

UNFCCC Expert Workshop on
Local Coping Strategies and Technologies for Adaptation to Climate Change
12-13 October 2003, New Delhi

Country Presentation on Bhutan

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Country Background

Bhutan is a small country located in the Eastern Himalayas with an area of 38,394 km² and estimated population of 800,000 (in 2002). As a mountainous country, the elevation ranges from 150 meters in the southern foothills to 7500 meters of the northern peaks, all within a range of just 150 kms. The high variability in the altitude, and the country's location at the juncture of two bio-geographical realms, has resulted in one of the highest concentrations of biodiversity in the world. Also contributing to this high diversity is the rich forests cover (70% of land area).

With a fragile mountain ecosystem and it's as a least developed country Bhutan is one of the most vulnerable to the impacts of climate change. The population is largely agrarian with 79% of the people practicing subsistence farming on just 8% of the total land. Even though the density of population over the whole country is low, almost all arable land is already under cultivation, so the density of population per area of arable land is one of the highest in the world at 520 km² of arable land. Largely pristine watersheds, heavy monsoon rains and steep gradients mean that the potential for hydropower generation in Bhutan is tremendous and is estimated at 30,000 MW. Presently only about 1.5% of this hydroelectricity potential has been tapped through run-of-the-river schemes and contributes about 45% of the government's revenue earnings. With the pristine environment and rich cultural heritage, tourism is another important sector of the economy and is a major source of hard currency. The manufacturing industry is still in an early stage of development and comprises mainly of agro and forest based industries, and mineral processing.

Bhutan stands out as one of the very few countries with net sequestration of greenhouse gas emissions, largely due to the vast forest cover, limited industrialization, and use of clean energy. The First National Greenhouse Gas Inventory produced in 2000 provides the annual GHG emission figures and estimates that, in 1994, the country's forests and land use system sequestered 3,549.52 gigagram (Gg) of CO₂ annually, while total CO₂ emissions were only 228.46 Gg. While Bhutan itself is a net sequesterer of greenhouse gasses, it is highly vulnerable to the impacts of climate change.

Recognizing the serious economic, social and ecological consequences of climate change, and as a LDC party to the UNFCCC, Bhutan will be preparing its National Adaptation Programme of Action (NAPA) in 2004. This will be an important first step towards developing a national response strategy that deals with the possible impacts of climate change in Bhutan. Few of the important sectors that need to be considered in the NAPA for Bhutan are discussed below.

Some Potential Impacts of Climate Change and Response Measures

Developing successful coping strategies and identifying appropriate technologies for climate adaptation can build on existing strategies to reduce vulnerability to present climate variability. Many programs and strategies have been put in place to provide development and thereby reduce vulnerability of local communities. Such programs and institutional arrangements can serve as a basis for developing adaptation strategies, especially in the context of a rapid assessment such as the NAPA

Agriculture

With agriculture being one of the most socially and economically important activities, addressing vulnerability in this sector is vital for Bhutan. With a warming temperature, agro-ecological zones are expected to shift northward and to higher altitudes. Although there may be potential benefits as colder regions experience extended growing seasons, growth and yields are very susceptible to climatic variations, pests and diseases.

Helping farmers adapt to a changing climate will mean finding new crop varieties or species that are more resilient to new climatic conditions, pests and diseases, and as a result farmers may also need to adapt new farming techniques. The present practice in Bhutan has regional agricultural research centers collaborating with farmers in testing new varieties of crops in their fields. Some varieties of improved rice and other crops have already been adopted in many areas, and experiments to develop rice varieties suitable for high altitude areas (3000m) have already met some success in Bhutan. Such collaborative arrangements to develop and test crop varieties suitable under change climate for all agro-ecological zones needs to continue, and such arrangements must also ensure that farmers are able to learn new techniques for any crops that may be introduced. A crucial technology that is required to reduce present vulnerability, and even more so under climate change, is the forecasting of local weather to help farmers and researchers reduce vulnerabilities to erratic weather patterns.

Water resources and forests

Changes in rainfall patterns and the hydrological system will also have a significant impact on Bhutan. Streams and small rivers are the source for irrigation, and springs and streams provide drinking water and monsoon rains and winter snows are needed to recharge these water sources. More erratic and unpredictable rainfall patterns (more intense monsoons and failure of snow in winter) will affect agriculture yield and could also lead to water use conflicts, while declines in river flows will lead to the loss of hydropower generation.

There is not much that can be done to affect rainfall patterns so the proper management of forests and watersheds, will be important for protecting water supplies for drinking, agriculture and hydropower generation. The forest policy of the Royal Government to maintain at least 60% of land under forest cover is in recognition of the fragility of its mountain ecosystem and the importance of watersheds in water resources management. Maintaining this policy will prove to be even more crucial in reducing vulnerability under climate change. This will involve restoration of degraded watersheds and protection of critical watersheds. Initiatives to involve community participation in natural resource management need to be supported, and increasing awareness will be crucial in ensuring that local pressures on watersheds are kept in check. For example, protection of communal drinking water sources and management of the surrounding watershed are more successful in practice when people are aware of the connection between the protection watersheds and water supply.

Glacial Retreat and Glacial Lake Outburst floods

Glacial Lake Outburst Floods (GLOF) are one of the most immediate and visibly dramatic effects of climate change in the Himalayan region. Several GLOF events have already taken place in Bhutan in the past century with the most recent being in 1994. Adaptation measures are needed urgently as 24 of the 2,674 glacial lakes in Bhutan have already been identified as potentially dangerous with a high risk of bursting. Many villages, towns, agricultural land and important infrastructure such as hydropower installations are located

downstream of rivers fed by these high-risk glacial lakes. Any GLOF event will have a devastating impact on life, settlements and infrastructure.

A limited amount of measures have been implemented in a few places in Bhutan. Personnel with radio communication systems have been posted in remote locations to monitor lakes in remote areas as a rudimentary early warning system. These systems needed to be supported and improved with automated sensors and alarms systems suitable for remote and harsh locations. Risk assessment and mapping have been carried out to determine the most vulnerable areas and populations. Remote sensing technology is crucial for monitoring changes in glacial retreat and the growth of glacial lakes. Some engineering measures such as lowering the water levels of high-risk lakes have also been taken. Other measures will involve relocation of the most vulnerable populations, reinforcing of bridges and roads and construction of check dams and riverbank protection walls.

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