Partner Report Series No 13

An Analysis of Forestry Policy, Acts and Rules of Bhutan to Mainstream Climate Change Adaptation

Thinley Wangdi
Phurba Lhendup
Norbu Wangdi

ADAPTATION KNOWLEDGE PLATFORM

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The *Partner Report Series* highlights the insights and outcomes of studies, assessments and other field activities that our national implementing partners have undertaken in their countries to mainstream adaptation into plans, policies and programmes. The intention of the series is to disseminate their findings to partners and relevant professionals in Asia.

We welcome suggestions or comments.

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About the authors

Thinley Wangdi is a Forest Researcher at the Ugyen Wangchuck Institute for Conservation and Environment based in Bumthang, Bhutan. He heads the Department of Sustainable Forestry. His research efforts focus on understanding the ecological as well as management and policy aspects of forest resources and lands.

Phurba Lhendup is a programme officer who coordinates and implements the climate change and freshwater programme of WWF Bhutan. In addition, he also conducts research on climate change and aquatic biodiversity in the protected areas of Bhutan.

Norbu Wangdi is a Forest Researcher at the Ugyen Wangchuck Institute for Conservation and Environment based in Bumthang, Bhutan. He heads the Department of Water Resources. His research focuses on understanding the ecological as well as management and policy aspects of water resources.

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Preface

During the last three years, the Regional Climate Change Adaptation Knowledge Platform (AKP) has worked towards building bridges between existing knowledge on adaptation to climate change and the governments, agencies and communities that need this knowledge to inform their adaptation to the impacts of climate change, while working toward poverty reduction and environmental sustainability. AKP's work has been carried out following three key objectives:

1. Promoting dialogue and improving the exchange of knowledge, information and methods within and between countries on climate change adaptation, and linking existing and emerging networks and initiatives.

2. Generating new climate change adaptation knowledge, promoting understanding and providing guidance relevant to the development and implementation of national and regional climate change adaptation policy, plans and processes focused on reducing vulnerability and strengthening the resilience of the poor and women: the most vulnerable segments of society in most Asian countries.

3. Synthesizing existing and new climate change adaptation knowledge and facilitating its application in sustainable development and poverty reduction practices at the local, national and regional levels.

This publication is a result of these objectives. AKP supported thirteen countries in the Asian region to strengthen their capabilities to mainstream adaptation, introduce effective adaptation measures and assess their needs and priorities for adaptation. Bhutan is one of the thirteen countries supported by AKP.

AKP is implemented by the Stockholm Environment Institute (SEI), AIT's Regional Resource Centre for Asia and the Pacific (AIT RRCAP), and the United Nations Environment Program Regional Office for Asia and the Pacific (UNEP ROAP) with funding provided by the Swedish Government through the Royal Swedish Embassy in Bangkok and the Swedish International Development Agency (Sida). The former Swedish Environmental Secretariat for Asia (SENSA) was also instrumental in setting up and supporting AKP.

AKP's publications provide insights on adaptation in the region. A consolidated initiative, known as the Asia Pacific Adaptation Network (APAN), has been established and will be fully implemented starting 2013. Its ultimate objective is to assist the region to build the climate resilience of human systems, ecosystems and economies through the mobilization of knowledge and best practices, enhanced institutional capacity, informed decision making processes, and facilitated access to finance and technologies.

The outcomes of AKP have been made possible by the active participation of partners and various stakeholders. SEI acknowledges the editorial assistance provided by Marion Davis, Skye Turner-Walker and Pin Pravalprukskul. SEI also expresses heartfelt thanks to John Soussan, Lailai Li, Kai Kim Chiang, Lisa Schipper, Sabita Thapa, Tatirose Vijitpan, Muanpong Juntopas, Nantiya Tangwisutijit, Chanthy Sam, and Dusita Krawanchid for their contributions to AKP.

Introduction

Bhutan is a small, mountainous country on the southern slopes of the eastern Himalayas. It has only about 738,000 inhabitants,[1] but it is home to an astounding array of biodiversity. In fact, the country is in one of the world's ten biodiversity "hotspots" (Myers 1988), situated at the convergence of the Paleartic and Indo-Malayan regions and containing tropical/subtropical, temperate and alpine species. The flora includes 579 species of wild orchids alone, at least 30 bamboo species, and more than 300 medicinal plants; the fauna includes 678 recorded species of birds and close to 200 species of mammals – among them the rare Royal Bengal Tiger.[2]

Bhutan's biodiversity is due, to a great extent, to its geography and rugged topography, with elevations ranging from less than 150 meters to more than 7,500 meters above sea level. At least as important is that Bhutan has protected large areas of pristine natural forest; around 72% of the land is under forest cover (Gilmour et al. 2009).

For Bhutan's people, the forests provide food, timber, fibres and medicines; a wide range of ecosystem services (e.g. water regulation and purification, pollination, soil formation, nutrient recycling and climate regulation); and recreational, aesthetic, and spiritual benefits. From a global perspective, Bhutan's forests are also valuable carbon sinks, absorbing an estimated 6.3 million tonnes of carbon per year – more than four times the country's emissions in 2000 (Kingdom of Bhutan 2011).

Bhutan's forests are also critical to its agriculture sector, which employs about 60% of the labour force and contributed nearly 17% of Bhutan's GDP in 2010 (National Statistics Bureau 2007), even though just under 3% of Bhutan's land is available for farming (Kingdom of Bhutan 2011). The forests are particularly important to Bhutan's poor, most of whom live in rural areas. While only 1.7% of Bhutan's urban residents lived in poverty as of 2007, and 0.2% in extreme poverty in rural areas, the rates were 30.9% and 8% respectively (National Statistics Bureau 2007).

An overview of the policy context

Bhutan's ability to emerge into the 21st century with most of its biological wealth intact is due to the vision and leadership of its leaders and a tradition of living in harmony with nature. With the commencement of planned development in the 1960s, numerous conservation policies were introduced to guide and safeguard Bhutan's natural resources from over-exploitation. The philosophy of Gross National Happiness[3] and the constitution of the Kingdom of Bhutan are two of the overriding policies that support Bhutan's conservation policies.

Bhutan has also ratified numerous international treaties and conventions, including the United Nations Convention on Biological Diversity (UNCBD), United Nations Framework Convention on Climate Change (UNFCC), United Nations Convention to Combat Desertification (UNCCD), and the United Nations Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). More recently, at COP15 in Copenhagen, Bhutan committed to remaining carbon-neutral.[4]

[1] Per World Bank data, http://data.worldbank.org/country/bhutan.

[2] Per Bhutan's Royal Society for Protection of Nature; see http://www.rspnbhutan.org/about-bhutan/biodiversity.html.

[3] See http://www.grossnationalhappiness.com for a history and overview of the GNH concept.

[4] For a short news report on the pledge, see Kuensel Online (2009), 'Bhutan pledged to carbon neutrality'. 12 December. http://www.kuenselonline.com/modules.php?name=News&file=article&sid=14207.

Bhutan's forest policies have been particularly progressive and invaluable in the protection of the country's rich natural resources. Bhutan nationalized its forests in 1969, then approved a National Forest Policy in 1974 that set a goal of maintaining 60% of the land under forest cover in perpetuity, creating a framework for scientific management of the forests, and providing for the restoration of degraded land. Several updates have followed, most notably the Forest and Nature Conservation Act (1995), which restored communities' traditional rights to use forests, and provided for private forestry in privately registered lands and for community forestry on government forest lands . The ensuing Forest and Nature Conservation Rules, promulgated in 2000 and revised in 2003 and 2006, enabled a rapid expansion of community forestry, with 16,400 ha in 135 community forests by 2009, benefiting more than 6,000 households (Gilmour et al. 2009). The net result of nationalization and then subsequent reforms has been to ensure all Bhutanese citizens – not just the wealthy land owners – can benefit from the forests, enhancing livelihoods and helping reduce poverty. At the same time, these policies have forged connections between communities and forestry professionals and engaged the broader population in protecting forest resources. Table 1 provides a brief summary of the policy and legal timeline concerning the management of Bhutan's forests.

Table 1: Timeline of key forest policies and laws in Bhutan

Year	Forest Policies and Laws
1958	Thrimshung Chenmo
1969	Bhutan Forest Act
1974	National Forest Policy
1974	Notification for Wildlife Sanctuaries
1979	Nationalization of logging
1983	Shifting of Forest Department from Ministry of Trade and Industry to Ministry of Agriculture
1990	Master plan for forest development
1995	Forest and Nature Conservation Act
2000	Free Market Ban on export of logs
2003	Forest and Nature Conservation Rules
2006	Revision of Forest and Nature Conservation Rules
2010	Revision of Forest Policy (draft)

Bhutan's forest policies also provide timber subsidies to rural communities, allowing them to obtain lower-priced wood to build or renovate their houses. In addition, rural communities benefit from roads built to support forestry operations under the Forest Management Unit. The establishment of a protected area network and biological corridors has further enhanced the preservation of local cultural and environmental heritage. And as part of forest protection, there are provisions for watershed catchment conservation and soil and land management, which also benefit farmers and also help ensure water supplies for drinking, household use and irrigation alike.

Implementing agencies

The main agency implementing Bhutan's forest policies is the Department of Forests and Park Services, part of the Ministry of Agriculture and Forests. Various divisions exist within this department; their functions are summarized in Table 2.

Table 2: Department of Forests and Park Services units and responsibilities

Division name	Year established	Functions/core mandates
Forest Protection and Utilization Division (FPUD)	1991	• Processes approval for allotment of forest land swapping, leasing, mining, quarrying and forestry clearances • Manages forest fires, land use and forest resource utilization • Monitors and assesses the supply of forest produce • Coordinates anti-poaching programmes
Wildlife Conservation Division (WCD)	1992	• Plans and implements conservation programmes in the country • Provides technical back-stopping to protected areas and biological corridors management in the country • Manages biodiversity data, monitors and evaluates conservation programmes implemented by the field divisions
Social Forestry Division (SFD)	1989	• Guides the planning and implementation of plantation programmes in the country • Develops forest fire management strategy and implements it in coordination with field offices • Facilitates establishment of community and private forests • Provides technical back-stopping of *Dzongkhag* Forestry Programmes • Monitors and evaluates the impact of social forestry and plantation programmes
Forest Resource Development Division (FRDD)	1971	• Conducts national forest inventory and ensures sustainable supply of timber • Provides technical back-stopping of Forest Management Plan (FMU) implementation • Maintains database on forest resources • Prepares management plans for commercial harvesting of forest resources

Division name	Year established	Functions/core mandates
Watershed Management Division (WMD)	2006	• In coordination with field offices, identifies critical watersheds • Facilitates the development of watershed management plans • Technical back-stopping of field staff in the implementation of watershed management plans • Develops proposals for funding
Nature Recreation and Ecotourism Division (NRED)	2010	• Identifies and implements natural, recreational and ecotourism programmes • Develops policy frameworks, strategies, guidelines and standards for the establishment of nature recreational areas and eco-tourism programmes • Creates a database to regulate, monitor, evaluate and provide technical back-stopping to all field programmes on nature recreation and eco-tourism • Imparts environmental education and awareness to encourage and increase public support towards conservation

There are 12 field territorial divisions, eight protected area field offices and 20 *dzongkhag* forestry offices spread throughout Bhutan that support the implementation of the plans and programmes initiated by the central divisions. The principal law enforcement agencies are the territorial divisions, which regulate the movement of all forest products (both timber and non-wood) within Bhutan. Field offices in protected areas are responsible for the implementation of conservation programmes and the sustainable management of forestry resources as provided by law. The promotion of community and private forestry is conducted by *dzongkhag* forestry offices, in consultation with local government institutions and territorial divisions.

Related policies

Along with the Forest and Nature Conservation Act and related policies and regulations, several other national laws and policies are relevant to forest governance and management in Bhutan. They include:

The **Land Act of Bhutan** (2007) is an important law with major implications for forest management. It clarifies that trees, either naturally grown or planted, belong to the landowner when grown on registered land. The Act also provides for the leasing of government reserved forest land for economic and various other activities.

The **Environment Assessment Act (**2000) requires the government to ensure that environmental concerns are considered when formulating, renewing, modifying and implementing any policy, plan or programme. Issuance of an environmental clearance is to be a prerequisite to the issuance of any development permit.

The **National Environment Protection Act** (2007) outlines principles and a legal framework that have implications for forest governance and management. It requires that a person taking natural resources from the environment, or deriving economic benefits from it, should ensure sustainable use and management of the resources and ecosystems.

The **Mines and Minerals Act** (1995) requires that all minerals be developed in accordance with the policies of the Royal Government of Bhutan, with due respect paid to the efficient use of resources, protection of the environment, public health and safety.

The **Biodiversity Act of Bhutan** (2003) provides for the conservation and sustainable use of biological and genetic resources, the equitable sharing of benefits from the use of genetic resources, as well as the transfer of technology and capacity-building at national and local levels on conservation and the use of biological diversity.

Photo Credit: creativecommons | Zachary Collier

The **Water Policy (**2002) recognizes that the sustained flow of good-quality water depends on the integrity of the watersheds. It places an emphasis on water resource management within river basins and aquifers, including upstream and downstream water users. It calls for an integrated approach to the management of water resources and provides a directive to protect all forms of these resources. The policy seeks sound watershed management through extensive soil conservation, watershed area treatment, conservation of forests and increasing the extent of forest cover in order to reduce the incidence and intensity of floods.

The **Road Act of Bhutan** (2004) defines and establishes an efficient system of road networks in the country. It also aims to ensure a socio-economically balanced approach to development and promote social equity, justice and general welfare.

All these laws and policies have direct or indirect implications for the implementation of forest laws and policies that seek to safeguard the country's forests and natural resources by imposing restrictions to ensure sustainable use for future generations. In fact, disagreements often arise in the field when executing these policies and legislation. These suggest that greater synergies or consensus are needed amongst stakeholders when framing policies.

Policy gaps in formulation and implementation

Numerous other conservation policies have also been framed by other government institutions and enacted by the National Assembly that are equally difficult to implement. While Bhutan has ratified numerous treaties and conventions for the conservation of natural resources, for example, clear policies on climate change have yet to be developed, despite the recent recognition and understanding of climate change as a real threat to forests, biodiversity and people's livelihood. Through the National Adaptation Programme of Action (NAPA), a strategy for climate change was developed in 2006. However, since then, few activities have been proposed or undertaken, mainly due to a limited understanding of the impacts of climate change.

Therefore, some of the policy gaps that need to be addressed are:

i. While the government is responsible for the formulation of an act, the responsibility for the implementation of forestry programmes and management of forests in accordance with the policy guidelines rests with the field divisions under the Department of Forest and Park Services. Due to some institutional and financial constraints and provisions that come into conflict with the public interest, it is sometimes difficult to transform policy guidelines into actual field interventions.

ii. Forestry has always been a low priority in terms of funding and public support for its protection. Thus, interventions needed to transform government policy guidelines into programmes, projects and strategic action plans at the ground level have not received adequate funding, and the underlying policy objectives have not been fully met.

iii. The Forest and Nature Conservation Act was formulated in an ad hoc fashion and was not based on any research studies on the implementation and monitoring of previous policies. This has resulted in some guidelines that are not suitable for implementation at the field level.

iv. There is conflict between the energy sector and biodiversity conservation (e.g. support for the construction of dams against opposition from environmentalists who want to conserve ecosystems). The Act does not outline any approach to avoiding these conflicts.

v. There is limited capacity to incorporate the provisions of the UN Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification (UNCCD) and the UN Framework Convention on Climate Change (UNFCCC) in the Act. Biodiversity conservation and the management of forests as carbon sinks are not fully reflected in the Act.

vi. In the past, forest policies were prepared in isolation from other sectors (e.g., agriculture, wildlife, fisheries, tourism, population planning, energy, water etc.). This isolation and lack of coordination still persist at the policy formulation and implementation levels.

vii. The Act does not appear to take into account the large-scale conversion of forest land into non-forestry uses, and no legislation exists to control this. Illegal forest encroachment has increased over the years. However, the existing legislation lacks adequate mechanisms to deal with it (for instance, the current eviction process is too lengthy).

viii. The section related to rural timber allocation is being misused. The sole purpose of this provision is for timber to be used in house construction for poor households at a subsidized rate. However, many people are claiming they are entitled to this, leading to a widespread abuse of this provision.

ix. The establishment of community forests has become one of the top priorities for the Department of Forests and Parks Services, in order to empower local communities in resource management and utilization. While facilitating the establishment of community forests, conflict sometimes arises among different stakeholders, including institutions such as FMU and the Biological Corridors and National Parks and Wildlife Sanctuaries.

x. There is an opportunity for community members to raise their income levels and reduce poverty through the sale of non-wood forest products such as sand, boulders and stone from quarries. However, the provisions supporting these activities are currently unclear to policy implementers.

xi. Human settlements and increasing populations in and around forest areas (mostly in the valleys) are making the management of forests more complex, raising the question of whether control of forest resources should be centralized or decentralized.

Photo Credit: creativecommons | Curt Carnemark

The roles of Local Authorities and people in implementing the Forest and Nature Conservation Act

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The Private Forest Rules and Community Forest Rules were framed under the 1995 Forest and Nature Conservation Act. The main purpose of the Private Forest Rules was to encourage local people to grow firewood and construction timber for their own use as well as a source of additional cash income. Registration of private forests could be achieved through the local community leader, district administration and the Forest Department. No permission was required to harvest plants (except those listed as "endangered" by the Forest Department). However, in order to deter theft, the owner had to produce documentary evidence when transporting forest products outside of his private forest.

Under the community forest rules, a group of at least 10 households who wanted to establish, control and manage a forest area as a community forest in accordance with these rules could form a community forest management group (CFMG). Under the rules, the CFMG was then authorized to control the management of the community forest in accordance with the management plan prepared by the CFMG and approved by the district administration following the recommendations of the Divisional Forest Officer. The management plans contain maps of the community forest boundaries plus management objectives, descriptions of forest types and species, an assessment of the forest condition and an inventory of the forest area. Rules did not allow for royalties from the bona fide use of forest products from the community forest by CFMG members. However, if the forest products were sold to outsiders, they were subject to taxation.

At the local level, a village forest guard, known as a *reesup* (village forest guard) is elected on an annual or biannual basis with village elders deciding upon the *reesup*'s main duties and responsibilities. Following this, the *reesup*, in consultation with the local forest officer, is responsible for regular patrols to detect any illegal activities with regard to forest protection and report any incidents to the forest officers. The *reesup* is given authority to ensure that everyone has adequate firewood and construction timber and is empowered to enforce *reedum* (the prohibition of certain forestry activities, including the extraction of bamboo and grazing during the summer, June-October). Although the *reesup* has no authority over the management of community forest, increasingly, they have taken on a policing role. A *reesup* is now required to report any illegal forestry activities and forest fires to forestry institutions.

Local-level climate change awareness and risk assessment

A CASE STUDY OF BUMDELING WILDLIFE SANCHUARY

Background to case study

The case study was conducted in Bumdeling Wildlife Sanctuary (BWS) in the eastern part of Bhutan. BWS is one of 10 protected areas in Bhutan. The sanctuary covers an area of 1,487 km^2. Of this 35% is coniferous forest; 34% is broad-leaf forest; 17% is covered by snow, ice and rocks; 10% is scrub; 2% is pasture; and 1% is agricultural land (NCD 2001). The elevation ranges from 150 to 6,450 metres above sea level. The area is characterized by a warm temperate climate in the south and an alpine climate in the mountainous region in the north. The sanctuary also encloses the catchments of two of Bhutan's major rivers, the Kulong chhu and the Dangme chhu. Due to the varied altitude and climatic conditions, the area includes a wide array of ecological habitats, including sub-tropical, temperate broad-leaf and coniferous forests, alpine scrubs and meadows, and a permanent snowline in the north.

The sanctuary was established to protect high- and medium-altitude habitats or "eco-zones", increase knowledge on nature conservation, protect cultural heritage, and raise the living standards of communities in and around the sanctuary. Although human settlements are not allowed in protected areas in most of the world, in Bhutan they are – in fact, communities are considered an integral component of the parks. The latest BWS socio-economic survey found 867 people living inside the park, all of whom relied upon its biological resources for their livelihoods.

Photo Credit: creativecommons | Michael Foley

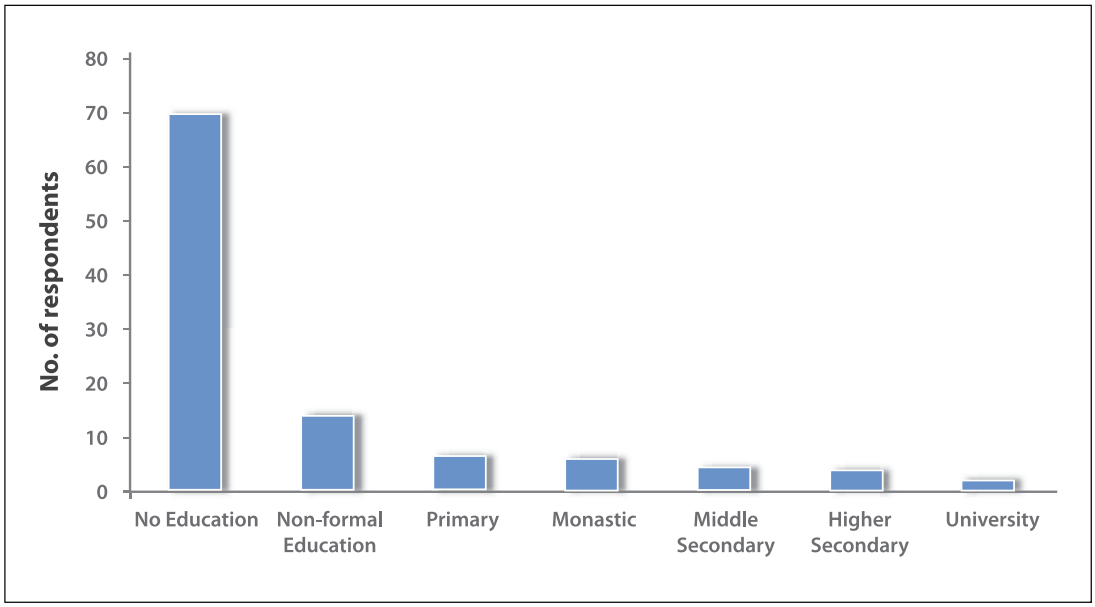
Agricultural production and the rearing of livestock are the main livelihoods for people living within the sanctuary, although the collection of cordyceps (a fungus used for medicinal purposes) has recently emerged as a significant source of revenue. The main crops raised are millet, wheat, barley, buckwheat (sweet and bitter), paddy, mustard, potatoes and vegetables, depending on the altitude of the villages. Villages at lower elevations practice wetland agriculture, growing paddy as the main crop.

The majority of households own livestock, particularly cattle, yak and sheep. Typically, livestock are reared in large herds. Forests are often regarded as open access for grazing. Yak- and some sheep-rearing occur in the northern part of the park, while cows are typically reared at lower elevations. Other livestock include horses, poultry and pigs, depending on the elevation. Livestock losses attributed to attacks by wild animals such as tigers, leopards, wild dogs, bears, snow leopards and wolves are common, and often lead to conflicts between humans and wildlife.

Methodology

The study focused on the community and household level through the application of participatory rural appraisal (PRA) tools and key informant household interviews. Since vulnerability is context-specific and often varies from village to village, the survey used representative sampling. Of 385 households, 157 were interviewed, or about 41% of the total households living within the BWS. Of the respondents, 69% were from illiterate farming communities, and the remaining 31% were monks, students or participants of non-formal education programmes (Figure 1).

Figure 1: Education levels of the respondents



Community perception on climate change and its impacts

Nearly all (93%) of the 157 households interviewed said they believe the climate is changing (Figure 2), and described what they believed to be signs of climate change such as erratic rainfall, snowfall and frosts, as well as hydrometeorological hazards such as floods and cyclones (Figure 3). Local-level indicators of temperature rise included physical evidence such as the viability of vegetable crops that previously could not be grown in the area.

Figure 2: Household perceptions: Is climate change happening?

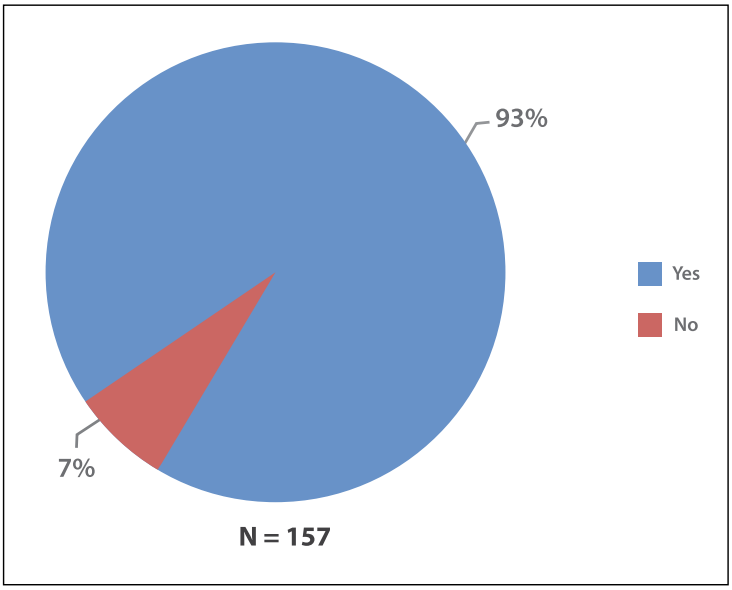
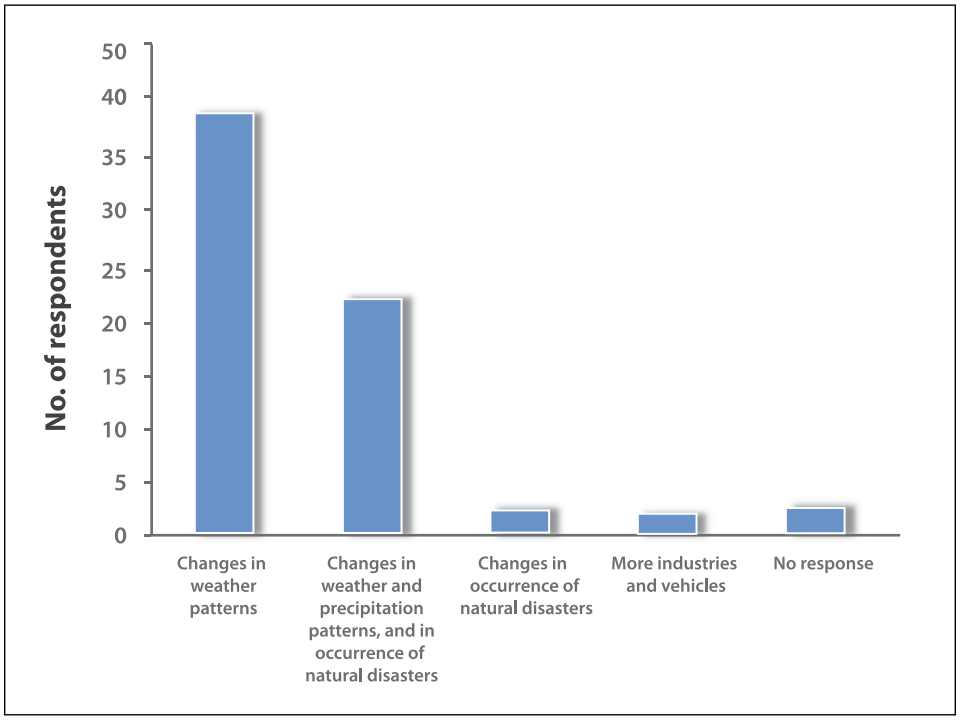
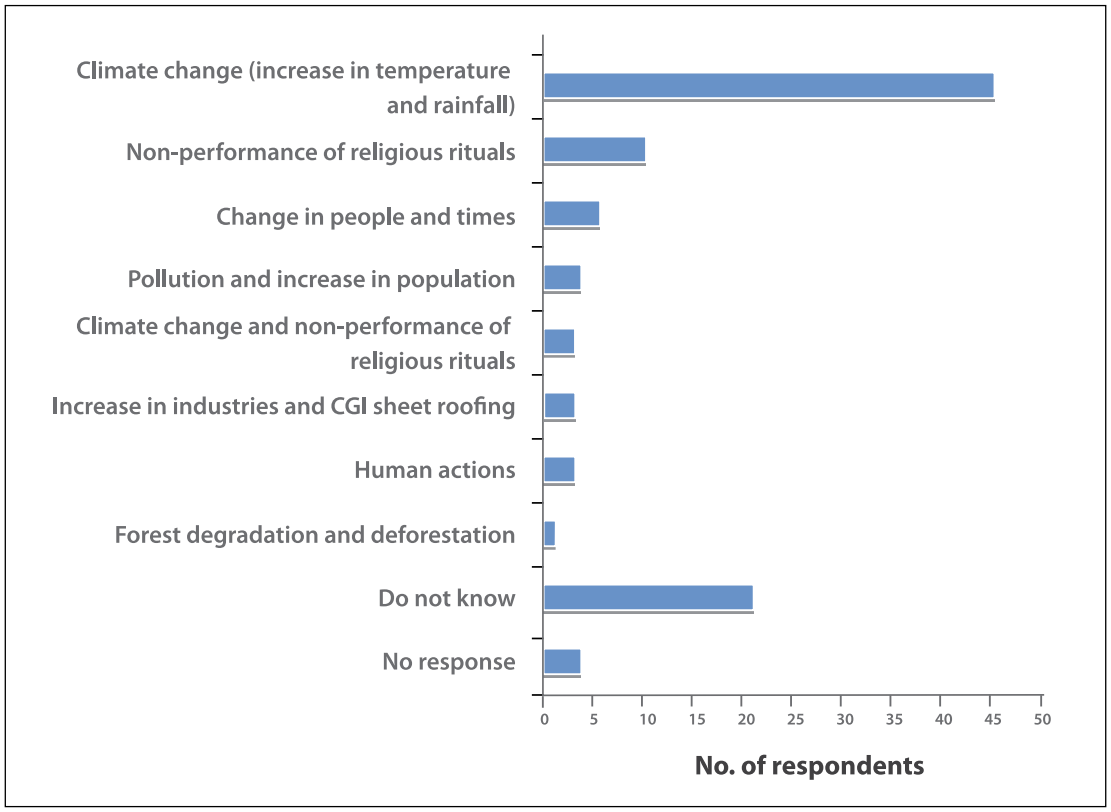


Figure 3: Signs of climate change reported by households



Changes in plant phenology, outbreaks of new plants and domesticated animal diseases, and the incidence of mosquitoes were also noted; 45% of respondents felt that natural disasters (floods and cyclones) were due to climate change. Some (10%) believed that the calamities occurred due to the non-observance of local religious rituals (*rimdo*) (Figure 4).

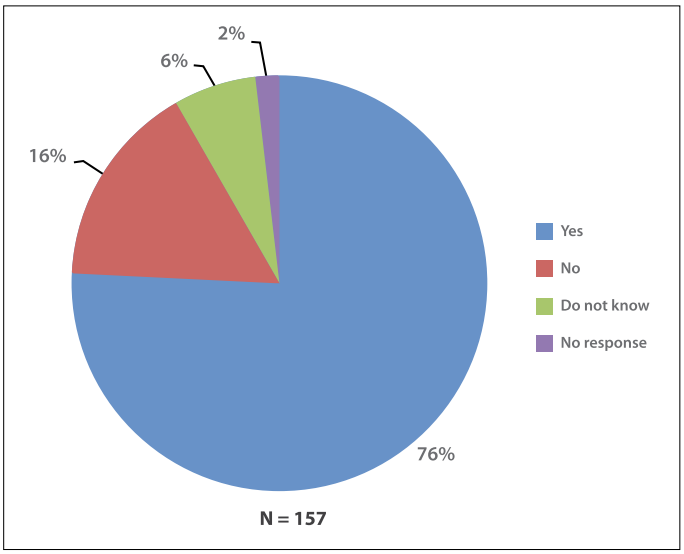
Figure 4: Reasons for the occurrence of natural disasters



As the main source of livelihood in the region is agriculture, changes in climatic parameters such as temperature, rainfall, snowfall and frosts could have serious consequences. In fact, changes in rainfall patterns were noted as having an adverse impact on the livelihoods in most communities, and therefore, increasing their risk of food insecurity. Erratic rainfall patterns hamper the growth of crops and can result in soil erosion, landslides and sedimentation downstream. These, in turn, result in the loss of soil fertility, decreased crop yields and increased crop damage.

Recently, the incidence of pest and disease outbreaks has increased (Figure 5). People reported a high incidence of pests such as ants in potatoes, trunk borers (in rice and wheat), fruit flies and diseases such as citrus greening.

Figure 5: Occurrence of pests and diseases in agricultural crops and vegetables



Common pests affecting vegetable crops included cut worms, which cut through the stems of cabbage and chili seedlings and feed on potatoes and turnips. Meanwhile, other crops were affected by a fungal disease which infests the leaves of vegetables and, in some cases, paddy. The increase in the incidence of pests has led farmers to use more pesticides, which could have human and environmental impacts. Also, there was a fear that further climate change would bring new pests and diseases from the foothills to Bhutan's hillsides and mountainous regions.

Local awareness of the Forest and Nature Conservation Act and its impacts

The local community's awareness of the FNCA is one of the most crucial factors in enabling forestry officials to enforce forestry acts and rules. Of the people interviewed, 96% were aware of the existing acts and rules (Figure 6). People received this information through mixed sources, and particularly through awareness-raising programmes run by forestry officials (Figure 7).

Figure 6: Local community awareness on FNCA and forestry rules

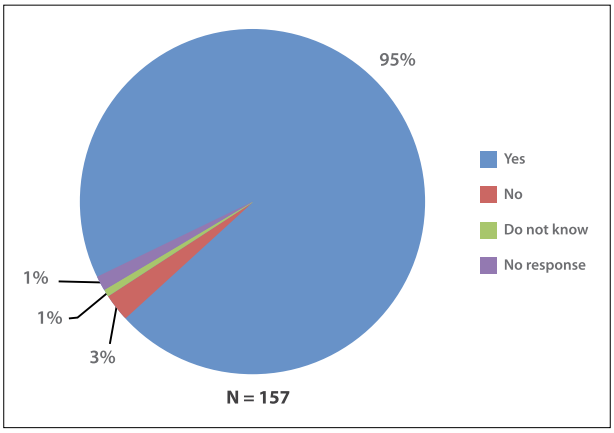
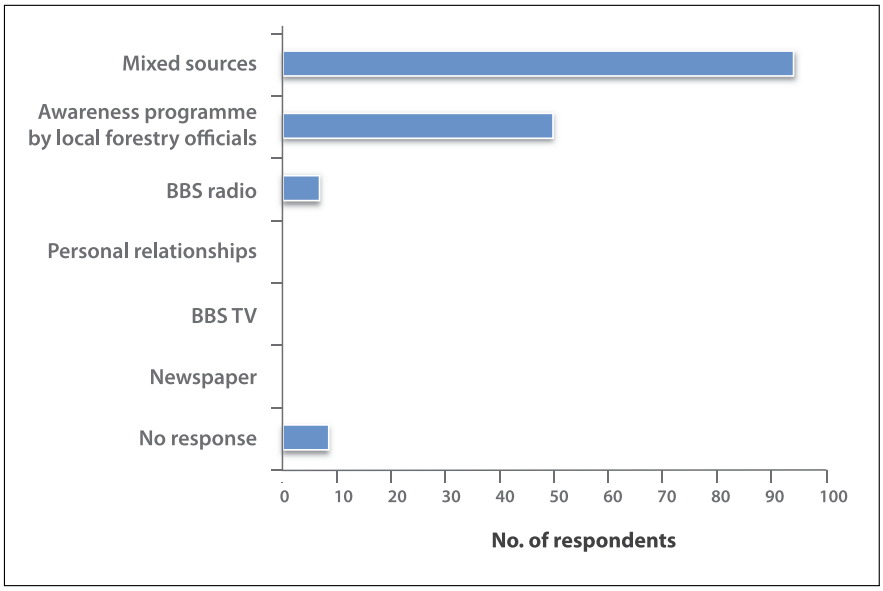


Figure 7: Means by which local community become aware of FNCA and rules



The local community (94% of the respondents) felt that the FNCA and its rules intended to protect and maintain forestry resources at a local and national level, and had safeguarded forestry resources and biodiversity from over-exploitation and degradation.

The most vulnerable groups

Although no detailed study of household income level was conducted, the majority of the households appear to have been poor. Most people depended on subsistence agriculture. However, this only partially met household needs. It should be noted that household income levels seemed to increase with the legalization of cordyceps collection and sale.

It appears that the impacts of climate change in the study area have weakened the livelihood systems of both poor and middle-income households. However, they have had a more significant impact on low-income groups. Rich households have the ability to buy inputs such as vegetable seeds (tomatoes, cabbages, cauliflower, etc.), insecticides and chemical fertilizer. However, poor households are deprived of this opportunity. Similarly, in the case of livestock, rich households can afford to keep improved breed cows (Jersey) and have well-developed pasture around their houses. Conversely, poor farmers depend on large herds of traditional breeds which are grazed in the forest. Here, cattle are at greater risk of diseases and have to graze on less nutritious forest fodder. This limits productivity. Rich yak herders are able to keep greater numbers of yaks, which they can easily replace. However, poor herders can only afford to keep a few animals. These disparities often exist within the same community and invariably the poorer members are more vulnerable to the impact of climate change.

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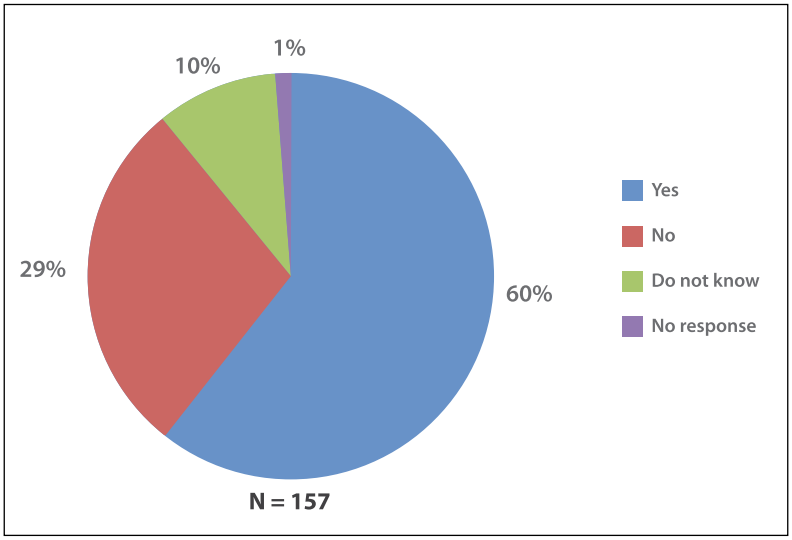
Current coping mechanisms

Current coping mechanisms are limited, and highly dependent on locally available resources. The analysis indicated that a large number of people in the community were ready to face future climate risks (Figure 8). Unfortunately, they had limited ideas and access to technology to deal with the consequences of climate change catastrophes, unless the government provided necessary assistance.

Figure 8: Local community preparedness to cope with climate change effects



A significant number of respondents (30%) felt that it was necessary to perform religious rituals as part of climate adaptation measures. In addition, 39% said they did not have any idea on what should be done to cope with climate change effects. Others believed that the local community should conserve forests, control forest fires, build river embankments and plant trees. A few people felt that there was a need to reduce the size of houses (and build huts instead of large structures), encourage the use of electricity for cooking and heating, restrict the number of industries and vehicles, and diversify agricultural crops (Figure 9). The majority of the people interviewed used firewood for cooking (89%) and heating (93%); only a small section of the community used other sources of energy (electricity, kerosene and LPG) (Figure 10).

Figure 9: Climate change adaptation at the local level

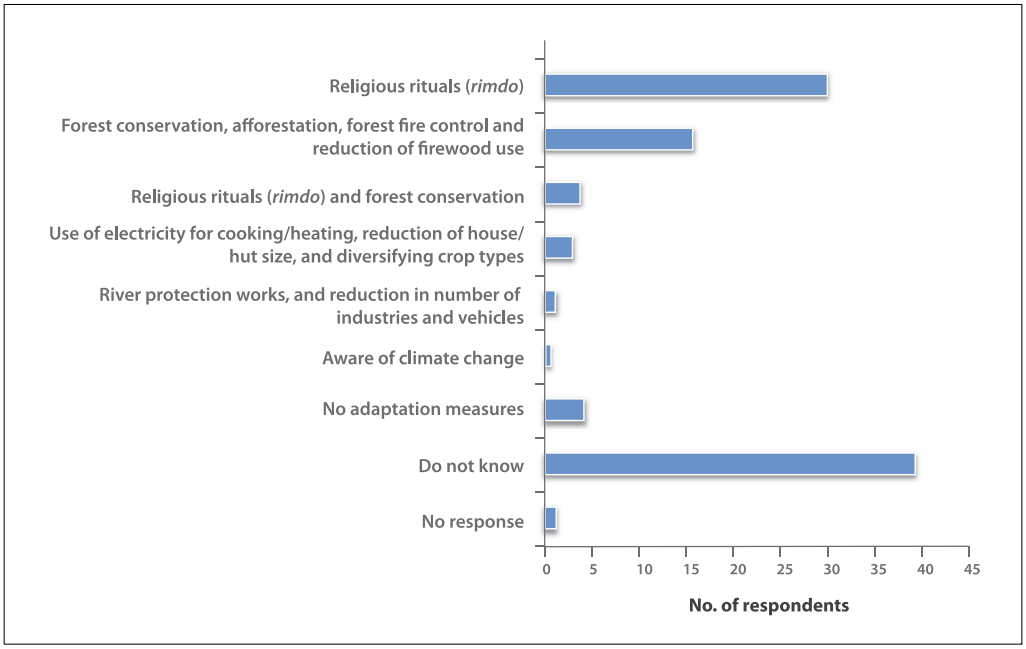
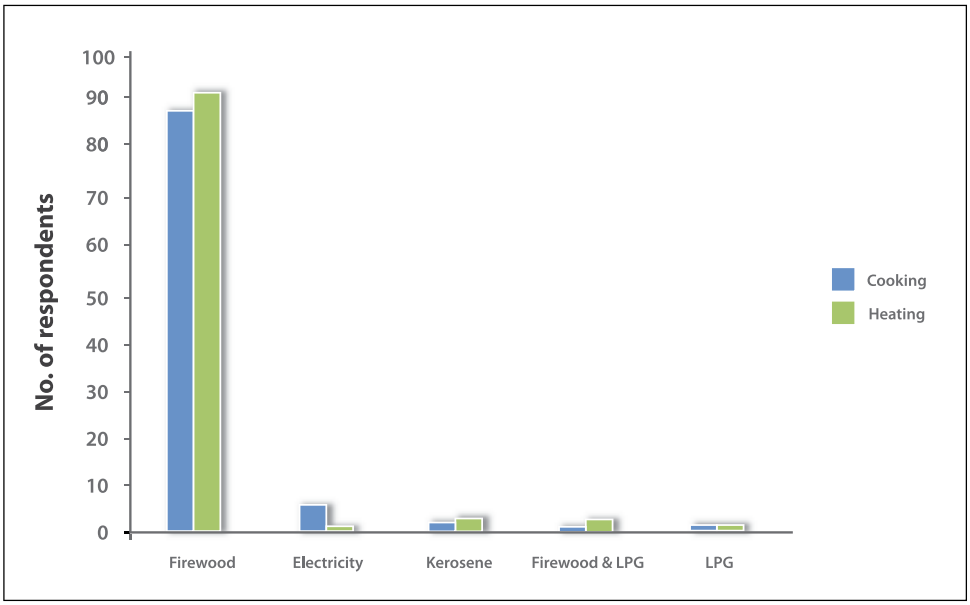


Figure 10: Use of energy for cooking and heating by the Bumdeling community



In the event of crop failure, it was revealed that the local community turned to wage labour, which was available at road and house construction sites.

Recommendations

Climate change is a cross-cutting issue affecting all sectors. Therefore, adaptation measures require an integrated approach with consideration of the agriculture, water resource management, soil and forest conservation, and disaster risk reduction sectors. They need to consider the diversification of a community's livelihood strategies. It is also necessary to mainstream climate change into all development sectors. Based on the impact assessment and policy literature review, proposed adaptation strategies are as follows.

Proposed adaptation measures at the national level

Synchronization of policies and acts

There are currently a number of in-country policies and legislations addressing the environment, forests, biodiversity, food security, etc. While the environment is considered a crucial pillar of the national development philosophy of "gross national happiness", the specific concerns of climate change and its impact upon the environment, and particularly biodiversity, have not been adequately addressed. Nevertheless, due to the impacts of climate change, it is necessary for Bhutan to address climate change concerns through the development of coherent policies within its sectoral plans and programmes that consider the impacts of climate change on forests.

Bhutan's National Adaptation Programme of Action (NEC 2006) is the first and only document that focuses purely on the urgent need to address vulnerabilities to climate change. However, forests and biodiversity issues are not reflected as immediate short-term priorities within this plan. In order to ensure biological diversity, policies for climate change adaptation and mitigation to climate change need to be both sound and farsighted. They should also respect the role that diverse natural ecosystems play. Some of the recommendations that need to be taken up immediately are:

- Holding a national policy synchronization workshop incorporating all conservation policy stakeholders; and
- Introducing senior-level and inter-sectoral legislative seminars to harmonize the identified policy gaps regarding field-level conservation programmes.

Research and education

As climate change is a fairly new and emerging issue in Bhutan, there is limited understanding of its causes and impacts. So far, no specific research in determining the impacts of climate change on forests and biodiversity has been conducted. The vulnerability of species and ecosystems to the impacts of climate change is not well documented, and huge knowledge gaps exist concerning species at risk, keystone and range-restricted species, and species' responses to climate change. In order to protect natural ecosystems, prevent biodiversity loss, and monitor climate change, existing studies on the composition, distribution and dynamics of forests within Bhutan should be strengthened to include details of invasive plant species, forests pests and diseases.

Institutional linkages and coordination

Currently, there are numerous government institutions and non-governmental organizations working in isolation on biodiversity and climate change issues. Therefore, there is an urgent need to revisit and realign the existing framework to ensure that all organizations work transparently and in synergy with one another. This could assist in the effective utilization of the limited resources available and enhance the delivery of results.

Capacity-building and finance

Inadequate capacity and finance are barriers to understanding the responses of biodiversity to climate change. They also constrain activities related to climate change adaptation and biodiversity conservation. Therefore, there is a need to develop technical expertise, both in terms of human capacity and infrastructure (for example, weather stations placed at different elevations), in order to achieve a better understanding of the impact of climate change on forests and biodiversity.

Proposed local level adaptation measures

Awareness on the causes and impacts of climate change

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Although community members seemed to be aware of climate change, they had a limited understanding of its causes and its impacts on remote areas. A significant portion of the community thought that climate change was occurring due to the non-performance of religious rituals. Rural communities already have a good understanding of local climate patterns and are accustomed to dealing with them. However, an important reality of climate change is that it is likely to lead to more uncertain and possibly more extreme climate events. The implications of this are that current practices, systems and infrastructure, which are more or less adapted to current climate variability, could become increasingly unsuitable. This issue is further aggravated by the fact that local perceptions and interpretations of climate variability can be broad and diverse among different communities and social groups. Therefore, community awareness needs to be raised to help reverse these trends and increase local resilience. This could also help encourage more environmentally sustainable behaviour. Awareness-raising activities could also help enhance adaptation planning by identifying the problems related to climate change, knowledge gaps and useful local knowledge and practices.

Promotion of small scale cottage industry

Small-scale industries should be promoted as a means to provide off-farm income generating opportunities to supplement the community's livelihoods in the event of climate disasters (early/late rains, pest damage, frosts, hail storms or droughts). Promotion of small-scale weaving centres and Bhutanese traditional paper (*desho*) making industries could help the local community of Bumdeling earn additional income. There is also an opportunity for the introduction of a small-scale furniture industry in the village. The government should also encourage the community to establish a *shazo* (a wood turning and lacquering centre) to produce different types of wood containers and masks that can be sold to tourists and other communities.

Diversifying agricultural crops

Agriculture will continue to be the major source of livelihoods for rural communities. However, it needs to be diversified to withstand the impacts of climate change. The area suitable for farming is limited, and settlements are scattered across the mountain terrain. Determining technologies to meet the requirements of farming communities is also a considerable task, as the local environment varies widely from one valley to another. The size of agricultural land holdings is also decreasing as the size of households increases. Soil is another factor that decreases agricultural productivity if not properly managed. Crop varieties need to become more diversified to include those that perform best under erratic climate conditions. More research on crop varieties is necessary, to examine their suitability. If the annual crop fails, farmers should be encouraged to turn to perennial crops such as fruit or crops that can withstand these new conditions.

The promotion of organic pesticides and fertilizers is required. In addition, storage facilities for horticulture crops such as potatoes and fruit are needed. Improved infrastructure such as roads and irrigation channels are also critical.

Sustainable land and soil management

Soil and land management technology that suits a mixed farming environment is the key to reducing soil erosion and increasing crop diversity and fodder availability. In Bhutan, more than 31% of agricultural land is situated on slopes steeper than 50%. This causes erosion that contributes to the sediment loads of rivers. Fodder trees and grasses planted along the farmland as hedges could provide additional animal fodder and help minimize erosion. In fact, the loss of soils has been reduced by up to 50% through the introduction of such systems. This also helps build up the soil's carbon and organic matter. Unfortunately, farmers find it difficult to introduce this practice, mainly due to limited arable land and the farming systems practiced. For example, the average holding is around 4.3 acres, and most of the farmers let their cattle loose to graze the land following harvest. This poses a problem in maintaining hedgerows during winter. Soil and land management are important measures in adapting to the impacts of climate change, and measures will be required to build the resilience of agricultural land to withstand not only an excess of water due to high levels of rainfall, but also droughts.

Soil organic matter should be conserved through low tillage and by maintaining soil cover. This practice will help improve and stabilize the soil structure, allowing soils to absorb higher amounts of water without causing surface runoff. Crop rotation should also be encouraged to maintain permanent soil cover, as leaving crop residues or cover can increase a soil's organic matter and reduce impacts from flooding, erosion, drought, heavy rain, etc.

Establishment of storage facilities

Establishing improved or upgraded storage facilities in a few strategic locations within the *gewog* will help store agricultural products obtained during good harvests. This will provide access to food grains as insurance against losses and damages.

Reduction of house sizes in the community

Some respondents felt the need to reduce the size of houses in the villages; the government should encourage people to build smaller houses by providing incentives. Encouraging communities to build small structures has several benefits, as construction costs would be lower, and there would be less property damage in the event of natural disasters. It also reduces timber demand and leads to less exploitation of forestry resources.

Initiation of crop and livestock insurance schemes

Currently, only people and property are insured. Increasingly, the government has taken the lead in initiating and encouraging people to apply for crop and livestock insurance so that they do not suffer in the event of natural disasters or extreme weather.

Local capacity-building programme

The capacity of local leaders and the community in considering crop and livelihood diversification options should be strengthened. A scientific approach to community forest management to meet the diverse requirements of mitigating climate change impact and conserving ecological services should be promoted to local leaders and community forest owners. This transfer of skills and knowledge requires an assessment of the impacts of climate change on forestry, agriculture, livestock and health. Adaptation measures such as crop diversification and crop and livestock insurance should be developed to minimize the risk of climate change.

Mainstreaming adaptation into local development plans

Vulnerability assessments and mapping exercises should become an integral part of local development plans and identify key areas at risk from climate change. The integration of adaptation strategies in development plans is also important. A *gewog* development plan should incorporate strategies and actions that promote community based adaptation. Local leaders should also be encouraged to consider the long-term impacts of climate change when drafting five-year plans.

Table 3: Summary of proposed climate adaptation activities, by sector

Sector	Proposed adaptation activities
Agriculture	• Develop and introduce crop and livestock varieties that are more resilient and better suited to limited arable land and extreme temperature and rainfall events • Promote agro-forestry or agro-silvo-pastoral systems to reduce soil erosion and runoff on steep slopes, and to mitigate heat stress and respiration problems • Improve food security for marginal farmers • Terracing and contour bunding • Change cropping patterns • Improve or upgrade storage facilities to store and provide access to food grains as insurance against crop loss or damage or bad yields
Forests and biodiversity	• Promote community-based forest management and afforestation projects as ways to conserve land, water resources and wood production • Develop a socio-economic system that ensures that society is in harmony with the natural environment
Water resources	• Raise community awareness on sustainable use of water resources • Improve land-use planning in degraded water catchment areas to promote afforestation; improve watershed management • Extend, improve and maintain water supply infrastructure • Improve efficiency in irrigation • Recognize and support local involvement through traditional performance of religious rituals (indigenous methods for bringing about timely rain, adequate water for irrigation, ward off pests and diseases and usher good harvests)
Human health	• Ensure safe drinking water • Organize regular cleaning and vaccination campaigns • Control vector-/water-borne diseases • Monitor air and drinking water quality

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Stockholm Environment Institute, Asia Centre
15th Floor, Witthyakit Building,
254 Chulalongkorn University,
Chulalongkorn Soi 64,
Phyathai Road, Pathumwan,
Bangkok, 10330 Thailand
Tel: +66 225 144 15
Website: http://www.sei-international.org

AIT-UNEP RRC.AP

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