

ADDRESSING THE CHALLENGES OF LANDSCAPE CONSERVATION AND
RESTORATION IN THE HINDU-KUSH HIMALAYAN REGION WITH
ATTENTION TO TRANSBOUNDARY ISSUES

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ABSTRACT

Physical and biological changes within a landscape can disrupt ecosystems and threaten the livelihoods of people living there, and possibly beyond the particular landscape. The landscapes in the Hindu-Kush Himalayan (HKH) region are particularly vulnerable to changes because of the region's complex and vulnerable ecosystems and because many people are dependent on natural resources for their livelihoods. In principle, many people think that an ecosystem, which is a main component of a landscape, should be maintained and conserved because of its value and necessity for lives. But even though people generally think that ecosystems within a landscape should be protected and preserved because of their intrinsic biological value and their sustaining people's livelihoods, in practice these ecosystems are often allowed to become degraded, or are actively degraded through people's activities. There are often socio-economic trade-offs involved in ecological conservation, and socio-economic benefits which can improve personal and social welfare have kept people from accepting costs and limitations that would sustain ecosystem benefits.

Politics can play a role in managing and balancing the trade-offs in the public sphere. Political decisions can give priority to ecosystem conservation and to protecting landscapes from exploration for economic purposes, yet this does not always happen. This is because those decisions are mainly determined by a limited number of persons in positions of authority, or in positions to influence those in authority roles. Those persons in authority roles often have difficulty to weigh properly ecosystem conservation and restoration with a long-term perspective, as they function in the real world. For example, those persons in positions of authority may pay most attention to the immediate needs and opinions of their constituents, or even just a few of their constituents who are influential. They may by their decisions or inaction undermine the needs and interests of many people who are not their constituents but whose lives are affected by natural resource management decisions, both governmental and individual, within their jurisdiction. These non-constituents (1) can be living on the natural resources

associated within that jurisdiction, or (2) they can be the future generations living within that jurisdiction.

This issue of non-constituents being affected adversely by decisions governing natural resource use is further complicated when the one landscape reaches across national borders. Transboundary landscape conservation and restoration should be considered at a super-national level since composition and functions of landscapes, particularly complex interactions among ecological elements, are not physically or biologically separable from national boundaries and are not coterminous with these. Transboundary issues commonly make it difficult to coordinate transboundary cooperation.

This paper discusses how the ecological, socio-economic and political domains interact with each other, and how transboundary issues make landscape conservation and restoration more complex and more difficult to implement. It does so by analyzing elements in each domain and tracing linkages among these domains. Further, this study examines the case of the Koshi River Basin which crosses the borders of China, Nepal, and India by analyzing the three domains and transboundary issues.

The implications drawn from the case study show that key actions to conserve and restore transboundary landscapes would include: (1) enhancing people's propensity for collective action and (2) influencing persons in positions of authority to orient their thoughts and actions towards transboundary cooperation while avoiding getting tangled in transboundary issues. In order to implement these actions successfully, this study proposes that initiatives for transboundary cooperation need to (1) better involve resource users, (2) launch those initiatives at the community level, and (3) ensure connections between those initiatives and persons in positions of authority. To this end, this study recommends two programs, an agricultural exchange program, and a voluntary vegetation planting program, which can promote people's propensity for collective action, involve persons in positions of authority, and enhance transboundary cooperation. These are not solutions in themselves but they could help to create a situation more conducive to better handling of transboundary issues.

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LIST OF ABBREVIATIONS

DAO	District Administration Office in Nepal
FAO	Food and Agriculture Organizations of the United Nations
GEF	Global Environment Facility
HKH	Hindu-Kush Himalayan
ICIMOD	International Centre for Integrated Mountain Development
KBP	Koshi Basin Programme
UNCCD	United Nations Convention to Combat Desertification
WUMP	Water Use Master Plan

1. INTRODUCTION

1.1. Framing the concept and reality of a landscape

Ecosystem goods and services are vital resources to our lives. With various forms of natural resources, such as water, land and vegetation, ecosystems provide us food and other sources of livelihoods. While people have benefited from ecosystem goods and services for a long time, many studies warn that ecosystems have been under increasing threat of degradation (e.g., Shrestha et al., 2015; Karki, 2012). Since people cannot live without ecosystem goods and services, ecosystems have to be conserved and restored before human activities completely deplete them. Conservation and restoration are necessary not only for supporting the lives of the current generations but also for fulfilling the future needs. Yet, limiting the use of ecosystem goods and services may severely disrupt the livelihoods of the current generations. Therefore, strict restriction on access to ecosystems without the consideration of negative effects on human lives is not reasonable, even if ecosystems need to be conserved.

There are often thought to be trade-offs between ecological and economic resources. For example, during the Green Revolution, the rapid growth of agriculture production had been achieved through increasing the use of land, water, fertilizer and other resources (Food and Agriculture Organizations of the United Nations [FAO], 2017). In recent years, different approaches have gradually drawn interests. The new approaches try to increase socio-economic benefits without severely undermining ecological benefits through seeking synergies among environmental, social and economic objectives as much as possible. The concept of meeting the current needs while minimizing compromise for future needs can be referred to as sustainable landscaping (Shames et al., 2017).

A landscape refers to a socio-ecological system that is comprised of natural and/or artificial ecosystems, and it is often characterized by a configuration of topography, vegetation

and other land use (Scherr et al., 2013). A landscape is evolved through ecological, economic and social processes and activities within a certain area. As the concept of landscape indicates, a landscape is not determined by individual sectors (e.g., agriculture, infrastructure etc.) or administrative districts. Rather, it is delineated by an ecological sphere that involves various sectors and often extends beyond administrative boundaries. A landscape can even extend across national borders. For these reasons, compared to siloed landscape management by individual sectors or districts, landscape management with the consideration of ecological characteristics requires additional efforts. For example, cross-sectoral landscape management needs to coordinate cooperation and collaboration among various stakeholders who have different backgrounds, motivations and interests (Scherr et al., 2013). Their interests can even compete with each other. Hence, landscape management is an attractive and desirable idea as it aims to increase socio-economic benefits without compromising needs for future generations, yet it can involve tough negotiation processes in order to reach an agreement for effective landscape management.

1.2. Landscape changes and their impact on a society

Changes in a physical and ecological landscape have drawn attention from various entities in the world due to its expected serious impacts on a society. One example of an ecological landscape change is land degradation. Deteriorating land reduces organic matter, moisture and minerals in soil. As a result, the land is reduced its capability to maintain the original ecosystem, such as losing the vegetation cover. This may lead to a reduction in surface water and groundwater, migration or death of plants and animals, and eventually, land degradation changes the whole ecosystem. These changes can threaten people's lives, especially

those who heavily depend on ecosystem goods and services as sources of livelihoods, such as food, water, timber, and biomass (Corvalan et al., 2005).

Agriculture is one example that may cause land degradation and subsequent ecosystem degradations. Repeated cultivation on the same farmland may reduce soil fertility and productivity. In order to make up for the declined productivity and to ensure food security, people may need to cultivate new farmlands. As the majority of the land has already been cultivated or the remaining land is not suitable for farming, forest and grassland are increasingly being used for cultivation. However, using forest and grassland for cultivation can damage the ecosystems and lose certain natural resources, such as lands, water and timber. Because these natural resources are important for both ecosystems and humans, adopting intensive agriculture and expanding farmland may disrupt both of the ecological and human societies.

The Global Environment Facility (GEF) reported that nearly two-thirds of the existing farmland have been degraded over the past 50 years and more than half of the degraded farmland is under a threat of serious degradation (GEF, 2009). Many people, especially those who live in developing countries, make a living with agriculture. They often face various challenges, such as insufficient profits and unstable weather, and land degradation will make their lives much harder. Land degradation is estimated to have negative impacts on the livelihood, well-being, and nutritional status for more than one billion people in developing countries (GEF, 2009).

1.3. Landscape changes in the Hindu-Kush Himalayan region

The Hindu-Kush Himalayan (HKH) refers to a region that consists of a series of high mountains in South Asia and China. Ranging from Afghanistan in the west to Myanmar in the

east, this region extends 3,500km (Karki, 2012) (Figure1). The HKH region reaches over 3.4 million km² and covers eight countries: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.

The HKH region is known for its complex and unique ecosystems. This region has extended and rugged high peaks, various types of mountain soil, large amounts of glacier and permafrost, large river basins, and diverse climates. More than ten peaks exceed 8,000m, including the world's highest peak Mt. Everest. These natural conditions have generated various unique ecological elements, such as hydrological cycle, wetland, flora, and fauna (Karki, 2012; National Research Council, 2012). Due to the region's complex topographical and other ecological features, one landscape often goes across administrative boundaries.

The abundant natural resources in the HKH region sustain the lives of 210 million mountain-dwelling people. This number goes up to nearly 1.3 billion when including people who live on the water provided from the river basins in the HKH region.

The complex ecosystems in the HKH region are, at the same time, fragile to changes because they are sustained by numerous micro-environments and habitats, which are generated from specific combinations of ecological elements. A change of an ecological element may create chain of events and change the entire ecosystem (Karki, 2012). Hence, ecosystems are fragile and should be protected carefully.

However, human activities have caused visible and invisible changes in the Himalayan ecosystems (e.g., Karki, 2012; Joshi et al., 2013). For example, forest and rangeland areas have been decreased in the HKH region at an alarming rate mainly due to development activities. Between 1990 and 2005, the annual deforestation rate was over 3% in Afghanistan, nearly 2% in Pakistan, and around 1.5% in Myanmar and Nepal (Karki, 2012; Leslie, 2009). During the

same period, India had increased its forest cover area by 1.3% due to the afforestation program, yet this program intensively promoted fast-growing species and enhanced monoculture, which raised another issue (Dhar, 2000). Similarly, rangeland degradation is particularly serious in China, in which 90% of the rangeland has been deteriorated and one-quarter of deteriorated rangeland are under the threat of desertification (Yi & Sharma, 2009).

In addition, climate change is expected to have additional impacts on the status of land cover (Karki, 2012). For example, some plant species may be forced to migrate in response to the rising temperature and irregular rainfall patterns, which may lead to scarce vegetation cover in some areas and competitions between other plant species in other areas. As such, physical and ecological landscapes in the HKH region have gradually and certainly changed so far and will experience further changes in the future.

Recent radical demographic changes in and socio-economic characteristics of the HKH region have put development pressure on the ecosystems. For example, the population size is growing in all regional countries, and some countries have experienced rapid population increase (Karki, 2012). In order to deal with the population growth, ensuring food security and having a certain income are essential. While these regional countries have achieved economic growth, food insecurity and high dependence on natural resources are still common in mountain communities (Kurvits et al., 2014). Since economic opportunities are limited in mountainous areas, local people have no choice but depend on ecosystem goods and services for their livelihoods. Hence, further ecosystem degradation, caused by increasing consumption of ecosystem goods and services, may not be inevitable in the future.



Figure 1.1: Geographic location of the HKH region. Reprinted from ‘Mapping the vulnerability hotspots over Hindu-Kush Himalaya region to flooding disasters,’ by S. Elalem, & I. Pal, January 23 2018, retrieved from https://www.researchgate.net/publication/269336224_Mapping_the_vulnerability_hotspots_over_Hindu-Kush_Himalaya_region_to_flooding_disasters Copyright 2014 by Weather and Climate Extremes.

1.4. Framing transboundary views

A boundary of a physical and ecological landscape does not always correspond with administrative boundaries and it can go beyond national borders. Landscapes that go across national borders are called ‘transboundary landscapes’ (Pasakhala et al., 2017). The unique Himalayan topography indicates the existence of many transboundary landscapes in the HKH

region. For example, China, Nepal and Bhutan have very high peaks while other countries located in the mid-hill and/or bottom of the mountains, therefore many rivers originated in high peaks may flow into the lowlands while crossing the national borders.

In fact, the International Centre for Integrated Mountain Development (ICIMOD) has identified several landscapes and river basins that are crossing multiple countries in the HKH region (Molden et al., 2017). Since these landscapes and river basins are parts of the vulnerable ecosystems, some international and regional organizations have advocated the necessity to manage these landscapes and river basins at the transboundary level. Indeed, some of these organizations have attempted to coordinate transboundary initiatives. In spite of past efforts for coordinating transboundary cooperation, discussions for transboundary cooperation are still in the progress. For instance, the Koshi Basin Programme (KBP), initiated by ICIMOD in 2012, aims to manage water resources in the Koshi Basin, the river basin that extends across China, Nepal and India, in a regionally-coordinated manner (ICIMOD, 2012). Over five years have passed after its inception, yet these three countries have not been able to create successful agreements on transboundary water resource management.

1.5. Landscape changes as a challenge

As seen above, the Himalayan ecosystems are facing a threat of serious degradation. Signs of ecosystem degradation, such as deforestation and climate change, have already been observed. These warning signs indicate the necessity of ecosystem conservation and restoration. However, ecosystem conservation and restoration cannot be implemented without the consideration of the impacts of these attempts on local people's lives. A landscape approach, focused on balancing both ecological and human benefits, can be a reasonable solution to the

problems of physical and biological changes within a landscape and ecosystem degradation. However, a landscape approach is not easily implemented because it requires stakeholders from various sectors to collaborate. It is even more difficult to implement when a physical and ecological landscape goes beyond national borders. Therefore, studying the challenges of transboundary landscape conservation and restoration, and exploring initiatives to address these challenges, are useful to discover possible solutions to these challenges.

To understand the causes of the difficulty in conserving and restoring landscapes, this paper analyzes the challenges of landscape conservation and restoration from three perspectives: ecological, socio-economic, and political. This analysis will help to explain why ecosystems are vulnerable, why ecological and socio-economic benefits are not easily balanced, and how ecological and socio-economic benefits are balanced or undermined in the political sphere. In order to understand these issues comprehensively, this study will first look into the elements in each domain and then trace the linkages among the ecological, socio-economic, and political domains. Thereafter, this study analyzes how transboundary issues can be related to the challenges of landscape conservation and restoration.

This study focuses on the HKH region because: (1) its ecosystem is likely to be visibly and invisibly degraded and this is an emergent issue, (2) there are no decision-making bodies to enforce rules or regulations across the regional countries, and (3) therefore transboundary landscape initiatives cannot be organized without regional countries' willingness to and agreement on transboundary cooperation.

This paper discusses the following four research questions. (1) How are the ecological, socio-economic and political domains linked, in terms of landscape conservation and restoration? (2) How are transboundary issues related to these three domains? (3) How can the

concept of the three domains together with the transboundary issues be applied to challenges of transboundary landscape initiatives in the HKH region? (4) How can the complexity and difficulty of coordinating transboundary cooperation for landscape conservation and restoration be addressed?

There are many existing studies, including studies that focus on the Himalayan region, discussing the issues of ecosystem degradation and the challenges of socio-economic contexts, and the relationships between them. However, there are few studies that analyze and conceptualize the issues of physical and ecological landscape changes from the combination of the perspectives of ecology, socio-economy, and politics, which may allow us to understand these issues deeply and analytically. In addition, by adding the consideration of transboundary issues, this study attempts to conceptualize why the issues of physical and ecological landscape changes are so complex when a landscape goes beyond national boundaries.

2. REVIEWING MAJOR CAUSES OF LANDSCAPE CHANGES WITH A PARTICULAR FOCUS ON THE HINDU-KUSH HIMALAYAN REGION

Various causes can degrade land and change landscapes. These causes can be either natural or anthropological factors, or a combination of these factors. Causes of land degradation are different from area to area, yet there are some common major causes throughout the HKH region. These causes are not easily addressed, partly because some challenges have impeded the conservation and restoration of lands from being implemented. This chapter reviews major causes of physical and ecological landscape changes with an attention to land degradation in the HKH region, and major challenges for conservation and restoration initiatives in this region. As a summary of this chapter, the conceptual model of major causes and challenges is shown in Figure 2.1.

2.2. Major causes of land degradation

This section describes six common, major causes of land degradation in the HKH region. These six causes are: deforestation and forest degradation, intensive agriculture and soil degradation, expanding cultivation into marginal areas, overgrazing, ineffective water resource management, and climate change. In addition, other causes, mainly induced by natural factors, are also discussed at the end of this section. Each subsection consists of a description of the cause and how this cause can degrade land and affect ecosystems.

2.1.1 Deforestation and forest degradation

Forest, which covers nearly one-fourth of the HKH region, plays many important roles in sustaining both of the ecological and human societies. Forest retains and increases the fertility and moisture in soil, maintains hydrological circulation, offers habitats for plants and animals, and provides timber, food, fuels and other natural products for humans (Kotru et al., 2015; Uddin

et al., 2015). In addition, forest protects the area it covers from natural disasters by absorbing excess water and stabilizing lands.

In spite of those important functions, the area of forest cover in the HKH region has decreased at a rapid pace. As a result, forest's ability to fulfil these functions has declined. Deforestation and forest degradation are mainly caused by an overexploitation of woods and other forest products, and expansion of settlement, roads, and other infrastructure through urbanization processes (Karki, 2012). Agriculture is another major cause and it is described and detailed in later subsections.

Decreasing forest cover leads to land degradation in various ways. Land that has lost vegetation cover loses their ability to retain water, organic matter, minerals, and other essential components in soil (Sitaula et al., 2004). When soil is fertile, the land can be resilient and regenerate lost vegetation by itself. However, because the HKH region is a mountainous area, its terrain is often difficult and rugged and its soil is relatively infertile. As a result, once vegetation cover is degraded or lost, the land can easily lose its ability to regenerate vegetation by itself. Problems of losing vegetation cover are more serious when the land is severely degraded. On severely degraded lands, soil erosion, massive topsoil runoff and landslides may occur more often than on land with fertile soil, and these incidents can expand degraded areas.

In addition, changes in land cover often deprive plants and animals of their natural habitats (Hansen et al., 2012). Plants and animals that have lost their original habitats may not be able to live in the current area and need to migrate other areas in order to find new habitats. These plants and animals sometimes play essential roles in the lives of other species, and the migration of these plants and animals can lead to forcing out these other species. Furthermore,

migration of plants and animals can cause competition with other plants and animals in other areas. As such, changes in land cover may result in disrupting the entire ecosystem.

In some areas in the HKH region, especially in China and India, forest cover has increased recently due to the implementation of afforestation programs. Yet, because these programs had focused on planting quick-growing species, the diversity of the tree species had decreased and the afforestation had raised a monoculture (Kotru et al., 2015; Dhar, 2000). The impacts of monoculture are less obvious compared to deforestation and forest degradation, yet reduced diversity may force some plant and animal species to migrate to other areas and change the status of the ecosystem.

2.1.2. Intensive agriculture and soil degradation

In the HKH region, since difficult and rugged terrain and insufficient infrastructure limit available economic opportunities, agriculture is the major source of income and well-being for local people. In fact, over 80% of the population in the region was engaged in farming in 2000, and agriculture is still an important industry in mountainous areas even in the process of changing industrial structures (Tulachan, 2001; Kurvits et al., 2014). Despite the fact that many local people engage in agriculture, mountainous terrain limits arable areas. Even when land is arable, mountain agriculture tends to be inefficient because of less accessibility, poorer soil moisture and conditions, a short growing season, and smaller parcels of farmland (Tulachan, 2001).

To make a living and support families with a small farmland area, some farmers practice intensive agriculture, such as reducing fallow periods and applying much fertilizer. Although these practices may allow farmers to increase their yields, these practices can cause imbalanced

soil nutrients (Tulachan, 2001). Furthermore, the national governments sometimes distributed and encouraged farmers to cultivate the same types of crop all over the nation, including the Himalayan area, without considering the unique natural conditions in mountain areas. These crops were sometimes less suitable for mountainous areas and planting these crops not only sometimes resulted in failed harvests but also made the land more fragile (Tulachan, 2001).

Similar to the negative impacts caused by deforestation and forest degradation, intensive agriculture can reduce soil's capacity to retain organic matter, mineral and other essential components, and decrease yields (Blanco-Canqui & Lal, 2008). While forest is often common property and therefore individual activities may be monitored by others, farmland is usually individual property and therefore there is minimal, if any, oversight to prevent individuals from applying intensive agriculture. Therefore, intensive agriculture can degrade land more rapidly and seriously than deforestation and forest degradation.

2.1.3. Expanding cultivation into marginal areas

Many farmers, especially full-time farmers, need to support their families with food and income obtained from agriculture, the economic value of which are often low. Hence, increasing yields is important to improve their well-being. In addition to intensive agriculture, expanding the acreage of cultivation is another common way to increase yields. Due to the fact that individual landholdings have been fragmented and become smaller because of population growth, expanding cultivation is sometimes necessary for farmers to maintain and increase their agriculture production (Tulachan, 2001). However, almost all fertile land has already been reclaimed and therefore only less fertile and marginal areas are generally available for additional cultivation. By and large, it is forest and grassland areas that are being converted into farmland in order to deal with the limitation of small and fragmented landholding. Cultivating these areas

lead to loss of vegetation cover. In addition, farmers may apply a large quantity of agrochemicals and fertilizers to increase yields with less fertile land, which can seriously degrade land and soil.

The impacts of expanding agriculture can be severer in mountainous areas compared to flatland areas because of the vulnerability of ecosystems. In addition, expanding agriculture may rapidly and severely degrade land in that it may induce farmers to apply intensive agriculture, and vice versa. When the productivity of farmland decreases due to intensive agriculture, farmers may have no choice but to expand cultivation in order to make a living. Since the remaining arable land can be less fertile, farmers may apply intensive agriculture and which in turn may stress the soil further, and lead to further decreased in yields within a short period. As such, the necessity to sustain lives with a limited amount of arable land can cause a chain reaction of ecosystem deterioration.

2.1.4. Overgrazing

In addition to crop harvesting, pastoralism is another major source of livelihoods in the HKH region. Broad rangeland, which covers more than 60% of the region, is a major source of forage for livestock animals (Karki, 2012). As a result, livestock production sometimes causes overgrazing and it poses the threat of rangeland degradation.

Overgrazing is caused by mainly two factors. One factor is an increase in livestock population. Over the last 50 years, the livestock population has quadrupled while the human population has doubled, which shows the rapid increase in domestic animals, even compared to humans (Joshi et al., 2013). The rapid growth of livestock population results in the decrease of available rangeland area per livestock animal (Tulachan, 2001). Another factor is the tightening of regulations on open grazing. As a result of these regulations, the area of rangeland available for feeding has decreased (Tulachan, 2001). Both of these factors lead to decreasing available

rangeland for livestock animals and farmers may apply intensive grazing within a limited area to deal with the reduction of available rangeland per animal. Indeed, rangeland has been degraded throughout the HKH region and especially in China. Half of the rangeland in the Tibetan Plateau is estimated to be degraded or even desertified in serious cases (Wilkes, 2008).

Similarly to other cause of land degradation, overgrazing reduces and degrades vegetation cover that lead to decreasing organic matter, minerals and moisture in soil (Sitaula et al., 2004). As a result, rangeland may decline in its capacity to regenerate pasture by itself. Compared to forest management, rangeland is often poorly managed due to several reasons. For example, rangeland is less economically valuable than forest, therefore groups or people who are to manage rangeland are less incentivized to oversee and maintain rangeland carefully. In addition, in the HKH region, the area of the rangeland is much larger than the forest area, thus there are likely to be many areas where people are unable to monitor or prevent the overexploitation of pasture.

2.1.5. Ineffective water resource management

One remarkable feature of the Himalayan ecosystem is its huge amount of recurrent water resources. In particular, there are ten major river basins in the HKH region that provide water for nearly 210 million people (Karki, 2012). People use water taken from the river basins for various purposes, such as irrigation, drinking, sanitation, and other industrial and household uses. Water in the river basins is continuously replenished by rain, melted glaciers, and snow.

Since agriculture, the main industry in the HKH region, requires a huge amount of water, water management for agricultural use can be a major determinant of the effectiveness of water resource management. In terms of farming, water resource management can be broadly categorized in two methods: irrigation and watershed management.

An irrigation system stores a sufficient amount of water to be stored on a regular basis for human use, which allows farmers to secure water for agriculture and increases their yields. However, installing an irrigation system may result in land degradation and decreasing yields when the system is mismanaged. For example, an irrigation without proper drainage systems may cause water erosion and salinization. Water erosion and salinization decrease groundwater and reduce the water retention of the soil and thus the land is degraded (Bhan, 2013; Sentis, 2005).

Despite a risk of causing land degradation and decreasing yields, an irrigation is still a major and preferred water management system. However, there are many areas where irrigation systems have not been installed due to various reasons, such as a lack of financial resources, difficult terrain, marginality, and low accessibility. Indeed, in the HKH region, the percentage of irrigated farmland is less than 50% in six out of eight regional countries (Vaidya, 2015). In this case, watershed management, which tends to focus on managing rain water, is also an alternative method of water management.

A watershed refers to a hydrological unit delineated by stream systems and their topographical features. Watershed management focuses on maintaining and improving natural resources that consist of streams, such as vegetation and soil, as well as retaining and increasing water retention. When a watershed is poorly managed, such as by overexploiting water for irrigation or the loss of riverside vegetation, the availability of water in the watershed decreases. Because precipitation is highly variable and a dry season is relatively long in the HKH region, local people can suffer from water shortages during the dry season without a sufficient supplied water in the watersheds. Hence, mismanaged watersheds can cause water scarcity, farming without sufficient water and land degradation.

2.1.6. Climate change

Land degradation is likely to be closely linked with other environmental issues, especially with climate change (e.g., GEF Scientific and Technical Advisory Panel, 2006; Barbut & Alexander, 2016). Land degradation often interrupts nutrient, carbon, and hydrological cycles in an ecosystem and disturbs carbon storage in soil and vegetation. As a result of disturbed carbon storage, a large amount of carbon dioxide is released from soil and vegetation into the atmosphere. This large amount of carbon dioxide may raise temperatures and induce extreme weather conditions, and so influence the climate.

High temperature and limited rainfall decrease soil moisture and cause land deterioration even more (United Nations Convention to Combat Desertification [UNCCD], 2015). In addition, extreme precipitation events induced by climate change may disrupt and degrade vegetation, leading to land degradation (You et al., 2017). Because recent warming trends in high elevations in the HKH region are above the average compared to the world average, the negative impacts of climate change can be particularly serious in this region (You et al., 2017; Karki, 2012).

2.1.7. Other factors

In addition to the above anthropological factors, natural factors sometimes influence the conditions of land. For instance, natural disasters, such as floods and landslides, may disrupt vegetation cover and natural habitats and cause land deterioration. The impact of natural disasters can be particularly serious in the HKH region. This is because risks of natural disasters in mountainous areas tends to be high due to steep slopes, relatively fragile soil, low temperature and other mountain conditions, (Shaw & Nibanupudi, 2015).

Additionally, a series of high peaks generates unique air circulations and weather systems in the HKH region, which brings high precipitation in the southern areas but a dry

climate in the northern and western areas (National Research Council, 2012). A dry climate can deprive the soil of moisture and make the land less fertile.

2.2. Major challenges

Several challenges may have prevented the above causes of land degradation from being addressed. This section discusses three major challenges: limited economic opportunities, the large size and rapid growth of the population, and the marginality of the area. Each subsection describes what these challenge are and how these challenges may have impede land degradation from being addressed.

2.2.1. Limited economic opportunities

Due to difficult and rugged terrain, marginality and remoteness, and poor infrastructure, economic opportunities are limited in many areas in the HKH region. With few economic opportunities, natural resources produced by the Himalayan ecosystems are important sources of livelihoods for local people. Indeed, major economic activities in the HKH region are heavily dependent on ecosystem goods and services. According to Tulachan (2001), as of 2001, over 80% of the HKH population was engaged in agriculture, which consumes a huge amount of land and water.

Land degradation can be mitigated by reducing the consumption of natural resources. However, the consumption may not be reduce without regulating the use of natural resources, including for agriculture. This may make the lives of people who are heavily dependent on natural resources much harder. Hence, exploiting forest products, intensive and expanding agriculture, and overgrazing may not be prevented as long as people who make their living from these activities cannot find alternative sources of their livelihoods.

2.2.2. The size and growth of the population

The size of the regional population is already huge. 210 million people are living in the HKH region and 1.3 billion people are dependent on water resources taken from the Himalayan river basins (Karki, 2012). In addition, the size of the population is increasing in all regional countries. For example, between 2000 and 2009, the annual growth rate was particularly high in Afghanistan (3.9%) and also high in Pakistan, Nepal, and Bhutan (2%) (Karki, 2012). The growth rate was a bit lower in China and India in that period, yet these countries already had huge populations.

The more and more that population increases, the more and more resource that will be needed to make a living of people living in the region. As seen in the previous subsection, the amount of consuming natural resources per person cannot be easily reduced because of limited economic opportunities in a mountainous area. Hence, the size and growth of the population may impede the consumption of natural resources from being reduced, but instead, the land and ecosystems can be more degraded due to increasing the use of natural resources.

2.2.3. The marginality of the area

Some mountain communities are marginalized because of the difficult topography and their remoteness. Due to marginality, the needs and opinions of people in these communities can be overlooked and considered less important in the political sphere. In addition, policy-makers who are from lowland areas cannot understand the needs and reality of mountainous lives, which also leads to making policies without the consideration of these needs and opinions.

Land degradation may be mitigated and addressed with appropriate policies for mountainous areas, such as developing and introducing agriculture practices that can maintain soil fertility, or planting trees with the consideration of increasing diversity. However, if policies,

regulations and other relevant political mechanisms fail to consider the uniqueness of ecological and social contexts in mountainous areas, land degradation cannot be prevented.

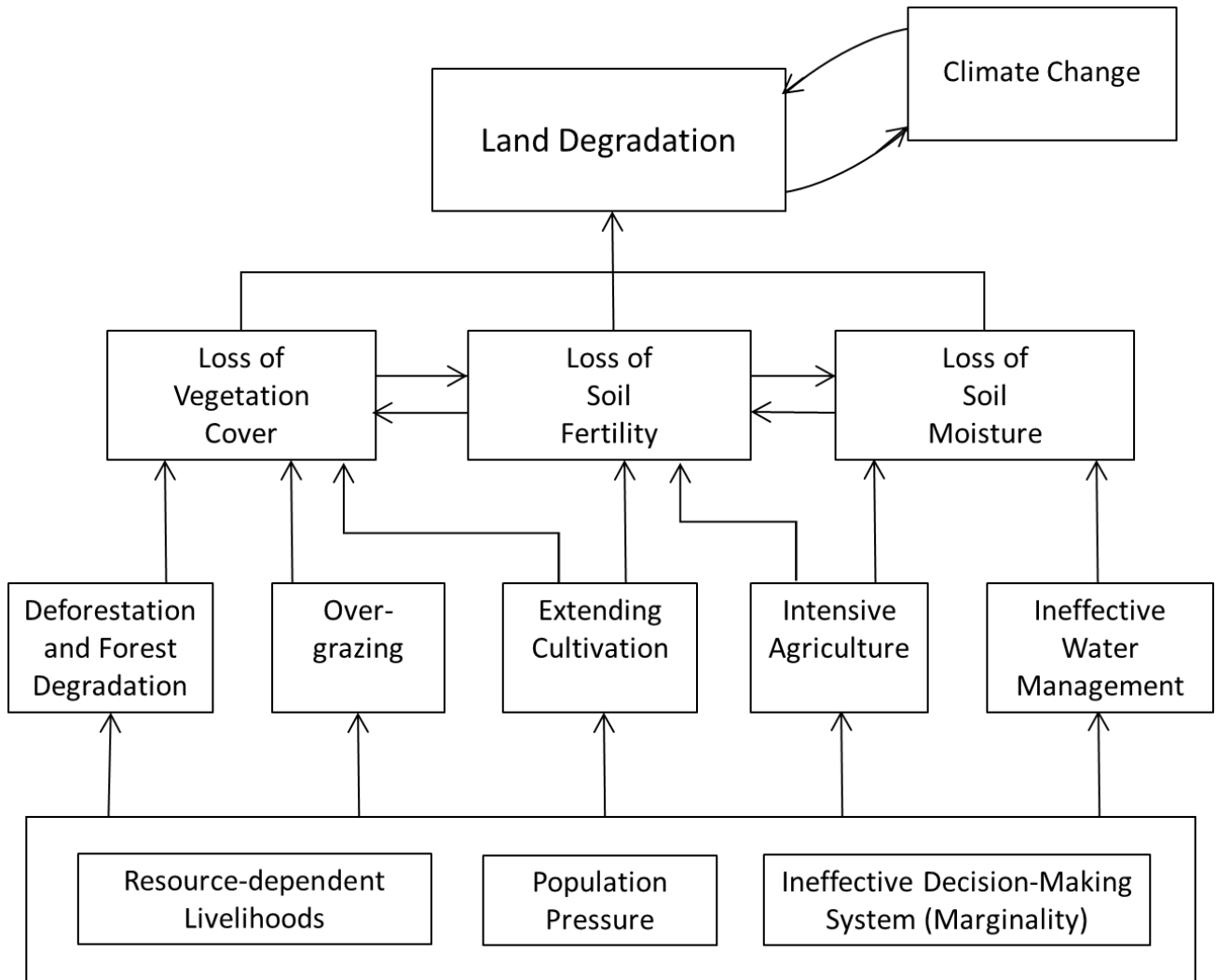


Figure 2.1: Conceptual model of the major causes and challenges of landscape changes

3. THREE DOMAINS OF LANDSCAPE FUNCTIONING, AND LINKAGES AMONG THEM

As described in chapter one and two, landscapes can be evolved or degraded through ecological, economic and social processes. In other words, landscapes are a product of interactions between elements in ecological and socio-economic domains. When people obtain socio-economic benefits from ecosystems, ecological benefits can be lost. Actions to exploit natural resources can be regulated by political decisions and actions. That is, political decisions may be able to control and influence the interactions between the ecological and socio-economic domains. This indicates that the ecological, socio-economic and political domains are linked together.

This chapter analyzes the linkages among the three domains by looking into elements in each domain, and then tracing the linkages among the elements and the domains. Figure 3, shown at the end of this chapter, presents the conceptual model of the three domains and the linkages between and among them.

3.1. Ecological domain

An ecosystem is a complex system comprised of biotic (living or once-living organisms) and abiotic (non-living elements) components and interconnections between them. Components of a mountain ecosystem are numerous, yet in the HKH region, five environmental features and challenges regarding ecosystem conservation are often focused on by international and regional organizations. These five features and challenges are: high altitudes, river basins, climate change, land use changes, and biodiversity (e.g., Karki, 2012). Hence, this study categorizes components of an ecosystem into five major elements: topography, water, soil and land, climate, and flora and fauna. In each ecosystem element, this study analyzes the role of the element in the entire ecosystem and the influence of human activities on each element.

Topography is physical shapes and features of the earth and ground, such as hills, plains, and valleys. In a mountainous area, topography is a significant determinant of the diversity and characteristics of other ecosystem elements, such as hydrology, land cover, soil and mineral, climate, and biosphere. The more topography is varied and complicated, such as a series of high peaks and valleys connected with steep slopes, the more the ecosystem will be diverse, with modifications according to slope gradients along with changes of the altitude and slope direction (Khan et al., 2012). Topographical features are usually fixed and rarely alter drastically. They can change when forces are applied, such as flows of water, wind erosion, and landslides, but the natural forces only change the features of the topography in small ways, especially within a short period.

While human activities are largely influenced by topography, human interventions have, like natural forces, few influences on topography. Rugged terrain and steep slopes in a mountainous area make human lives difficult, and since topography is fixed and rarely changed, people living in a mountainous area will always have to deal with difficult conditions.

Water takes several forms, such as flows of a river, glaciers and snow, moisture in soil and vegetation, and precipitation and vapor in the air. While changing the form from one to another, water circulates in every part of ecosystems. Precipitation provides water in an area, sometimes with the form of snow and ice, by which water is stored in the air, glaciers, rivers, ponds, and soil. Some glaciers are melted and seeped into rivers, soil, and other water reservoirs. As such, glaciers play a role in replenishing water to rivers, especially during dry seasons. In river streams, water flows from upstream to downstream along the topography, propelled by the force of gravity, while providing water to soil, vegetation, and animals in the surrounding areas. The remaining water flows into the sea. Soil absorbs water from various sources and holds or

releases it into the air and vegetation. Plants absorb water from the soil and release it into the air, or into animals as food. Animals take water from streams, ponds, plants, and other animals, and release it into the air or other animals by way of food. Vapor will be turned into precipitation and provide water to the ecosystem again. As such, water circulation systems continuously provide water to ecosystem elements and contribute to sustaining the entire ecosystem.

Although water is rarely static and is distributed all over the environment, the amount of water stored in certain parts of the water circulation system is relatively stable, as long as water circulates among air, ground, and creatures in a sustainable manner. Yet, since water circulates everywhere while continuously changing its state, hydrological cycles can be readily influenced by external forces.

Humans intervene in natural water circulation for different purposes in various ways. For example, people continuously take water from reservoirs, such as rivers, ponds and groundwater, to use for industrial, household, and other purposes. Constructing dams and changing the courses of rivers are other ways to capture water for human use. These actions allow people to secure a vast amount of water on a regular basis. In the HKH region, the amount of water used by people may be a small part in comparison to the entire amount of preserved and retained water in the ecosystem. Yet, continual capture of water from natural hydrological circulation system (including during dry seasons) cannot be just a minimal amount (Shrestha et al., 2015). Human interventions can cause biased water distribution and water shortages in some parts of the water circulation system.

Soil can be categorized into different types in accordance with stocks of biomass, organic carbon, and texture and sizes of particles, which are major determinants of the fertility and water retention of soil. Diverse topography generates variances in exposure to the sunlight and wind of

soil, steepness of the grounds, and directions of slopes. As a result, conditions and types of mountainous soil are also diverse. In general, mountain soil tends to be less fertile, especially at higher elevations, because low temperatures reduce biological activities and the gravity and steep grounds make the layers of the soil thinner (Romeo et al., 2015). Freeze-and-thaw cycles of the water contained in soil also reduces soil's fertility and capacity to retain water.

Soil's fertility and water retention are significant determinants of types and conditions of land cover, and vice versa. When soil is fertile and retains a sufficient amount of water, the land can sustain lush vegetation, and this vegetation helps the soil to maintain its fertility and water retention. However, if soil is infertile and retains little water, the land is probably covered by poor vegetation or could be barren. As well as topography and water, soil and land cover, especially those in a good condition, are determinants of the entire ecosystem and contribute to sustaining other ecosystem elements.

Conditions of soil and land cover can be influenced not only by the application of direct forces but also by the indirect impacts, such as changes in land and soil conditions in surrounding areas. For instance, when land loses its vegetation cover, the soil's fertility will be reduced and moisture and vegetation may wither in an adjacent area. When the vegetation in the adjacent area is lost or degraded, the fertility and water retention of the soil in this area will decline as well.

Humans have used land and soil to generate sources of livelihoods. One example is agriculture. In the HKH region, a large area is cultivated for raising crops and a large grassland is grazed to feed livestock animals (Tulachan, 2001). By doing so, local people obtain income and food. These activities, however, influence the conditions of land and soil, often in negative and unexpected ways. This is especially true of fragile and vulnerable mountain soil. Once

fragile land and soil deteriorate, recovering the conditions of the land and soil will take many costs, time, and efforts.

Climate is the pattern of average weather over a long-term period that is occurring mainly due to flows of the air and water circulation. High peaks and deep valleys in the HKH region influence the course of the air flows and hydrological patterns. Therefore, as a result of the complex topography, water circulation, and water cycling system, climate is gradient and diverse (National Research Council, 2012). This condition even creates a micro-climate throughout a mountainous area. Because most ecosystem elements, such as hydrological patterns, conditions of soil, and flora and fauna, are highly influenced by temperature, humidity, and other climatic factors, the gradient and diverse climate in the HKH region is essential to maintain the Himalayan ecosystems.

Climate is amorphous and does not have any particular boundaries. Its lack of boundaries can make it susceptible to any changes in the atmosphere. Yet, fixed topography, stable water circulation patterns, and other stable ecosystem factors allow climate to be seasonally steady, which enables the ecosystem to maintain a stable condition. However, continuous and persistent changes in the ecosystem can have impacts on the climate patterns.

The magnitude of the influence of human activities on climate is less obvious. For example, human activities may directly change the water circulation patterns or the conditions and types of land cover and soil, yet people usually cannot directly change the climate. Instead, human activities can affect climate in indirect ways by accumulating greenhouse gas through continuous certain activities, such as plant operation and agriculture. Greenhouse gas emitted from human activities is often invisible and spreads very quickly and infinitely. Hence, people

may be less sensitive to their influence on the climate patterns than the influence on other ecosystem elements.

However, the influence of climate change on the conditions of ecosystems can be greater than the influence on other ecosystem elements. For instance, when patterns of weather, temperature, and precipitation are changed due to climate change, water circulation system, conditions of land cover, soil, flora, and fauna can be changed and degraded. These ecosystem elements can be influenced by climate change almost directly and simultaneously. Hence, the negative impacts of climate change can be immediate and intensified among ecosystem elements.

Flora and fauna are a collection of plant and animal species in a given ecological area, which are produced by physical, hydrological and climatic factors, and interactions within and between plant and animal species. In the HKH region, complex and diverse physical, hydrological, and climatic factors generate a highly diverse biosphere (Sharma, 2009). While flora and fauna are products of ecosystem elements, they also play essential roles in maintaining the ecosystem.

Resilience of flora and fauna to external forces is different from species to species, yet many plant and animal species in the Himalaya are vulnerable to changes because their habitats are in specific and unique environments (Sharma, 2009). Hence, any changes in water circulation, soil fertility, land cover, and the climatic patterns can alter flora and fauna. The impact of altered flora and fauna can be extended and amplified when further changes occur. For example, some plants are vital food for some herbivores and other plants can benefit from the herbivores' eating behavior, which could provide them with sunlight after the plants are consumed. Therefore, if these plants are gone, these herbivores may not be able to survive in

this area, and other plants also may not be able to survive. In addition, when the herbivores are gone, carnivores eating these herbivores may not be able to survive as well. As such, a change in flora and fauna can cause chain of events in the whole biosphere.

Flora and fauna are important sources of income and well-being for humans. These include sources of food, fiber, medicine, and sometimes tourism. Therefore, humans can be incentivized to overexploit useful and valuable plant and animal species. As seen above, many Himalayan plants and animals, especially ones living in micro-environments, are vulnerable to external forces. Due to interactions among flora, fauna, and other ecosystem elements, the overexploitation of plants and animals may drastically change the biosphere and the entire ecosystem.

3.2. Socio-economic domain

Numerous socio-economic factors can influence and can be influenced by ecosystems. This study particularly focuses on four issues that are often mentioned by international and regional organizations as challenges to achieving sustainable mountain development in the HKH region. These four challenges are: demographic changes, social inequities and inclusion, economic growth and disadvantages, and changes in land use (e.g., Karki, 2012). Hence, as socio-economic elements, this study analyzes the following four factors: population size, social composition and equity, economy and well-being, and land use. What follows is an analysis of regional and local socio-economic contexts and influences of socio-economic elements on the Himalayan ecosystems.

Since each individual needs to consume some natural resources to live, *population size* can be one indicators of the consumption of ecosystem elements. Population size is increasing in

all regional countries. During 2000-2009, the average population growth rate of the regional countries was 2% (Karki, 2012). This increasing trend is a concern in developing particularly because the number of people who are in poverty can increase. Low-income people may hardly control the number of their children because of various reasons, such as a lack of knowledge and support for family planning. Indeed, the data shows that birth rate can be higher in areas where a poverty rate is high (Hunzai, 2011).

Regional countries have not been able to stop this increasing trend so far. Controlling the population size can be difficult for policy makers not only because of financial and administrative reasons but also because controlling reproduction may cause cultural, moral, and other ethical problems. On the contrary, the death rate is likely to decrease due to technological and economic developments, such as an improvement in health care and an increase in affordable medicine. Hence, population size is likely to continue to grow, at least for a while.

The more and more that the population size grows, the more and more that people will need natural resources for their lives. People will need more food, income, water, land, and other natural resources, yet the amount of ecosystem goods and services is limited. As a result, more Himalayan ecosystems will be consumed and can be intensively degraded.

Another remarkable demographic characteristic is the region's *social composition and equity*. Social composition refers to the different social groups in a society, whose emerging actions and needs as a group are often different from those of other groups. For example, roles of men and women in a society and household are often different because of the customs, traditions, and cultures. The relationships and power balance among groups are not always equal, and therefore equity is often a serious problem derived from social composition. For instance, due to the remoteness and marginality of mountain communities, ethnicity and social groups are

diverse, and some of them are disadvantaged (Gurung, 1999; Karki, 2012). These social conditions have caused problems in the use and management of natural resources.

Gender issues are often focused on and discussed as the issues related to natural resource management by international and regional organizations (e.g., ICIMOD, 2017). In the HKH region, women are often responsible for collecting natural resources for their household use (ICIMOD, 2017). Therefore, they can have knowledge and experience of managing natural resources more effectively. However, decision-making for managing resources is often men's role, even though they may not know how natural resources are actually collected and how resource management can be improved.

Similarly, opinions from some disadvantaged social groups can be undermined due to power imbalances between social groups. For instance, use of natural resources by indigenous groups may compete with the demand for the same resources by other communities. Indigenous groups' traditional resource management may be well developed with careful consideration of the efficiency and sustainability of resource use. However, indigenous groups are sometimes less dominant in their society and, as a result, new rules and regulations can be created that prohibit or restrict traditional methods of resource use (Banjade & Paudel, 2008).

Economy and well-being are things that many people care most about, especially at the individual and household levels, in order to improve their well-being. Activities to obtain sources of income and well-being usually involve some natural resources, and the amount and types of natural resources needed for income and well-being are different from activity to activity. In the HKH region, types of viable economic activities are limited to specific industries, such as crop harvesting, livestock raising, and harvesting forest products (Hunzai et al., 2011). Activities that can generate high income often require large and special machinery and equipment with well-

developed infrastructure, which are difficult to install in a mountainous area due to its topography and accessibility. As a result, the average poverty rate in a mountainous area in one country is often higher than the national average in that country (Hunzai et al., 2011).

Economic activities that are suitable for a mountainous area tends to be heavily dependent on natural resources. While these activities consume a lot of natural resources, their outputs tend to have low economic value. Hence, in order to maintain and improve well-being, local people need to adopt practices that can increase their production. There are various practices that have a potential to improve productivity and the amount of additional inputs is mainly determined by the types of practices. Some practices may involve much additional inputs in order to increase the outputs, while other practices may have a potential to increase production with only a few additional inputs or even lesser inputs. For example, farmers may improve the productivity by increasing the usage of fertilizer and agrochemicals (intensive practice), or reducing tillage (less intensive practice). Researchers found out that low-income people often have difficulty in adopting less intensive practice (Pannell et al., 2014). They cannot easily adopt practices that take a long time for a yield increase or practices that involve a risk of decreasing yield.

Land use means modifying a surface of the ground for human use. Topography, climate, resource availability, and other ecological factors are major determinants of the types of land use people employ. For instance, people may want to change from grassland to farmland if this grassland is accessible and fertile, yet people may want to use grassland for grazing if this land is less accessible and infertile.

In the HKH region, due to difficult and rugged terrain, a harsh climate, and resource scarcity, there is a large difference in population density between high elevations and low

elevations. This difference in population density leads to a large difference in land use between high elevations and low elevations. For example, the population density is fewer five people per square kilometer in the Tibetan Plateau but it is greater than 500 people per square kilometer in the northeastern part of India (Wahid et al., 2017). Accordingly, higher elevations are less dominated by human settlements and other modified land that are to generate sources of income and well-being (e.g., farmlands), while lower elevations are highly developed and there are few remaining untouched lands.

As a result, the Himalayan ecosystems are tends to be exposed to different levels of development pressure depending on their altitude. Ecosystem elements in the lower elevations, where population density is high, are often under threat of overexploitation. People need to develop infrastructure and bring land into cultivation in order to improve their well-being and make their lives easier. As a result, land can be severely degraded and plants and animals are deprived of their habitats. In addition, a huge amount of water is consumed in areas where population density is high, which can lead to the overexploitation of both surface water and groundwater. If infrastructure is developed to some extent, local people can have easy access to natural resources and frequently exploit these resources. Hence, although an ecosystem might once have had the ability to regenerate exploited ecosystem elements, frequent human interventions are likely to erode an ecosystem's ability to recover.

Relative to ecosystem elements in the lower elevations, elements in the higher elevations are generally less likely to be overexploited. However, since there are less economic opportunities in the higher elevations, people in these areas may need more natural resources for their livelihoods than people in the lower elevations. As a result, although ecosystem elements in

the higher elevations are exposed to the lower development pressure, this does not mean that these elements are not under a threat of overexploitation.

3.3. Political domain

The political domain encompasses multiple processes of decision-making that lead to policies, programs, laws, regulations, and other mechanisms for shaping collective action which is expected to serve some public purposes and values. Politics may influence and control ecological and socio-economic benefits. In order to analyze linkages between the political domain and ecological and socio-economic elements, this section focuses on three components within the political domain. The first component encompasses the roles and activities of decision-making together with resource mobilization and management, which are identified by Uphoff (1986) as parts of the basic functions that are relevant to collective action. The second component involves jurisdictions, which Shames, Heiner and Scherr (2017) mentioned as a significant barrier to sustainably managing landscapes. The third component is social energy, a phenomenon arising from people's values and affinities (Uphoff, 1996). This can be a key to promote people's propensity for collective action, especially on behalf of people who do not have the rights to influence political decisions regarding natural resource management.

The multiple processes of *decision-making* lead to political mechanisms, such as policies and regulations, which both initiate and regulate collective action within the public sphere.

Mobilizing and managing resources is one such mechanism for shaping and enabling collective action. People who are subject to the decisions and resource allocations made by persons in roles of authority may have some influence on decision-making within the public sphere by participating in political processes (e.g., voting). However, only a limited number of persons will have responsibility for making those decisions or some significant influence on those decisions.

In any governmental structure, and within designated domains, usually nested, there are a limited number of persons who claim and/or are assigned authority by virtue of the position they hold within the respective governments at different levels. People who support a person in a position of authority expect that he or she represents their opinions and makes decisions to address and satisfy their needs in the public sphere.

Decisions and commands made by persons in positions of authority are not always perceived as legitimate by all of the people who are subject to the decisions (Uphoff, 1989). Hence, when persons in positions of authority make decisions and commands in the name of their positions that invoke the assignment of authority to their roles, there is a chance that some of the targeted people will reject these commands or be unwilling to comply with these commands. It is especially true when people who are subject to the decisions are dissatisfied with these decisions and/or with the implementations of the commands. Accordingly, persons in positions of authority are likely to try to satisfy the needs of people who are subject to the decisions (especially their constituents) so as to maintain their support and legitimacy. These persons in positions of authority may be particularly interested in addressing the needs of people who have significant influence on other people (e.g., community leaders), in order to acquire, exercise, and retain authority. By doing so, persons in positions of authority can increase the probability of getting their constituents and other community members to do what the persons in positions of authority want them (everyone, or some specific community members) to do.

Since most people care most strongly about the economy and their livelihoods, as they affect people's well-being, the processes that govern allocations of economic resources along with the making of political decisions will tend to draw the most public attention. Many people also care about ecosystems in which they live and about the sustainability of natural resources.

Yet, people generally have to choose between obtaining sources of livelihoods by consuming natural resources and conserving ecosystem resources thereby possibly diminishing their access to the benefits of consumption. For example, farmers may have to choose either earning additional food and income by expanding farmland into forests, or conserving the forests by not expanding farmland and therefore giving up additional food and income. Political decisions have the impacts on the mobilization and management of those resources through the implementation of policies, regulations, programs, laws, and other mechanisms.

Persons in positions of authority, when they make decisions, are likely to consider how their decisions about the mobilization and management of economic and natural resources influence their hold upon authority. In general, raw materials including natural resources are economically less valuable than goods and services that have been processed, produced and prepared for human use. Economic resources are significant sources of power bases. Therefore, people who are in favor of giving priority to economic benefits over ecosystem considerations are likely to have more influence on persons in positions of authority than are other people. This can lead persons in positions of authority to pay more attention to mobilizing and managing economic resources than to conserving natural resources.

Jurisdiction is the demarcated area within which roles and responsibilities for decision-making and enforcement of decisions are assigned among government institutions at different levels. A jurisdiction delineates who are the constituents and who will be subject to the decisions and commands made by the persons in positions of authority within that jurisdiction. Jurisdiction is delineated at and for different levels, from the international and national levels, to regional, district and sub-district levels, and finally to the locality and village levels. Levels of jurisdiction are hierarchically structured, and each level of jurisdiction is nested within higher levels of

jurisdiction. For example, a national-level jurisdiction covers multiple areas of regional jurisdiction, and each regional jurisdiction covers multiple jurisdiction areas at the district level.

Although jurisdiction refers to the people who are subject to the pronouncements made by persons in positions of authority, it also refers to the physical territory that demarcates the area of operations within which these people live, and thus people will be subject to a particular hierarchy of jurisdictions based on where they live. Territorial boundaries of jurisdictional areas have been usually determined by historical decisions or happenstance, reflecting various interests and the prioritization of convenience, over ecological considerations. These boundaries have seldom been delineated with regard to units of an ecological landscape, such as watersheds and habitats of keystone species, within which there is some interaction and interdependence in terms of topological, hydrological, biome or even climatic interactions.

There are a disjunction or non-correspondence between political-administrative domains defined by legal jurisdictions and natural biophysical domains determined by ecological features. These discrepancies can make jurisdictionally based decisions on natural resource management ineffective. This situation arises because of the fundamental differences between the political and ecological domain. The political domain is mainly constituted by hierarchical structure (two-dimensional way) and the boundaries of jurisdictions are usually static, delimited by law. Conversely, the ecological domain is more than two-dimensional (spatial dimension combined with time scale i.e., seasonal changes and evolving or diminishing over longer periods) and the boundaries of ecological landscapes are rarely static. Jurisdictional systems do not take into account these differences of dimensions and variabilities, and thus individual jurisdictions cannot take into account the boundaries of ecological landscapes into landscape management. As a result, people who live on natural resources associated with the same origin (e.g., upstream and

downstream areas within a single watershed) can belong to different political jurisdictional areas. And thus people who live in one jurisdictional area are not legally subject to the political decisions that are made in the other jurisdictional areas, even though these decisions have much to do with the use and management of the natural resources coming from the same origin.

Since persons in positions of authority can acquire, exercise and retain authority only with respect to their individual jurisdictions, they often are too focused on issues that are related to the people within their jurisdictions. As a result, these persons in positions of authority can make decisions that undermine the interests of people who live outside jurisdictions. Even when dealing with an issue (e.g., natural resource management) can benefit people outside jurisdictions, persons in positions of authority usually cannot influence the behavior of people who live outside their jurisdiction. This makes it difficult to tackle and resolve issues which require cooperation and coordination among multiple governments that are responsible for different jurisdictional areas, either at the same level (e.g., district) or within different strata of the same area (e.g., a locality within a sub-district).

The nested nature of political jurisdictions is supposed to resolve most if not all of these problems, because logically conflicts of interest between two adjoining districts should be addressed and ironed out at the next higher level of the government (e.g., region, or possibly nation). But this then introduces the dynamics and vagaries of politics, which often influence authoritative decisions at a higher level. In such considerations, the interests of natural resources often go unexpressed, as only people can speak, lobby, agitate, negotiate, or bargain.

In addition, persons in positions of authority are accountable to only their current constituents and not to future generations. By responding to the consumption needs of the current generation, persons in positions of authority can undermine the needs of the future generations

by undercutting the sustainability of natural ecosystems through things like deforestation, soil erosion, disruption of hydrological flows and cycles, and sabotaging biodiversity. As seen above, due to the political and jurisdictional systems, persons in positions of authority can be encouraged to secure economic benefits and sustain the livelihoods of the current constituents. This can be achieved through the exploitation of ecosystem goods and services, and this activity can undermine the ecosystem in the longer-run.

Degrading the ecosystem, its balances and dynamics, can make it unsustainable and will diminish its usefulness to future generations. However, it is difficult for younger and future generations, who have limited or no rights and means of political participation, to influence contemporary political decisions that could secure natural resources for future beneficiaries. The inability of younger and future generations to advocate for themselves in the present is another factor that makes it difficult for persons in positions of authority to properly weigh ecosystem conservation when making political decisions.

Furthermore, a hierarchical and nested jurisdiction system makes it even more difficult to achieve optimal resource allocation that considers conservation of ecosystems. Because ecosystems are different from area to area, the uniqueness of each ecosystem may need to be considered carefully during the processes of decision-making. For example, when considering afforestation to protect one watershed from degradation, suitable species of trees are not always the same between upstream and downstream areas, even if the watershed itself is the same. This can happen due to different conditions of ecosystems, such as the types of soil and the existence of predators. Yet, these differences cannot be considered when planning the program, especially when it is planned by governments with upper-level jurisdiction.

Since governments with upper-level jurisdiction are likely to control a larger amount of financial and human resources than governments at lower levels of jurisdiction, resource support from governments at upper levels may be necessary to implement some projects such as the ones that involve high costs or need special expertise. When the governments at different levels are involved in a single issue, different entities make decisions on the same issue at different stages in the processes, such as planning, implementation, and management. In general, the governments with upper-level jurisdiction make decisions in earlier stages such as planning, while the governments with lower-level jurisdiction make decisions in later stages, such as implementation. Different entities which make decisions at different stages on a single issue may reduce the efficacy of the attempts because the governments with upper-level jurisdiction may make plans with a lack of consideration of localities, such as suitable tree species. In addition, there also can be reasons of reduced efficacy in the governments with lower-level jurisdiction in that they may fail to understand the objectives and intentions of the earlier decisions made by other entities (i.e., governments with upper-level jurisdiction).

As seen above, political systems can make it difficult to achieve optimal resource allocation, if people, especially persons in positions of authority, make decisions and actions mainly based on their short-term self-interest. Opportunities will be lost to manage natural resources in a sustainable manner and this will impose significant costs on future generations when resources are depleted. Conversely, an analysis of past programs conducted by Uphoff and Krishna (2000) shows that people have a propensity for collective action that allows for increasing overall benefits.

Hirschman (1984) called this propensity *social energy*. A propensity for collective action allows both individuals and social groups to cooperate for achieving optimal resource allocation.

According to Hirschman, one of the characteristics of social energy is its renewability. Hence, once social energy becomes active, collective action can occur repeatedly, which may result in establishing an enduring system of a cooperative and sustainable natural resource management.

Uphoff (1996) drew three factors from his experiments to explain people's propensity for collective action. These three factors are ideas, ideals, and friendship. When ideas are connected to people's values, these ideas may influence cognition and behavior that lead people to seek positive-sum outcomes, meaning outcomes that are both in their own and in other's interests. Ideas can even change people's perceptions and understanding of their material interests, and as a result, collective interests can come to outweigh individual self-interest. Ideals are a special category of ideas that encourage people to be concerned with common interests and welfare as a whole. Ideals can enlist people to increase support and cooperation for others. Finally, friendship makes people value and be concerned for the lives of others as well as for their own lives. Friendship can spread and grow among individuals and groups, which enhances collective action on a larger scale. The concept of social energy indicates the existence of opportunities to establish cooperative relationships for better resource allocation.

The significance of such bonds and a sense of mutuality is probably more important with respect to the management of natural resources than in other areas of public policy. This is because natural resource management within one jurisdictional area often has an impact on the availability of natural resources for people who live outside that area and for future generations, and thus who do not have the rights or means to influence political decisions. That is, decisions regarding natural resources have implications for others both in time and space, and decisions that are short-term and self-centered can have long-lasting and widespread adverse effects on others' lives.

3.4. Linkages among the three domains

Within the ecological domain, five ecological elements, topography, water, soil and land, climate, and flora and fauna, are closely linked together. As a result, changes in the status of one element can cause chain of events and eventually change the entire ecosystem. In a mountainous area, ecosystems are particularly vulnerable to changes because these ecosystems are often generated as a result of a specific combination of ecological elements. These consist of specific hydrological circulation, types and fertility of soil, micro-climate, and flora and fauna, which may not be sustained even only one element changes its status. The topography, which mostly determines the characteristics of the mountainous conditions, is static and rarely changes, and its vulnerability is likely to be continuous.

However, economic benefits, which are essential for people's well-being, cannot be obtained without consuming some ecosystem elements. In the HKH region, since population size is increasing, more economic benefits will be needed to sustain the increasing population, which in turn may require the consumption of more and more ecosystem elements. In other words, there are trade-offs between ecological and socio-economic domains. The linkages between ecological and socio-economic elements can be particularly tight in a mountainous area because mountain ecosystems are vulnerable to changes yet mountain-dwelling people often have few choices but to heavily rely on ecosystem elements in order to sustain their livelihoods.

Mountainous ecosystems also generate another unique condition. Harsh conditions at higher elevations derived from difficult terrain, colder climate, and relatively infertile soil, lead to lower population density with less consumption of ecosystem elements. Conversely, more suitable conditions for human settlement in lower elevations lead to higher population density with much more consumption of ecosystem elements. As a result, the intensity of human intervention on ecosystems is uneven throughout the mountainous area. In addition, in the HKH

region, due to the inequities among social groups, patterns of access to natural resources are not the same for people in different social groups, which makes conserving ecosystems more difficult.

Natural resources are generally open to everyone, thus individuals who have access to natural resources may consume as many resources as they want. Without the consideration of the sustainability of resources, individual activities can severely degrade ecosystems. These individuals and other resource users cannot obtain economic resources once natural resources are depleted. Decisions made through the political processes may be able to influence individual activities by shaping collective action which serves some public purpose. In other words, the political domain can play a role in controlling and influencing the linkages between the ecological and socio-economic domains.

Those political decisions are often highly influenced by a limited number of persons who are in roles of authority. Although these decisions are expected to serve public values, what the persons in roles of authority care most about may not be public values but protecting their own self-interest. As a result, even when the public assigns a high value to ecosystems, this value can be undermined by the decisions and actions made by the persons in roles of authority, decisions and actions which aim to assign more value to economic benefits. The values of ecosystems can often be undermined also because jurisdictional systems may encourage those persons to focus on their constituents, even though natural resource management can have significant impacts on the lives of people who are not their constituents.

Consequences that undermine the value of ecosystems in the political domain are more likely to happen when people think and act based on their self-interest. Yet, people do not always focus on their self-interest, but instead, they may prioritize collective interests because of their

inherited propensity for collective action. The impact of having that propensity can be particularly significant on preventing the value of ecosystems from being undermined because this can be partly caused by the failure to incorporate interests of non-constituents into the political actions and decisions. If persons in positions of authority and their constituents both include their interests and the interests of non-constituents (i.e., collective interests), the outcomes led by processes of decision-making can serve the values of future generations (time) and those outside of their jurisdiction (space).

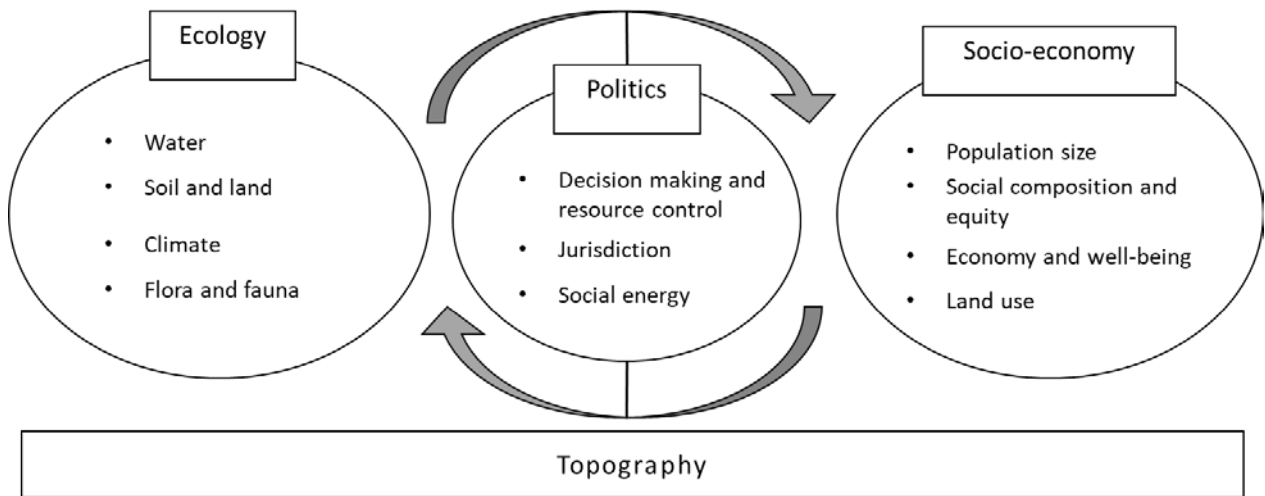


Figure 3.1: Conceptual model of the three domains and linkages among them

4. LANDSCAPE ISSUES IN TRANSBOUNDARY PERSPECTIVE

Boundaries of physical and ecological landscapes do not always correspond with boundaries of jurisdictions because a boundary of a single landscape is not always within one country but can go across national borders. A watershed is one common example of a physical and ecological landscape that sometimes straddles multiple countries. When one country is located in a higher elevation while the adjacent country is located in a lower elevation, water in a river originating in a higher elevation flows to a lower elevation, often going beyond national boundaries.

In this case, landscape conservation and restoration can be more effective when the countries sharing the same landscape work together. This requires these countries to cooperate with each other. However, transboundary cooperation cannot be coordinated without resolving transboundary issues. In other words, transboundary issues may make challenges of landscape conservation and restoration further complex and difficult to be addressed. This chapter analyzes the types of transboundary issues that can be associated with physical and ecological landscapes, and how these transboundary issues can be related to the concept of the ecological, socio-economic and political domains.

4.1. Issues arising from transboundariness

In order to coordinate transboundary cooperation to initiate landscape conservation and restoration across national borders, people who work to coordinate cooperation can face issues that arise from transboundariness. These transboundary issues that are associated with challenges for landscape conservation and restoration are: (1) the absence of institutions that have a right to enforce decisions across national borders, (2) hostile relationships among countries derived from historical, political, and social factors, (3) differences in social, cultural,

and environmental contexts, and (4) the existence of competing policies and political systems among countries.

There are no institutions that deal with the entire HKH region that have a right to enforce decisions for landscape conservation and restoration on individual countries. Some international and regional organizations may be able to promote transboundary cooperation by providing financial and technical assistance. Yet, even if transboundary cooperation is coordinated with support from these international and regional organizations, this cooperation may not be long-lasting because the motivation for regional countries to agree on transboundary cooperation can be merely financial and technical assistance. Hence, transboundary cooperation can be terminated if the countries are no longer provided with the assistance. This indicates that long-lasting transboundary cooperation can be coordinated only when all countries are motivated and willing to initiate landscape conservation and restoration in a cooperative manner.

Relationships among countries can be one determinant of the success or failure of transboundary cooperation. Some countries have hostile relationships derived from historical, political, and social factors. For instance, India, China, and Pakistan have had boundary disputes in the Jammu and Kashmir regions arising from their political relationships and motivations.

Countries may not want to cooperate with each other when national relationships are adversarial. If people who disagree on transboundary cooperation have significant influence on political decisions, their influence can prevent transboundary cooperation from being coordinated. That is, persons in positions of authority, who often participate in discussions among countries to represent national opinions, may disagree on transboundary cooperation in order to avoid dissatisfying their constituents and decreasing their own authority.

Differences in social, cultural and environmental contexts may cause misunderstandings about the contexts, needs, and stakes of other countries, which can lead to conflicts of opinion among countries and a failure to achieve mutual agreement on cooperation. Indeed, in the HKH region, social, cultural, and environmental contexts are diverse, and as a result, human needs in one area can be very different from those in other areas (Chettri & Sharma, 2006). Because of the remoteness and relative inaccessibility of mountain communities, customs, cultures, and religions have evolved in each community uniquely and with little interaction with other mountain communities. This can lead to significant differences among mountain communities in different countries (Schild, 2008; FAO, 2016).

Environmental contexts are also varying among regional countries. Almost the entire area of some countries is mountainous with very high elevations, while a mountainous area is only partial and the elevation is relatively low in other regional countries (Karki, 2012).

In addition, demography and economy are different from country to country. For instance, the population size is huge in China and India and these countries have rapidly improved their economic performance, while the population size is relatively small and economic performance has been relatively low in some other regional countries. These contextual differences may generate very different views, stakes and needs of landscape conservation and restoration, which can make it difficult for regional countries to accept and agree on other countries' opinions.

The existence of competing policies and political systems can be another determinant of the success or failure of transboundary cooperation. In order to coordinate transboundary cooperation, regional countries' existing policies and political systems may have to align with the cooperative approaches. However, there are often gaps in existing policies and political systems in individual countries, which can cause conflicts and impede transboundary

cooperation. It is especially true when some regional countries have to revise their current policies and political systems in order to resolve conflicts and coordinate cooperation. For example, if countries have their own regulations to conserve landscapes but the restrictiveness of regulations is different, these countries may need to have the same criteria of restrictiveness in order to conserve landscapes in a cooperative manner. Otherwise, a country that has more restrictive regulations cannot agree on cooperation due to unfair efforts by other countries for landscape conservation.

If these countries set the common criteria as less restrictive, landscapes can be more severely and rapidly degraded in the country that has more restrictive regulations. Yet, setting the common criteria as more restrictive is likely to be difficult for the country that has less restrictive regulations. This is because many stakeholders in a country may disagree with making regulations for landscape conservation more restrictive in order to avoid reducing the current benefits obtained by exploiting natural resources. Hence, persons in positions of authority can be discouraged from cooperating with other regional countries in order to avoid a risk of decreasing their own authority.

An example of mismatched political systems is jurisdiction. If transboundary cooperation involves some regulations, such as regulating access to landscapes, this cooperation has to involve the governments from regional countries. When regional countries have different jurisdictional systems, such as differences in the size of the area of governance or the level of authority assigned from governments at upper levels to the ones at lower levels, there may be no same-level entities across countries that are suitable to coordinate cooperation for landscape conservation and restoration. For instance, Nepal has a jurisdiction at the district level but does not have a jurisdiction at the state level, while India has jurisdictions at both the state and

district levels. If coordinating cooperation at the state level is more suitable than other jurisdictional levels because of the delineated area of a landscape, Nepal does not have an entity that is suitable to take initiatives for transboundary cooperation.

Although the governments at the national level or district level may be able to take initiatives for transboundary cooperation, there are drawbacks in the absence of a suitable entity. The government at the national level may govern too large an area to focus on the conservation and restoration of small landscapes. Government officials generally have many projects throughout the country, so they may not be able to pay enough attention to transboundary cooperation within a limited area. Yet, the governments at the district level may govern too small an area to cover the entire landscape. In this case, discussion of transboundary coordination cannot be initiated without first coordinating multiple districts within a country, which makes coordinating transboundary cooperation more challenging.

4.2. Relationships between transboundary decision-making and the ecological, socio-economic and political domains

Coordinating transboundary cooperation, especially cooperation involving regulations, is generally the responsibility of persons in positions of authority. They are required to represent the opinions of their country and find acceptable agreements that can bring benefits to their country. Hence, transboundary issues associated with ecological landscapes can be regarded as belonging to the political domain. This implies that transboundary decision-making is constituted by two distinct and interrelated processes of decision-making. These two processes are decision-making within a country and decision-making among countries.

Broadly speaking, decision-making within a country determines to what extent economic benefits can be sacrificed to maintain and increase ecological benefits, and decision-making

among countries determines whether or not cooperating with other countries can be acceptable when considering various additional costs associated with transboundary issues. In order for transboundary cooperation to be coordinated, persons in positions of authority in one country may need support from their constituents to give importance to landscape conservation and restoration, and to agree on transboundary cooperation.

As seen in the previous chapter, landscape conservation and restoration cannot be easily initiated because preserving ecosystem elements involves some sacrifice of economic benefits. Persons in positions of authority can be discouraged from giving priority to ecological benefits over economic benefits since economic benefits often contribute to those persons increasing their own authority. In addition, the analysis of transboundary issues indicates that persons in positions of authority can be discouraged from coordinating transboundary cooperation. This is because transboundary issues may cause their constituents to disagree with the cooperation, which can lead to a loss of their political authority. These reasons can explain why transboundary cooperation for landscape conservation and restoration is rarely coordinated in spite of its potentially significant benefits for ecosystems and the entire society.

The transboundary issues mentioned in the previous section do not always impede transboundary cooperation. For instance, even if countries have had border disputes, the persons in positions of authority can recognize that the landscape conservation and border disputes are separate issues, and therefore their actions and decisions on the landscape conservation are not influenced by these border disputes. However, transboundary issues do not promote transboundary cooperation but often impede transboundary cooperation, sometimes significantly.

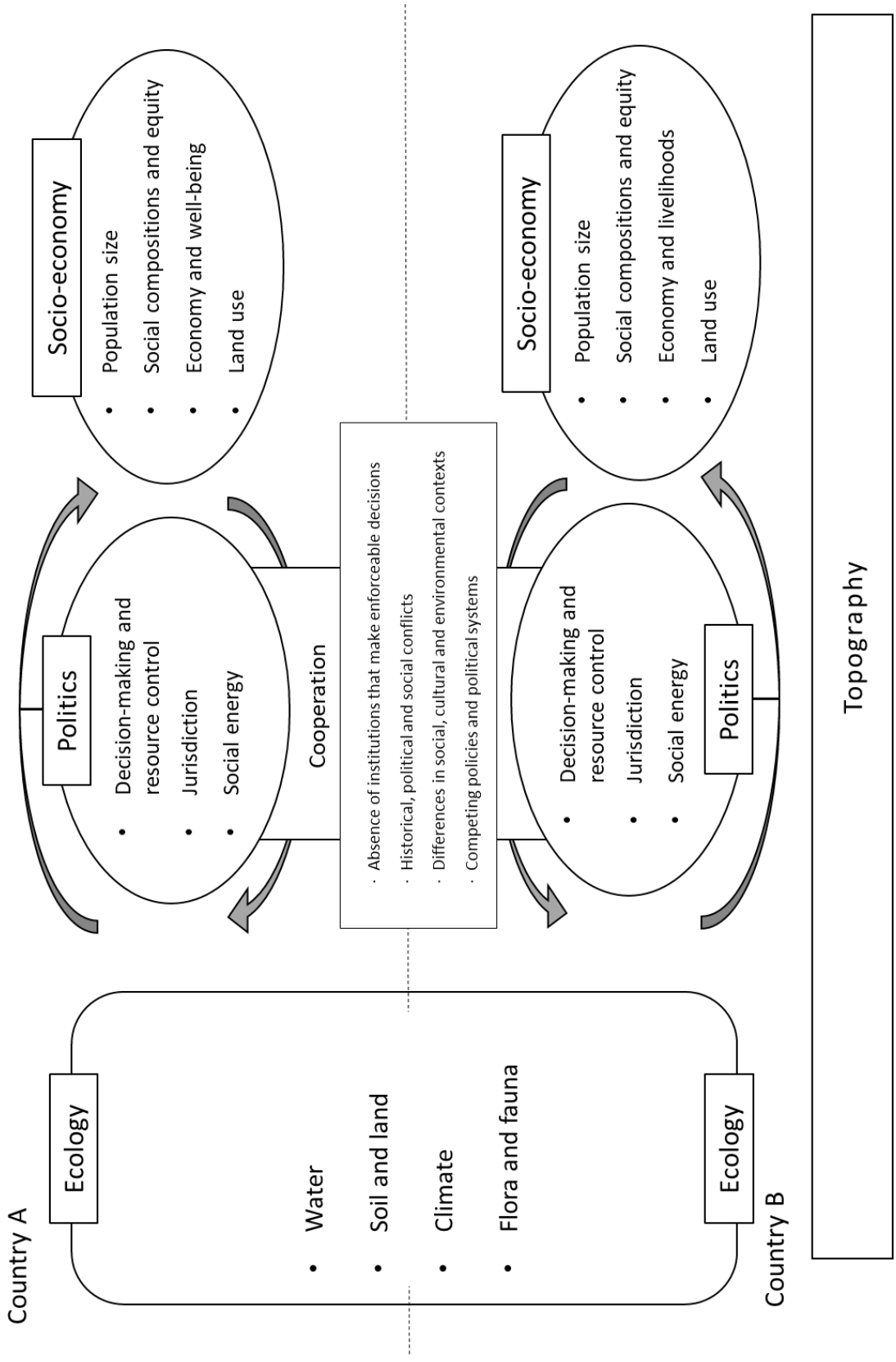


Figure 4.1: Conceptual model of the three domains and transboundary issues

5. CASE STUDY: PAST ATTEMPTS AT ESTABLISHING TRANSBOUNDARY INITIATIVES FROM THE PERSPECTIVES OF THE THREE DOMAINS AND SELECTED TRANSBOUNDARY ISSUES

There are a number of transboundary landscapes in the HKH region. For example, ICIMOD has identified six landscapes and seven river basins that exist at the transboundary level. These landscapes can be managed more effectively by using landscape-wide cooperation to address issues of conservation. The Koshi River Basin is the transboundary river basin that extends across three countries: China, Nepal, and India.

ICIMOD has attempted to coordinate transboundary cooperation for enhancing effective water resource management. In spite of those efforts, the three countries have not agreed on transboundary river basin management. This chapter analyzes the contexts of the Koshi River Basin and past attempts for transboundary initiatives from the perspectives of the ecological, socio-economic, and political domains, and analyzes selected issues arising from transboundariness. By doing so, this study attempts to draw insights regarding the contexts of the river basin and find possible causes of unsuccessful past efforts for transboundary initiatives.

5.1. Description of the Koshi River Basin and past attempts at creating transboundary initiatives

- Description of the Koshi River Basin and the Koshi Basin Programme

The Koshi River Basin is the area within which the Koshi River and its tributaries extend. The river basin consists of seven major sub-basins and covers nearly 87,000 km². The water resources originating in the Tibetan Plateau in China move down to the lowlands and floodplains in Bihar State in India while passing through high Himalayan peaks and mid-hills in Nepal. Maps of the location and topography of the river basin are shown in Figures 5.1 and 5.2.

The attempt to coordinate transboundary initiatives, the Koshi Basin Programme (KBP), was launched in 2012 by ICIMOD. This program aims to manage water resources in the Koshi

Basin in a regionally-coordinated manner. It ensures the well-being of the people who live there while not undermining the sustainability of the ecosystem (ICIMOD, 2012). Based on this vision, ICIMOD and regional countries agreed upon several expected outcomes that include improvements in basin-wide cooperation to implement sustainable management of freshwater ecosystems.

The KBP has made progress toward several outcomes. For example, the program installed a communication system between upstream and downstream communities in order to reduce the risk of floods and avoid massive water-related damage in downstream communities. This approach made a remarkable impact in 2017 when downstream communities received information about floods from upstream communities before the floods came. As a result, the downstream communities were able to prepare and evacuate to deal with these floods. However, the KBP has made little progress in improving basin-wide cooperation for sustainable management of ecosystem resources. Hence, there can be some factors that have prevented transboundary cooperation for the river basin conservation from being coordinated but have had little influence on other initiatives within the KBP.

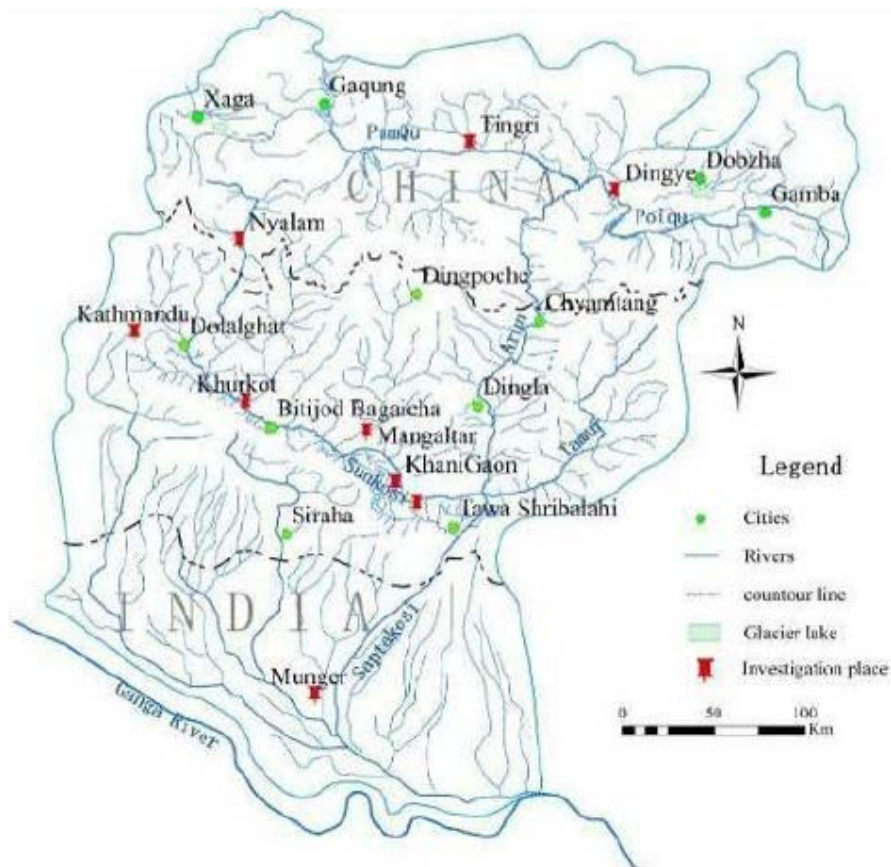
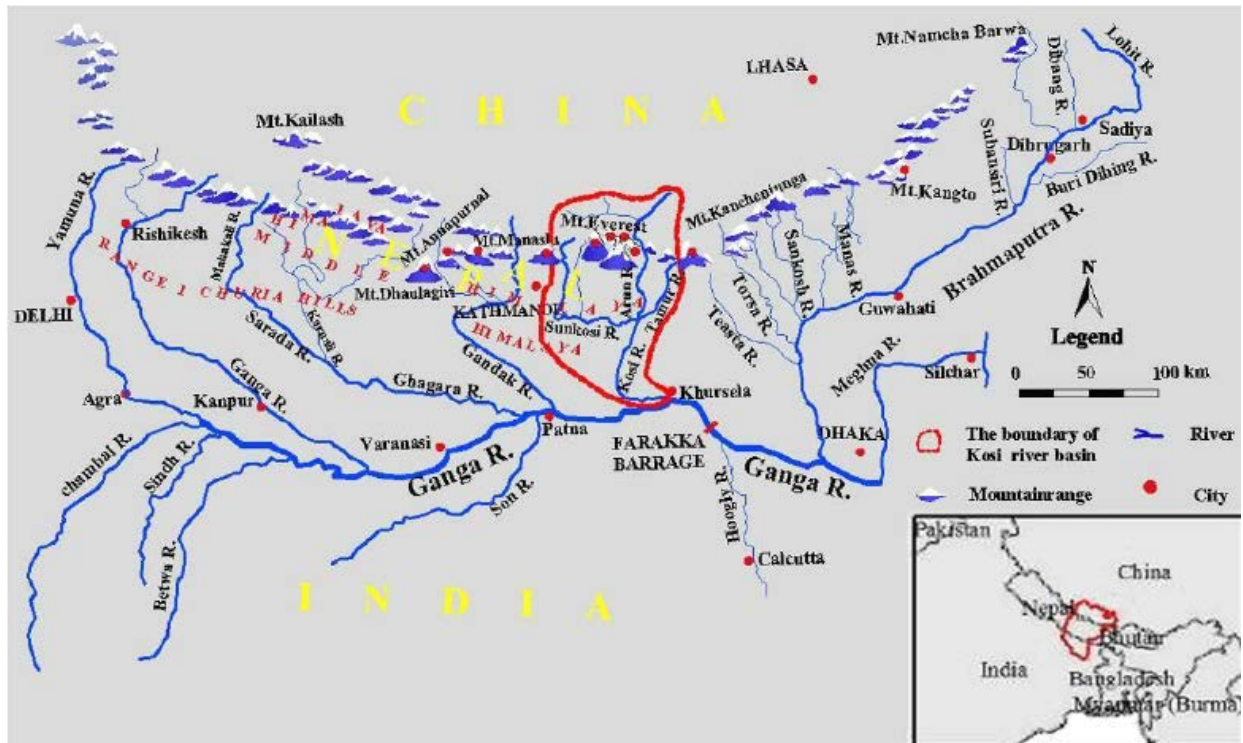


Figure 5.1 & Figure 5.2: The geographic location (Figure 5.1) and the topography (Figure 5.2) of the Koshi basin area. Reprinted from 'On the water hazards in the trans-boundary Koshi River Basin,' by N. Chen et al., March 29 2018, retrieved from https://www.researchgate.net/publication/258806557_On_the_water_hazards_in_the_trans-boundary_Kosi_River_basin, Copyright 2013 by Chen, N. et al.

- The ecological, socio-economic and political domains

This subsection discusses the characteristics of the Koshi River Basin and challenges to river basin conservation by analyzing the river basin from the perspectives of the ecological, socio-economic and political domains. Factors in the ecological domain indicate the vulnerability of the river basin to external forces and the necessity to conserve the river basin to sustain the entire ecosystem. Factors in the socio-economic and political domains indicate that the potential of economic benefits obtained from natural resources in the river basin may have been obstacles to prioritizing river basin conservation.

The following ecological analysis consists of five components: topography, water, climate, soil and land, and flora and fauna, which together allow us to understand the vulnerability of the ecosystem. In order to explain the vulnerability of the ecosystem, the harsh and unique environment in the basin area and interactions and interdependence among ecological components are described.

The basin area is only about 88,000 km² (smaller than the size of the state of New York in the U.S.) yet it is comprised of rugged and varied topography including high Himalayan peaks (8,800m at a maximum) and floodplains (21m at a minimum) (Bhatta et al., 2016). From the south to the north, the altitude tends to become higher till Mt. Everest, the world's highest peak, and then the altitude tends to become lower toward the northern Tibetan Plateau.

In the high peaks, the huge amount of snow and glaciers are accumulated, which plays a role in continuously replenishing water to the Koshi River and its tributaries. The basins water

resources include both snowmelt in high peaks and rainfall throughout the basin area. The river water flows swiftly along with the steep slopes, propelled by the force of gravity, from the Tibetan Plateau in China to the Ganga Plain in India while passing through a series of hills in Nepal.

The rugged and varied topography also generates the basin area's diverse climate. This climate is graduated along with changes of the altitudes and can be categorized into a cold climate in high peaks, a subtropical and temperate climate in mid-hills, and a humid and tropical climate in lowland areas (Wahid et al., 2017).

Seasonal patterns of precipitation in the basin area are highly variable due to the influence of airflows, particularly monsoons, which are generated by the series of high peaks (National Research Council, 2012). The southern part of the basin area has a large amount of precipitation, yet nearly 80% of the precipitation occurs during a monsoon season that is only a few months long. This large amount of precipitation recharges groundwater that sustains various ecosystem elements, such as soils, plants and animals, by providing a sufficient amount of water during a dry season. The northern part of the basin area lies in a rain shadow and receives only a small amount of precipitation throughout the year.

Land use patterns in the basin area are aligned with the changes in altitude. The higher altitudes are dominated by untouched lands, such as grasslands, shrubs, and forests, while the lower altitudes are dominated by developed areas, particularly by farmland (Bhatta et al., 2016). The fertility of the soil is important for both natural land and farmland, yet according to the study conducted by Uddin et al. (2016), nearly 40 million tonnes of soil had been lost between 1990 and 2010, mainly caused by monsoon flooding and wind erosion.

Highly diverse and unique plant and animal species live in diverse micro-habitats in the basin area. These micro-habitats are produced by the variances in topography, unique hydrological systems and land cover, and variation of climate. Because these habitats are formed by a specific combination of ecological elements, many habitats can be vulnerable to external forces. Because of this, there are a number of designated protected areas in the basin area, such as global Biodiversity Hotspots, national parks, conservation areas and wildlife reserve areas (Bhatta et al., 2016).

Socio-economic analysis consists of four factors: population size, social composition and equity, economy and well-being, and land use. These factors can explain why ecosystems in the river basin are not easily protected.

Over 11.5 million people are living in the Koshi River Basin and nearly half of them are Nepalese. The high proportion of Nepalese is mainly due to the fact that the half of the basin area belongs to Nepal, yet the patterns of population density are not even throughout the basin area. Population density tends to be very high at lower altitudes and low at higher altitudes (except for Kathmandu in Nepal) (Wahid et al., 2017). As a result, levels of development pressure are also not even throughout the basin area, and ecosystem elements at lower altitudes tend to be continuously under threat of overexploitation.

The pace of population growth is different from area to area, yet population size is increasing throughout the basin area. The population growth rate is especially high in the areas where population density is already high, such as Bihar State in India (nearly 2.5% increase per year) and Kathmandu in Nepal (nearly 4% increase per year). Therefore, people are likely to demand more natural resources in the future throughout the basin area and especially in the areas with high population density.

In the Koshi River Basin, gender issues are closely related to the effectiveness of water resource management. Traditionally, managing water for household use is primarily women's role (ICIMOD, 2017). However, women rarely take leadership in local-level institutions, which has led to underrepresenting women's views and opinions on water resource management at the local level. The importance of women's views and opinions has been gradually recognized by local people, and as a result, the Water Use Master Plan (WUMP) was enacted in Nepal in order for women to participate in the planning processes in a public sphere. However, although WUMP has improved the proportion of women in local committees for resource management, key positions for decision-making, such as the chair of the local committees, have been still dominated by men (ICIMOD, 2017).

Another issue of social composition in the basin area is the inequities among different social classes and groups. For example, in Nepal, social groups living in the lowlands tend to be less dominant than social groups living in hill and mountain areas, which has led to depriving less dominant groups of access to clear water (ICIMOD, 2017). Similarly, lower caste people are less likely to have access to clear water than higher caste people (ICIMOD, 2017). These social inequities can make challenges to water resource management even more complex.

The economic performances of the communities in the basin area tend to be lower than the corresponding part of the national average. For example, the estimated average percentage of the population living below the poverty line is 40% in the basin area in Nepal, while that of the national average is 30% (Wahid et al., 2017). The highest poverty rate in the Nepalese district in the basin area is 60%, which is nearly double the national average. Similarly, in India, Bihar State had a poverty rate of over 40% while that of the national average is nearly 30% (Wahid et al., 2017).

One possible reason for the higher poverty rates in the basin area is the difference in the main source of income for local people, and in fact, the basin area particularly relies on its income on agriculture. For instance, in Nepal, more than 80% of the population is engaging in agriculture and the half of the total population relies on agriculture as the primary source of livelihoods (Wahid et al., 2017). Moreover, the majority of people (nearly 80%) in the state of Bihar is also engaging in agriculture (Rasul & Sharma, 2014). Therefore, a sufficient amount of water resources taken from the rivers are likely to be a continuously essential source of livelihoods for the majority of local people.

The pattern of land use in the basin area is closely aligned with the changes in altitudes and population density. Most of the land cover at lower elevations has been transformed by people, especially for agricultural use (Bhatta et al., 2016). In addition, the proportion of land use has changed because more land has been modified for humans use over the years. Over the past 30 years, farmland area has increased by 1% and forest area has slightly decreased (Bhatta et al., 2016). In particular, farmland has gradually extended from south to north with the increase in altitude, which indicates that farmland has expanded to the marginal area (Paudel et al., 2016). Although the forest area has increased in some Nepalese areas due to successful forest management by communities, the pace of the increasing farmland has outweighed that of increasing the forest area, which has resulted in decreasing the total forest area. Those changes in land use imply that more and more land has degraded. In fact, the risk of soil erosion had worsened during 1990-2010 (Uddin et al., 2016). Although the cause of soil erosion is not always changes in land use, high potential levels of erosion are concentrated in the area with intense agriculture, which indicates that the changes in land use have contributed to land degradation.

The following political analysis consists of two components: factors that can affect decision-making in the political field, and jurisdictions and their boundaries that cross in the river system. These components suggest how political systems may decrease the effectiveness of landscape conservation.

Political conditions have been unstable in both India and Nepal. Politics in Bihar State are described in a report as a lack of norms, frequent political interferences, and a non-meritocratic bureaucracy (World Bank, 2005). These conditions can be partly caused by the system of political reservation for disadvantaged minority groups (Rasul & Sharma, 2014). This system allows some politicians from less dominant groups to be elected not because their abilities in politics but simply because they belong to those minority groups. World Bank's report also characterizes the politics in Bihar as personalized because of the politicians' attitude of resistant to the delegation. As a result, decision-making in the political sphere has not been well institutionalized, and it favors individual politicians' decisions.

In Nepal, although the recent transition from hereditary monarchy to democracy has introduced the election system, a transition which has often been perceived positively, it has encouraged politicians to gain support by facilitating patronage appointments and nepotism (McCourt, 2001). These customs may have promoted corruption throughout Nepal. In fact, Nepal is famous for its corruption and ranked 122 out of 180 countries on the corruption perceptions index in 2017 (Transparency International, 2018). These political conditions in the basin area may have encouraged persons in positions of authority to focus on their self-interest and prioritize generating economic benefits over ecological benefits in order to retain and increase their own authority. These activities can, however, significantly undermine the value of natural resources and degrade the ecosystems in the river basin.

Due to delineated jurisdictional boundaries across the Koshi River and its tributaries, one physically and biologically inseparable ecological system (i.e., the river basin) is assigned to separate jurisdictions. Assigning one landscape to separate jurisdictions may have allowed people, particularly persons in positions of authority, to neglect the negative impacts of changes in ecological landscapes and ecosystem degradation on other jurisdictional areas. For example, farmers in the upstream areas may take water from the river for irrigation without considering the impact of consuming too much water on the lives of people in the downstream areas. Even within Nepal, the Koshi River Basin covers seventeen districts and creates upstream-downstream relationships among these districts, which may encourage individual districts to focus their management of water within their districts rather than within the basin-wide area. Upstream districts may have fewer worries on water shortage and may be less interested in applying basin-wide water resource management, even if downstream districts are suffering from water scarcity.

- Transboundary issues

Multiple transboundary issues may have prevented transboundary cooperation from being coordinated. In order to understand how these transboundary issues may have affected past transboundary initiatives, this section analyzes four selected transboundary issues. These four issues are: complex and sensitive national relationships, contextual differences, differences in jurisdictional systems, and the existing water management policies and strategies in individual countries.

National relationships among China, Nepal and India can be described as complex and sensitive. China and India have had border disputes in several areas, such as the states of Arunachal Pradesh and Kashmir. As a result, persons in positions of authority in China and

India may have difficulty in establishing a cooperative relationship. It is especially true as transboundary cooperation needs to involve some compromises, such as reducing the current consumption of water. If some constituents disagree with making compromises because of the hostile national relationship, the persons in positions of authority may not want to coordinate cooperation so as not to dissatisfy their constituents. As such, national relationships can influence the success or failures of transboundary cooperation.

In terms of water resource management in the rivers that cross Nepal and India, including the Koshi River, their national relationship is also likely to be sensitive due to the historical disputes regarding the use of water resources (Upreti, 2006). Nepal, located in the upstream, has had a relatively plentiful supplied water that support and cover its relatively smaller size of the population and territory. Conversely, India, located in the downstream, has had scarce availability of water resources for its huge size of land and population. To secure sufficient water for local people, and also to utilize water to generate electricity, India has implemented several water-related projects, of which some facilities, such as dams and reservoirs, have been constructed alongside the border with Nepal.

Hence, in principle, India should have consulted with Nepal about those water projects because providing facilities close to the national border may have some influence on beyond the boundary. However, India had implemented projects without providing enough information to Nepal, which has resulted in flooding some Nepalese territory (Upreti, 2006). In addition, although Nepal had leased its territory to India for project implementation, Nepal has not received sufficient compensation for that territory, which has evoked complaints among Nepalese (Upreti, 2006). Despite these water-related conflicts over the years, Nepal has not

been able to resolve those conflicts successfully partly because of Nepal's weaker bargaining power relative to India.

In the Koshi basin area, social, cultural and environmental contexts are diverse and different from country to country. For example, population density is very high in India but it is relatively low in the Tibetan Region (Wahid et al., 2017). Nepal's population density is inversely proportionated to its altitude (except for Kathmandu).

Diversity of environmental contexts among the three countries are largely related to patterns of altitude and population density. In the Koshi basin area, India is located in the lowland area where water and other natural resources are relatively scarce, while the Tibetan Region is located in the high altitudes where the conditions are harsh, meaning a cold, semi-dry climate and relatively scarce vegetation cover due to a short growing season (ICIMOD, 2017; Tashi et al., 2002). In Nepal, an environmental context is diverse, from very high altitudes including some peaks that are over 8,000m, to lower elevations such as below 2,000m, and there are different climates and unevenly distributed natural resources (Bhatta et al., 2016).

In terms of economic performance, there are no significant differences throughout the basin area and the performance is relatively low, with a high poverty rate. However, there are huge differences in economic performance at the national level. India and China have rapidly improved their economic performance over the past decades, while Nepal has still experienced low economic performance (Karki, 2012). These contextual differences generate diverse needs, stakes and concerns in each country, which may make transboundary cooperation complex by requiring it to take into account these differences.

Jurisdictional systems in the three countries may make transboundary initiatives even more complex. The Tibetan plateau, the part of the Koshi River Basin, is the autonomous region

and thus its jurisdictional system is different from other countries. Since this jurisdiction is autonomous, the Tibetan region is independent from the country to some extent. Hence, in order to coordinate transboundary cooperation, China and the Tibetan region need first to determine which entity will take initiatives for transboundary cooperation and how China will be involved in these initiatives before discussing transboundary cooperation with Nepal and India. This requires more time and efforts to coordinate transboundary cooperation. Indeed, there have been few participants in the KBP activities from public entities in both China and the Tibetan region, which implies unclear roles in transboundary cooperation between them (e.g., ICIMOD, 2012).

In addition, the jurisdictional systems in India and Nepal are not the same. India has a state-level jurisdiction that is below the union (central) government, and the state governments are entitled to enact and enforce state laws separately from their union counterpart. Nepal does not have state-level jurisdiction but has district-level jurisdiction governed by the District Administration Office (DAO), which is expected to play a role in representing the central government, such as maintaining law and order. Individual districts in Nepal are too small to represent the Koshi River Basin area because the basin area covers seventeen districts. In addition, there are likely to be a huge difference in the mandate and the amount of controllable resources between the state-level government and district-level government. Since individual countries first have to decide which entities are responsible for transboundary initiatives, the absence of the same-level jurisdiction because of different jurisdictional systems can be an obstacle for transboundary cooperation.

Nepal and India have their own policies and strategies for water resource management in the Koshi River Basin, which may compete with each other. On the one hand, Nepal created the Koshi River Basin Management Strategic Plan, a ten year plan (2011-2021) prepared by the

government of Nepal that aims to improve the well-being of people in the Koshi River Basin by “optimizing the use of water and related resources” (Government of Nepal, 2010). On the other hand, India created the Ganga River Basin Management Plan-2015, a plan prepared by a consortium of seven institutes that aims to preserve and invigorate the river Ganga, including the Koshi basin area, by managing the resources from a basin-wide perspective (Consortium of Seven Indian Institute of Technology, 2015). Although both plans highlight the importance of managing resources from the basin-wide perspective, these plans seem not to consider cooperation with the other countries in the basin area. Transboundary cooperation for water resource management may require countries to review and revise these existing policies. However, in order to review and revise the current policies, individual countries may need to negotiate and consult with many and different stakeholders, which can discourage the countries from cooperating because these processes will take a lot of time, money and efforts.

5.2. Summary of the analysis from the perspectives of the three domains and transboundary issues

The above analysis highlights the importance of conserving the river basin at the basin-wide level in a transboundary manner, and the difficulties of coordinating transboundary cooperation.

From the ecological perspective, both systems of hydrological circulation and the entire ecosystem are unique and valuable yet vulnerable. The functions and roles of the hydrological system indicate that the ecosystems in the Koshi basin area are unlikely to be sustained without this hydrological system. Since this hydrological system is physically and ecologically inseparable even if it goes across the three countries, river basin conservation cannot be effective without taking basin-wide approaches.

From the socio-economic perspective, consuming a certain amount of ecosystem elements is essential to sustain the livelihoods of people living in the basin area. Hence, strict restrictions on the consumption of natural resources can harm the lives of these people, especially those who are surviving on low incomes and who are heavily dependent on natural resources for their livelihoods. In the current phase of population increase, the consumption of natural resources is likely to increase more and more. Furthermore, the complexity of the socio-economic contexts, such as the uneven patterns of land use and the social inequity tied to differences in the access to natural resources, make conserving the river basin and the ecosystems even more difficult.

From the viewpoint of the political domain, the current political conditions and systems in the basin area may have been obstacles against initiating and promoting river basin and ecosystem conservation. A system that prioritizes economic benefits over ecological benefits can be attractive for persons in positions of authority, because the political domain does not function to balance the trade-offs between economic and ecological benefits. Those persons in positions of authority may promote the overexploitation of ecosystem elements in order to serve the interests of constituents and especially those who politically and financially support them. In addition, jurisdictional systems that assign one river basin to separate jurisdictions can lead to jurisdictionally-based decisions on water resource management, which are likely to be ineffective compared to basin-wide approaches.

Yet, Nepal and India have created national water management plans for the Koshi River Basin, which indicates that the basin countries, at least Nepal and India, may want to balance ecological and economic benefits. Hence, transboundary issues can have prevented successful basin-wide cooperation. Because there are no institutions that can enforce rules or regulations

for river basin conservation on regional countries, individual countries may need to be motivated and show willingness to cooperate with other basin countries. In order to promote this motivation and willingness in countries, people's propensity for caring about collective interests may need to be promoted.

6. DISCUSSION: HOW POSSIBLY TO COORDINATE COOPERATIVE INITIATIVES THAT TRANSCEND TRANSBOUNDARY ISSUES?

The analysis of the cause of the Koshi River Basin highlights the underlying linkages within and among the ecological, socio-economic, and political domains, together with transboundary issues. The result of this analysis allows us to explain the necessity and difficulty in coordinating transboundary initiatives. In this chapter, this paper discusses implications drawn from the case study and how these implications can be useful to inform strategies to promote transboundary cooperation.

6.1. Implications of the case study from the perspectives of the three domains and transboundariness

This section discusses five findings drawn from the case in the Koshi River Basin. These five findings are: (1) resource management can be significantly ineffective when one ecological landscape crosses national boundaries, (2) China, Nepal, and India may have very different attitudes towards transboundary initiatives, (3) past attempts for transboundary cooperation have reached out to only a few persons in positions of authority, (4) main resource users have rarely been involved in these attempts, and (5) transboundary communication at the community-level has been rarely focused on by ICIMOD and those three countries.

First, while there are strategies and plans for water resource management at the national level, which cover multiple jurisdictions within a country, there have been no agreed strategies or plans for water resource management at the transboundary level. This indicates that there is a significant difference in the difficulty in coordinating cooperative relationships for water management between the national level and super-national level. Indeed, both water resource management plans in Nepal and India have few mentions about the other basin countries, which indicates that each country is likely to have had few discussions with their neighboring countries

when they created the plans. Basin countries can possibly cooperate with each other without any written documents, especially when people in different countries have bonds and a sense of mutuality with each other. However, there seem to be few interactions across nations in order to cooperatively manage water resources, hence there is likely to have been no formal or informal systems for transboundary water resource management. As a result, the effectiveness of water resource management can be seriously undermined.

Second, the three countries may have different attitudes towards transboundary initiatives, which can cause complexities in negotiations for these initiatives. For example, in the inception workshop for the KBP, Nepalese participants were from various backgrounds, such as the governments, non-profit organizations, and academia, but all Chinese participants were only from academia. One Indian participant was from the government, but his division was not natural resource management or ecosystem conservation but disaster management. The diversity of participants from a single country implies its level of interest in transboundary cooperation. In other words, transboundary initiatives may draw much attention from Nepal in various fields while these initiatives may not be able to draw attention from China. Transboundary initiatives may draw some attention from India, but this attention can be only in a field of disaster management. ICIMOD has held several workshops and other relevant events for the KBP at both super-national and national level, yet the three countries have not changed their attitudes towards transboundary initiatives.

Furthermore, the studies on the Koshi River Basin conducted as the part of KBP include sufficient information about Nepal and India yet little information about China, which also implies the differences in the degree of involvement in the initiatives. When the countries have

very different attitudes on transboundary initiatives, these countries may not be able to reach agreements on transboundary cooperation.

Third, past attempts for transboundary initiatives may not have been able to effectively reach out to persons in positions of authority, who could have significant influence on decisions for forming collective action in the public sphere. The KBP has held several workshops and other events to enhance basin-wide cooperation and develop transboundary approaches for water resource management. However, the majority of national participants, especially Chinese and Indian participants, are from academia and they may not have influence on political decisions. As an institute that focuses on research, ICIMOD might have intentionally tried to not to be heavily involved in political interactions. Yet, without directly or indirectly influencing persons in positions of authority, transboundary initiatives may not be institutionalized, which can undermine the stability and effectiveness of such initiatives. Hence, the attempts for transboundary cooperation should have direct or indirect channels to persons in positions of authority.

Fourth, so far, past attempts for transboundary initiatives have created few opportunities for resource users to interact across nations. Instead, past attempts have focused on establishing relationships across nations among people who may have expertise and knowledge on water resource management (e.g., scholars) yet who do not always use the resources that they are discussing. Of course, establishing relationships among experts across nations can be effective in identifying efficient methods of resource management. However, even if those methods are scientifically valid, these methods cannot be effective without being accepted by the resource users. This is especially true when those new methods involve reducing inputs, which may cause concerns of decreasing their current benefits among resource users. Yet, if resource users

in different countries have interacted with each other and built bonds and a sense of mutuality between them, they may be willing to reduce the consumption of resources in order to meet the collective interests.

In addition, since people's propensity for collective action (i.e., social energy) is renewable, the effect of social energy can expand and involve many people once it is generated. This effect can even reach out to the persons in positions of authority, who may be willing to institutionalize those cooperative actions. Therefore, involving resource users in initiatives can be effective not only for increasing the acceptability of resource management but also for incorporating initiatives into political systems.

Finally, past attempts for transboundary initiatives have mainly focused on creating connections among people at the national level, such as the persons from national governments, organizations, and academia. Yet, those attempts have created few connections among people at the community level. If promoting ideas, ideals, and friendship can be a key to encourage motivation and willingness for transboundary cooperation, as discussed in the previous chapter, connections at the lower jurisdictional level, especially at the community level, can be important. This is because while water management for one river basin is often separated from personal lives of people who are working at the national level, these two factors are often closely tied issues for people working and living in communities.

The impacts of cultivating ideas, ideals, and friendship can be greater when these three factors are connected to the personal lives of people in these communities. Hence, enhancing transboundary communication at the community level can effectively promote social energy, which may lead to transboundary cooperation. Initiatives at the national level are often thought to be more effective in terms of scale compared to initiatives at the lower level. However,

launching initiatives at the lower level jurisdictions does not always have an impact on the limited area. Once social energy is successfully generated, it can expand and have impacts on a large scale. For example, in the Gal Oya irrigation in Sri Lanka, as a result of establishing a system of farmer organizations that successfully support mutually beneficial collective action, the number of participating farmers increased from 12,500 to 250,000 in three years (Uphoff & Wijayarathna, 2000). Therefore, even when considering the scale, initiatives at the community level can be effective by growing and expanding social energy.

6.2. Possible key factors to promote transboundary cooperation

The implications discussed in the previous section indicate possible key factors to increase the probability of coordinating transboundary cooperation. These possible key factors would be: (1) involving main resource users from different countries in initiatives and enhancing their interactions, (2) launching transboundary initiatives at the community level, and (3) ensuring that transboundary initiatives can directly and/or indirectly influence persons in positions of authority.

First, in the HKH region, there are no super-national level institutions that have the right to enforce decisions across national borders. In this situation, a key to promote transboundary cooperation can be developing the propensity of resource users for collective action, which can lead them to care about the interests of resource users in other countries. If resource users value and are concerned for the lives of others, they may voluntarily change their patterns of consuming water and other natural resources. Furthermore, if constituents are willing to give up part of their current benefits because they care about the interests of non-constituents, the persons in positions of authority will encounter fewer obstacles to coordinate transboundary

cooperation. On the contrary, those persons in positions of authority may be willing to support non-constituents' interests.

In fact, there are cases of persons in positions of authority supporting their constituents' actions for benefiting non-constituents. For example, in the Gal Oya irrigation area, local politicians played an active role in supporting upstream farmers' voluntary actions to share and allocate scarce water resources to downstream farmers (Uphoff & Wijayaratna, 2000). These actions were oriented by farmers who shared ideas and values with other farmers. This case can support the impact of the resource users' propensity for collective action on natural resource management. Cultivating shared ideas and ideals, and building friendship, may promote the collective action of resource users. These three factors cannot be fully cultivated without face-to-face communication. Therefore, enhancing interactions of main resource users in different countries can be a key for transboundary cooperation.

Second, initiatives launched at the community level can be more effective in fostering ideas, ideals, and friendship than initiatives at the national levels. As discussed in the previous section, cultivating those three factors can be more effective when initiatives are closely connected to personal lives. However, when people working at national levels interact to coordinate transboundary cooperation for water management, they may separate transboundary cooperation and their personal lives, especially when they do not use these water resources. In this case, ideas, ideals, and friendship may be poorly cultivated. Conversely, when initiatives are launched at the community level, these initiatives are generally directly connected to the lives of the community. Ideas, ideals, and friendship can be enhanced by envisioning the impact of effective water resource management on personal lives. This can be especially true when people see other people living in difficult situations.

In addition, persons in positions of authority may encounter fewer political obstacles to coordinate transboundary cooperation in the community-level initiatives, as compared to the national-level initiatives. This is because the differences in the attitudes towards transboundary initiatives among the three countries can be derived from national-level political conflicts. Examples of national-level political conflicts are the sensitive relationship between the Chinese government and the Tibetan Autonomous Region, and competing water management strategies between India and Nepal. These conflicts may not impede transboundary initiatives at the community level as much. Furthermore, when social energy is successfully generated as a result of initiatives, this impact has the potential to expand and scale up to the upper level.

Third, another key factor may be ensuring that transboundary initiatives have direct and/or indirect channels to persons in positions of authority. This aims to institutionalize transboundary initiatives and establish stable and enduring mechanisms that balance trade-offs between the ecological and socio-economic domains at the basin-wide level. Otherwise, even when transboundary cooperation is initially coordinated, this cooperative relationship may not be long-lasting without mechanisms to maintain and develop that relationship. And since persons in positions of authority often have significant influence on creating those mechanisms, transboundary initiatives should be able to influence them.

There are various channels that potentially reach out to the persons in positions of authority. In addition to direct influence by involving those persons in initiatives, working with community members who have connections to and influence on those persons may allow an increase in the probability of institutionalizing transboundary initiatives. The influence of those community members may be derived from their role in increasing, retaining or decreasing

authority. Hence, in order to identify proper community members, it is important to understand the flows of authority in that community.

7. RECOMMENDATION: AGRICULTURAL EXCHANGE PROGRAM AND VOLUNTARY VEGETATION PLANTING PROGRAM

As discussed in the previous chapter, three possible keys to promote transboundary cooperation are: enhancing interactions among main resource users in different countries, launching transboundary initiatives at the community level, and ensuring that transboundary initiatives can directly and/or indirectly influence persons in positions of authority. These key actions may promote the cultivation of ideas, ideals, and friendship among people across nations, and promote people's propensity for collective action. Transboundary initiatives can be institutionalized by involving persons in positions of authority. Institutionalized transboundary initiatives can have long-lasting and broader impact.

This study recommends two programs to promote people's propensity for collective action: an agricultural exchange program and a voluntary vegetation planting program. This chapter focuses on water resource management, yet the first programs can be effective not only for managing water resources but also for managing various natural resources. The following is comprised of four parts: (1) a description of the program, (2) estimated costs and potential implementers and contributors, (3) anticipated constraints and mitigation measures, and (4) potential impacts of the programs on enhancing transboundary cooperation.

7.1. Agricultural exchange program

- A description of the program

An agricultural exchange program selects participants from a network of transnational communities with shared access to the same water resources. Participants are sent from their own communities to another ones across the national border, hereafter referred to another ones as "partner communities".

People who will be sent to the partner communities are selected from candidates who are eager to become decision makers or work on resource allocation issues in the public sphere. This program limits candidates to young people because they are more likely to develop emotional attachments through social relationships and interactions, and thus they can become emotionally attached to the members of their partner communities (Choudhury et al., 2006). If emotional and social connections are successfully created, when these young people eventually enter the public sphere within their own communities, they may be more likely to consider how decisions will influence the lives of people in the partner community. As a result, these decisions, especially decisions regarding water and other natural resource management, would be more likely to benefit not only members of their own communities but also members of their partner communities. In addition, since the ecological benefits of natural resource management tend to accrue to areas larger than those occupied by individual communities, many communities can benefit from effective natural resource management in one community. In order for such a program to be effective, however, the length of a young person's stay in the partner communities has to be long enough for him or her to build strong social and emotional connections with members of the partner communities and to become fully integrated into these communities.

Young people who are sent to the partner communities will engage in farming and participate in community activities. Through farming activities, they can foster a better understanding of how much water is needed for agriculture and how much water can be obtained from the shared water reservoir in the partner communities. In addition, through farming activities, they can create social and emotional connections with local farmers. Through community activities, the young people can create and develop connections with many and

various local people. Since some farmers can be well-connected to the community, good relationships with local farmers may support and promote expanding these connections. Among various community activities, school activities can be particularly effective to create strong connections with local people, because local students can be around the same age with the visiting young people.

To utilize every opportunity to cultivate social and emotional connections, visiting young people will stay in a private home and live together with a local family. Local families who provide accommodation for these visiting young people will be selected, as much as possible, from parents whose child is also sent to the neighboring countries. This is because parents can be more emotionally attached to a young person from another country when they can imagine their child is likely to have a similar experience. These strong emotional ties can lead to creating a close connection at the household level. A household-level connection may allow young people to keep in touch even after they go back to their own communities, which can help to retain community-level connections.

- Estimated costs and potential implementers and contributors

The estimated two main costs for the program are: travel and living costs for young people who are sent to the partner communities, and administration costs for planning and implementation. The total program costs is largely determined by the number of communities that participate in this program (administration costs), the number of the young people who are sent to the partner communities, the length of their stay in the partner communities (living and travel costs), and the distance between partner communities (transportation costs).

This program should be planned and implemented by community-level organizations, such as the governments, public or private organizations, or grassroots organizations. This

community-level organization will perform four main tasks: receiving applications from young people and deciding who will be sent to the partner communities, arranging accommodation for young people coming from another country, organizing farming and social activities for them, and managing and monitoring the progress of the program. In order to make a plan for farming and community activities, the implementer needs to consult and collaborate with farmers, community groups, and other local stakeholders.

The implementer may need financial assistance to implement the program, especially from outside communities. This is because this program can generate few monetary profits for the implementer, and community-level organizations often do not have sufficient financial resources. The governments with upper-level jurisdictions, such as the national or state governments, may afford and be interested in funding this program. In addition, transboundary cooperation for improving the effectiveness of natural resource management can bring benefits to a broader area than that of one community. For example, if downstream communities will be able to improve the availability of water resources, the agricultural productivity can be increased. This may allow the communities to export more agricultural products and improve the food security in a broader area.

This program can be also supported by international and regional organizations. The Himalayan ecosystems and landscapes are famous throughout the world for their uniqueness and value as well as their vulnerability to external forces. Hence, there can be a number of international and regional organizations that are interested in supporting the program, especially those whose mission is relevant to ecosystem conservation and restoration.

- Anticipated constraints and mitigation measures

There are several constraints that can negatively affect the feasibility and effectiveness of the program. The three constraints to be discussed below are: cultural, custom and language barriers; the lack of attractiveness of the program; and the lack of opportunities for social interactions.

The most significant constraint is barriers derived from the differences in cultures, customs, and languages. Young people coming from another country need to stay comfortably in the new environment in order to create social and emotional connections with local people. However, the differences in cultures, customs, and languages often prevent them from getting used to the new environment. When people have competing cultures and customs, they may not easily accept the new ones, which can cause problems in living in a new environment. In addition, differences in languages may make communications with local people difficult. As a result, those visiting young people may not be fully integrated into the partner communities and may not be emotionally attached to those communities. If members of these communities perceive that the visiting people do not enjoy living there, the community members may have difficulty forming attachments with those visiting people.

The second constraint is that this program may not be attractive to local people, and thus they would not want to participate in it. Without a sufficient number of participants, this program cannot be implemented. Yet, there are an incredible small number of young people who want to become decision makers or work on resource allocation issues in the public sphere, and are willing to stay in a neighboring country for a long time. In addition, there are few families who will want to allow visiting people to stay in their home due to concerns about living with people who have different cultures, customs, and native languages. Moreover, there are few farmers who will want to accept visiting young people to work together since teaching

farming techniques and managing young people's tasks can be additional burden for farmers. Furthermore, this program needs at least two communities at the transnational level that are located within one landscape. However, there may not be enough communities to implement the program, particularly communities that do not have concerns regarding the amount of water resources (e.g., upstream communities) and therefore this program may bring few profits to these communities. Hence, this program has to be attractive at both the community level and individual level, yet this is difficult to achieve.

The third constraint is that there are insufficient opportunities for young people from another country to interact with local people. Social and emotional connections cannot be created without having enough time for people to have personal interactions. However, creating opportunities for social interactions for visiting people is not always easy. For instance, few schools may accept visiting people due to a lack of a capacity to have additional students or to deal with language and cultural barriers. Also, there are few community events that are welcoming to people who have different cultures and customs, in terms of traditions and beliefs. Additionally, if farmers accept visiting young people because farmers regard young people as merely labor and expect them to work a lot of time in order to supplement labor shortage, these visiting people may not have enough time to interact with local people.

The negative impacts of these constraints can be mitigated by appropriate preparation. Three mitigation measures discussed below are: providing preparation training, promoting the program by utilizing various channels, and careful monitoring of the program.

The first measure is offering preparation training for participants, including sharing information about local cultures and customs, and letting them practice local cultures, customs and languages. By doing so, young people who will be sent to the neighboring country can

recognize the differences in cultures and customs, and they can anticipate what challenges they may face during their stay in foreign countries. With sufficient preparation, they can reduce unexpected discomfort and enjoy lives in a different cultural context. Additionally, providing preparation training can alleviate concerns for local families and farmers that are derived from differences in cultures, customs, and native languages.

Second, promoting the program to local people can improve the attractiveness and acceptability of this program. And since there is likely to be no single channel to promote the program to people with various backgrounds, it can be effective to draw interests from various people by utilizing various channels, especially through word of mouth. Schools can be one effective channel to promote this program because the promotion can almost certainly reach out to local young people. If school workers think that this program can help their students to expand their future opportunities, school workers may cooperate to promote the program. They may even be willing to accept young people coming from the neighboring country.

Another channel that can effectively promote the program is farmers groups. If farmers groups think that this program can benefit them by increasing the availability of water and other natural resources, they may help to promote the program to their members. This promotion can encourage farmers' children to apply to the program and encourage farmers to accept people from the neighboring country to work in their farmland. Successful promotion can motivate young people to apply to the program, which may encourage their families to provide accommodation in order to support their children. In addition, this program will subsidize families who provide accommodation as compensation for the living costs, which may help to promote the attractiveness of this program.

Third, in order to ensure that young people coming from the neighboring country have enough opportunities to interact with local people, this program requires the implementer to monitor the progress of this program carefully. This program can be monitored by receiving the activity reports from those visiting young people and checking these reports with the original program's plan in order to recognize whether there are significant differences between the plan and the actual activities. The implementer is required to consult with farmers and other community partners if these young people do not have enough opportunities to interact with local people as initially planned. In addition, the implementer is required to ask local people regularly about how and how often they interact with these young people. By receiving reports from direct and indirect program participants, the implementer can encourage visiting young people to have more interactions with local people.

- Potential impacts of the program on transboundary cooperation

This program is expected to promote ideas, ideals, and friendship among resource users in different countries, and promote their propensity for collective action through their personal interactions. In addition, by involving persons who are eager to become decision makers or work on resource allocation in the public sphere, this program also aims to establish connections between transboundary initiatives and persons in positions of authority. Since young people have not worked in politics yet, they will encounter fewer political stakes and obstacles to interacting with community people in different countries.

When social energy is successfully generated among local resource users across nations, they may come to care about the lives of people in the partner communities and may voluntarily reduce the use of water and other natural resources. Furthermore, in the future, when young people who stayed in the neighboring country are in the positions of authority, they may make

decisions on resource management that take into account the influence of the decisions on those in neighboring countries. Additionally, by requiring these young people to share their experience with others, this program may be able to expand its impact to a broader area. Because this program focuses on community-level activities, it can create strong bonds and a sense of mutuality through their personal experience with others.

7.2. Voluntary vegetation planting program

- A description of the program

A voluntary vegetation planting program creates opportunities for water users in different countries to work together in order to establish vegetation cover along river banks. By doing so, this program aims to establish social and emotional connections among resource users across countries, and also improve the river's water retention. This program particularly focuses on creating connections among upstream and downstream countries living on the same watershed.

This program seeks community members to volunteer to plant vegetation. Volunteers are sought from community members with various backgrounds, including farmers and persons in positions of authority. In order to enhance communication between people who have different native languages, this program hires facilitators who are fluent in participants' native languages and have experience in facilitating communication at a super-national level.

Regular interactions between upstream and downstream communities may make their relationships better and more enduring. Hence, this program seeks volunteers and holds planting sessions regularly, such as semi-annually or annually. As part of the program activities, volunteers will visit the sites where volunteers previously planted vegetation to see the growth of the vegetation and the effect of the vegetation cover on water resource management. By doing so, participants from different countries may share the feeling of fulfillment and

achievement, and strengthen their bonds and a sense of mutuality. In addition, this program provides communities' traditional meals to reward their work and foster cross-cultural understanding, and create trust among participants (Meyer, 2015). In order to provide traditional meals, this program also seeks volunteers who can cook these dishes.

- Estimated costs and potential implementers and contributors

The estimated three main costs to implement this program are: costs for planting vegetation such as seedlings, seeds, fertilizer, and equipment; costs for volunteers such as transportation and meals; and administration costs for planning, implementation and hiring facilitators. The total program costs is largely determined by the number of communities participating in this program (administration costs), the number of volunteers and the distance between the communities (costs for transportation and meals), the size of the planting area and types of vegetation required (costs for planting vegetation), and the frequency of the volunteer work (the overall costs).

Organizations working at the community level can be an appropriate implementer for this program. This is because the implementer may need to be known locally in order to recruit a sufficient number of volunteers. In addition, the implementer will be required to take initiatives to decide the locations to plant vegetation, and the ownership of this vegetation and therefore the implementer needs to know the community very well.

Similarly to the agricultural exchange program, this program may need to be financed by outside donors. This is because the program cannot generate sufficient monetary profits for the implementer, and local-level organizations generally do not have sufficient financial resources. In a similar ways to the agricultural exchange program, this program can be funded by the government with upper-level jurisdictions and international and regional organizations, since

they may be interested in supporting landscape conservation. In addition, since selecting planting locations and types of vegetation requires expertise and specialist knowledge, research institutes can be interested in providing scientific and technical support.

- Anticipated constraints and mitigation measures

There are two expected constraints for the voluntary vegetation planting program. These two constraints are a lack of participants and the risk of vegetation withering within a short period. The language barrier can also be a constraint. Yet this constraint is a problem only when volunteers are interacting. This can be solved by hiring facilitators who are fluent in volunteers' native languages, this constraint is not discussed in this section.

To mitigate the influence of constraints, this study proposes taking a cooperative approach involving various organizations and social groups, and discussing a strategy for seeking a sufficient number of volunteers and a strategy for vegetation management.

As with the agriculture exchange program, one constraint is that the voluntary vegetation planting program may not be attractive to community members and so may not have a sufficient number of participants, especially volunteers. This is especially true when community members perceive that this program brings little value to them, for example, when selected planting locations are far away from their homes. Additionally, even if some community members are interested in this program, they may not have enough time and income to do the volunteer work. Recruiting volunteers with various backgrounds is even more challenging because there are likely to be no single ways to reach out to people belonging to various social groups.

Another constraint is that the vegetation can wither within a short time if it is not properly managed. Damaging to the vegetation can seriously worsen the relationship between communities in different countries when volunteers in one community perceive that another

community does not appropriately value their work. If this occurs, this program cannot create bonds and a sense of mutuality, but instead, this program makes coordinating transboundary cooperation even more difficult.

In order to have a sufficient number of volunteers, one mitigation measure could require various organizations and social groups in a community to support the implementer by promoting the program to their members. This allows this program to be more effective at capturing attention from people with various backgrounds.

In order to maintain the vegetation properly, another mitigation measure could require the implementer to assign the ownership of vegetation to selected owners who have a capacity to take care of the vegetation. The owners will be, in principle, selected from organizations or groups (not individuals) in order to maintain the vegetation under collective responsibility and to increase the probability that the vegetation is appropriately managed. The owners can participate in all kinds of decision-making and make the final decision on the types of the vegetation used, and they will be eligible to harvest from the vegetation, so that they are incentivized to take ownership and maintain the vegetation properly.

- Potential impacts of the program on transboundary cooperation

This program is expected to increase the availability of water in the river by providing vegetation. Also, this program aims to cultivate ideas, ideals, and friendship among resource users in different countries by allowing them to work together for the same purpose and share the feeling of achievement. Since this program attempts to seek volunteers with various backgrounds, the impact of this program can expand to various organizations and social groups, especially when volunteers share their experience with others. This can increase the probability

of the program having the potential to directly or indirectly influence persons in positions of authority.

Similarly to the agricultural exchange program, when social energy is successfully generated among resource users across nations, resource users in one country may value and be concerned for the lives of resource users in another country. When people in different countries care about the lives of others, the allocation of natural resources can be optimized so that one community is unlikely to exploit too many natural resources. Furthermore, if social energy is generated and resource users care about the lives of people living outside their communities, persons in positions of authority may be more likely to make decisions regarding natural resource management that consider the influence of decisions on non-constituents. In this case, those persons in positions of authority may encounter few obstacles to making decisions that weigh the lives of non-constituents as well as those of their constituents.

8. CONCLUSION

The analysis of the linkages among the ecological, socio-economic, and political domains, and the relationships between these three domains and transboundary decision-making, reveals the complexity and difficulty in conserving and restoring landscapes and ecosystems at the transboundary level. Coordinating transboundary cooperation can be particularly difficult in an area like the HKH region where there are no decision-making bodies at a super-national level. The case study of the Koshi River Basin illustrates the complexity and difficulty in transboundary initiatives in concrete terms. At the same time, the application of the perspectives from the three domains and transboundary issues on transboundary landscapes allows us to propose possible approaches to promote transboundary cooperation.

As initiatives that may enhance transboundary cooperation, this study proposes two programs. The first program is an agricultural exchange program, which sends selected young persons to communities in different countries that share natural resources originating in the same landscape. These young persons will interact with local people through farming and other community activities. By doing so, this program may create bonds and a sense of mutuality between the communities in different countries. The second program is a voluntary vegetation planting program, which seeks volunteers from upstream and downstream communities in different countries who work together to plant vegetation along one watershed. This program aims to create bonds and a sense of mutuality between upstream and downstream communities, and also improve the watershed's water retention.

Of course, there are many other possible initiatives that can enhance transboundary cooperation. More importantly, these programs themselves are not solutions to transboundary issues but they merely could help to create a situation more conducive to better handling of these issues. What this study attempts to highlight is the importance of taking into account the underlying linkages among ecological, socio-economic, and political factors. This study also attempts to

emphasize the potential to create bonds and a sense of mutuality in order to make political decisions with the consideration of the lives of non-constituents.

The Koshi River Basin is only one of the many transboundary landscapes in the HKH region. Similarly to the Koshi River Basin, many transboundary landscapes play important roles in sustaining both ecological and human societies, yet they tend to be vulnerable to external forces. Possible causes of changes in ecological landscapes are various, but as long as one ecological landscape extends over multiple countries, transboundary cooperation may almost always be able to improve the effectiveness of landscape conservation and restoration.

The analysis from the perspectives of the ecological, socio-economic and political domains with the consideration of transboundary issues can be useful to trace possible explanations as to why transboundary cooperation has not occurred. Yet, this study has limitations that can lead to overlooking important factors. In its concluding remarks, this study discusses five limitations.

First and foremost, information in the case study is collected only from secondary sources. In this case, the analysis of the case study may not be comprehensive and may fail to consider some key information. In particular, factors in the political domain often provide qualitative rather than quantitative information, yet there is little available qualitative information about politics, particularly information related to authority, in secondary sources. However, the analysis of the three domains indicates that authority can be a key factor in giving priority to landscape conservation and restoration. Indeed, the success or failure of creating policies can be influenced by whether a few key persons agree or not on these policies. Hence, the failure to consider this information can change the outcomes and conclusions of the analysis. Additionally, the case study does not include much information about the Tibetan Autonomous Region, which is barely mentioned in the secondary

sources yet can be important to analyze transboundary issues. As such, since the case study depends on secondary information, this study may fail to include important considerations.

Second, although this study mentions some of the issues of social composition and equity as one of the socio-economic factors, this study may not sufficiently consider the impact of these issues on landscape conservation. More specifically, this study discusses the issues of social composition and equity as possible causes of the failure to consider the opinions of people who may have important knowledge and experience for improving resource management. However, these issues can influence additional factors which have not been discussed. For example, women have experienced an increase in the burden of household tasks because of the increase in men's outmigration to earn a better income. As such, this study may underestimate the significant impact of social composition and equity issues.

Third, this study assumes that people in academia have little influence on the political sphere and scientific research draws little attention from people who have significant influence on political decisions. However, in reality, the impact of academia and scientific evidence is likely to be different from country to country. In some countries, people in academia can be highly esteemed and scientific research can be taken very seriously in the political sphere. However, this study does not consider the influence of academia and science on political decisions, but instead, this study focuses on the existence of direct and indirect connections between people in scientific and political fields. As a result, the influence of academia and scientific research on transboundary cooperation can be underestimated in this study.

Fourth, the case study in this paper regards the concept of an ecosystem and a landscape as identical, because conserving and restoring landscapes can lead to conserving and restoring ecosystems. However, while the concept of an ecosystem only focuses on ecological elements, the

concept of a landscape gives nearly equal importance to both ecological and social elements. Hence, landscape conservation and ecosystem conservation could have been better differentiated.

Differentiating an ecosystem and a landscape in the case study may lead to different findings and recommendations.

Finally, the analysis of the issues of physical and biological landscapes from the perspectives of the three domains may simplify the real conditions too much. The real world is comprised of an infinite number of agents that repeatedly interact with other agents and generate emerging properties. Hence, even if agents that belong to the ecological, socio-economic, and political domains can be influential for physical and ecological landscapes, the rest of the millions of agents may have some impact on these landscapes. The accumulated impact of the millions of agents also can be determinants of the success or failure of landscape conservation and restoration. In addition, since so many elements can belong to each of the three domains, the significance of each element cannot be sufficiently highlighted in the analysis. For example, a better education system can increase the awareness of the negative impacts of ecosystem degradation or can develop sophisticated skills to conserve landscapes more effectively. This suggests that the education system has the potential that improves the effectiveness of landscape conservation and restoration. However, since this study only focused on factors that can be particularly relevant to and important for physical and ecological landscapes, it may underestimate the significance of other factors, even if they belong to the three domains.

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