adaptation to climate change. The government considers that poverty can be eradicated automatically with their existing development growth, mostly through economic growth. Thus, instead of really thinking about why 11% of their population are under the poverty line, their adaptation goals are focused on pursuing their objective of economic growth, and ensuring that climate change does not affect their target, rather than solving the underlying causes of poverty. For example, the GOI perceives that the poor people are vulnerable to climate change mostly due to their lack of knowledge of climate change instead of due to other factors

or processes, which make them poor:

“Thus, climate change can pose serious problems such as sea water flood, disease vector and drought which can affect people particularly poor people which do not have the knowledge and capacity to respond to climate change impacts.” (Second Year of RAN API, 2016).

As a consequence, the underlying causes of poverty are not covered in adaptation policy. Adaptation policy should become an opportunity to highlight the underlying causes of poverty in order to reduce their vulnerability to climate change. My research shows that the GOI’s approach to adaptation to climate change policy is not based on vulnerability assessment, because the most vulnerable people are missing. Furthermore, it is believed that for good adaptation policy, it should begin with vulnerability assessments to define biophysical hazards, and then evaluate the populations who is most at risk from them (Ayers and Forsyth, 2009). The discussion on the more detailed biophysical hazards related to climate change and who are most at risk from them is lacking in climate change adaptation policy in Indonesia.

6.3.3 Lack of Participation from Local Governments

The GOI realizes that adaptation to climate change must be conducted cross-sectorally with multiple stakeholders’ participation, as they note:

“The purpose of the development of RAN-API is to produce a national action plan to adapt to the impacts of climate change, which is coordinated in an integrated manner with all stakeholders involved, including the government, community organizations, public, private, and so forth.” (Bappenas, 2014 p. 1).

However, the level of stakeholders’ participation in Indonesia is still low based on the number of stakeholders involved, and the number and type of activities. In the second year of RAN-API, the Secretariat documented that some activities related to

climate change have been conducted by only three government divisions (Ministry of Energy and Mineral Resources, Ministry of Transportation, and Ministry of Environment and Forestry) and seven institutions (BNPB, BMKG, BIG, Bappenas, LIPI, BPPT). By the second year of its establishment, RAN-API is still undertaking activities such as workshops, talk shows and seminars to ministries and local government, which indicates that stakeholders' awareness on climate change adaptation remains a challenge. In the second year of RAN-API, there was also only one coordination meeting between the RAN-API Secretariat and each ministry or institution. This shows that the coordination and synergy among sectors and stakeholders important for climate change adaptation policy has not occurred in Indonesia.

Local government is expected to refer to the National Medium Term Development Plan (including inputs from RAN-API) when developing their Regional Medium Term Development Plans (RPMJD) (explained further in the case study later in this chapter). The RAN-API Secretariat selected 15 pilot areas for Indonesia based on parameters of the availability of vulnerability assessment and local government commitment. From these 15 pilot areas, in its second year, RAN-API secretariat conducted some activities in eight areas, including vulnerability and climate change risk assessments, workshops, campaigns, roundtable discussion and focus group discussions on adaptation. The RAN-API Secretariat acknowledged that there are still many of these pilot areas that do not have their own activities related to adaptation to climate change: *"Out the 15 pilot provinces and cities, 7 do not have activities related to adaptation in March 2015 to February 2016: South Sumatera Province, Pekalongan City, Malang City, Blitar City, Tarakan City and Malang District."* (Bappenas, 2014). Only nine areas had some activities in the second year of RAN-API, which shows a low level

of participation, despite the fact that these areas are considered as having the most potential readiness compared to other areas in Indonesia.

6.3.4 Lack of Funds and Lack of Power for Adaptation

From nine areas that had activities in the second year of RAN-API, it is clear that adaptation activities in them could be only be materialized due to support from donors. Different donors supported different areas, for example, the Ministry of Environment of Japan through Kiyoshi Takahashi from the Center for Social and Environmental System Research supported adaptation action in North Sumatra, the Asian Development Bank supported the adaptation action in West Java, JICA supported the adaptation action in East Java, Mercy Corps and ICCTF supported Tangerang City, and ICCTF, APEKSI and RAN-API Secretariat supported adaptation actions in West Nusa Tenggara Province, Banjarmasin and Bandar Lampung (Second Year RAN-API doc). Supports from donors are different in terms of length and types of commitments, and intensity of adaptation activities at the local level is also dependent on types of programs being supported and the available budget for funding.

The emergence and non-emergence of adaptation activities in Indonesia shows that funds for adaptation programs are crucial because adaptation at the local level is limited without donor support. To date, local governments are unable to make their own adaptation measures due to lack of national funding specific for adaptation. This hinders the activities of the Secretariat such that in two years they only were able to conduct activities in 9 priority areas and the type of the activities are generally a one or two-day workshop without long-term commitments. This shows the other challenge of the co-benefit trap in that adaptation is integrated to existing

development plans where the budget is not allocated in a way to specifically address adaptation. Therefore, RAN-API Secretariat also needs to depend on or wait for donors to be able to achieve their objectives.

The absence of legal and policy instruments that mandates adaptation to climate change has also caused low participation. Different from mitigation to climate change that has legal and policy instruments in the form of two Presidential Decrees, there is no legal instrument for adaptation to climate change in Indonesia. With the powerful legal and policy instruments of mitigation, the government can impose a moratorium on the clearing of primary forest and prohibit conversion of peat land. For adaptation to climate change, the GOI has only issued the RAN-API document, which does not have the power to impose certain adaptation actions as mandatory. The RAN-API document can only “encourage, provide direction, and provide guidance” to sectors and local government to implement adaptation actions. Consequently, initiatives and participation on adaptation are only voluntarily and depend on the good will of sectoral and local governments. There is a possibility that the lack of participation is also a part of power struggles that creates tensions among sectors and between national and local government for authority and recognitions, as have been noted in other countries (Nightingale, 2017; Adu-Boateng, 2015), and which I will explain further in a case study later in this chapter.

6.3.5 Lack of Adaptation Programs that Address Climate Change

The GOI has appointed certain sectors and ministries to take actions to achieve certain adaptation targets: food security, energy security, livelihood resilience, settlement, infrastructure and ecosystem, and resilience of special areas (cities, coastal

areas and small islands). In general, actions claimed as “adaptation to climate change” from the ministries or institutions do not always directly address climate change, but are often “business as usual” that is simply labelled adaptation.

TABLE 6.1: National Level Government Actions for food security and vulnerability (modified from Second Year RAN-API)

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
	Agriculture Sector			
1	Community Relations, Public Information Management, Cross-Sectors Relations and Protocols in Agricultural Sector.	X		
2	Nuts and Tubers Processing.	X		
3	Cereals Processing.	X		
4	Staple Food Seeds Management System	Y	Food security	X
5	Strengthening of protection of Staple Food from OPT and DPI	Y	Food security	X
6	Staple Food Processing and Marketing	Y	Food security	X
7	Development of Seeds Quality Testing and Application of Quality System, Seeds Testing Laboratories.	X		X
8	Development of Prediction of Pest Outbreaks	Y	CC sensitivity	X
9	Increasing the Production and Productivity of Vegetable and Environmental-Friendly Medicinal Plants	Y	Income	X

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
10	Development of Horticulture Seeds System		Income	X
11	Development of Environment-Friendly Protection System for Horticulture Plants	X		X
12	Increasing Production of Fruits and Floriculture	Y	Income	
13	Processing and Marketing of Horticulture Products	Y	Income	
14	Increasing the Production and Productivity of Spice Plants and Refreshers	X		
15	Increasing the Production and Productivity of Seasonal Plants	Y	Income	
16	Increasing the Production and Productivity of Annual Crops	Y	Income	
17	Support for Post-Harvest Processing and Mentoring for Business Development	Y	Income - aspiration	
18	Support for Plantation Protection	X		
19	Seed Quality Testing and Quality Supervision and Preparation for Plantation Technology Protection	X		
20	Increasing Livestock Productivity	X	Income - aspiration	X
21	Increasing the Production of Livestock Feed	X	Income - aspiration	X

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
22	Strategic Control and Countermeasures for Infectious Animal Disease and Zoonotic Disease	X	Income - aspiration	X
23	Increasing the Quantity and Quality of Seeds and Seedlings.	X	Income - aspiration	X
24	The Guarantee of livestock that is competitive	X	Income - aspiration	X
25	Water Management for Agricultural Irrigation	X	Water availability	X
26	Irrigation Water Management for Agricultural Needs. 1,493.98 950.89 Expansion of Agricultural Areas and Management of Agricultural Areas.	X	Water availability	X
27	Management of the System of Provision and Surveillance of Agricultural Machinery	X	Physical	X
28	Fertilizers and Pesticides Facility	X	Increasing vulnerability	
29	Agricultural Financing and Rural Agribusiness Development	X	Income - aspiration	X
30	Research and Improvement on Biotechnology and Genetic Resources in Agriculture.	X	Climate change sensitivity	
31	Research and Improvement on Post Harvests	X	Income, food security	

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
32	Research and Improvement on Agricultural Lands	X	All	
33	Assessment and Acceleration on Agriculture Technology Innovation Dissemination	X	Physical	
34	Research/Engineering and Agricultural Machinery Development	X	Physical	
35	Research/Agriculture Socio-Economic and Policy Analysis	X	All	
36	Research and Horticulture Development	X	Income	
37	Research on and Development of Plantation Crops	?	?	
38	Research on and Development of Animal Husbandry	X	Income - aspiration	
39	Research on and Development of Staple Crops	X	Food security	
40	Development of Library and Agricultural Technology Dissemination	X	?	
41	Consolidation of Agricultural Training System	X	?	
42	Revitalization of Agricultural Education and Development of Standardization and Certification for Agricultural Profession	X	?	

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
43	Consolidation of Agricultural Extension System	X	?	
44	Agricultural Secondary Education	X	?	
45	Development of System for Distribution and Stabilization of Food Price	X	Income, food security	X
46	Development Provision of Food and Response to Food Insecurity	X	Food security	X
47	Development of Consumption Diversity and Food Security	X	Food security	X
48	Enhancement on Obedience, Cooperation and Quarantine Information System	X		
49	Enhancement of Animal Quarantine System and Animal Biological Safety	X		
50	Enhancement of Plants Quarantine System and Plant Biological Safety	X		
51	Improvement of Standard Examination and Application Laboratories	X		
52	Technique and Method of Agricultural Quarantine	X		
53	Improvement of Agricultural Quarantine Services and Biological Safety Surveillance	X		

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
	Marine and Fishery Sector			
54	Management of Fish Hatchery	X		
55	Fish Processing and Fish Farming	X		
56	Fish food processing	X		
57	Research and Improvement on Fisheries Science and Technology	X		
	BNPB			
58	Socio-Economic Rehabilitation and Reconstruction on Post Disaster Areas.	X		
	National Statistical Bureau (BPS)			
59	Provision and Servicing of Statistical Information at Provincial Level	X		
60	Provision and Improvement of Statistics of Staple Food, Horticulture and Plantation	X		
61	Publications/statistical report on Staple Food, Horticultures and Plantations.	X		
62	Publications/statistical report on animal husbandry, fisheries and forestry	X		

Table 6.1 continued from previous page

No	Activities	Relevance to vulnerability in study area	Vulnerability	Program in study areas
	Indonesia Science Institute (LIPI)			
63	Biological Research	X	?	X
64	Functional Microbes Technology for Adaptation to Climate Change		?	X

Table 6.1 shows that only one out of 64 actions from five ministries and institutions specifically mentions climate change (action number 64). Most of the programs and activities considered as related to climate change issues do not directly it and can be regarded as regular programs undertaken by ministries or institutions regardless of climate change, as shown in six actions related to quarantines (actions 48 to 53). Some programs are potentially even counterproductive with adaptation in other targets such as actions related to fertilizers and pesticides (action no 28). It is true that programs related to adaptation to climate change do not always need to be directly linked with climate change. It is also true that development will increase resilience to climate change, but from the many adaptation actions, it is not clear how ministries and institutions relate their activities to vulnerability reduction. This has also confirmed some evidence that co-benefit approaches can be a trap because all ministries and institutions' programs can be claimed as adaptation.

The incoherence between the narrative and goals of adaptation cause difficulty in addressing climate change in terms of specific actions. For example, many actions identified as adaptation to climate change addressing food security issues are not related to food security. Decreasing paddy production, for example, acknowledged as a risk of climate change in the RAN-API document is not addressed by any action. In addition, there is also a mismatch between the institutions that are assigned to address certain issues. The incoherence among rationale, goals and actions will all make it difficult to evaluate the success of the implemented adaptation programs. Different sectors also seem to make their own actions despite the purpose of the RAN-API to build synergy among sectors. The cooperation among sectors, ministries and institutions has not resulted in any action.

There are some ministries and institutions that address climate change in their actions such as the Ministry of Health, Indonesia's Science Institute (LIPI), and the Agency of Technology Assessment and Application (BPPT) (Bappenas, 2014). Why are some ministries or institutions able to address climate change in their actions while some others are not? I would argue that the exposure of certain institution to climate change issue is one of the important factors. Two institutions that really address the impact of climate change are BPPT and LIPI, which are research institutions. As research institutions, they have access to data and more updated information or research findings related to climate change that help them develop actions. However, determining the factors that make other non-research institutions, such as the Ministry of Health, develop programs to directly address the climate change issues is outside the scope of this study and needs to be further investigated.

6.3.6 Top-down Approach

The RAN-API Secretariat itself is at risk from playing a more directive role instead of facilitation role in defining adaptation actions. They can be trapped in directing sectors and local governments to follow certain design, which has been pre-determined instead of building from the bottom up. The RAN-API activities that jump from workshops to inventory programs show that adaptation is forced to fit into the existing program. The RAN-API secretariat then put the actions of the sectors into the category of food security, energy security, ecosystem, urban, small islands, etc. The adaptation actions did not come from collective awareness, because they are not based on analysis of vulnerability and adaptation targets conducted collectively. Instead of undertaking coordination, the RAN-API Secretariat now acts as a

center by collecting all the lists of programs from many sectors. They have nothing to coordinate, because there is no single climate change related issue that is truly addressed by multi-sectors and multiple stakeholders. Hence, so far they fail to build synergy, which was their main goal originally. The coordination and synergy targets of RAN-API could not be reached because there are important steps missing, namely facilitating cross sectors and multi stakeholders to do vulnerability assessments and defining target of adaptation actions.

6.4 Water and Watershed in Climate Change Adaptation Policy

The GOI acknowledges the pressing issue of water security due to the impact of climate change. The RAN-API document puts decrease in water availability as a major climate change risks, along with other impacts such as flood, drought, food security and spread of disease. Indonesia's Intended Nationally Determined Contribution (INDC) document also mentions that climate change will affect water, food and energy systems, hence, it is crucial for Indonesia to build resilience:

“Climate change presents significant risks for Indonesia’s natural resources that will in turn impact the production and distribution of food, water and energy. As the population grows, there will be increasing pressures on Indonesia’s already limited resources. As a response, Indonesia plans to build resilience into its food water and energy system.” (INDC RI, 2009).

The significance of water is also observed in the INDC as it includes integrated watershed management as one of the actions to achieve economic resilience and ecosystem resilience. However, in a more detailed target of adaptations actions in the

RAN-API document, water is not addressed specifically. Unlike energy and food security, which are the specific subsectors for adaptation targets, there is no specific adaptation target for water security. In other ministries, even though they conduct actions related to water issues, the actions are the standard or normal actions taken regardless of climate change issues. In other words, they are not specifically intended to solve the problems of decreasing water availability due to climate change.

In Indonesia's NAPAs, the water issue is included in the ecosystem resilience target where one of the strategies is: "Securing the availability of water and protection against extreme climate events and maintaining of water supply sustainability, conservation of ecosystem and biodiversity conservation." (RAN-API). Increasing the quantity and quality of forest cover in priority river basin areas is the primary action conducted by the government in order to maintain water supplies. This indicates that, for GOI, water availability is something that would be achieved naturally if they protect the ecosystem. This is a contested approach, because in the context of climate change, increasing and securing forest cover do not directly increase water availability, because the rain intensity may decrease. Hence, even if the forest cover remained in abundance, it does not mean that water would be available. Moreover, not only is water availability related to the ecosystem especially forest cover, but also to the physical environment, and policy. Areas with vast forest cover sometimes can suffer worse water scarcity problems than others with less forest cover, as has happened in the Batulante watershed, where even though the area is forested, it still suffers severe water problems, due to its hilly topography and high altitude, making it difficult to retain water. Solving the water availability problem by using the ecosystem approach alone, which is merely based on increasing forest cover, cannot address the

real and deeper problem of water availability, especially for the ones who live close to the forest. Moreover, the target to increase the forest cover in order to solve the water availability issue is not easy to achieve, because there are many people living near the forest mostly depending on agriculture. Instead of solving the water availability problem, this action would increase vulnerability for certain population, which would be then counterproductive to the objective of adaptation to climate change.

The local government of Sumbawa has allocated the upper watershed mostly for forest conservation but this policy makes development programs or government actions very limited in the upper watershed, as presented in Table 6.2.

TABLE 6.2: Local government programs and policy in the upper watershed (modified from RPJMD of Sumbawa Government 2016–2021)

Programs/policy	Vulnerability tackled	Additional info
Roads connecting Lenangguar - Orong Telu - Batulante - Sumbawa.	Road	
Water resources network system in Sumbawa with the priority on Priority/Strategic Watersheds.		Water but this is for downstream
Maintaining the areas of protection forest, sanctuary, conservation areas, hunting park, protection of essential ecosystem and cultural sites.		Contraproductive with the existing livelihoods and smallholders aspirations and goals
Development of priority sectors in trade, services, industries, agriculture, plantation, livestock, fisheries, mining and tourism.	Economy	

Source: Musrenbang document

The Sumbawa government is also concerned with water as shown by the specific

section in the RPJMD document discussing rivers, springs, and river discharge potential for hydropower or other needs. However, the inventory document of rivers and springs does not mention any river in the upper Batulanteh despite the fact that big rivers in Batulanteh watershed are the sources of water for Sumbawa city, such as Setongo River. There are 34 rivers and 120 springs across Sumbawa identified in the RPJMD document, and there is no mention of any river or spring in Batulanteh Watershed in spite of the fact that the narrative around Batulanteh Watershed has been centered on their importance for water supply for downstream populations in Sumbawa Besar City. Furthermore, water scarcity is a persistent problem in the upper watershed that can only be resolved if the local government acknowledges it as a problem instead of excluding them from the development plan.

The conflict over forests will likely get worse because the local government has its policy to allocate upper watershed as protection areas, the national government's policy is also along the same line: the upper watershed is important for regulating water availability and ecosystem services, so it must be protected with the consequence of limited development. Moreover, in the light of climate change, the government clearly stated that they would increase their protected forest to hit their climate mitigation targets. In addition, climate change adaptation policy is also in line with the mitigation policy that conservation areas must be increased to ensure water availability. If at the national level a policy to increase conservation areas, mostly forest, is enacted, then there is a big chance that this will increase smallholders' vulnerability, because it will be difficult to reduce smallholders' vulnerability under limited development conditions.

In the following sections I look at two case studies of the particular problems facing the local level in developing appropriate adaptation policy.

6.5 Adaptation to climate change policy at local government level: Case Study 1

In Sumbawa District, the climate change issue was introduced by the central government in 2014 during the ongoing Regional/Local Mid-term Development Plan (RPJMD) 2011 – 2015. As a consequence, the local government could not easily change their RPJMD to accommodate the issue of climate change because the plan had already been agreed to:

“This climate change issue emerged around mid to end of 2014, while at that time we had already the ongoing 2011 – 2015 RPJM that had also been legalized through the district government regulation. Since the issue appeared in the middle of the ongoing RPJM, so we adjusted existing programs agreed to have relevancy to climate change. In RPJM 2016 – 2020, the climate change issues must be included. We need a massive campaign. The National Development Planning Agency has issued a book. But this issue is less strong compared to infrastructure issues. That is what happened. We do not feel the direct impacts of climate change. The local community cannot get the direct benefit of programs related to climate change adaptation because the impact is long-term. It is different from building infrastructure that people can see the tangible product such as good road access. On the contrary, the impacts of activities or programs related to climate change, such as planting trees is not directly tangible. This makes it less popular.” (Regional Planning Agency of Sumbawa District, 2016).

The local government in Sumbawa was aware that the issue of climate change should be integrated in the upcoming 2016 – 2020 RPJMD. However, climate change issues, including exposure, vulnerability and adaptation, are absent in the 526 pages of the RPJMD 2016 – 2021. Thus, the absence of adaptation policy at the local

government of Sumbawa indicates that there are challenges at the local government level, which I present below.

6.5.1 Head of District is a central figure for local policy

The Head of Sumbawa District is a very influential figure in shaping local policy. The vision, mission and programs of the elected head of district constitute a main consideration in developing local policy. The RPJMD is made to translate the priorities of the elected leader into policy and programs:

“The purpose of RPJMD Sumbawa District year 2016 – 2021 is to (i) translate the vision, mission and programs of elected Head/Vice-Head of Sumbawa District to a more detailed, measurable, and doable policy and development programs from 2016 to 2021.” (RPJMD Sumbawa 2016 – 2021 p. 74).

There is potential here for local government to develop specific climate change adaptation policy that suits their local climate change realities. However, it will depend on the head of the district, as noted by the Head of Planning Section, Sumbawa District Regional Planning Board:

“Actually climate change adaptation policy highly depends on the political will of the head of district. If he wants to put climate change as the district concern, it is easy. He can make a declaration following with some district regulation. Then, the governmental agencies will have no choice but to follow it.” (Regional Planning Agency of Sumbawa District, 2016).

However, this condition can be problematic for adaptation policy at local level because even though at the national or provincial level there are policies on climate change, the elected head of the district will prioritize fulfilling his political promises rather than following the RPJMN or national or provincial policy, mainly because they aim to get elected for a second term.

6.5.2 Climate change is Not a Popular Issue

Despite the fact that climate change affects smallholders in the upper watershed of Batulanteh, climate change is not perceived as a strategic problem to be addressed in policy, compared to other problems such as economy and infrastructure. From 48 identified strategic problems in the RPJMD document, none of them mentioned anything about climate change. They prioritize economic issues as observed in the vision of the Sumbawa District RPJMD for 2016 – 2021:

“Sumbawa District RPJMD’s vision is related to the vision of RPJPD Kabupaten Sumbawa (2005-2025) as being set in the district regulation Peraturan Daerah Nomor 31 Tahun 2010, which is “the realization of Sumbawa District as a competitive agribusiness area as a means to achieve prosperous society.” (RPJMD Kabupaten Sumbawa, 2016).

Economic issues are considered the most convincing to obtain votes or to attain constituent support. During the election, the opportunistic political leaders promise to overcome existing economic problems. The political leaders will only address issues perceived important by smallholders to gain voters or to keep their constituents once they are elected.

This indicates the importance of climate change knowledge and awareness in policy-making. The local government acknowledges their lack of their knowledge of climate change which limits them in formulating adaptation to climate change policies: *“What needs to be done is to raise the climate change knowledge of the local government first.” (Regional Planning Agency of Sumbawa District, 2016).* Increasing climate change knowledge and awareness from the elected head of district could influence their vision directly, which then will be the impetus for local policy. In addition,

increasing climate change knowledge and awareness of the head of district or political leaders will potentially increase climate change knowledge and awareness of their constituents. They can make a narration of their potential program from problems and vulnerability related to climate change and offer it to their constituents.

The same effect can happen if the community's knowledge and awareness is also increased and they can voice their aspiration on vulnerability reduction or adaptation to climate change and force the local leader to make it as their political priority, as one informant noted:

“And this is weird that every Musrenbang each year, local people never propose anything related to climate change. For example, there is no proposal on planting trees. What they propose is roads, drainage, irrigation, health centers, and schools.” (Regional Planning Agency of Sumbawa District, 2016).

In fact, what has been proposed by the local community is strongly related to climate change issues, such as roads, drainage and irrigation. But since the government considers identifies climate change issues primarily around carbon and tree planting, they consider that the local community's aspirations are not related to climate change.

6.5.3 Opportunistic Political Leaders and Smallholders

Despite the fact that local leaders have knowledge and understanding regarding high risks associated with climate change, they become opportunistic and practical in their approach to climate change issues by adjusting their political promises and programs. On the other hand, even though TEK system can increase smallholders' climate change knowledge and awareness, it does not mean that smallholders will

aspire for programs that will reduce their vulnerability to climate change. Smallholders can also become opportunistic and practical. They learn from their experience through time that asking for economic and infrastructure related programs have better chances of approval from the government. This shows that local people also think strategically and try to use opportunities from the existing local political system for their benefit.

Local policy as a reward and punishment. Winning an election makes elected leaders steer resources at the local level to fulfill their political promises. Oftentimes, a development project is conducted as a reward to their constituents and the absence of a program or development is a punishment for the community that does not vote for the elected head of district. This was revealed through interview with smallholders in Sampak Village.

“If we collectively chose candidate X during the election, there is a big chance for our road to be improved. But, yesterday, the votes from this village were split. So we do not have a good bargaining position with potential leader to fix our road if they get elected. If we had one voice, we could present to them that if you promise to fix our roads, we will vote for you. But it did not happen. People here are stupid. Some votes for candidate A, some for B and some for C. We do not have anything to bargain.” (Manes, Male, Sampak Village 2016).

“A (male): well, for me, I vote for the number 2 because to be honest, he gave money. We do not have rice, so we used that money to buy rice. Well, I do not mind to vote for number 3 anyway if other people in this village voted for him, but I will get the money from the number 2 anyway.”

“B (male): Yeah, some people mostly voted because of the money. But their act ruined other smallholders in the long run. Once they get the money, which is around IDR 200.000 (\$15), they run out of it in few days, then what is left? The money is only for short term. We should pay for these split votes; it is difficult to get the road improvement in our village due to it.”

“C (male): That’s what happened during the last election. No leaders came to visit us here because of the splitting votes. One candidate got 5 votes, the other 20 and 14, and on and on. We are ashamed to bring that amount of votes

to the candidates in order to ask for them to fix the road or making the dam structure here.”

The quotes above also show that social capital is very important for climate change adaptation at local level. The splitting of votes has caused smallholders to lose their bargaining position to the political leaders. Increased social capital could play an important role to reduce the gap between the different goals and to come up with “community” goals rather than aspiration of certain groups or local elites, as noted above.

6.6 Individual – Community Adaptation to Climate Change Decision-Making: Case Study 2

In the upper Batulante Watershed (and in Indonesia in general), there is a mechanism and platform to connect smallholders’ aspiration with resources available in the government. This mechanism is called Musyawarah Perencanaan Pembangunan (Development Planning Forum) that is widely known as Musrenbang. Musrenbang is expected to be a bottom-up and participative approach providing rooms for local people to voice their needs to the government, which then becomes the basis for the relevant government agencies in allocating budget and planning programs, so as to be in line with local people’s aspirations. Musrenbang is an annual agenda, which is conducted from the smallest level (household unit group or village level), where the community meets to discuss their problems, express their aspirations, and make decisions on short-term development priorities in their area. When priorities have been set, they are then proposed to the government in higher levels, and through

Bappeda (Regional Planning Agency), the local people's proposal will be categorized based on the theme and budget allocation. Climate change again exposes this decision-making process to further questions: Can this platform work for adaptation to climate change? What are the bottlenecks and opportunities for adaptation policy in this decision making process? I provide an assessment of my observations of the Musrenbang process in Bantulante and the challenges of integrating adaptation policy in it.

The Subdistrict Musrenbang in Batulante started with an introduction speech from the head of the subdistrict, followed by a speech from the head of the police department, and the head of the district, who was represented by one of the government officers from the Regional Planning Board of Sumbawa District. Basically, the speeches from these considered very important persons act as guidance, endorsement, and legitimation of the Musrenbang that would be taken place soon after they finish. Not long after, the audience started to discuss their local aspirations, all the important persons left the meeting and they did not come back again that day. The audience who mostly consists of the government officers from the subdistrict office and various governmental agencies changed their seats, so that they could face each other for more serious discussion. They took out their laptops and turned them on. They were then absorbed into a very intense discussion about the aspirations of stakeholders who were not in fact there:

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FIGURE 6.1: Batulanteh Subdistrict Musrenbang, 2017

the speeches from these considered very important persons act as guidance, endorsement, and legitimation of the Musrenbang that would be taken place soon after they finish. Not long after, the audience started to discuss their local aspirations, all the important persons left the meeting and they did not come back again that day. The audience who mostly consists of the government officers from the subdistrict office and various governmental agencies changed their seats, so that they could face each other for more serious discussion. They took out their laptops and turned them on. They were then absorbed into a very intense discussion about the aspirations of stakeholders who were not in fact there: smallholders (Figure 6.1). Even though Musrenbang is intended to be a bottom-up approach, in practice, Musrenbang is very top-down, as smallholders do not really participate in the decision-making process and there is

no dialogue between them and the government.

In the upper watershed, Musrenbang at the village level does not always taken place. The subdistrict officer said that not all villages submit the results of village level Musrenbang to the subdistrict office to be compiled and passed upwards. The subdistrict office does not try to find out why. When they do not receive the Musrenbang report at village-level, they will use the report from the previous year or the latest the village has. This shows that Musrenbang is not considered important by the smallholders from the village. This might be because they feel skeptical about the Musrenbang process, that even if they get involved actively in voicing their aspirations in their village-level Musrenbang, their voices will not reach or will not be heard by the decision makers.

While at its lowest level (the village-level), Musrenbang is intended to capture the finest scale of aspiration, some groups of people are still excluded in the decision-making process. Community meetings are attended by the head of RT (the smallest community organization unit consisting of 30 households), the head of RW (a community organization consisting of several RT), the public figure in the village, the village house of representatives (BPD), and the village officials. In this scheme, the ordinary smallholders and certain groups of communities such as women and young people are excluded, which causes their aspirations to not being captured in the process.

Different actors at the different levels of Musrenbang also contribute to the distortion of smallholders' livelihood aspirations. In the village-level Musrenbang, the meeting is attended by the many elements of communities, while in subdistrict Musrenbang, the meeting is attended by subdistrict village officials, while smallholders

are being represented by the head of the village and BPD. In the district-level Musrenbang, where the resource allocation decision-making is taking place, the meeting is attended by the subdistrict officers and some government officials from each agency in Sumbawa District. Oftentimes, the government officers who make the decision for smallholders have never visited the village, which makes it difficult for them to understand the local reality.

6.6.1 Distortion and Simplification of Local Reality in the Decision Making Process

The different levels between where the local reality of climate change impacts and adaptation happens with the level of where the decision-making for resource allocation happens raises a major challenge. Tables 6.4, 6.3, and 6.5 shows that smallholders' aspirations at each level of Musrenbang are significantly different in terms of its type and number. If we look closely into the aspiration that I gathered from the individuals using the interviews and focus group discussions (in Tables 6.4, 6.3, and 6.5), these aspirations are also different from the aspirations produced in Musrenbang. At individual level, smallholders' aspirations that I gathered using individual interviews and small group discussions are centered on livelihood issues. However, at village-level Musrenbang, the livelihood issues become less important; at the community level, most of the aspirations are centered on infrastructure, such as building a new mosque, building fences for the cemetery, village offices, or schools.

The lower the level of Musrenbang, the more the aspirations related to adaptation. On the contrary, the higher the level of Musrenbang, the less the adaptation aspirations are. This shows that along the way from the village level to the district

TABLE 6.3: Aspiration of Batudulang Village in 2016 Musrenbang

Village	Subdistrict
Establishment of new mosque	Fruit plants (durian and mangosteen)
Drainage	Freshwater fish aquaculture
Fence of the village office	Establishment of Junior high school 1 Batulante fence
Incentive PPKBD and sub PPKBD	
Sport activities	
Assistance for PKK	
Assistance for operation of LPM	
Incentive for mosque leader	
Incentive for mosque caretaker.	
Fence of polindes	
Floor for drying crops	
Land certification for people's garden.	

Source: Musrenbang document

TABLE 6.4: Aspiration of Sampak Village in 2016 Musrenbang

Village	Subdistrict	Approved
Irrigation channel	Asphalting of road in Sampak and Ai Ngelar, district roads.	Meeting hall (Using village budget)
Asphalting of road sampak		
Provision of corn grinding machine		

level, smallholders' aspirations are being filtered, sorted out, and simplified. The simplification of aspirations happens for a number of reasons, as described below.

6.6.2 Individual vs Community Aspirations: challenge of synchronization and compromising

One thing that stands out from the FGD and the Musrenbang documents is that there is a significant difference of aspiration between individual and community levels.

TABLE 6.5: Aspiration of Kelungkung Village in 2016 Musrenbang

Village	Subdistrict
Clean water network	Various fruits seeds (longan, rambutan)
Drainage	Calves for puncak panto group
Road in RW 02 Kelungkung	Asphalting of road in kelungkung crossroad
Kelungkung Office name signage	Drainage
Fence of PAUD INSAN CEMARA	Rehabilitation of community health center
Fence of cemetery kelungkung	Drainage in Puskesmas (community health center)
Asphalting district road	Office building of national education agency
Drainage along the district road	Roof rehabilitation of Puskesmas (community health center)
Office of UPT SD and PAUD	
Rehabilitation of pustu (community health center)	

Source: Musrenbang document

While climate change impacts hit the most at individual level and adaptation at individual level is urgent, Musrenbang does not cover it really well, because aspiration in Musrenbang is intended to be community-based. In the process of simplifying the individual aspirations to be community aspirations, climate change related aspirations that mostly are at the individual level are filtered and sorted out. The remaining community aspirations oftentimes do not relate to climate change adaptation, such as village office name signage, fences for village offices and village cemetery, or incentives for village officers and religious leaders.

6.6.3 The Domination of Local Elites and Local Politic Intrigue

Conflict, alliances, and power struggles are inherent in decision-making processes for development. The domination of local elites in the Musrenbang process is also one of the factors creating a bottleneck for adaptation policy. Oftentimes, village level aspirations brought to Subdistrict Musrenbang are only made by some elites.

This is made possible because the village elites such as the village head and BPD (village house of representative) are the ones who represent smallholders and bring the results of village Musrenbang to the next level (the subdistrict Musrenbang). This can happen intentionally by the local elites or because the local people do not want any longer to participate in village Musrenbang. In Kelungkung Village, the local people are reluctant to attend village Musrenbang because they already know that the meeting will be dominated by the village's elites and that even though they propose anything, at the end it will not be recorded in the Musrenbang report. Local people are also aware that eventually it is the village elites who have the final say in Musrenbang and that these elites will put their own interest in the proposals brought forward to the subdistrict:

“The same people always get the aid. Those people are the ones who decide the results in Musrenbang. If not for those people, the aid or program must be for their relatives. They have the insiders in government agencies that help them to get the aid or program. So why should we attend the Musrenbang?” (Hamid, 33 years old, Kelungkung Village).

The proposals in the 2016 Musrenbang in Kelungkung Village confirmed that village elites could easily modify the results to favor their interests. In the subdistrict Musrenbang, one of the proposals is a request for livestock for the Puncak Panto Farmer Group (see Table 6.5). This proposal was never mentioned in the village Musrenbang. This Puncak Panto Farmer Group is considered as receiving assistance from the government rather frequently, and the group turned out to be one of the elites in the village who attended Musrenbang at village level. Smallholders feel envious toward certain groups who always get government assistance; for them, government assistance is not evenly distributed and only enjoyed by certain people. Ordinary

smallholders are more reluctant to be actively involved in the decision-making processes, because they think that the results are not for them. Their withdrawal from Musrenbang even further hinders their adaptation aspiration for being heard and taken into account in the decision-making process for adaptation.

In addition to becoming the place of collusion for political elites, musrenbang is also seen as the fighting arena for local political elites. Sometimes Musrenbang becomes an arena for revenge for some adversaries. It is difficult to avoid this situation because the local elites have been involved in political contention earlier, such as in the election of the village head. The losing side will automatically be the village house of representative (BPD), which oversees the elected village government. Furthermore, in Musrenbang, they both are expected to cooperate together to develop common proposals to benefit the village. Furthermore, the proposal from village Musrenbang will be considered as legitimate only after it has been signed by both the village house of representative and the village head. This makes Musrenbang subject to chronic conflicts, for example the case of Kelungkung Village as shown in the excerpt from my interview below:

Subdistrict officer: “for Batudulang Village, even if they do not have Musrenbang, they already have their proposals. They are very cohesive. But for Kelungkung Village, the Musrenbang is usually fierce, very difficult to make any decision. The latest Musrenbang in Kelungkung was still on until late afternoon. I just left the meeting before it ended”. The subdistrict secretary: “Oh, so now I know that you did not attend the meeting until the end. It is your duty to attend the meeting until it finishes.” Subdistrict officer: (laughing), “because it was too long Ma’am, like no end. All parties are persistent towards their interests especially the head of village and the village house of representative (BPD), they disagreed towards each other all the time”.

In other villages, smallholders usually skip Musrenbang, possibly because they want to avoid conflicts. The local elites make proposals for Musrenbang on behalf of

the community without having to go through Musrenbang. Even though eventually they must get the signature of the village house of representatives, at least they are able to minimize open conflicts in front of the community which will erode their credibility as the leaders of the village. Or they can choose the option of not conducting Musrenbang at all, so then the subdistrict Musrenbang will use the proposals from previous year's village Musrenbang.

6.6.4 Adaptation Decision Making: A Tale of Conspiracy, Favoritism, and Convenient

The decision-making process in Musrenbang enables conspiracy between government with local elites, as the government can tell the local elites what to put in their aspirations to get better chance for approval. This is a way government could impose their aspiration. Local elites become opportunistic in that they put aspirations that will be more likely in line with the government's aspiration so that they get better chance to get it, rather than putting smallholders' aspirations. Conspiracy between local elites and government can be seen in the case of one village Musrenbang in 2016. Smallholders did not put an aspiration to get the support for corn seeds and fertilizer in their village Musrenbang aspiration. They agreed that they would put those aspirations for the next year. Later on, smallholders found out that certain groups of people got the corn seeds and fertilizer support from the government. This caused disappointment and angry feelings for many smallholders in Kelungkung Village. Once certain group gets the seed and fertilizer support, they may sell it to other farmers in other villages. They will share the money gained with the government officer involved, such as the extension officers.

Government officials also can get the benefit from the programs they have in the village. In Batulanteh Watershed, the local government has become the important player in honey marketing. The government, through the Forest Management Unit (KPH) Batulanteh, initiated the establishment of the Sumbawa Forest Honey Network (JMHS) and it was later a part of the Indonesia Forest Honey Network (JMHI). The idea was to establish a cooperative for honey gatherers in villages so that they can compete better in the market. JMHS gets a contract to send honey to Jakarta and becomes the supplier for JMHI. As a part of the effort to gain more access to the market, the government also gives training to harvesting honey sustainably, processing beeswax, making candles, soaps, etc. The Government also supports the cooperative with water content testers, dehumidifiers to reduce water content, and some equipment for better packaging the honey. The government on behalf of the JMHS gets better access and opportunities to propose budgets to local governments and development grants to be channeled to JMHS. The government lobbying is also able to mobilize big grants from National Bank to help the JMHS.

Even if JMHS is intended to benefit smallholders in the upper watershed, in reality, the local elites become the leaders of this cooperative, where they have the power to set honey prices that they get from smallholders. The equipment provided previously became the property of individuals and is used to make honey brands for those elites. The government official that initiated the JMHS also became a part of the honey business. The government official, from his strategic position, has provided government assistance (i.e. access to the market, tools for increasing the honey quality, product marketing) to the JMHS elites who then use such assistance for their own personal benefit. The government also tries to exploit and channel all

the government assistance, researches, and visits from NGOs to Batudulang Village, where one of the cooperatives is operating. Visits from NGOs, press, researchers, and government from the provincial and national level, are directed to Batudulang Village, which is their display that the project is a success story.

The government tends to avoid making programs in villages that they consider problematic and riskier. Smallholders in Kelungkung found it difficult to sell their honey because they did not get similar programs and attentions as received by Batudulang. The government's reluctance to give market access to Kelungkung is because the government thinks that Kelungkung Village is not conducive for their programs due to the frictions among the community in the village. The government also considers some village officials are too critical towards the government, so the government does not want to conduct any program in Kelungkung Village.

Within the community, this mechanism promotes new local elites and strengthens the existing local elites. By the time, these elites become so powerful that they represent an obstacle for other smallholders to gain access to the market. In Kelungkung Village, it is mentioned that the elites always block other smallholders to start a new business. The elites take control over the majority of opportunities and do not allow participation by other smallholders. For example, when there was a meeting conducted by the government, and the government ordered the food from one of the community members, the elites became angry. The elites also came to the house of the community members who opened a new business and said that they ran the business first. This has caused the smallholders, whose power is weaker than the elites, became reluctant to start any new business.

The government also approves smallholders' aspirations based on convenience.

For example, in 2016, one group of farmers from Sampak Village and two groups of farmers from Kelungkung Village submitted their aspirations to get support for fresh water fish and ponds. In 2017, the two groups of farmers in Kelungkung Village got it, while the government did not approve the same proposal from Sampak Village. It turned out to be that there is no one in the marine and fishery agency who wanted to go and check the group of farmers and their potential fishpond location due to the bad road access to Sampak Village. Furthermore, to approve smallholders' aspiration, they are required to do some verification in the field.

6.6.5 Fierce Competition for Limited Resources

The higher the level of Musrenbang, the more competition smallholders' aspiration will face. The aspirations from the village level, which are brought to the subdistrict level, will have to compete with other aspirations from other villages in the same subdistrict. The aspirations from these three villages will have to compete with other aspirations from 15 villages in Batulanteh Subdistrict. Therefore, aspirations should be filtered and sorted out in this stage. For district level Musrenbang, the competition at this level is even fiercer, because at this stage, the subdistrict aspirations will have to compete with other 14 subdistricts in Sumbawa.

Moreover, adaptation aspirations will compete with other non-climate change issues in the decision-making process. Adaptation to climate change is an issue considered less important than other issues such as infrastructure, while at the village level, smallholders' aspirations are centered around livelihood issues. However, at the subdistrict level, the livelihood issues are filtered and sorted out, and the aspirations brought to the district level focus on issues of infrastructure, because it is easier for

people to see the materialization of the allocation of budget and to claim the success of the development project. Furthermore, for adaptation to climate change, the programs needed will be potentially “soft”, which include programs to increase climate change knowledge or to help smallholders to be able to voice their opinion, whose success, most of the time, cannot be seen as clearly as the infrastructure projects.

The limited budget from the government compared to people’s vast aspirations is also one of the factors determining which aspirations can and cannot be supported. The budget available is far less than the budget needed to support the whole aspirations from smallholders. Thus, the aspirations should be prioritized. The aspiration approved is the one that is compatible with the available resources and objectives, goals, and programs of the national government.

Apart from the national influence through state budget (APBN) allocation for Sumbawa District, Sumbawa District has its own district budget (APBD) to fund its own aspirations or goals that will be more compatible with the local reality. Therefore, if a district government has a strong and clear vision on adaptation to climate change, they can act on it by using their own budget. Therefore, the district level is very critical for adaptation to climate change. The resources from the state and the district are accumulated at the district level before its allocation to the village level. Thus, the government officials’ interpretation on climate change becomes crucial, because the resources are already there, and it is only a matter of how they can direct them into aspirations that could promote adaptation. With a strong leadership that favors climate change in the district level, adaptation to climate change would be more successful, as districts can even make their own local policy on climate change adaptation.

Additionally, new policies regarding budget allocation give new opportunities to support local people's aspirations. Currently, there is an ongoing policy: one billion one village. It is a policy to give IDR 1,000,000,000 (around US\$ 100,000) budget directly to each village. This policy is still under some reviews, pilots, and refinement. If the decision making mechanism remain the same, i.e. with the exclusion of certain groups and greedy local elites, then the same thing will happen, resources will only be enjoyed by some elitists in the community. Even worse this could bring new conflicts in community or deepen the existing horizontal conflicts that may diminish social capital important for adaptation when all the resources needed from the government are unavailable or the policy is changing.

6.7 Conclusions

A sustainable adaptation policy is absent in the upper watershed of Batulanteh. This is caused by the insufficient and ineffective national climate change adaptation policy resulting mostly from a co-benefit approach. The co-benefit approach in Indonesia, which is linked closely to their ongoing development goals, makes adaptation policy not specific to climate change and not directly linked to reducing exposure and vulnerability. Critical thinking about the most vulnerable populations under the context of climate change is missing in the policy, which further leads to a failure to address the underlying causes of vulnerability. Because the integration of climate change adaptation into the existing strategic development goals requires no special budget, no structural changes and no new policy instruments, development goals and

all existing programs in ministries and institutions are claimed as adaptation programs. Therefore, the co-benefit approach does not make an expected transformative change possible.

While at the national level adaptation policy is lacking, local governments, closer to the lived reality of smallholders, might be expected to make better local adaptation policies that are appropriate. However, climate change adaptation policy is also absent at the local government level in Sumbawa District, mostly due to the fact that the Head of District mostly prioritizes policies to fulfill their political promises to their constituents rather than to address the adaptation concerns of the most vulnerable populations. Local policy is also used by the elected leaders to steer resources to please their constituent as a reward or as a punishment for not having voted for the leaders. Consequently, climate change is not a popular issue to be addressed compared to other issues such as economy and infrastructure, both for the citizens and the government.

At the same time, the local government has limited knowledge of climate change: vulnerability and other social aspects of climate change issues have not been properly understood and the government focuses most of its attention to climate change issues around carbon and tree planting. In this regard, smallholders in the upper watershed are often considered unimportant by elected local leaders, because they often live in low populations and remote areas difficult to be reached by the local leaders during their political campaigns.

The decision-making platform (Musrembang) that connects smallholders and the government can be considered a top down approach that the participation of smallholders' is very low. The ordinary smallholders and certain group of communities

such as women and young people who are the most vulnerable groups are excluded in the process of decision-making. The domination of local elites at the Musrenbang process is also one of the factors creating a bottleneck for adaptation. The aspirations brought to Subdistrict Musrenbang oftentimes are made by elites only, and along the way from the individual and village level to the district level, smallholders' aspirations are filtered, sorted out, simplified, and even distorted. Given the fact that smallholders cannot really voice their aspirations, then adaptations to climate change are missing from the decision-making process in Musrenbang. Even if there are programs for smallholders that possibly can help them to adapt to climate change, the programs are often given based on favoritism and conspiracy between the government and local elites that will prevent smallholders to gain benefits.

Adaptation policies and programs in the upper watershed of Batulante are also limited due to the fact that the local government allocates the upper watershed as protected areas in their regional planning, which makes development programs or government actions very limited. The government even plans to increase the target of reforestation and rehabilitation of critical lands and the policy of forest protection will be potentially reinforced in the context of climate change mitigation needs. Such policies do not address the vulnerability of smallholders who live in the forest in the upper watershed, and risk increasing smallholders' vulnerability.

Chapter 7

Conclusions

7.1 Postscript

Kelungkung Village, January 2017, 05.30am

The shining from the bright sky began to glow from the crevices of the wooden walls. The rooster had been crowing several times. Anjes's wife had lit a fire in the kitchen, and she was about to prepare breakfast. I offered her to assist in carrying water from the well so that she could complete her cooking. Her face changed anxiously as she remembered that the water was far away. She realized that, by that time, the well might have been exhausted, as people often queued since early in the morning. Then, in order to avoid the long queues in the nearby spring, I strode toward the further one. When I arrived, I came across Deta, one of the participants in my forest conservation project. Two women also stood near the well, along with their buckets full of dirty clothes. Not far away, tied to a fence, I could also see their two skinny cows. Deta stared at me, smiling wryly and said, "no water, sister". I saw him filtering out a small amount of water with thin clothes, where moss and gravel were percolated. "The water is dirty and we have to filter it before using it for a shower,

because otherwise our body would get dirty instead of clean,” he explained. Then, he added: “I have been waiting for this water since some time ago, but this water does not rise, though, yesterday, the well was not as dry as today.” He looked back at his empty bucket and then, toward the dry well and became increasingly anxious as at 6.30am he had to go to school. I decided to go to the main spring in the village that has a larger supply. On the way to the spring, I encountered people who were rushing back to the village in disappointed mood. Their empty buckets swayed slightly on their feet. The spring was very quiet despite the fact that it was already 6.15 in the morning. Only two girls were still trying to draw the remaining water droplets from the dry well. My attempt to obtain the water was ultimately failed like many others that day.

“What is your action plan against the increasingly severe water problems that your people are already facing? Water is not enough for everybody, and there is no sign of rain to fall soon,” I asked the head of Kelungkung Village in his office. I had been listening to him for almost an hour, as he had described the great potential of his village, he had told me about his strong connections to some important people in Sumbawa, and mainly about his children, who are extremely successful in their lives. While smoking his cigarette, he said proudly: “oh, this village is the most feared by the legislative and the government of Sumbawa, because we usually protest in numbers to their offices every time there is water problem. They do not dare ignore us, because they know that the population in Sumbawa City is very much dependent on us for their water supply. We told them: ‘if we are not given the water, we will damage the pipes that drain the water into the city’. Therefore, whenever there is a drought, the government always sends the trucks of water to our village.

A few days later a water truck from Sumbawa city arrived, carrying the water needed by the smallholders in the upper watershed. Ironically, the water that it was conveying from Sumbawa City originated from the upper watershed itself. People flocked to queue in front of a large blue water container that had been installed in front of the head of the village's house. Some people returned to their home disappointed because they did not get any water. "The government's water is always not enough for everyone and the people who get it are always the same: local elites and the people close to them," they complained as they stared at the water truck moving away, raising dust between its large tires.

For the time being, this water assistance made the situation in the village rather calm. Although only a small portion of the community obtained the water from the government, at least the queues in the springs were slightly reduced for few days. Yet the water scarcity problem is far from being solved. It is only one of many pressing problems that people have to deal with in the upper watershed in their everyday life.

Months after my fieldwork, I happened to come across the Facebook status of the head of the forest management unit of Batulanteh. He published a new post about the latest tree planting that was attended by other government officials from the provincial and national levels. I observed some of the published photos, showing them wearing their sunglasses, outdoor adventure hats, and the same t-shirt that was intentionally being printed for those planting actions. They took many selfie pictures, revealing their happy faces in their action of planting the trees and digging the soil. One of the group of pictures exhibited a large banner that said: "The Cajuput tree planting with the community for the Indonesia Tree Planting Day and the national month of planting held by Environmental Agency NTB Province, Forest Management Unit

of Puncak Ngengas Batulanteh, Ministry of Forestry, Forester.” Local people were not appearing in the pictures. This is not their first absence from the tree-planting event; they were also absent in the previous years of the government’s persistent tree planting programs. These programs are reported to have failed miserably to reforest the land and to gain local people’s support.

7.2 Conflicting Goals over Forest Utilization

Conflicting goals over forest utilization between smallholders, who aim for income pursuits, and the government, who aims for forest conservation, are inherent in the livelihood of smallholders who live in the forest margins in the upper watershed of Batulanteh. The inevitable conflicting goals affect smallholders’ livelihood outcomes, vulnerability, and adaptation to climate change. The government’s goals to sustain a water supply for the downstream population is manifested into the policy to allocate forest in the upper watershed as forest conservation. As a result, the forest conservation policy limits smallholders’ access to forest, which is very important for their livelihood. For smallholders whose major livelihoods are land-based livelihood, forest is seen as a potential resource to be converted into agricultural land, as a means to increase their yield and income. The conflict over forest utilization prevents smallholders from achieving their income pursuit goal, because their major livelihoods, which are land-based livelihoods, are conducted under conditions of limited land. Such limitations have their cause in the limited access to the forest compounded by the condition that the limited land is a low-productivity dry land. While the program introduced by the government was believed to be sustainable for the environment, it

was de facto not viable for smallholders and did not help them to increase their income.

Adger (1999) notes that existing vulnerability determines the outcome of stressors and responses of people toward any hazard. In this regard, this dissertation shows that smallholders were already in vulnerable condition before climate change hit, due to their low yield and profitability of livelihood conducted under conflicting goals between locals and the government. These conflicts over forest utilization that have been continuing for years have absorbed the focus of both the vulnerable and the government. Smallholders' focus on their lack of land that is highly related to the conflict over forests, which hinders them to focus on other important factors that could help them better address their vulnerability. Smallholders perceive that the lack of land is their biggest livelihood problem, whereas this study shows that their vulnerability and adaptation are strongly influenced by the problem of lack of water.

The ongoing and prolonged conflict over forest utilization that leads to a negative perception of the government toward smallholders also hinders the government from seeing smallholders' vulnerability. The government's willingness to assist the community in adapting to climate change is also influenced by their relationship with the community. These conflicting goals decrease the government's willingness to help the community in the margin forest to adapt to climate change. At the same time, the government's assistance is very important for smallholders' climate change adaptation, since the impact of climate change is beyond smallholders' adaptive capacity and the outcome of some of their coping actions has been maladaptation. Occasionally, the government also uses adaptation to climate change policy and programs as tools for punishment or rewards to communities that oppose or support their goals,

respectively. In the case of the conflicting goals with the community who live in the forest margin, the absence of adaptation programs or policy can be seen as a form of punishment to the community, as the government will prefer to implement adaptation programs in communities that are less conflictive in order to increase the success rate of the project. Moreover, given the fact that the funds for adaptation are lacking, the government is more selective to choose the communities where the adaptation programs will be implemented. Therefore, the conflicting communities, which oftentimes are the most vulnerable communities, will become the last in the government's priority or even totally excluded from adaptation programs.

Conflicting goals also become a barrier for the development of smallholders' climate change knowledge that is currently limited. Smallholders resist the climate change information given by the government due to the ongoing forest conflicts. For the local people, accepting knowledge and information from the government, including climate change information, implies that they also agree with the government's claim on forest boundaries, which have been contested for years. The smallholders' acceptance of the climate change knowledge from the government is also influenced by conflict within communities: the more conflicting the community, the more they prefer to trust the climate change information from outside.

Conflict over forest utilization will potentially increase under the context of climate change combined with the double exposure of globalization, which will further push smallholders' income pursuit goals. Although forest-based livelihoods are important for smallholders, they still prioritize land-based livelihoods, as the outcome of forest-based livelihood is not considered sufficient. Pressure on the forest from the land-based livelihoods is coupled with the fact that smallholders rely heavily on it

for coping to climate change. Furthermore, the increasing environmental problems in downstream areas such as floods, droughts, and water problems will justify and potentially further advance the government's goals in forest conservation. At the same time, the existing forest conservation policy to sustain water for downstream population is reinforced by a policy of mitigation to climate change, which targets increased forest cover in critical watersheds. This policy has been implemented in the upper watershed of Batulanteh through the reinforcement of forest boundary during the last 5 years (2010-2015), and the local government plans to increase the targets of reforestation. Maintaining water supply is also included in the ecosystem resilience target of Indonesia NAPA, to be achieved by increasing the quantity and quality of forest cover in priority river basin areas.

7.3 Climate Change Impacts and Smallholders' Vulnerability

Smallholders in the upper watershed of Batulanteh perceive that climate change is happening and that it has been occurring for the last 5 or 6 years: they have been observing and suffering a number of climate change phenomena, such as strong winds, rainfall decreases, or erratic rainfall patterns. However, smallholders were already in a vulnerable condition by the time climate change started to manifest, since their livelihood had been conducted under conflicting goals, whose outcome caused low revenue and low yield. Climate change further decreases smallholders' income, increases food insecurity, exacerbates water scarcity problem, and aggravates health problems. Being intertwined with market stressors, not only does climate change decrease the

revenue and increase the harvest failure risk, but also it reduces smallholders' product prices, increases the price of staple food, and destroys rural infrastructures, such as important roads for accessing the market. However, even though smallholders are aware of climate change stressors, they do not consider climate change as the central problem and they are more concerned about other issues, such as their perceived lack of land.

There is a significant difference in the perception of vulnerability between men and women, showing that gender roles in the household and community affects such perception. Women mostly feel vulnerable concerning domestic issues such as food security and the lack of income, while men are concerned about the lack of land. The vulnerability perception is also highly influenced by experience through time. Older generations, if they perceive a significant improvement in their lives in comparison with the past, feel less vulnerable than what they actually are, while younger generations tend to perceive that their well-being is far from satisfying.

Further, vulnerable conditions are experienced differently by distinct groups of people. Male adult smallholders are exposed to higher physical risks because rural livelihoods mostly rely on intensive male labor. Elderly persons, who have limited livelihood options due to their diminished physical conditions, also feel overstretched when climate change exhibits its effects, as they have to fulfill their guidance role for their community in spite of their limited climate change knowledge. Additionally, they are also troubled by the increasing vertical and horizontal conflicts related to land and water that appear under the effects of climate change effects. Climate change also increases women's vulnerability, since they serve as a last resort to overcome negative impacts by working as a TKW, and women working as a TKW are physically and

emotionally vulnerable and also exposed to exploitation and maltreatment when they perform their TKW duties abroad.

Vulnerability is also not always easy to be articulated by the vulnerable persons themselves and oftentimes the vulnerable subjects do not even realize the depth of their vulnerability. For example, culture can be a barrier for men to really grasp their vulnerability. As the breadwinners of their families, men are expected to be strong and they have to hide their vulnerability to keep their image intact. Furthermore, elderly people tend to downplay vulnerability, because of their role to maintain the sense of stability and security in the community.

Certain vulnerabilities are also hidden due to the marginality of certain groups. The vulnerability they experience may be taboo and it can be shameful to share or discuss about it. Also, being in a marginal and powerlessness situation for a long time can also make the vulnerable persons normalize their vulnerability, thus they do not feel that they are actually vulnerable. Belief also leads to vulnerability bias and articulating vulnerability can be considered as a complaining and ungrateful attitude toward God. There is also a risk of bias from the third person's point of view or the inability of the third person to capture children's vulnerability.

This research shows that globalization is an important factor that influences smallholders' vulnerability and adaptation to climate change along with the conflicting goals over forest utilization. The income pursuit is the major livelihood goal of smallholders in the upper watershed of Batulanteh. Furthermore, being resilient to climate change, the preservation of the social capital, and the conservation of the environment are among smallholders' goals. Due to their income pursuit goals, globalization

becomes an important stressor in their livelihood. Smallholders base their vulnerability perception on aspects that are related with globalization. For instance, in this research, I found that smallholders feel vulnerable if they do not have money to enjoy the comfort that the globalization can offer. Thus, globalization adds complexity to the adaptation policy because the vulnerability that is addressed by the current policy may no longer be enough in the future. Overall, the cognitive baseline of vulnerability may be highly dynamic through time depending on processes of globalization.

Solving everyday risk is essential for vulnerability reduction because, as Adger (2007) has mentioned, existing vulnerability will influence people's vulnerability when climate change hits. Thus, giving attention to everyday risks that people perceive can help solve existing vulnerability. Solving the everyday risk that people perceive is also thought to be more participative, since vulnerability reduction should be bottom up, addressing vulnerability through the eyes of the most vulnerable. However, this research shows that there are bias in risk perception, which brings some complications for vulnerability reduction. Smallholders' perception tends to be biased as they focus on less influential factors that affect their vulnerability and adaptation to climate change. Thus, their vulnerability perception could be misleading for programs for the reduction of vulnerability. In this study, bias leads smallholders' attention to the issue of the lack of land, and it lets them ignore the lack of water or climate change issues, which are actually more important and significant in reducing their vulnerability and to successfully adapt to climate change. The bias in risk perception is caused by the on-going conflict over forest utilization between smallholders and the government.

Thus, due to its tendency to be biased, smallholders' own perception of vulnerability is not a panacea for vulnerability reduction. The different perception of vulnerability of different groups of people shown in this research raises a question on whose vulnerability and what vulnerability counts, especially if vulnerability reduction is to be implemented under limited adaptation funds. The hidden vulnerability that cannot be captured by the perception of the vulnerable persons shown in this research also highlights the need to bring an outsider such as researcher to define the vulnerability of certain population, as smallholders are potentially more vulnerable than what they think they are. There are certain vulnerabilities that cannot be captured through the view of the vulnerable, caused by culture, belief, experience, or marginality of certain groups.

7.4 Adaptation to Climate Change

Despite the fact that they are able to notice the changes in climate, smallholders' traditional ecological knowledge (TEK) related to climate change is still limited and can be ineffective to guide smallholders to adapt to climate change. In addition, my research shows that the tendency towards declines in TEK will complicate the existing discussion on the importance of TEK for climate change adaptation. Up to this point, the discussion on TEK has been centered on the assumption that TEK indeed exists and that it is being practiced by smallholders. However, my research found that TEK is not as important as the proponents of TEK thought it is. Rural livelihoods related with the TEK system are few and they are also changing and being more integrated into the market. As a result, smallholders deliberately tend to abandon the practice

of their TEK system. Furthermore, the livelihoods that sustain TEK are important for the preservation of the social capital required for the success of the adaptation programs. Therefore, my research finding on the declining of TEK questions the on-going efforts that advocate that TEK should be integrated into adaptation policy.

Smallholders use the forest and their human labor and sell their assets to cope with the impact of climate change. These coping strategies can increase their vulnerability instead of reducing it, an outcome known as maladaptation. The absence of strategies that are critical to adaptation can also be considered as maladaptive. In this study, the lack of strategies to solve water scarcity problems shows that smallholders' coping strategies do not address the underlying causes of their vulnerability. Water is an issue that is critical in the upper watershed in a way that smallholders are vulnerable mostly due to the persistent water scarcity problems, while the government uses the sustainability of water for downstream population as an issue to justify and implement its forest conservation policy. The lack of strategies from smallholders and the lack of attention from the government to solve the water scarcity problem in the upper watershed of Batulante have caused persistent vulnerability.

The factor that hinders smallholders the most and that prevents them from focusing on the water scarcity problems is belief. The water scarcity problem is considered as a natural process that it is beyond human power to solve. Due to smallholders' belief that climate change belongs to the domain of God, the increasing severity of the water problem is considered to be unsolvable by humans. Nevertheless, the persistence of the water scarcity problem is also caused by smallholders' lack of agency. They prioritize using their income to buy goods such as motorcycles, smartphones, furniture, etc. rather than solving the water problem, such as by digging new water

wells. This shows that even if smallholders achieve their income pursuit, there is no guarantee that they will use it to reduce their vulnerability or to adapt to climate change. Although the government is trying to solve the water problem, the success of these programs is also largely determined by declining social capital.

7.5 Inadequacy of Climate Change Adaptation Policy

The inadequate climate change policy in the upper watershed of Batulanteh is an outcome of weak climate change adaptation policy at the national level. The GOI has adopted a co-benefit approach by integrating climate change adaptation with the existing development goals. This study shows that the co-benefit approach does not lead to a robust adaptation policy in Indonesia. The co-benefit approach for climate change adaptation policy development acts more as challenges for adaptation that leads to incoherence and unclear targets of adaptation policy, lack of participation from stakeholders, lack of adaptation programs, lack of funding, and missing attention to vulnerability. By integrating the climate change adaptation policy into the existing strategic development goals, the GOI does not allocate a special budget for climate change adaptation and it is not being specifically used for climate change. The existing programs in all ministries and institutions are also conveniently claimed to be adaptation to climate change programs. Therefore, the co-benefit approach for developing climate change adaptation policy hinders the occurrence of transformative changes that are expected to emerge from adaptation policy.

An adaptation policy is also lacking at local government level, exacerbated by the local political realities. The head of district tends to prioritize the development of policies to fulfill political promises to their constituents rather than to address the adaptation of the most vulnerable populations. The local policy is also exploited by the elected leaders to steer the existing resources into their constituents as a reward, and political leaders prioritize their programs in places where many potential voters live such as in coastal areas, whereas remote areas are not considered as important. In addition, climate change is not a popular issue to be addressed by the local government policy and programs compared to other issues such as economy and infrastructure.

The lack of adaptation policy is also exacerbated by the inadequacy of the existing decision-making process and platforms (such as *Musrenbang*) that are supposed to be a bottom-up platform to connect smallholders' aspirations and the government as resource allocators. Along the way from the individual and village level to the district level, where the final decision of resource allocation and development programs is made, smallholders' aspirations are lost. With the aim of channeling the individual aspirations into community aspirations, climate change related aspirations, which mostly emerge at the individual level, are also lost. Moreover, ordinary smallholders and certain group of communities such as women and young people, who are the most vulnerable group of population, are excluded in the decision-making process. The domination of local elites in the *Musrenbang* process is also one of the factors creating a bottleneck of adaptation and the aspirations brought to higher levels of decision making are often made by few elites. Even if there are programs for smallholders that possibly can help them to adapt to climate change, they are often assigned based on favoritism and conspiracy between the government and local elites, preventing

smallholders from gaining any benefit.

Not only is adaptation policy lacking, but also it reinforces the existing forest protection and mitigation policy. These policies, which will potentially limit the access of smallholders to the forest, risk increasing smallholders' vulnerability. This adaptation policy does not help to solve the problem of limited development in the upper watershed essential for successful adaptation to climate change.

7.6 Future Research

Drawing from the findings of this dissertation, I offer potential avenues for future studies on adaptation to climate change. In many respects, this dissertation has shown some challenges for adaptation to climate change from the individual to national levels in Indonesia. This dissertation shows that successful adaptation to climate change can only be achieved if the conflict between the vulnerable and the government over natural resources is reduced or removed. Conflict reduction is an important step to adapt to climate change as it will address some of the barriers to adaptation as mentioned earlier. Thus, further research on conflict resolution in the context of climate change is needed. However, considering that both the vulnerable and the decision makers for adaptation to climate change are being absorbed by the conflict, facilitation from "neutral" actors is required. Facilitation can potentially bring out the voice of the vulnerable groups to be heard by other actors, and in this regard, facilitation can help to level the playing field between the powerless smallholders and the more powerful local elites and the government. Facilitation also potentially can help to mainstream the climate change issue and to help different

actors to communicate and exchange their climate change knowledge, which is now still missing. Facilitation will also help increase the transparency and accountability of the adaptation policy and programs that are now being used for the benefit of a few local elites and government officers.

Considering the potentially important role of facilitation for climate change adaptation, future research on mechanisms for facilitating climate change adaptation is needed. It will potentially further extend our understanding on factors that influence the opportunities and challenges for facilitation and conflict resolution and the potential use of climate change for conflict resolution. There are many research questions that can be opened by facilitation for climate change adaptation studies, such as the way facilitation can be accomplished under a strong domination of a local elite and a top-down adaptation, mitigation, and forest conservation policy; how methods for effective facilitation for conflict resolution under the context of climate change can be developed; who will implement the facilitation; how such facilitation can be funded under the constraint of a limited budget adaptation; and how to position facilitation in larger structures of adaptation policy. Facilitation to climate change studies will open the venue for more interdisciplinary studies on coupled human and natural systems that will widen the use of the literature in communication, psychology, and conflict resolution to compliment vulnerability, SLA, and PE literatures.

This study also shows that bias in perception leads smallholders to focus on the issue of lack of land and ignore the lack of water or climate change issue, which actually is more important and significant to reduce their vulnerability. The existing bias could lead to severe and systematic errors (Tversky and Kahneman, 1973). This uncorrected bias has created the persistent vulnerability in the upper watershed of

Batulanteh. Yet bias in perception is possible to be corrected, as it is possible for people to learn to recognize their bias and to deliberately make appropriate corrections (Tversky and Kahneman, 1973). Therefore, further research to understand the factors that can correct the bias in perceptions regarding vulnerability should be undertaken rather than just to accept the perception and its bias as it is. Research on bias correction is becoming more important because some scholars promote the inclusion of public perception studies of the environment into practical decision-making (Attanasio, 2009). The success of any project will be achieved if the local people are involved mentally and physically. Thus, perception of the vulnerable will be critical for the success of adaptation to climate change problems, as people will get involved in adaptation to climate change project only if they perceive they are vulnerable to climate change.

This research shows the potential of climate change to correct the bias in people's perception. The increasing climate change awareness along with livelihood aspirations appraisal could potentially reduce the conflict over forest and address smallholders' vulnerability. This shows the importance of climate change knowledge for adaptation to climate change. The increasing awareness of environmental degradation does not necessarily lead to conservation action (Napier and Brown, 1993). However, climate change impacts that hit smallholders stronger than environmental degradation can possibly increase smallholders' likelihood to take real action. Therefore, empirical studies are required on whether the climate change awareness and the sustainable smallholders' aspirations can lead to sustained actions.

This research shows that adaptation policies in Indonesia are limited and inadequate for smallholders to adapt to climate change. They are too focused on natural

resource conservation and were designed with little attention to human activities and the priorities and needs of people, as they neglected the vulnerable voice in the decision making process related with adaptation to climate change. The top-down approach of adaptation policy also gives more power for the governments to justify their narration about environmental degradation and to develop adaptation policies that suit their interests and to steer the resource for adaptation programs (Guthman, 1997). The government can also use the adaptation programs as rewards or punishments for certain communities who oppose to the government because climate change adaptation policy is developed and being implemented under the context of existing conflicting goals. The study of adaptation policy so far is related to how countries develop their adaptation policy in national levels and the dynamic between local and national governments for the policy implementation, rather than with attention to contexts like local conflict (Dupuis and Biesbroek, 2013; Adu-Boateng, 2015).

Studies on a bottom-up approach to adaptation policy are lacking and need to be undertaken considering that the policy is so far top-down and not addressing the vulnerability of the most vulnerable populations. Furthermore, participation of the vulnerable is a key for the success of any development project and the solution must not ignore the basic needs of people living in upland watersheds (Tennyson, 2002; Achouri, 2002). Considering that the most vulnerable population is also subjected to a top-down mitigation policy that coming from the international pressure rather than from the necessity and aspiration of the developing countries, further research on the challenges of bottom up approaches for adaptation to climate change needs to be undertaken. How can a bottom-up approach of adaptation policy be made possible under existing conflicts, a non-effective decision making platform, the presence of

dominating local elites, the marginality of the most vulnerable, and top down mitigation policy at national levels? And how can a bottom-up approach of adaptation policy be developed and promoted to empower the most vulnerable and to transform the existing inadequate decision-making process that excludes the voice of the most vulnerable and lacks of transparency and accountability?

This study also shows the challenge to solve water scarcity problem in the upper watershed. Water scarcity in the upper watershed does not get proper attention from smallholders and the government. Meanwhile, water is the central issue that becomes the rationale of forest conservation policy in upper watershed. Water is also one of the underlying causes of vulnerability for smallholders in the upper watershed and also a critical resource for adaptation to climate change. Thus, research on adaptation to climate change policy that address water scarcity issues in the upper watershed is critical to be undertaken.

This research also shows the potential paradox of development that is being integrated and used interchangeably with adaptation policy. On one hand, adaptation to climate change cannot occur without development, while on another hand, development in the upper watershed is limited due to mitigation policy. Thus, the overlap between development, adaptation and mitigation policy needs to be further investigated. Research on adaptation policy should also be extended to understand the link between adaptation and globalization better. As one of the most important factors that affects vulnerability to climate change, as shown by O'Brien and Leichenko, 2000, globalization will further increase the complexity of the development of adaptation policy, as globalization also redistributes vulnerability from one place to another (Atteridge and Remling, 2017). Future research on how adaptation policy

in rural areas can be developed within the context of globalization that crosses scales and levels, and that is difficult to control, needs to be undertaken.

Appendix A

Survey and Interview Instruments

Survey and Interview Instruments

Household Survey

Code for household : _____

Interviewer : _____

Date of interview: _____

Location (Village): _____

Section 1. Household Demographics

1. Age:(years)
2. Gender: ☐1. Male ☐2. Female
3. Highest year/grade of schooling completed
☐1. No education ☐2. Elementary ☐3. Secondary ☐4. Tertiary ☐5. High degree/university
4. Are you the head of the household?
☐1. Yes
☐2. No, the relationship with the head of household is.....
☐1. Spouse ☐2. Daughter/son/grandchild
☐3. Parent ☐4. Other (specify).....
5. How many people live in your household?persons
6. How long have you and your family lived here?.....years

Economic indicators

1. What is your house constructed from?
☐1. Permanent (e.g. all walls are made of brick or strong wooden house)
☐2. Semi permanent (e.g. walls are made from brick and wood/bamboo)
☐3. Not permanent (e.g. no brick. Walls made from wood or bamboo)
☐4. Other, specify
2. Does your household have electricity? ☐1. Yes ☐2. No
3. What is used for cooking?

<input type="checkbox"/> 1. Gas	<input type="checkbox"/> 2. Fuel wood	<input type="checkbox"/> 3. Kerosene	<input type="checkbox"/> 4. Other.....
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4. What is the source of water of your household?

<input type="checkbox"/> 1. Piped water	<input type="checkbox"/> 2. Well/tube well/hand pump	<input type="checkbox"/> 3. Spring	<input type="checkbox"/> 4. Purchased	<input type="checkbox"/> 5. Other (specify).....
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5. Does anyone in the household own any of the following assets?
☐1. Car/Truck ☐2. Motorbike ☐3. TV ☐4. Satellite TV antenna ☐5. Radio
☐6. Telephone/mobile phone ☐7. Refrigerator
☐8. Farm equipment
☐a. Hand tractor ☐b. Threshing machine ☐c. Plow
☐d. Others (specify).....
☐9. Livestock (how many)
☐a. Cow:.....☐b. Buffalo:.....☐c. Goat:.....
☐d. Chicken:.....☐e. Other, please specify.....
6. Land holding (land area)
☐1. Irrigated farm:m²/acre/hectare
☐2. Rainfed farm:.....m²/acre/hectare
☐3. Hazelnut plantation:.....m²/acre/hectare
☐4. Teak plantation:.....m²/acre/hectare
☐5. Coffee plantation:.....m²/acre/hectare
☐6. Orchard:.....m²/acre/hectare
☐7. Other:.....m²/acre/hectare

Where is your farm?

Approximately, how far is your farmland from the protected forest?

☐a. < 1 km ☐b. 1-2 km ☐c. 3-5 km ☐d. 5-10 km ☐e. > 10 km

Section 2. Livelihood strategies

What are the major sources of income in your household?

☐Agriculture

☐1. Coffee ☐2. Paddy ☐3. Corn ☐4. Other.....

Please give more detailed information about your practices below.

<input type="checkbox"/>	<p>a. Why do you do this farming practice?.....</p> <p>b. How long have you been doing this?.....</p> <p>c. Are any household members involved in this farming practice? <input type="checkbox"/>1. Head of household <input type="checkbox"/>2. Wife <input type="checkbox"/>3. Son(s) <input type="checkbox"/>4. Daughter(s) <input type="checkbox"/>others.....</p> <p>d. What resources are needed?.....</p> <p>e. How do you get the resource needed?.....</p> <p>f. What are the costs associated with this farming? IDR..... Please breakdown the cost:</p> <p>g. How do you get the money to pay for these operating expenses?.....</p> <p>h. When did you start planting last year?.....</p> <p>i. When did you harvest last year?</p> <p>j. How much did you harvest last year?.....</p> <p>k. What proportion of the yield was sold?</p> <p>l. How much income do you receive from selling it?.....</p> <p>m. What did you do with the money?..... <input type="checkbox"/>1. Used to buy food <input type="checkbox"/>2. Used for children's education <input type="checkbox"/>4. Used for the next planting season <input type="checkbox"/>5. Used for doing other livelihoods, (please specify):..... <input type="checkbox"/>6. Used to buy farm equipment, (please specify):..... <input type="checkbox"/>7. Used to improve natural resource assets. <input type="checkbox"/>a. Land extensification <input type="checkbox"/>b. Improving soil quality <input type="checkbox"/>c. Others (specify):..... <input type="checkbox"/>8. Others (specify):.....</p> <p>n. What is the trend of the yield over the last 5 years? <input type="checkbox"/>much more <input type="checkbox"/>more <input type="checkbox"/>same <input type="checkbox"/>less <input type="checkbox"/>much less Other (specify):..... Why?.....</p> <p>o. What is the trend of income from this commodity? <input type="checkbox"/>increasing <input type="checkbox"/>decreasing <input type="checkbox"/>unstable <input type="checkbox"/>Other(specify):..... Why?.....</p> <p>p. What do you like about this farming practices?.....</p> <p>q. What you do not like about farming practices?.....</p> <p>r. Will you do this farming practice in the future? <input type="checkbox"/>1. Yes. Why?..... <input type="checkbox"/>2. No. Why?.....</p>
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<input type="checkbox"/>	<p>a. Why do you do this farming practice?.....</p> <p>.....</p> <p>b. How long have you been doing this?.....</p> <p>c. Are any household members involved in this practice?</p> <p><input type="checkbox"/>1.Head of household <input type="checkbox"/>2. Wife <input type="checkbox"/>3. Son(s) <input type="checkbox"/>4. Daughter(s)</p> <p><input type="checkbox"/>others.....</p> <p>d. What resources are needed?.....</p> <p>.....</p> <p>e. How do you get the resource needed?.....</p> <p>.....</p> <p>f. What are the costs associated with this farming? IDR.....</p> <p>Please breakdown the cost:</p> <p>.....</p> <p>g. How do you get the money to pay for these operating expenses?.....</p> <p>.....</p> <p>h. When did you start planting last year?.....</p> <p>i. When did you harvest last year?</p> <p>j. How much did you harvest last year?.....</p> <p>k. What proportion of the yield was sold?</p> <p>l. How much income do you receive from selling it?.....</p> <p>m. What did you do with the money?.....</p> <p><input type="checkbox"/>1. Used to buy food <input type="checkbox"/>2. Used for children's education</p> <p><input type="checkbox"/>4. Used for the next planting season</p> <p><input type="checkbox"/>5. Used for doing other livelihoods, (please specify):.....</p> <p><input type="checkbox"/>6. Used to buy farm equipment, (please specify):.....</p> <p><input type="checkbox"/>7. Used to improve natural resource assets.</p> <p><input type="checkbox"/>a. Land extensification <input type="checkbox"/>b. Improving soil quality <input type="checkbox"/>c. Others (specify):.....</p> <p><input type="checkbox"/>8. Others (specify).....</p> <p>n. What is the trend of the yield over the last 5 years?</p> <p><input type="checkbox"/>much more <input type="checkbox"/>more <input type="checkbox"/>same <input type="checkbox"/>less <input type="checkbox"/>much less</p> <p>Other (specify).....</p> <p>Why?.....</p> <p>o. What is the trend of income from this commodity?</p> <p><input type="checkbox"/>increasing <input type="checkbox"/>decreasing <input type="checkbox"/>unstable <input type="checkbox"/>Other (specify).....</p> <p>Why?.....</p> <p>p. What do you like about this farming practice?</p> <p>.....</p> <p>q. What you do not like about farming practices?.....</p> <p>r. Will you do this farming practice in the future?</p> <p><input type="checkbox"/> 1. Yes. Why?.....</p> <p><input type="checkbox"/> 2. No. Why?.....</p>

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Have you cultivated different agriculture commodities before?

☐1. No

☐2. Yes. Please specify:.....

Why are you no longer cultivating it?.....

.....

☐Forest-based income

☐1. Honey bee ☐2. Timber ☐3. Rattan ☐4. Other.....

Please give more detailed information about your practices.

☐.....

a. Why do you do this practice?.....

.....

b. How long have you been doing this?.....

c. Are any household members involved in this practice?

☐1.Head of household ☐2. Wife ☐3. Son(s) ☐4. Daughter(s)

☐others.....

d. What resources are needed?.....

.....

e. How do you get the resource needed?.....

.....

f. What are the costs associated with this practice? IDR.....

Please breakdown the cost:

.....

.....

.....

g. How do you get the money to pay for these operating expenses?.....

.....

h. When did you harvest /gather it?

i. How much did you get last year?.....

j. What proportion was sold?

k. How much income do you receive from selling it?.....

l. What did you do with the money?.....

☐1. Used to buy food ☐2. Used for children's education

☐4. Used for the next planting/gathering season

☐5. Used for doing other livelihoods, (please specify):.....

☐6. Used to buy farm equipment, (please specify):.....

☐7. Used to improve natural resource assets.

☐a. Land extensification ☐b. Improving soil quality ☐c. Others (specify):.....

☐8. Others (specify):.....

m. What is the trend of the yield over the last 5 years?

☐much more ☐more ☐same ☐less ☐much less

Other (specify):.....

Why?.....

n. What is the trend of income from this practice?

☐increasing ☐decreasing ☐unstable ☐Other (specify):.....

Why?.....

o. What do you like about this practice?

p. What you do not like about this practice ?.....

r. Will you do this practice in the future?

	<input type="checkbox"/> 1. Yes. Why?..... <input type="checkbox"/> 2. No. Why?.....
<input type="checkbox"/>	<p>a. Why do you do this practice?.....</p> <p>b. How long have you been doing this?.....</p> <p>c. Are any household members involved in this practice? <input type="checkbox"/> 1. Head of household <input type="checkbox"/> 2. Wife <input type="checkbox"/> 3. Son(s) <input type="checkbox"/> 4. Daughter(s) <input type="checkbox"/> others.....</p> <p>d. What resources are needed?.....</p> <p>e. How do you get the resource needed?.....</p> <p>f. What are the costs associated with this practice? IDR..... Please breakdown the cost:</p> <p>g. How do you get the money to pay for these operating expenses?.....</p> <p>h. When did you harvest /gather it?</p> <p>i. How much did you get last year?.....</p> <p>j. What proportion was sold?</p> <p>k. How much income do you receive from selling it?.....</p> <p>l. What did you do with the money?..... <input type="checkbox"/> 1. Used to buy food <input type="checkbox"/> 2. Used for children's education <input type="checkbox"/> 4. Used for the next planting/gathering season <input type="checkbox"/> 5. Used for doing other livelihoods, (please specify):..... <input type="checkbox"/> 6. Used to buy farm equipment, (please specify):..... <input type="checkbox"/> 7. Used to improve natural resource assets. <input type="checkbox"/> a. Land extensification <input type="checkbox"/> b. Improving soil quality <input type="checkbox"/> c. Others (specify):..... <input type="checkbox"/> 8. Others (specify).....</p> <p>m. What is the trend of the yield over the last 5 years? <input type="checkbox"/> much more <input type="checkbox"/> more <input type="checkbox"/> same <input type="checkbox"/> less <input type="checkbox"/> much less Other (specify)..... Why?.....</p> <p>n. What is the trend of income from this practice? <input type="checkbox"/> increasing <input type="checkbox"/> decreasing <input type="checkbox"/> unstable <input type="checkbox"/> Other (specify)..... Why?.....</p> <p>o. What do you like about this practice?</p> <p>p. What you do not like about this practice ?.....</p> <p>r. Will you do this practice in the future? <input type="checkbox"/> 1. Yes. Why?..... <input type="checkbox"/> 2. No. Why?.....</p>

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Did you gather different forest products in the past?

☐1. No. Why do you no longer gather those products?.....

.....

☐2. Yes. Please specify:.....

<input type="checkbox"/> Livestock(specify)..... ...	<p>a. Why do you do this practice?.....</p> <p>.....</p> <p>b. How long have you been doing this?.....</p> <p>c. Are any household members involved in this practice?</p> <p><input type="checkbox"/>1. Head of household <input type="checkbox"/>2. Wife <input type="checkbox"/>3. Son(s) <input type="checkbox"/>4. Daughter(s)</p> <p><input type="checkbox"/>others.....</p> <p>d. What resources are needed?.....</p> <p>.....</p> <p>e. How do you get the resource needed?.....</p> <p>.....</p> <p>.....</p> <p>f. What are the costs associated with this practice?</p> <p>IDR.....</p> <p>Please breakdown the cost:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>g. How do you get the money to pay for these operating expenses?.....</p> <p>.....</p> <p>j. How many livestock did you sell last year?.....</p> <p>l. How much income do you receive from selling it?.....</p> <p>m. What did you do with the money?.....</p> <p><input type="checkbox"/>1. Used to buy food <input type="checkbox"/>2. Used for children's education</p> <p><input type="checkbox"/>4. Used for the in buying improving livestock</p> <p><input type="checkbox"/>5. Used for doing other livelihoods, (please specify):.....</p> <p><input type="checkbox"/>6. Used to buy farm equipment, (please specify):.....</p> <p><input type="checkbox"/>7. Used to improve natural resource assets.</p> <p><input type="checkbox"/>a. Land extensification <input type="checkbox"/>b. Improving soil quality <input type="checkbox"/>c. Others (specify):.....</p> <p><input type="checkbox"/>8. Others (specify).....</p> <p>n. What is the trend of the yield over the last 5 years?</p> <p><input type="checkbox"/>much more <input type="checkbox"/>more <input type="checkbox"/>same <input type="checkbox"/>less <input type="checkbox"/>much less</p> <p>Other (specify).....</p> <p>Why?.....</p> <p>o. What is the trend of income from this practice?</p> <p><input type="checkbox"/>increasing <input type="checkbox"/>decreasing <input type="checkbox"/>unstable <input type="checkbox"/>Other (specify).....</p>
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	Why?..... p. What do you like about this practice? q. What you do not like about this practice?..... r. Will you do this practice in the future? <input type="checkbox"/> 1. Yes. Why?..... <input type="checkbox"/> 2. No. Why?.....
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<input type="checkbox"/> Orchard <input type="checkbox"/> 1. Hazelnut <input type="checkbox"/> 2. Guava <input type="checkbox"/> 3. Cashew <input type="checkbox"/> 4. Other..... Please give more detailed information about your practices.	
<input type="checkbox"/>	a. Why do you do this practice?..... b. How long have you been doing this?..... c. Are any household members involved in this practice? <input type="checkbox"/> 1. Head of household <input type="checkbox"/> 2. Wife <input type="checkbox"/> 3. Son(s) <input type="checkbox"/> 4. Daughter(s) <input type="checkbox"/> others..... d. What resources are needed?..... e. How do you get the resource needed?..... f. What are the costs associated with this practice? IDR..... Please breakdown the cost: g. How do you get the money to pay for these operating expenses?..... h. When did you start planting?..... i. When did you harvest last year? j. How much did you harvest last year?..... k. What proportion of the yield was sold? l. How much income do you receive from selling it?..... m. What did you do with the money?..... <input type="checkbox"/> 1. Used to buy food <input type="checkbox"/> 2. Used for children's education <input type="checkbox"/> 4. Used for the next planting season <input type="checkbox"/> 5. Used for doing other livelihoods, (please specify):..... <input type="checkbox"/> 6. Used to buy farm equipment, (please specify):..... <input type="checkbox"/> 7. Used to improve natural resource assets. <input type="checkbox"/> a. Land extensification <input type="checkbox"/> b. Improving soil quality <input type="checkbox"/> c. Others (specify):.....

	<p><input type="checkbox"/>8. Others (specify).....</p> <p>n. What is the trend of the yield over the last 5 years? <input type="checkbox"/>much more <input type="checkbox"/>more <input type="checkbox"/>same <input type="checkbox"/>less <input type="checkbox"/>much less Other (specify)..... Why?.....</p> <p>o. What is the trend of income from this practice? <input type="checkbox"/>increasing <input type="checkbox"/>decreasing <input type="checkbox"/>unstable <input type="checkbox"/>Other (specify)..... Why?.....</p> <p>p. What do you like about this practice?</p> <p>q. What you do not like about this practice?.....</p> <p>r. Will you do this practice in the future? <input type="checkbox"/>1. Yes. Why?..... <input type="checkbox"/>2. No. Why?.....</p>
<input type="checkbox"/>	<p>a. Why do you do this practice?.....</p> <p>b. How long have you been doing this?.....</p> <p>c. Are any household members involved in this practice? <input type="checkbox"/>1.Head of household <input type="checkbox"/>2. Wife <input type="checkbox"/>3. Son(s) <input type="checkbox"/>4. Daughter(s) <input type="checkbox"/>others.....</p> <p>d. What resources are needed?</p> <p>e. How do you get the resource needed?</p> <p>f. What are the costs associated with this practice? IDR..... Please breakdown the cost:</p> <p>g. How do you get the money to pay for these operating expenses?</p> <p>h. When did you start planting?.....</p> <p>i. When did you harvest last year?</p> <p>j. How much did you harvest last year?.....</p> <p>k. What proportion of the yield was sold?</p> <p>l. How much income do you receive from selling it?.....</p> <p>m. What did you do with the money?..... <input type="checkbox"/>1. Used to buy food <input type="checkbox"/>2. Used for children's education <input type="checkbox"/>4. Used for the next planting season <input type="checkbox"/>5. Used for doing other livelihoods, (please specify):..... <input type="checkbox"/>6. Used to buy farm equipment, (please specify):..... <input type="checkbox"/>7. Used to improve natural resource assets. <input type="checkbox"/>a. Land extensification <input type="checkbox"/>b. Improving soil quality <input type="checkbox"/>c. Others (specify):..... <input type="checkbox"/>8. Others (specify).....</p> <p>n. What is the trend of the yield over the last 5 years? <input type="checkbox"/>much more <input type="checkbox"/>more <input type="checkbox"/>same <input type="checkbox"/>less <input type="checkbox"/>much less Other (specify)..... Why?.....</p> <p>o. What is the trend of income from this practice? <input type="checkbox"/>increasing <input type="checkbox"/>decreasing <input type="checkbox"/>unstable <input type="checkbox"/>Other (specify)..... Why?.....</p> <p>p. What do you like about this practice?</p> <p>q. What you do not like about this practice?.....</p>

	r. Will you do this practice in the future? <input type="checkbox"/> 1. Yes. Why?..... <input type="checkbox"/> 2. No. Why?.....
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<input type="checkbox"/> Non farm-based income <input type="checkbox"/> 1. Migrant labor <input type="checkbox"/> 2. Farm labor <input type="checkbox"/> 3. Taxi motor <input type="checkbox"/> 4. Other.....	
Please give more detailed information about your practices.	
<input type="checkbox"/>	a. Why do you do this practice? b. Where do you do this practice? c. How long have you been doing this? d. Are any household members involved in this practice? <input type="checkbox"/> 1. Head of household <input type="checkbox"/> 2. Wife <input type="checkbox"/> 3. Son(s) <input type="checkbox"/> 4. Daughter(s) <input type="checkbox"/> others..... e. What resources are needed? f. How do you get the resource needed? g. What are the costs associated with this practice? IDR Please breakdown the cost: h. How do you get the money to pay for these operating expenses? i. How much income do you receive from this practice ? j. What did you do with the money? <input type="checkbox"/> 1. Used to buy food <input type="checkbox"/> 2. Used for children's education <input type="checkbox"/> 5. Used for doing other livelihoods, (please specify) <input type="checkbox"/> 6. Used to buy farm equipment, (please specify) <input type="checkbox"/> 7. Used to improve natural resource assets. <input type="checkbox"/> a. Land extensification <input type="checkbox"/> b. Improving soil quality <input type="checkbox"/> c. Others (specify):..... <input type="checkbox"/> 8. Others (specify) l. What is the trend of income from this practice? <input type="checkbox"/> increasing <input type="checkbox"/> decreasing <input type="checkbox"/> unstable <input type="checkbox"/> Other (specify) Why? m. What do you like about this practice? n. What you do not like about this practice ?..... o. Will you do this practice in the future? <input type="checkbox"/> 1. Yes. Why? <input type="checkbox"/> 2. No. Why?
<input type="checkbox"/>	a. Why do you do this practice? b. Where do you do this practice? c. How long have you been doing this? d. Are any household members involved in this practice? <input type="checkbox"/> 1. Head of household <input type="checkbox"/> 2. Wife <input type="checkbox"/> 3. Son(s) <input type="checkbox"/> 4. Daughter(s) <input type="checkbox"/> others e. What resources are needed? f. How do you get the resource needed? g. What are the costs associated with this practice? IDR Please breakdown the cost: h. How do you get the money to pay for these operating expenses? i. How much income do you receive from this practice ? j. What did you do with the money? <input type="checkbox"/> 1. Used to buy food <input type="checkbox"/> 2. Used for children's education <input type="checkbox"/> 5. Used for doing other livelihoods, (please specify) <input type="checkbox"/> 6. Used to buy farm equipment, (please specify) <input type="checkbox"/> 7. Used to improve natural resource assets. <input type="checkbox"/> a. Land extensification <input type="checkbox"/> b. Improving soil quality <input type="checkbox"/> c. Others (specify):..... <input type="checkbox"/> 8. Others (specify) l. What is the trend of income from this practice?

	<input type="checkbox"/> increasing <input type="checkbox"/> decreasing <input type="checkbox"/> unstable <input type="checkbox"/> Other (specify) Why? m. What do you like about this practice? n. What you do not like about this practice ? o. Will you do this practice in the future? <input type="checkbox"/> 1. Yes. Why? <input type="checkbox"/> 2. No. Why?
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Did you have other practices as your sources of income in the past? ☐1. No ☐2. Yes. Please specify
Why are you no longer doing those practices?
Are there any other occupations in the village (other than the practices that are your source of income)?
☐1. No ☐2. Yes. Please specify
Why are you not doing those practices?

Section 3. Perception of climate change and vulnerability

- 3.1. Do you perceive the below changes?
☐1. Rainfall timing has changed. ☐1. No ☐1. Yes. Please specify.....
☐2. Rainfall amount has changed. ☐1. No ☐1. Yes. Please specify.....
☐3. Temperature has changed. ☐1. No ☐1. Yes. Please specify.....
☐4. Storm is increasing. ☐1. No ☐1. Yes. Please specify.....
☐5. Other, please specify.....
3.2. When the changes started to happen?
☐a. This year ☐b. 1-3 years ago ☐c. 3-5 years ago ☐d. 5-10 years ago
3.3. Did the changes affect your livelihood?
☐1. No. Why?
☐1. Yes. How?
3.4. What did you do in response to the impact of these changes?
3.5. Why was that your response?
3.6. What was the outcome of your response?
3.7. Will the changes continue to happen in the future?
☐1. Yes ☐2. No ☐3. I do not know

Section 4. Livelihood Aspiration

- 4.1 Are you satisfied with your current livelihoods?
☐1. Yes. Why?.....
☐2. No. Why?.....
4.2. Are there any types of livelihoods (other than what you do now) that you want to do?
☐1. No. (If no, please stop here).
☐2. Yes. Please specify what types of livelihood.....
4.3. Why do you want to do those livelihoods?
☐1. It increases income.
☐2. It increases yields.
☐3. It is more resistance to climate change and variability.
☐4. It improves the environment.
☐5. Other, please specify.....
4.4. How would you spend the outcome of those livelihoods?
4.5. Are you able to do those livelihoods now?
☐1. Yes. How?.....
☐2. No. Why?.....
4.6. How could you overcome these constraints?

4.7. Are there any other people in your village that can do those livelihoods now?

☐1. No.

☐1. Yes.

Why they are able to do that?

Appendix B

Government Interview Guideline

Government Interview Guide

1. Perception of environmental degradation

- 1.1. What are the environmental problems in the watershed?
- 1.2. How do you know that the problems are happening?
- 1.3. What are the drivers of the problem?
What/who cause it? Why they/it cause it? How they/it cause it?
- 1.4. When did the problem begin?
- 1.5. What are the impacts of the problems?
- 1.6. Who are the most affected by the impacts? Why?
- 1.7. Will the problem continue in the future? Why?
- 1.8. What initiatives have been taken to reduce the problems?
- 1.9. What are the outcomes of the initiatives? Have it reduce the problems? If yes, what made it work? If no, why it did not work?
- 1.10. Is there any other responses that are supposed to do to reduce those problems?
- 1.11. Why those responses could reduce the problems?
- 1.13. Is the government able to do the responses? Why yes, why no?
- 1.14. What the government will do to be able to do the response needed?

2. Policy of environmental management

- 2.1. What are the local policies (or programs) of environmental management in the watershed?
- 2.2. What are the objectives of those policies/programs?
- 2.3. What are the outcomes of the policies/programs?
- 2.4. What are the challenges to implement the policies and programs?
- 2.5. What support the implementation of the policies and programs?
- 2.6. What should be done to implement better the policy/programs and the programs?

3. Perception of climate change

- 3.1. Do you think that climate change is an important issue? Why?
- 3.2. Do you think that climate change is happening in the watershed? How?
(If yes) What are the drivers of the change?
(If yes) What are the impacts of climate change?
(If yes) Who are the most affected by the impact of climate change? Why? How?
- 3.3. Is there any of your policy and program related to climate change related issues?
(If yes) Which policies and programs?
(If yes) What are the objectives of those policies and programs?
- 3.4. Do you think that the current policies and programs are good enough to deal with the climate change and its impacts? Why?
- 3.5. What should be done to improve policies and programs to deal with climate change?

Appendix C

Oral Consent Script

Study Consent Form:

Date:

Dear: _____:

My name is Ida Ansharyani. I am a graduate student at Rutgers University. I am conducting a research study to analyze the impact of climate change and multiple stressors on local livelihoods, vulnerability, and environmental degradation.

I am inviting you to participate in a research study. I am interested in learning about the livelihoods, perception of stressors, vulnerability, environmental degradation, and livelihood aspirations. To understand that, I have made a set of questionnaire to be asked to you through a face to face interview. Filling out the questionnaire will take approximately two hours of your time and it will take place at your home, farm, or your office. You may choose not to answer any of the questions. All information will be kept confidential. Please feel free to ask questions about the research and the questionnaire if you have any. I will be happy to explain anything in detail if you wish. Your involvement in the study is voluntary, so you may choose to participate or not, without penalty.

The benefit of this research is that you will be helping me to understand the climate change and its impact on rural livelihood, environmental degradation, and farmers' aspirations. This understanding is unlikely to lead to any immediate changes that would help you and/or the village in the short- run. Rather, the information gained will help in drafting policies that are more appropriate to the concerns of villagers. The result of this study will also be useful for other scholars in thinking about the approach to sustainable natural resources management in tropical rural areas under the context of climate change.

The information collected from you in this study will be used for dissertation, workshop material, and academic publications. Your identity will not be revealed in any publication resulting from this study. Your personal information will be treated confidentially and will be known only to the research investigators. Please note that we will keep this information confidentially by limiting individual access to the research data and keeping it in a secure location on computers. The Institutional Review Board at Rutgers University is the only party that will be allowed to see the data, except as may be required by law.

If you have any questions or concerns about this study or if any problems arise, please contact me at idaansharyani@gmail.com or phone +6281907672646. If you have any questions or concerns about your rights as a research participant, please contact the IRB Administrator at Rutgers University at Rutgers University Institutional Review Board for the Protection of Human Subjects: Office of Research and Sponsored Programs, 3 Rutgers Plaza, New Brunswick, NJ 08901-8559, Tel: +1-732-932-0150 x 2104 email: humansubjects@orsp.rutgers.edu.

I have read this consent form and have been given the opportunity to ask questions.

I agree to participate in this research study: _____

Principal investigator: _____

Bibliography

- Abdul, Jaleel (1993). "Synopsis of Istighfar". In: URL: <https://www.alislam.org/library/salaat/synopsis-of-istighfar/>.
- Achouri, Moujahed (2002). "Preparing the next generation of watershed management programmes". In: *PREPARING FOR THE NEXT GENERATION OF WATERSHED MANAGEMENT PROGRAMMES AND PROJECTS*, p. 11.
- Adato, Michelle and Ruth Meinzen-Dick (2002). "Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework". In:
- Adger, W. et al. (2003). "Adaptation to climate change in the developing world". English. In: *Progress in Development Studies* 3.3, pp. 179–195. DOI: [10.1191/1464993403ps060oa](https://doi.org/10.1191/1464993403ps060oa). URL: <http://search.proquest.com/docview/218143466>.
- Adger, W. Neil (1999). "Social vulnerability to climate change and extremes in coastal Vietnam". In: *World Development* 27.2, pp. 249–269.
- (2006). "Vulnerability". English. In: *Global Environmental Change* 16.3, pp. 268–281. DOI: [10.1016/j.gloenvcha.2006.02.006](https://doi.org/10.1016/j.gloenvcha.2006.02.006). URL: <http://www.sciencedirect.com/science/article/pii/S0959378006000422>.
- Adger, W. Neil, Nigel W. Arnell, and Emma L. Tompkins (2005). "Successful adaptation to climate change across scales". English. In: *Global Environmental Change* 15.2, pp. 77–86. DOI: [10.1016/j.gloenvcha.2004.12.005](https://doi.org/10.1016/j.gloenvcha.2004.12.005). URL: <http://www.sciencedirect.com/science/article/pii/S0959378004000901>.
- Adger, W. Neil et al. (2007). "Assessment of adaptation practices, options, constraints and capacity". In: *Climate change*, pp. 717–743.
- Adu-Boateng, Afua (2015). "Barriers to climate change policy responses for urban areas: a study of Tamale Metropolitan Assembly, Ghana". In: *Current Opinion in Environmental Sustainability* 13, pp. 49–57.
- Agrawal, Arun (2008). *The Role of Local Institutions in Adaptation to Climate Change*. English. Tech. rep. World Bank, Washington, DC. URL: <http://hdl.handle.net/10986/28274>.
- Agrawal, Arun and Nicolas Perrin (2009). "Climate adaptation, local institutions and rural livelihoods". In: *Adapting to climate change: thresholds, values, governance*, pp. 350–367.

- Ampaire, Edidah L. et al. (2017). "Institutional challenges to climate change adaptation: A case study on policy action gaps in Uganda". In: *Environmental Science & Policy* 75, pp. 81–90.
- Anwar, Syaiful (2003). "Watershed management in Indonesia". In: *PREPARING FOR THE NEXT GENERATION OF WATERSHED MANAGEMENT PROGRAMMES AND PROJECTS*, p. 93.
- Appadurai, Arjun (2004). "The capacity to aspire". In: *Culture and public action*, pp. 59–84.
- Attanasio, Orazio P. (2009). "Expectations and perceptions in developing countries: their measurement and their use". In: *The American Economic Review* 99.2, pp. 87–92.
- Atteridge, Aaron and Elise Remling (2017). "Is adaptation reducing vulnerability or redistributing it?" In: *Wiley Interdisciplinary Reviews: Climate Change*.
- Ayers, Jessica and Tim Forsyth (2009). "Community-based adaptation to climate change". In: *Environment: science and policy for sustainable development* 51.4, pp. 22–31.
- Bappenas (2014). "RAN-API National Action Plan for Climate Change Adaptation Synthesis Report Jakarta Indonesia". In:
- Barnett, Jon and Saffron O'Neill (2010). "Maladaptation". In: *Global Environmental Change* 20.2, pp. 211–213.
- Bayard, Budry and Curtis Jolly (2007). "Environmental behavior structure and socioeconomic conditions of hillside farmers: a multiple-group structural equation modeling approach". In: *Ecological Economics* 62.3, pp. 433–440.
- Bebbington, Anthony (1999). "Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty". English. In: *World Development* 27.12, pp. 2021–2044. DOI: [10.1016/S0305-750X\(99\)00104-7](https://doi.org/10.1016/S0305-750X(99)00104-7). URL: <http://www.sciencedirect.com/science/article/pii/S0305750X99001047>.
- Benda, Lee et al. (2005). "Geomorphology of steepland headwaters: the transition from hillslopes to channels". In: *JAWRA Journal of the American Water Resources Association* 41.4, pp. 835–851.
- Benhin, James KA (2006). "Agriculture and deforestation in the tropics: a critical theoretical and empirical review". In: *AMBIO: A Journal of the Human Environment* 35.1, pp. 9–16.
- Berkes, Fikret (2009). "Indigenous ways of knowing and the study of environmental change". English. In: *Journal of the Royal Society of New Zealand* 39.4, pp. 151–156. DOI: [10.1080/03014220909510568](https://doi.org/10.1080/03014220909510568). URL: <http://www.tandfonline.com/doi/abs/10.1080/03014220909510568>.
- (2012). *Sacred Ecology*. third. Routledge.

- Biagini, Bonizella et al. (2014). "A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility". In: *Global Environmental Change* 25, pp. 97–108.
- Boer, Matthias M. et al. (2009). "Long-term impacts of prescribed burning on regional extent and incidence of wildfires—evidence from 50 years of active fire management in SW Australian forests". In: *Forest Ecology and Management* 259.1, pp. 132–142.
- Bohensky, E. L. et al. (2016). "Climate knowledge cultures: Stakeholder perspectives on change and adaptation in Nusa Tenggara Barat, Indonesia". English. In: *Climate Risk Management* 12, pp. 17–31. DOI: [10.1016/j.crm.2015.11.004](https://doi.org/10.1016/j.crm.2015.11.004). URL: <https://doaj.org/article/e3cd3fc9cbde4276823bfa792b8a9977>.
- Borga, Marco et al. (2005). "Evaluating the influence of forest roads on shallow landsliding". In: *Ecological Modelling* 187.1, pp. 85–98.
- Bretschger, Lucas (2017). "Equity and the convergence of nationally determined climate policies". In: *Environmental Economics and Policy Studies* 19.1, pp. 1–14.
- Butler, JRA et al. (2014). "Framing the application of adaptation pathways for rural livelihoods and global change in eastern Indonesian islands". In: *Global Environmental Change* 28, pp. 368–382.
- Chambers, Robert (1994). "Participatory rural appraisal (PRA): Analysis of experience". In: *World Development* 22.9, pp. 1253–1268.
- (2005). "Rural appraisal: rapid, relaxed, participatory". In: Vikas Publishing House.
- Chambers, Robert and Gordon Conway (1992). *Sustainable rural livelihoods: practical concepts for the 21st century*. Institute of Development Studies (UK).
- Collins, Kevin and Ray Ison (2009). "Jumping off Arnstein's ladder: social learning as a new policy paradigm for climate change adaptation". In: *Environmental Policy and Governance* 19.6, pp. 358–373.
- Dahal, Ranjan Kumar and Shuichi Hasegawa (2008). "Representative rainfall thresholds for landslides in the Nepal Himalaya". In: *Geomorphology* 100.3, pp. 429–443.
- DeFries, Ruth S. et al. (2010). "Deforestation driven by urban population growth and agricultural trade in the twenty-first century". In: *Nature Geoscience* 3.3, pp. 178–181.
- Dietz, Thomas, Eugene A. Rosa, and Richard York (2009). "Environmentally Efficient Well-Being: Rethinking Sustainability as the Relationship between Human Well-being and Environmental Impacts". English. In: *Human Ecology Review* 16.1, pp. 114–123. URL: <http://www.jstor.org/stable/24707742>.
- Donner, Simon (2007). "Domain of the Gods: an editorial essay". English. In: *Climatic Change* 85.3, pp. 231–236. DOI: [10.1007/s10584-007-9307-7](https://doi.org/10.1007/s10584-007-9307-7). URL: <http://search.proquest.com/docview/198501612>.

- Dovers, Stephen R. and Adnan A. Hezri (2010). "Institutions and policy processes: the means to the ends of adaptation". In: *Wiley Interdisciplinary Reviews: Climate Change* 1.2, pp. 212–231.
- Dupuis, Johann and Robbert Biesbroek (2013). "Comparing apples and oranges: the dependent variable problem in comparing and evaluating climate change adaptation policies". In: *Global Environmental Change* 23.6, pp. 1476–1487.
- Dyer, Fred C. (1985). "Nocturnal orientation by the Asian honey bee, *Apis dorsata*". In: *Animal Behaviour* 33.3, pp. 769–774.
- Eakin, Hallie and Maria Carmen Lemos (2010). "Institutions and change: The challenge of building adaptive capacity in Latin America". In: *Global Environmental Change* 20.1, pp. 1–3.
- Eakin, Hallie C. and Anthony Patt (2011). "Are adaptation studies effective, and what can enhance their practical impact?" In: *Wiley Interdisciplinary Reviews: Climate Change* 2.2, pp. 141–153.
- Egeru, Anthony (2012). "Role of indigenous knowledge in climate change adaptation: A case study of the Teso Sub-Region, Eastern Uganda". In:
- Ellis, Frank (1998). "Household strategies and rural livelihood diversification". In: *The journal of development studies* 35.1, pp. 1–38.
- Environment, Indonesia Ministry of and Forestry (2015). *Intended Nationally Determined Contribution Republic of Indonesia*.
- Ervin, Christine A. and David E. Ervin (1982). "Factors affecting the use of soil conservation practices: hypotheses, evidence, and policy implications". In: *Land Economics* 58.3, pp. 277–292.
- FAO (1994). "Land Degradation in South Asia: Its Severity, Causes and Effects upon the People". In: URL: <http://www.fao.org/docrep/V4360E/V4360E01.htm#Summary>.
- (2006). *FAO Global Forest Resources Assessment 2005*. FAO Forestry Paper No. 147 UN Food and Agriculture Organization, Rome.
- (2009). *State of the World's Forest*. Rome: Food and Agriculture Organization of the United Nation.
- FAO, (2011). English. Mountain Forests in a Changing World: Realizing Values, Addressing Challenges Food et al. ISBN: 9251070768. URL: <http://boris.unibe.ch/6755/>.
- FAO (2015). "Global Forest Resources Assessment 2015: Country Report Indonesia. FAO, Rome". In:
- Forsyth, Tim and Andrew Walker (2008). *Forest guardians, forest destroyers: the politics of environmental knowledge in northern Thailand*. University of Washington Press.
- Füssel, Hans-Martin (2007). "Vulnerability: A generally applicable conceptual framework for climate change research". English. In: *Global Environmental Change* 17.2,

- pp. 155–167. DOI: [10.1016/j.gloenvcha.2006.05.002](https://doi.org/10.1016/j.gloenvcha.2006.05.002). URL: <http://www.sciencedirect.com/science/article/pii/S0959378006000525>.
- Geist, Helmut J. and Eric F. Lambin (2002). “Proximate causes and underlying driving forces of tropical deforestation: Tropical forests are disappearing as the result of many pressures, both local and regional, acting in various combinations in different geographical locations”. In: *Bioscience* 52.2, pp. 143–150.
- Gifford, Robert (2011). “The Dragons of Inaction”. English. In: *American Psychologist* 66.4, pp. 290–302. DOI: [10.1037/a0023566](https://doi.org/10.1037/a0023566). URL: <http://www.ncbi.nlm.nih.gov/pubmed/21553954>.
- Grothmann, Torsten and Anthony Patt (2005). “Adaptive capacity and human cognition: The process of individual adaptation to climate change”. English. In: *Global Environmental Change* 15.3, pp. 199–213. DOI: [10.1016/j.gloenvcha.2005.01.002](https://doi.org/10.1016/j.gloenvcha.2005.01.002). URL: <http://www.sciencedirect.com/science/article/pii/S095937800500004X>.
- Grothmann, Torsten and Fritz Reusswig (2006). “People at risk of flooding: why some residents take precautionary action while others do not”. In: *Natural Hazards* 38.1, pp. 101–120.
- Guthman, Julie (1997). “Representing Crisis: The Theory of Himalayan Environmental Degradation and the Project of Development in Post-Rana Nepal”. English. In: *Development and Change* 28.1, pp. 45–69. DOI: [10.1111/1467-7660.00034](https://doi.org/10.1111/1467-7660.00034). URL: <https://search.proquest.com/docview/1474233876>.
- Haan, Leo De and Annelies Zoomers (2005). “Exploring the frontier of livelihoods research”. In: *Development and change* 36.1, pp. 27–47.
- Hallegatte, Stephane et al. (2015). *Shock waves: managing the impacts of climate change on poverty*. World Bank Publications.
- Hardee, Karen and Clive Mutunga (2010). “Strengthening the link between climate change adaptation and national development plans: lessons from the case of population in National Adaptation Programmes of Action (NAPAs)”. In: *Mitigation and Adaptation Strategies for Global Change* 15.2, pp. 113–126.
- Hay, Iain (2010). *Qualitative research methods in human geography*. 3. ed. Oxford [u.a.]: Oxford Univ. Press. ISBN: 0195430158.
- Hidayati, Eni (2011). “Farmers’ perception of environmental problems: A case study in Batulante Watershed, Indonesia”. English. PhD thesis. URL: <https://search-proquest-com.proxy.libraries.rutgers.edu/docview/881293532>.
- IPCC (2007). *Climate Change: Synthesis Report*. URL: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.
- Jansen, Hans GP et al. (2006). “Policies for sustainable development in the hillside areas of Honduras: A quantitative livelihoods approach”. In: *Agricultural economics* 34.2, pp. 141–153.

- Juhola, Sirkku et al. (2016). "Redefining maladaptation". In: *Environmental Science and Policy* 55, pp. 135–140.
- Julmansyah, Julmansyah et al. (2008). *Baseline Data Sosial Ekonomi dan Biofosik (Need Assesment) Program Konservasi Kabupaten Sumbawa NTB – WRMP*. Bappeda Kabupaten Sumbawa dan Dinas Kehutanan dan Perkebunan Kabupaten Sumbawa NTB.
- Karlsson, Niklas et al. (2004). "Household consumption: Influences of aspiration level, social comparison, and money management". English. In: *Journal of Economic Psychology* 25.6, pp. 753–769. DOI: [10.1016/j.joep.2003.07.003](https://doi.org/10.1016/j.joep.2003.07.003). URL: <https://www.sciencedirect.com/science/article/pii/S016748700300093X>.
- Kates, Robert W., William R. Travis, and Thomas J. Wilbanks (2012). "Transformational adaptation when incremental adaptations to climate change are insufficient". In: *Proceedings of the National Academy of Sciences* 109.19. pmid:22509036, pp. 7156–7161.
- Kelman, Ilan, Jessica Mercer, and J. C. Gaillard (2012). "Indigenous knowledge and disaster risk reduction". In: *Geography* 97, p. 12.
- Kelman, Ilan and Jennifer J. West (2009). "Climate change and small island developing states: a critical review". In: *Ecological and Environmental Anthropology* 5.1, pp. 1–16.
- Kirono, Dewi G. C. et al. (2016). "Historical and future seasonal rainfall variability in Nusa Tenggara Barat Province, Indonesia: Implications for the agriculture and water sectors". English. In: *Climate Risk Management* 12, pp. 45–58. DOI: [10.1016/j.crm.2015.12.002](https://doi.org/10.1016/j.crm.2015.12.002). URL: <https://doaj.org/article/0d4f7785669b4a6e81cb8b5f7362fdee>.
- Kleinman, PJA, David Pimentel, and Ray B. Bryant (1995). "The ecological sustainability of slash-and-burn agriculture". In: *Agriculture, Ecosystems & Environment* 52.2-3, pp. 235–249.
- Kuruppu, Natasha and Diana Liverman (2011). "Mental preparation for climate adaptation: The role of cognition and culture in enhancing adaptive capacity of water management in Kiribati". In: *Global Environmental Change* 21.2, pp. 657–669.
- Lazrus, Heather (2015). "Risk perception and climate adaptation in Tuvalu: a combined cultural theory and traditional knowledge approach". In: *Human organization* 74.1, pp. 52–61.
- Leach, Melissa, Robin Mearns, and Ian Scoones (1999). "Environmental entitlements: dynamics and institutions in community-based natural resource management". In: *World Development* 27.2, pp. 225–247.
- Lebel, Louis (2013). "Local knowledge and adaptation to climate change in natural resource-based societies of the Asia-Pacific". In: *Mitigation and Adaptation Strategies for Global Change* 18.7, pp. 1057–1076.

- Leonard, Sonia et al. (2013). "The role of culture and traditional knowledge in climate change adaptation: Insights from East Kimberley, Australia". In: *Global Environmental Change* 23, pp. 623–632.
- Li, Tania Murray (2002). "Engaging simplifications: community-based resource management, market processes and state agendas in upland Southeast Asia". In: *World Development* 30.2, pp. 265–283.
- Linden, Sander van der (2016). "The social-psychological determinants of climate change risk perceptions, attitudes, and behaviours: a national study". English. In: *Environmental Education Research* 22.3, pp. 434–435. DOI: [10.1080/13504622.2015.1108391](https://doi.org/10.1080/13504622.2015.1108391). URL: <http://www.tandfonline.com/doi/abs/10.1080/13504622.2015.1108391>.
- López-Marrero, Tania and Brent Yarnal (2010). "Putting adaptive capacity into the context of people's lives: a case study of two flood-prone communities in Puerto Rico". In: *Natural Hazards* 52.2, pp. 277–297.
- MacKinnon, Kathy (1997). *The ecological foundations of biodiversity protection*. Oxford University Press. New York/Oxford.
- Marino, Elizabeth and Jesse Ribot (2012). "No title". In: *Special issue introduction: adding insult to injury: climate change and the inequities of climate intervention*.
- Martinez-Zavala, L., A. Jordin Lopez, and N. Bellinfante (2008). "Seasonal variability of runoff and soil loss on forest road backslopes under simulated rainfall". In: *Catena* 74.1, pp. 73–79.
- Matthey, Astrid (2010). "Less is more: the influence of aspirations and priming on well-being". English. In: *Journal of Cleaner Production* 18.6, pp. 567–570. DOI: [10.1016/j.jclepro.2009.03.024](https://doi.org/10.1016/j.jclepro.2009.03.024). URL: <https://www.sciencedirect.com/science/article/pii/S0959652609001589>.
- McNeeley, Shannon and Orville Huntington (2007). "Postcards from the (not so) frozen North: talking about climate change in Alaska". In: *Creating a Climate for Change*.
- Meijaard, Erik et al. (2013). "People's perceptions about the importance of forests on Borneo". English. In: *PloS one* 8.9, e73008. DOI: [10.1371/journal.pone.0073008](https://doi.org/10.1371/journal.pone.0073008). URL: <http://www.ncbi.nlm.nih.gov/pubmed/24039845>.
- Morton, John (2006). "Conceptualising the links between HIV/AIDS and pastoralist livelihoods". In: *The European Journal of Development Research* 18.2, pp. 235–254.
- Mustelin, J. et al. (2010). "Understanding current and future vulnerability in coastal settings: community perceptions and preferences for adaptation in Zanzibar, Tanzania". English. In: *Population and Environment* 31.5, pp. 371–398. DOI: [10.1007/s11111-010-0107-z](https://doi.org/10.1007/s11111-010-0107-z). URL: <http://www.jstor.org/stable/40666604>.

- Napier, Ted L. and Deborah E. Brown (1993). "Factors affecting attitudes toward groundwater pollution among Ohio farmers". In: *Journal of Soil and Water Conservation* 48.5, pp. 432–439.
- Napier, Ted L. and D. Lynn Forster (1981). "Farmer attitudes and behavior associated with soil erosion control." In: *Proceedings...Soil conservation policies, institutions, and incentives*.
- Nicholls, Neville (1999). "Cognitive illusions, heuristics, and climate prediction". In: *Bulletin of the American Meteorological Society* 80.7, pp. 1385–1397.
- Nightingale, Andrea J. (2017). "Power and politics in climate change adaptation efforts: Struggles over authority and recognition in the context of political instability". In: *Geoforum* 84, pp. 11–20.
- Nurchayati (2011). "Bringing agency back in: Indonesian migrant domestic workers in Saudi Arabia". In: *Asian and Pacific Migration Journal* 20.3-4, pp. 479–502.
- Nyong, Anthony, Francis Adesina, and B. Osman Elasha (2007). "The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel". In: *Mitigation and Adaptation Strategies for Global Change* 12.5, pp. 787–797.
- O'Brien, Karen et al. (2004). "Mapping vulnerability to multiple stressors: climate change and globalization in India". In: *Global Environmental Change* 14.4, pp. 303–313.
- O'Brien, Karen et al. (2007). "Why different interpretations of vulnerability matter in climate change discourses". In: *Climate policy* 7.1, pp. 73–88.
- O'Brien, Karen L. and Robin M. Leichenko (2000). "Double exposure: assessing the impacts of climate change within the context of economic globalization". In: *Global Environmental Change* 10.3, pp. 221–232.
- O'Riordan, Timothy (1971). *Perspectives on resource management*. Vol. 3. Pion.
- Parry, Martin et al. (2007). *Climate change 2007: impacts, adaptation and vulnerability*. Vol. 4. Cambridge University Press Cambridge.
- Patt, Anthony G. and Dagmar Schroter (2008). "Perceptions of climate risk in Mozambique: implications for the success of adaptation strategies". In: *Global Environmental Change* 18.3, pp. 458–467.
- Pelling, Mark (2010). *Adaptation to climate change*. English. GB: Routledge Ltd. ISBN: 0415477506. DOI: [10.4324/9780203889046](https://doi.org/10.4324/9780203889046). URL: <http://www.tandfebooks.com/isbn/9780203889046>.
- Perman, Roger (2003). *Natural resource and environmental economics*. Pearson Education.
- Petheram, Lisa et al. (2010). "'Strange changes': Indigenous perspectives of climate change and adaptation in NE Arnhem Land (Australia)". In: *Global Environmental Change* 20.4, pp. 681–692.

- Porter, Gina (2002). "Living in a walking world: rural mobility and social equity issues in sub-Saharan Africa". In: *World Development* 30.2, pp. 285–300.
- Ratner, Blake D. (2000). *Watershed Governance: Livelihoods and Resource Competition in the Mountains of Mainland Southeast Asia*. World Resources Institute Washington, DC.
- Ray, Debraj (2006). "Aspirations, poverty, and economic change". In: *Understanding poverty* 409421.
- Reardon, Thomas and Stephen A. Vosti (1995). "Links between rural poverty and the environment in developing countries: Asset categories and investment poverty". English. In: *World Development* 23.9, pp. 1495–1506. DOI: [10.1016/0305-750X\(95\)00061-G](https://doi.org/10.1016/0305-750X(95)00061-G). URL: <http://www.sciencedirect.com/science/article/pii/S0305750X9500061G>.
- Robbins, Paul (2011). *Political ecology: A critical introduction*. Vol. 16. John Wiley & Sons.
- Robinson, Guy M. (1998). *Methods and techniques in human geography*. John Wiley & Son Ltd.
- Rogers, Everett M. (2003). "Diffusion of innovations. Free Press". In: *New York*, p. 551.
- Safi, Ahmad Saleh, William James Smith, and Zhongwei Liu (2012). "Rural Nevada and climate change: vulnerability, beliefs, and risk perception". In: *Risk Analysis* 32.6, pp. 1041–1059.
- Scannell, Leila and Frederick ME Grouzet (2010). "The metacognitions of climate change". In: *New Ideas in Psychology* 28.1, pp. 94–103.
- Schipper, E. Lisa F. (2006). "Conceptual history of adaptation in the UNFCCC process". In: *Review of European, Comparative and International Environmental Law* 15.1, pp. 82–92.
- Scoones, Ian (2009). "Livelihoods perspectives and rural development". In: *The Journal of Peasant Studies* 36.1, pp. 171–196.
- Setyowati, Abidah B. (2014). ©2014 Abidah B. Setyowati ALL RIGHTS RESERVED.
- Silvey, Rachel (2006). "Consuming the transnational family: Indonesian migrant domestic workers to Saudi Arabia". In: *Global networks* 6.1, pp. 23–40.
- Stocking, Michael and Niamh Murnaghan (2001). *Handbook for the field assessment of land degradation*. London [u.a.]: Earthscan. ISBN: 1853838314.
- Stutzer, Alois (2004). "The role of income aspirations in individual happiness". English. In: *Journal of Economic Behavior and Organization* 54.1, pp. 89–109. DOI: [10.1016/j.jebo.2003.04.003](https://doi.org/10.1016/j.jebo.2003.04.003). URL: <https://www.sciencedirect.com/science/article/pii/S0167268103002038>.
- Sullivan-Wiley, Kira A. and Anne G. Short Gianotti (2017). "Risk Perception in a Multi-Hazard Environment". In: *World Development*.

- Sundblad, Eva-Lotta, Anders Biel, and Tommy Garling (2007). "Cognitive and affective risk judgements related to climate change". In: *Journal of Environmental Psychology* 27.2, pp. 97–106.
- Sunderlin, William D. and Resosudarmo IAP (1996). "Rates and causes of deforestation in Indonesia: towards a resolution of the ambiguities". In: *CIFOR Occasional Paper no. 9(E)*.
- Tennyson, Larry (2002). "Review and assessment of watershed management strategies and approaches". In: *PREPARING FOR THE NEXT GENERATION OF WATERSHED MANAGEMENT PROGRAMMES AND PROJECTS*, p. 19.
- Terpstra, Teun (2011). "Emotions, trust, and perceived risk: Affective and cognitive routes to flood preparedness behavior". In: *Risk Analysis* 31.10, pp. 1658–1675.
- Tsujino, Riyu et al. (2016). "History of forest loss and degradation in Indonesia". English. In: *Land Use Policy* 57, pp. 335–347. DOI: [10.1016/j.landusepol.2016.05.034](https://doi.org/10.1016/j.landusepol.2016.05.034).
- Tversky, Amos and Daniel Kahneman (1973). "Availability: A heuristic for judging frequency and probability". In: *Cognitive psychology* 5.2, pp. 207–232.
- Vedeld, Paul et al. (2007). "Forest environmental incomes and the rural poor". English. In: *Forest Policy and Economics* 9.7, pp. 869–879. DOI: [10.1016/j.forpol.2006.05.008](https://doi.org/10.1016/j.forpol.2006.05.008). URL: <http://www.sciencedirect.com/science/article/pii/S1389934106001146>.
- Vlek, Charles (2000). "Essential Psychology for Environmental Policy Making". English. In: *International Journal of Psychology* 35.2, pp. 153–167. DOI: [10.1080/002075900399457](https://doi.org/10.1080/002075900399457). URL: <http://www.tandfonline.com/doi/abs/10.1080/002075900399457>.
- Walle, Dominique Van de (2002). "Choosing rural road investments to help reduce poverty". In: *World Development* 30.4, pp. 575–589.
- Wani, Suhas Pralhad, Johan Rockstrom, and Theib Yousef Oweis (2009). *Rainfed agriculture: unlocking the potential*. Vol. 7. CABI.
- Wicke, Birka et al. (2011). "Exploring land use changes and the role of palm oil production in Indonesia and Malaysia". In: *Land Use Policy* 28.1, pp. 193–206.
- Wiratri, Amorisa (2016). "Is working an empowerment tool for women? Case study Indonesian migrant workers in Malaysia". In: *Masyarakat Indonesia* 39.1, pp. 105–131.
- Wisner, Ben (2010). "Climate change and cultural diversity". In: *International Social Science Journal* 61.199, pp. 131–140.