Shifting Cultivation in Bhutan: A Gradual Approach to Modifying Land Use Patterns

A case study from Pema Gatshel District, Bhutan

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Preface
The “problem” of shifting cultivation, which is accused of destroying forest resources, being uneconomical, leading to destruction of watersheds, erosion, desertification, etc., has already been the subject of two other case studies in this series (numbers 6 and 8). Those two studies tended to defend the view that the practice can be conserved for the time being in its traditional forms rather than being eliminated. The present case study, however, is built around the concept that under the present circumstances of social and economic change, shifting cultivation is not a viable solution in the long run. Therefore, the author, Kumar P. Upadhyay, an FAO forestry expert working in South Asia, examines ways in which the practice could be gradually phased out.

The case study is the result of one of the most sustained efforts made by the Royal Government of Bhutan to strengthen the agricultural base of people dependent on shifting cultivation. This effort, which began in the mid-1980s, involved undertaking a comprehensive evaluation of shifting cultivation and its practitioners, giving particular attention not only to the techniques of shifting cultivation and its environmental impacts but also to the social, institutional and cultural aspects of the communities depending for their subsistence on this form of cultivation, called tsheri in Bhutan. This breadth of inquiry was necessary to glean an understanding of why shifting cultivation has persisted despite repeated attempts to eradicate it.

Though there is increasing awareness that environmental conservation is incompatible with the form that modern shifting cultivation is taking, the case study reveals that shifting cultivation in Bhutan is not at all the unmitigated disaster it is usually made out to be. Shifting cultivation, when still practised using traditional methods, is significantly less destructive than current, more intensive agricultural practices. There are both advantages and disadvantages that need to be appreciated before other land use practices can be considered more suitable. Better infrastructure and technical options are necessary before alternatives are adopted.

This examination of shifting cultivation and its alternatives is dedicated to the Royal Government in its efforts to conserve the environment and improve the standard of living of the shifting cultivators. It is hoped that it will be of use to interested individuals in many countries who are facing the challenge of confronting practices like those described in Bhutan, and who need to explore new, softer ways to reduce shifting cultivation than those usually brought to bear.

The publication of this Community Forestry Case Study was funded by the multidonor trust fund that finances the Forests, Trees and People Programme (FTPP), which is devoted to increasing rural women’s and men’s livelihoods through sustainable self-help management of tree and forest resources. Within the FAO Forestry Department, FTPP is coordinated by Marilyn W. Hoskins, Senior Community Forestry Officer, Forestry Policy and Planning Division.

**NOTA BENE**

At the time of the original case study, in 1987, Bhutan had only 18 districts. By 1992, two more districts had been created - Gasa district, formerly apart of Punakha district in northwestern Bhutan, and Tashi Yangtse, formerly a part of Tashigang district. For the purpose of this publication, there is no major advantage to be gained by rearranging the data collected in terms of 20 districts. In any case, the study district, Pema Gatsel, has not been affected by the change. The data reported in the study mainly pertain to the mid-1980s, though where possible, the material has been updated to 1992 by the editors Karma Ura and Kunzang Norbu.

**Executive Summary**

**Background**

The commitment of the Royal Government of Bhutan to phase out shifting cultivation practices dates back to 1969 when the government promulgated the Bhutan Forest Act. It was recognized then that shifting cultivation, known in Bhutan as tsheri, results in clearing of forest - hastening topsoil loss and erosion and causing haphazard and inappropriate regeneration. In turn, this land use devalues the forest as a national resource. To prevent further land degradation, several policy decisions were taken by the government and corresponding actions were also planned. These policies and plans helped to create awareness about the problem, though very few of the planned activities could be carried out.

A decision was taken to postpone the implementation of ad hoc proposals and to initiate a more rational study of the situation in 1986, and the government asked FAO to assist in carrying it out in Pema Gatsel district, which is representative of Bhutan’s different bio-physical characteristics.

The study goal was to assess how best to implement the progressive phasing-out of shifting cultivation practices in Bhutan, replacing them with more productive and permanent forms of land use. It proposed to do this by developing proposals for appropriate land use systems for sustainable production, as an alternative to existing shifting cultivation. The study was to determine the impact of the new land use systems on the socio-economic conditions of the community, with particular consideration given to creating alternative sources of income. It was to determine how best to assist shifting cultivators and obtain the participation of the population in the implementation of the new policies.

**Reasons for shifting cultivation in the Pema Gatsel district**
The study reveals convincing biophysical, social and economic reasons for the adoption practicing and continuation of shifting cultivation practices in the case study area. The primary reason concerns the biophysical limitations of the land form, geology, climate and edaphic conditions in Bhutan’s mountainous terrains, which are not favorable for the expansion of cultivated areas. The land area available for permanent cultivation is not enough even for subsistence living for the majority of farmers. In fact, of the total cultivated land in Bhutan, 32 percent is under shifting cultivation, and this proportion goes up to 80 percent in the six critical districts.

Even where the biophysical setting allows permanent cultivation, the acute shortage of drinking water sources has restricted the expansion of sedentary agriculture. Opportunities to expand irrigation are limited, soil fertility is low and availability of farm labour is limited for adopting conservation measures. Shifting cultivation represents up to 75 percent of the annual family food requirements for some farmers in the district.

Among the social reasons for the widespread adoption of shifting cultivation is the fact that farmers, particularly in the Pema Gatschel district, prefer to work in groups as on a community farm, and shifting cultivation provides that opportunity. The economic justifications for the adoption and continuation of shifting cultivation include:

- crop production from tsheri converted into wages offers a better wage per day of labour than other work;
- no external inputs other than labour and some seed are required to produce the crop and enrich the soil;
- the crop is not affected by marginal variations in climate; and
- shifting cultivation does not require high-level management capability.

**Impact of shifting cultivation practices**

Shifting cultivation has contributed to both positive and adverse environmental impacts. On the positive side, this practice restricts the intensity of land use, reducing the rate of environmental degradation in situations where capital and land management capability are low. In situations where conservation practices on sloping, permanently cultivated land are restricted due to shortage of labour, shifting cultivation has in fact helped minimize erosion. Tsheri cultivation has helped to avoid social dislocation by providing farming opportunities to the landless around their own villages.

Some adverse environmental impacts have also been noted as a consequence of prolonged shifting cultivation in the study area, however. According to elderly farmers, the variety and growth of the natural vegetation is gradually declining after each cycle of cultivation, Leguminous and nitrogen-fixing plants are victims of recurrent burning. Productivity of tsheri land is declining; older farmers observe that the production from tsheri land is highest during the third cycle (the first cutting of natural vegetation for tsheri cultivation is considered as the first cycle) and thereafter declines. In addition, sheet, rill and gully erosion are increasing every year, especially in lower altitude tsheri land where intense rainfall can occur just after clearing, burning and sowing.

**Proposal for the gradual phasing-out of shifting cultivation**

Rather than recommending the complete and immediate abolition of shifting cultivation, some general strategies are suggested to create more productive agricultural systems while simultaneously conserving national forest wealth. The consequences of a sudden abolition of shifting cultivation would be extremely negative. Families dependent on this practice would no longer be able to sustain their own food needs. Consequently, changes should begin moderately and shifting cultivation practices should be replaced gradually.

These changes should aim to maximize production per unit area from all categories of land on a sustainable basis, with a minimum of environmental degradation and socio-economic dislocation of the farming community. Labour efficiency in agricultural activities must be improved to allow diversion of rural labour into other developmental activities. On-farm capital formation must be increased to help satisfy investment requirements for other developmental needs. To undertake these changes, it will be necessary to create a scientific and administrative framework capable of promoting rational land use.

The case study proposes that progress towards these goals be made in three distinct stages a pilot demonstration and infrastructural development phase; a consolidation phase- where the most successful strategies and techniques are established; and an expansion phase, where more appropriate land use practices are implemented on a regional scale. A pilot demonstration project is described that could be established in Bhutan in the Uri Chu watershed in Pema Gatschel district. The pilot project would demonstrate appropriate land use practices as alternatives to shifting cultivation, and test these alternatives in various agro-ecological situations. Particular attention would be paid to achieving community participation in an effort to promote and maximize the implementation of appropriate new land use strategies.

**Findings and conclusions**

This study seeks to provide an evaluation of shifting cultivation in relation to long-term sustainable land use in Bhutan and presents the several conclusions.

Compared to its neighbors in the Hindukush-Himalayan mountain chain, the environmental degradation in Bhutan is not as alarming, mainly because of low population density and less intensive land use. In a fragile environment like Bhutan where supporting infrastructure is poor, the present land use practices are less damaging than would be high intensity crop production practices without management. Shifting cultivation produces less environmental impact where farmers strictly follow traditional norms for fertility regeneration. Hence it is an ecologically more stable form of cultivation than existing permanent cultivation practices.
The policy of rapidly replacing extensive subsistence agriculture with intensive practices tends to ignore the real needs of small farmers. Until other methods of livelihood production can be introduced, shifting cultivation, usually combined with permanent cultivation, provides the best opportunity for subsistence to the majority of farmers. Socio-economic changes in rural areas make it more difficult to maintain traditional, environmentally sound practices used for cultivating tsheri land. The need to seek alternatives to shifting cultivation has become urgent.

Transforming extensive subsistence agriculture into intensive farming is a complex process. It requires, among other things, appropriate technology, adequate financial resources at farm level, marketing infrastructure, inputs services, extension, education and training, and a progressive attitude from farmers. Such prerequisites cannot be created overnight.

Intensive agriculture practices do not necessarily result in the rehabilitation of marginal lands. In the absence of an appropriate land use policy and an equitable land tenure system, poorer sections of the farming community may be pushed into the marginal land. An organizational and institutional framework to address land use issues is a prerequisite for land resources development initiatives.

Land use policies and programmes cannot be implemented without the active participation of a large number of small farmers. It is very important to mobilize a decentralized organization represented by different disciplines at various administrative levels and implement active extension (teaching and demonstration) programmes.

The study identifies and describes (Chapter 6) four models as possible alternatives to shifting cultivation:

1) nationalizing all land under shifting cultivation by paying compensation and reverting tsheri land back to forest;
2) improving existing shifting cultivation systems;
3) combining forestry and food production; and
4) conversion of tsheri land into permanent cultivated land.

Chapter 1

Introduction

This Community Forestry Case Study presents the results of a study of shifting cultivation carried out between 1987 and 1991 at the request of the Royal Government of Bhutan. The findings, conclusions and proposals of the study are given in the hope that they may be of use in regulating this practice through public policy measures in other countries where shifting cultivation on steep mountain slopes is becoming a problem due to growing population densities and a changing socio-economic landscape.

Shifting cultivation, known in Bhutanese as tsheri, is a predominant form of land use in Bhutan that is practised over an extensive area. According to estimates the study based on 1984 land registration records, the total land area under shifting cultivation is about 40600 ha (RGOB, 1986). However, recent estimates based on the interpretation of satellite imagery reveal that the area covered by shifting cultivation is nearly three times greater than the government estimates (Negi, 1983), or about 115000 ha.

Shifting cultivation has evolved as a land use practice in Bhutan primarily due to scarcity of appropriate land for permanent cultivation because of the extremely mountainous topography of most of the country. Low population densities and isolation from the rest of the world have helped slow the progressive decline of this traditional practice. In addition, shortage of farm labour has been a strong constraint to adopting more conservation-oriented, sedentary farming practices on steep agricultural land.

Until recently, shifting cultivation combined with dryland farming and animal husbandry has provided a minimum level of subsistence for the majority of farmers without appreciable damage to the natural environment. However, the increasing pressure on land exerted by the rising population has begun to destabilize a critical balance between man and nature in some parts of the country. Conversion of inappropriate tsheri land to more permanent dryland farming, expansion of tsheri cultivation into natural forest and reductions in the fallow period are beginning to have adverse environmental impacts at local as well as national levels.

Noticing the beginning of what could quickly become a larger crisis in the future, the Royal Government of Bhutan, when formulating its Fifth Plan, decided to phase out tsheri cultivation by the end of the plan period. During the Fifth Plan period, it was expected that suitable tsheri land would be converted to alternative uses such as dryland farming or reverted back to forest land. However, by 1982-83, several district offices (dzongkhags) raised problems with respect to this policy on tsheri land. They emphasized that the conversion of tsheri land would create considerable hardship for many families, a significant number of whom were dependent solely on tsheri cultivation for their livelihood. They therefore requested that the government allot substitute land. Thereafter, the objective of phasing out tsheri cultivation was not actively pursued, even
though the policy itself was left intact.

In November of 1984, the government developed a crash proposal to phase out tseri cultivation by buying these lands from the farmers and putting them to more appropriate use. The proposal envisaged a 10-year programme to buy 12180 ha (30 percent of the government’s estimate of total tseri land area) at an estimated cost of about Nu. 15 million (about US$ 1.2 million at the time). The proposal activity was to be implemented initially in the six eastern districts and eventually in the rest of the districts. The primary objective of the scheme was to identify critical tseri land, particularly that owned by small farmers, pay compensation and encourage them to buy or develop permanent land. If the permanent land could not be made available, the displaced cultivators were to be moved into resettlement areas. This proposal also recommended interim criteria for the evaluation of tseri land for alternative uses.

This proposal could not be implemented for several reasons. First, the project budget was too high for the government to afford. Second, the evaluation criteria for identifying critical land and poor farmers were vague and inadequate. Third the work force to implement such a big target was not available in the districts. Fourth, specific alternatives to shifting cultivation were not included in the proposal.

During the formulation of the Sixth Five-Year Plan, the government made the decision to defer the implementation of this proposal and initiate a more rational study of the situation in at least one district. Following this decision, the Royal Government of Bhutan in 1986 asked for FAO assistance in carrying out the study. Pema Gatshel district was selected for the case study, which began February of 1987.

Objectives of the study

The objectives of the study were:

1) to develop appropriate land use systems for sustainable production as an alternative to existing shifting cultivation;

2) to determine the impact of the above changes on the socio-economic conditions of the community - considering the main possible alternative source of income; and

3) to determine how best to lend assistance to and obtain the participation of the population in the implementation of new policies on land use.

Scope of the study

The study reviewed the status and problems of shifting cultivation practice in Bhutan in general and Pema Gatshel district in particular. It further examined the potential to convert land under shifting cultivation to other alternative uses and included an assessment of the ramifications of such changes at national and local levels. Different alternatives that could contribute to the phasing-out of shifting cultivation were proposed. The advantages and disadvantages of each alternative were discussed. The study looked at issues that needed to be addressed by the government before undertaking large-scale field interventions aimed at phasing out shifting cultivation. A pilot demonstration area was identified and recommended to test and demonstrate different alternatives. Land use models that could substitute for shifting cultivation practices were recommended for pilot demonstration activities in Pema Gatshel. Criteria for the preparation of a treatment-oriented land capability classification map were recommended for testing and application in the pilot demonstration area.

The study does not pretend to be an exhaustive analysis of biophysical, social and economic variables that determine appropriate land use. Such an analysis is possible only after a varied information base is established and the infrastructure to analyse such information is created. To help create such an infrastructure, this study has recommended the implementation of short, medium and long-term programme interventions for permanent and lasting land use planning in the country.

The collection and analysis of information required to complete this study involved the following steps:

1) a study of government policy and plan documents, feasibility and sectoral studies conducted by bilateral and international funding agencies, including studies conducted for this project by a land use consultant, a socio-economist and a soil management expert/agronomist, as well as an analysis of previous studies on issues related to shifting cultivation;

2) a review of the existing maps and aerial photographs in the office and in the field (though aerial photographs were available only for very limited areas);

3) extensive field visits in seven blocks (gewogs) of Pema Gatshel district, and visits to other districts; during the field visits 18 village meetings were conducted and 180 household surveys were completed; and

4) meetings with several government officials in Pema Gatshel and other districts and different departments and ministries in Thimphu, as well as with key officials of the United Nations Development Programme and FAO missions in Bhutan.

Chapter 2
Physical Environment and Land Use in Bhutan

The physical environment

Area and population

Bhutan is a mountainous country, with an estimated area of about 46500 km$^2$. It is bounded by the Tibetan plateau of China in the north, India in the east and south and Sikkim (now part of India) in the west. The country is normally classified into three geographical zones: the foothills, a 20 km-wide strip in the south, rising to an altitude of 1500 m; the middle mountains, rising gradually to an altitude of 5000 m; and the high mountains, with altitudes reaching over 7500 m (Bhutan’s two highest mountains are Jhumo Lhari at 7541 m and Kula Kangri at 7314 m). Flat land is limited to a few relatively broad river valleys in the mid country and a small section just below the foothills.

The population of Bhutan was estimated to be almost 600000 in 1993, and was 90 percent rural. Estimated population growth rate has remained at about 2 percent since the 1950s, and life expectancy is 45.8 years for men and 49.1 for women.

Physical characteristics

As is the case in neighboring Himalayan ranges, the land mass of Bhutan has fragile geology and immature soils. In the foothills, a combination of factors such as steep slope gradient and loosely consolidated bedrock tend to promote severe surface erosion in spite of thick vegetative cover. In the high mountains, rocks are resistant to weathering, and because of low rainfall and temperature, chemical weathering is also slow. Hence the soil formation is slow, leading to shallow soil depth with a high percentage of rockiness and stoniness. In the middle mountains, granites and limestones are highly weathered.

The series of mountains in Bhutan are dissected by fast moving rivers that flow from north to south through deep and narrow gorges and steep-sided ravines. These rivers are fed by perennial snows and the summer monsoon or both. The country is drained by four major river systems - the Torsa, the Wang Chu, the Sankosh and the Manas (see Map 2).

Owing to the wide variations in the physical features within short vertical as well as horizontal distances, Bhutan has great diversity in climate compared to other regions of similar size, ranging from hot and humid subtropical in the south to perpetual ice and snow in the high Himalayas. Each valley has unique climatic characteristics resulting from differences in altitude, rainfall, and exposure to sunlight and wind, but the predominant climatic feature is the southwest monsoon. Overall, 60-90 percent of the precipitation falls between mid-June and September. Precipitation decreases as altitude increases and as one moves from west to east. The foothills on an average receive more than 2500 mm of precipitation annually, whereas the middle mountain valleys receive between 500 and 1000 mm and the high mountains rarely more than 500 mm.

Mean temperature logically follows altitude, ranging from the subtropical belt at about 15° to 30°C, to middle altitudes of around 1500 m where the climate becomes cool and misty much of the year, to the high mountains at 3500 m and above, where the climate becomes increasingly severe with limited precipitation, short cool summers and long cold winters.

Vegetation

Sixty-four percent of the land area in Bhutan is covered by trees, 6.6 percent by alpine pasture/meadows and shrubs, 8.8 percent by agriculture, 10 percent by snow and glacier and 10.6 percent by exposed rock, grasslands, water, etc. (see Fig 1) Five distinct vegetation zones can be delineated according to altitude.

1) Below 1000 m: Tropical zone, with forests of Terminalia, Largerstroemia and Shorea spp. Much of this land is now being used for cultivation.

2) 1000 and 2000 m: Subtropical zone, with extensive forests of schima, Castanopsis and Lithocarpus spp. Some of these areas are now being used extensively for shifting cultivation.

3) 2000 to 3000 m: Temperate zone, forests of Quercus spp. (oak) and pines. Some of these areas are cleared for grazing and the remaining forests are also used extensively for grazing.

4) 3000 to 4000 m: Subalpine zone, forests characterized by Tsuga spp. and Abies with extensive areas of Rhododendron. In the drier areas Juniperous spp. are common. Some of these areas are overgrazed and this is seriously affecting forest regeneration.

5) Above 4000 m: Alpine zone, characterized by alpine grasslands and wet meadows above the tree line.

Farming systems and practices

Farming systems in Bhutan can be classified into three subsystems: pastoral-transhumance system; subsistence-level crop and animal husbandry; and early commercial farming. The present cropping calendar in valley cultivation proceeds according to traditional beliefs and experience, and has remained relatively unchanged for the past 20 years.
The pastoral-transhumance system resembles primitive hunting-gathering systems (Harwood, 1979). It consists of migratory communities primarily dependent on cattle grazing and is prevalent throughout the northern range and at altitudes of 2800-4500 m, often known as the "yak zone." Transhumant communities lead a semi-nomadic life, moving from one permanent habitation to another depending on the season and the availability of pasture. In winter, at lower altitudes, they trade livestock products and buy necessary consumer items, including low altitude food crops like rice. During summer they cultivate their land with barley, millet and buckwheat. The labour required in this farming system is varied enough to employ family members of all ages, including children and older people.

The majority farming system in the country is subsistence-level crop and animal husbandry. More than 90 percent of the farm production in this system is consumed directly on the farm and there is little selling or trading. Cash income is limited to seasonal marketing of fruits and dairy products. Agricultural inputs and improved seeds are rarely purchased, but leaf litter and compost are used to replenish soil fertility. Tools and equipment are indigenous and there is little mechanization. Households grow a wide variety of field and tree crops and keep an average of five to six head of cattle, producing food all year round. This system provides continuous employment for unskilled labour to tend crops and livestock.

In the southern foothill belt of the country, a small but encouraging amount of commercial farming has begun to emerge during the past 20 years. Here, some farmers are marketing their surplus production. Increased productivity has been achieved by introducing cash crops such as potatoes, chilies, cardamoms, oranges, apples and vegetables. In addition, modern inputs such as improved seeds and fertilizers are being introduced. Development efforts over the last 20 years have contributed to better irrigation facilities and extension services to the farmers and improvements in farm machinery, progressive mechanization, and the adoption of conservation practices.

Livestock grazing

The majority of settled farming households keep cattle for draught power and milking purposes. Manure from the cattle is extensively used as a fertilizer in crop production. Fewer cattle are kept in the south (about two animals per hectare of agricultural land) than in the rest of the country (about five per hectare).

While exact information on the extent of land used for grazing is not available, grazing land overlaps with forest land in all the districts, to the point where in some districts the predominant use of forest land is for livestock grazing. Official records estimate that approximately 10-12 percent (450-550,000 ha) of the total land area in Bhutan is presently under seasonal grazing. This grazing land is mainly located in the western region, while the eastern and southern regions have significantly less. Grazing land divides into the four vegetation zones: subtropical, temperate, subalpine and alpine.

Forestry in land use -Forest cover

The forest resource in Bhutan is unique in the Himalayan range due to its enormous variety, changing with altitude over a relatively short distance from subtropical forest through temperate broad-leaved and coniferous woodland to high alpine meadow and scrubs. The country is blessed with high grade forests, which represent its major renewable natural resource. Remote sensing data indicate that as much as 64 percent of Bhutan's land area is forested. Owing to the low population density, the forests in Bhutan are in much better condition than those found in neighboring Himalayan countries. Ninety-four percent of the land under forest is well stocked, 0.5 percent is covered by plantation and only 5.5 percent is degraded. Most
Community and private forests.

Three types of cultivation can be identified among Bhutan's subsistence farmers: valley cultivation, terrace cultivation and shifting cultivation (Negi, 1983). **Valley cultivation**, in areas with less than 30 percent slope, is on land that is normally terraced and irrigated (wetland or chushing). This type of land represents 18 percent of the total cultivated land, and is normally used to grow paddy rice (75 percent of the cropped area) on terraces as a summer crop and mainly wheat in the winter, with some buckwheat, potatoes, mustard, maize, pulses, and vegetables where altitude and irrigation permit.

**Terraced cultivation** is on rain-fed land (also referred to as dry land or kamshing) with more than 30 percent slope. Almost 50 percent of the cultivated land in the country is under terraced cultivation (on which the "terraces" are the natural result of years of cultivation, rather than being purposely constructed). Maize is the major summer crop, followed by buckwheat in areas not suited for maize due to cold summers. Wheat, barley, mustard, pulses, buckwheat and potatoes (gaining popularity as a cash crop) are common winter crops in maize growing areas.

The third type is **shifting cultivation** (tsheri), the subject of this study, practised on 32 percent of the cultivated land. Shifting cultivation is practised to hedge the risk of crop failure and to compensate for food deficit, and almost all farmers practising it can be regarded as subsistence farmers. Maize represents 68 percent of crops produced on this land.  

Forest management

The importance of forest management for sustainable use of forest resources has long been recognized by the Royal Government of Bhutan, and protection and management of forests has always remained a high priority in its development policies. To this end, a Forest Directorate was established early on in 1959. The present Department of Forests was organized in 1967 and it was one of the first government departments. All forest activities other than social forestry and forest fire control are under central administration. An integrated forest management and conservation project has been planned for a period of four years. It is expected that this project will be instrumental in assisting the Department of Forests to strengthen different aspects of forest management such as management planning, silviculture, protection and afforestation, watershed management, social forestry and the development of human resources.

Rights privileges and ownership of forest resources

The adoption of the Bhutan Forest Act in 1969 consolidated several previous polities and laws relating to forest rights, the transit of forest products, and forest royalties. A provision in the act declared that any forest land on which no person has a permanent, heritable and transferable right was a Government Forest Reserve, bringing almost all forest land under the control of the government. The act also stated that the government held rights on forest resources on private land. By assigning authority to enforce the rules to the Department of Forests, this was meant to bring under control the free grazing and uncontrolled utilization of forest resources practised by local communities. Yet almost all forest that is accessible to livestock is grazed, and shifting cultivation inside Government Forest Reserves, though banned by law, is widespread.

It soon became apparent that modifications were needed, and thus the Forest Policy Act of 1974 clearly stated the rights and privileges of the local communities. This act permitted private individuals to take dry fuelwood, including dead trees, from forest land upon presentation of a permit. The permits were free but were required mainly to control entry into the forests. A provision allowed for individuals to fell trees for purposes of personal construction, though they first had to obtain clearance from the Department of Forests and pay nominal royalties. Commercial utilization of forest resources was permitted in approved areas against the payment of royalties and a contractor license fee.

Two major changes were introduced in 1979: the government virtually nationalized all commercial logging operations, and movement of timber or logs by night was banned to control illicit felling and retrieval of timber. The government also restricted the export of logs and sawn timber in an effort to encourage more export earnings by locally processing forest produce.

Community and private forests. The Forest and Nature Conservation Act of 1993 introduced the possibility of practicing community forestry and private forestry, and it framed rules relating to this. According to the Community Forest Rules, any area of the Government Reserved Forest that is suitable for management by a local community can be designated as a "community forest area." All households traditionally using a particular forest land unit can constitute a user group. A community forest management plan is prepared by the district forestry extension agents involving the block headman (Gup). Seeds and seedlings and other extension services are provided by the government free of cost. The government does not levy any royalty for use of forest produce by the members of the user group. The group can sell forest products in excess of local requirements, but the proceeds of these sales must be put in a community account for use in implementing the management plan, protecting the forest and for other community purposes.

The Private Forest Rules allow any person to take forest produce from his own registered private land without a permit or royalties, provided that the tree was planted (or sprouted naturally) on the land no earlier than 1979. Private Forest can be established in dry land (kamshing), rotation land (pangshing - cultivated once every four to five years), shifting cultivation land (tsheri) and land adjacent to homestead provided it is registered and does not exceed 25 acres.

Cultivation systems

Three types of cultivation can be identified among Bhutan’s subsistence farmers: valley cultivation, terrace cultivation and shifting cultivation (Negi, 1983). **Valley cultivation,** in areas with less than 30 percent slope, is on land that is normally terraced and irrigated (wetland or chushing). This type of land represents 18 percent of the total cultivated land, and is normally used to grow paddy rice (75 percent of the cropped area) on terraces as a summer crop and mainly wheat in the winter, with some buckwheat, potatoes, mustard, maize, pulses, and vegetables where altitude and irrigation permit.

Shifting cultivation is practised to hedge the risk of crop failure and to compensate for food deficit, and almost all farmers practising it can be regarded as subsistence farmers. Maize represents 68 percent of crops produced on this land.
Chapter 2: End notes

1. Appendix A, Table 10 gives rainfall figures for some selected stations.

2. See Appendix A, Table 11, which presents maximum and minimum temperatures at selected stations.

3. The specific determinants of the cropping calendar pursued by Bhutanese farmers are listed in Appendix A.

4. Further information relating to the varieties of grazing animals is included in Appendix B.

5. Descriptions of the species composition of pasture can be found in Appendix B.

6. See Appendix C.

7. Production and sustained yield estimates are detailed in Appendix C.

8. For further details relating to crop yields and cropping intensity, see Appendix A, Tables 12-14.

Chapter 3
Pema Gatshel: The Study Area

The study method

The Royal Government of Bhutan selected Pema Gatshel as a representative district for a detailed study on the problems and practices of shifting cultivation in the country. The findings and conclusions presented in this case study are the result of extensive field visits in all the blocks of the district, including 18 village meetings and a survey covering 180 households. Field survey information was verified by extensive reviews of literature and of several district records available in the Pema Gatshel district office. The results of the study are presented in this chapter. These findings are considered to be reasonably representative of the overall problems of shifting cultivation in Bhutan, as well as those of many similar high altitude shifting cultivation areas in other parts of the world, and they are used to propose alter-natives to this system of land use.

Physical characteristics of the study area

Pema Gatshel lies in the east-central part of Bhutan, and has a total area of 490 km². The district is divided into seven "blocks" for all administrative purposes; they are Chimong, Chongshing Borang, Dungmain, Khar, Shumar, Yurung and Zobel. The land form is a moderately to steeply sloping mountainous terrain with limited areas occupied by ancient river terraces. River valleys are narrow and flood plains are restricted to narrow strips along the river beds.

The district represents the middle mountain chain of the eastern Himalayas and is characterized by moderately high altitude (300 -2500 m). It represents the catchment area of the Manas River and the main tributaries that drain different blocks in the district are Zalle Ri, Demri Chu, Uri Chu and Hyu Ri. The stream network of this district is very dense. Stream gradients are steep and drop suddenly when they enter valleys.

Soils are extremely variable, reflecting the differences in bedrock, geomorphology, microclimate and land use. The texture varies from sandy loam to clay loam. In tsheri land soil is generally poor. Soils are generally shallow, varying from 5 to 100 cm; PH varies from strongly acidic to alkaline; and varying degrees of stoniness and rockiness can be observed in tsheri land and dry land.

The range in climate of Pema Gatshel is from subtropical to lower temperate. At approximately 1600 m the climate is cool and misty during most months of the year. At an elevation of 2000-2500 m the climate is usually quite variable, generally temperate, with distinct changes in season. In the subtropical zone daily temperatures vary from 15° to 30° C and in the temperate zone the variation is from 5° to 24° C.

Rainfall data has only recently been collected at three points. At the station in Pema Gatshel average rainfall from 1986-87 was 1921 mm. In 1991, rainfall was recorded in Yurung at 2 301 mm and in Dungmain at 2 720 mm. The pattern of rainfall is generally evenly distributed, having a peak during July in all points of the district. Dry months are November and December as well as the latter part of July. Hailstorms present a definite hazard every year to crops over half of the district (Khar, Shumar, Dungmain and Chongshing blocks), whereas the remaining area suffers from hail at least once every three years. Frost is usually for a period of two weeks each year in all blocks, and it is of greatest intensity in Zobel, Shumar, Khar and Yurung blocks.

Forest land
Forest vegetation in the study area consists of subtropical forests between 500 and 2000 m and temperate forest at over 2000 m. At 68 percent, forest cover in the Pema Gatshel district is slightly higher than the national average. Most of the forest land is found above 2000 m, on slopes over 80 percent and along streams and riverbanks, and includes the four forest types described below.

The total growing stock is about 6.6 million m³, the net growing stock is 5.4 million m³ and the net annual yield is about 180000 m³ (DOF, 1986). Soils in the forest areas are rather acid and consist of loamy sand, silt loam and sandy loam. Levels of nutrients are low, though the soils are of good composition, and even on steeper slopes, the shallow topsoil overlies subsoil and weathered parent rock with relatively good root permeability. Topsoils and level of humus are deeper than in cultivated areas.

Two forest types predominate in subtropical forest. The first type is subtropical wet hill forest and occupies the slopes from about 1000 m to 2000 m. The dominant species are mostly evergreen, though deciduous trees (e.g., Betula) occur sometimes in pure consoilation. Main species are Betula spp., Castanopsis spp., Cre-drella spp., Albizia procera, Schima wallichii, Alnus nepalensis, and Engelhardita spicata. The second type, chirpine forest, is generally found between 1000 and 1500 m but can be found as low as 500 m on cooler slopes and up to 2000 m depending upon local factors. Chirpines are usually found in pure stands. Chirpine is also found in association with Rhododendron spp., Quercus spp., Schima wallichii, Castanopsis spp., Kydia calycina and Phyllanthus emplica.

Among temperate forests that occur at 2000 m and over, two forest types are found in this district. The first type, found between 2000 and 2500 m, is the east Himalayan wet temperate forest. The vegetation composition consists mainly of oaks such as Quercus Lamellosa and Quercus Pachyphylla, Acer spp., Betula alnoides and Magnolia spp. The second type occurs on cooler slopes, where blue pine forests predominate.

The main value of the forest to villagers comes from the leaves gathered for compost and forest plants gathered for food and medicines. Timber is taken out only with special permission from the Forestry Department.

**Population, settlement pattern and land use**

According to the district administration, there are altogether 2506 households in the district. With an average household size of seven members, the district population is about 17500. Accordingly, the population density in the district is estimated at about 36 persons per km², which is very high compared to the country average of 13. As can be seen in Table 1, Yurung (89 persons/km²) and Chongshing Borang (70 persons/km²) are the most densely populated blocks.

The settlement pattern is such that hamlets and villages tend to be somewhat isolated. In general, settlements are located in the middle ranges between mountain ridges and valley bottoms. Temperature, topography and availability of drinking water sources are the main factors deciding the settlements’ location. The houses are not normally clustered, with few exceptions like Yurung and Tongsa villages. In general, houses are separated at least by a kitchen garden.

<table>
<thead>
<tr>
<th>BLOCKS</th>
<th>NO. OF H/HOLDS</th>
<th>ESTIMATED POPULATION</th>
<th>GEOGRAPHIC AREA (KM²)</th>
<th>POP. DENSITY PERSONS/KM²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimong</td>
<td>183</td>
<td>1281</td>
<td>45.2</td>
<td>28</td>
</tr>
<tr>
<td>Chon.Borang</td>
<td>258</td>
<td>1806</td>
<td>26.2</td>
<td>70</td>
</tr>
<tr>
<td>Dungmain</td>
<td>282</td>
<td>2681</td>
<td>122.3</td>
<td>22</td>
</tr>
<tr>
<td>Khar</td>
<td>421</td>
<td>2947</td>
<td>115.2</td>
<td>26</td>
</tr>
<tr>
<td>Shurnar</td>
<td>593</td>
<td>4151</td>
<td>87.6</td>
<td>47</td>
</tr>
<tr>
<td>Yurung</td>
<td>376</td>
<td>2632</td>
<td>29.5</td>
<td>89</td>
</tr>
<tr>
<td>Zobel</td>
<td>292</td>
<td>2044</td>
<td>64.0</td>
<td>32</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2506</strong></td>
<td><strong>17542</strong></td>
<td><strong>490.0</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

In spite of the district’s higher proportion of forest land, per capita forest in Pema Gatshel is 1.8 ha per person overall, which is lower than the national average of 2.2 ha, due to the district’s higher population density. The higher density is also reflected in the much higher proportions of tsheri land (nearly six times the national figure) and cultivated land (more than double - see Table 2). Within this figure, Zobel, Khar, Dungmain and Chimong blocks have more per capita forest than the
national average, and Chongshing, Yurung and Shumar have far less per capita forest (Table 3). There is also great variation in household holdings of permanently cultivated land; Zobel has the maximum of 2.16 ha per household where as Yurung has only 0.59 ha. Household holding of tsheri land is highest in Dungmain (7.7 ha/household) and lowest in Zobel (1.5 ha/household - see Table 3)

TABLE 2: LAND USE TYPES IN PEMA GATSHEL COMPARED TO THE WHOLE OF BHUTAN

(Area in km², percentage in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>TSHERI LAND</th>
<th>PERM.CULT.LAND</th>
<th>FOREST LAND</th>
<th>TOTAL AREA (incl.other uses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pema Gatshel</td>
<td>87 (17%)</td>
<td>66 (13%)</td>
<td>336 (68%)</td>
<td>490 (100%)</td>
</tr>
<tr>
<td>Bhutan</td>
<td>1151 (3%)</td>
<td>2409 (6%)</td>
<td>25715 (64%)</td>
<td>40250 (100%)</td>
</tr>
</tbody>
</table>

SOURCE: Negi, 1983

Landownership pattern and land tenure

Of the 2506 households in Pema Gatshel district, 88 are landless. All the cultivated land is registered in the name of 2 182 household heads, while 236 households own cultivated land but their share of land has not been segregated from joint ownership in the land registration records (sathram). The detailed landholding pattern is presented in Tables 3 and 4. Table 4 indicates that 4 percent of the households are landless, 3 percent own only tsheri land, 78 percent have less than 1 ha of permanently cultivated land and 15 percent have more than 1 ha. Land is not normal rented for cultivation. There are very few absentee landlords in the district.

Household land is usually fragmented into several parcels, on average between three and five. However, farmers with as many as 10 parcels of land scattered all over the village can be observed in Yurung.

The 1979 Land Act of Bhutan prohibits sale of land if the family holding is less than 2 ha. As the majority of the farmers have a far smaller family holding, sale and purchase of land is minimal in Pema Gatshel. According to the Land Act, each member of a joint family has equal rights to land owned by the head of the family. However, inheritance of property is more or less defined by tradition and, ultimately, it is governed by the wish of the parents. In most cases, the head of the family leaves behind a will clearly indicating the details of distribution of family owned land. The right of a family member to the inheritance of property normally ceases if he or she leaves the house to stay with in-laws or is absent from the households for more than 10 years.

According to land registration records 84 percent of the farm households own tsheri land, though only about 4 percent own more than 1 ha of tsheri. However, the field situation is different from registration records. Cultivated land has not been accurately surveyed; farm boundaries are established according to the description in the registration records. Boundaries of tsheri are unclear and forest land is not demarcated, so that the frontier between forest land and cultivated land is vague. Most of the households in the project area are, in fact, dependent on tsheri cultivation for some portion of their subsistence. It is the increasing demand for food that is presently pressuring the tsheri land into shorter and shorter fallow periods.

TABLE 3: LANDHOLDING PER HOUSEHOLD IN PEMA GATSHEL DISTRICT

(Average household has seven members)

<table>
<thead>
<tr>
<th>BLOCK</th>
<th>HOUSEHOLD</th>
<th>CULTIVATED LAND (gross)</th>
<th>CULTIVATED (perm.)</th>
<th>TSHERI</th>
<th>FOREST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimong</td>
<td>183</td>
<td>4.2</td>
<td>1.0</td>
<td>3.2</td>
<td>18.4</td>
</tr>
<tr>
<td>Chon.Borang</td>
<td>258</td>
<td>4.1</td>
<td>0.8</td>
<td>3.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Dungmain</td>
<td>383</td>
<td>8.3</td>
<td>0.7</td>
<td>7.7</td>
<td>19.5</td>
</tr>
<tr>
<td>Khar</td>
<td>421</td>
<td>4.8</td>
<td>0.8</td>
<td>4.0</td>
<td>19.8</td>
</tr>
</tbody>
</table>
TABLE 4: BLOCKWISE LANDHOLDINGS BY HOUSEHOLD IN PEMA GATSHEL

(Average household has seven members)

<table>
<thead>
<tr>
<th>BLOCK</th>
<th>LAND LESS</th>
<th>LESS THAN 0.2 HA</th>
<th>0.21 TO 0.5</th>
<th>0.51 TO 0.8 HA</th>
<th>MORE THAN 0.81 HA</th>
<th>TOTAL HOUSE HOLDS</th>
<th>OWN ONLY TSHERI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimong</td>
<td>3</td>
<td>11</td>
<td>15</td>
<td>24</td>
<td>237</td>
<td>290</td>
<td>6</td>
</tr>
<tr>
<td>Chon.Borang</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>50</td>
<td>185</td>
<td>255</td>
<td>12</td>
</tr>
<tr>
<td>Dungmain</td>
<td>18</td>
<td>7</td>
<td>8</td>
<td>30</td>
<td>317</td>
<td>380</td>
<td>24</td>
</tr>
<tr>
<td>Khar</td>
<td>9</td>
<td>12</td>
<td>16</td>
<td>50</td>
<td>315</td>
<td>402</td>
<td>24</td>
</tr>
<tr>
<td>Shumar</td>
<td>22</td>
<td>13</td>
<td>24</td>
<td>123</td>
<td>257</td>
<td>439</td>
<td>10</td>
</tr>
<tr>
<td>Yurung</td>
<td>5</td>
<td>14</td>
<td>21</td>
<td>72</td>
<td>110</td>
<td>222</td>
<td>6</td>
</tr>
<tr>
<td>Zobel</td>
<td>24</td>
<td>4</td>
<td>15</td>
<td>55</td>
<td>184</td>
<td>282</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>88</td>
<td>67</td>
<td>106</td>
<td>404</td>
<td>1606</td>
<td>2270</td>
<td>66</td>
</tr>
</tbody>
</table>


1/ Households in the district total 2506, but some households are physically separated while their registration has not been segregated.

Farming systems

In Pema Gatshel district, 90 percent of the population are farmers. Almost all farm households farm at a subsistence level, including both crops and animal husbandry. This subsistence farming system is constrained by the shortage of land, labour and operating capital. Hence, there is practically no room for expansion and there is declining productivity resulting from increased frequency of tscheri cultivation. There are shortages of water, compost, fertilizers and pesticides. The growing population has increased the need to produce larger quantities of food from shifting cultivation, which in turn has prompted the Royal Government of Bhutan to seek alternatives to shifting cultivation.

Shifting cultivation is viewed not as an exclusive production system, but one integrated with other subsistence activities such as food gathering from the forest and rearing of livestock, especially cattle. Due to many limitations it has been impossible to commercialize any of these activities. Generally, there is very little surplus in a shifting cultivation system, market facilities in the district are limited and monetization is restricted. Many areas are actually food-deficient, particularly following a crop failure due to weather, pest attacks or other phenomena. Even the storage of crops, should a surplus occur, is a problem for shifting cultivators.

An estimated 65 percent of households keep cattle, and many of the others have some small stock, such as pigs and poultry. Production of manure for the preparation of compost is the main objective of keeping cattle. Draught work and dairy products are secondary benefits. Pigs are a principal source of meat, where meat is consumed. Poultry are kept primarily for eggs. Small ruminants (sheep and goats) are rarely kept, and in fact raising them is not encouraged by the government.

Food crops are primarily produced for home consumption. More than 90 percent of all production is consumed in the villages as food or alcohol (Table 5). At household level, 30-50 percent of all food grains are converted to alcoholic beverages for
Major Crops and land management practices in cultivated land

The terrain is composed of deep gorges and narrow valleys that provide limited opportunities for irrigated land use. Except for the limited valley bottom lands and natural table tops in the middle slopes, the majority of the permanently cultivated land is sloping dry land (rain-fed) where hill erosion is common. If the international norms for land use capability were to be applied to the district, most of this dry land would be recommended for alternative uses or for cultivation only after applying major conservation measures. A summary of crops, soils and land management practices is presented below.

TABLE 5: PERCENTAGE HOME CONSUMPTION AND SALE OF THE MAJOR FARM PRODUCE

<table>
<thead>
<tr>
<th>MAJOR FARM PRODUCE</th>
<th>PATTERN OF USE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% CONSUMED</td>
</tr>
<tr>
<td>Maize</td>
<td>100</td>
</tr>
<tr>
<td>Buckwheat</td>
<td>100</td>
</tr>
<tr>
<td>Dairy products</td>
<td>90</td>
</tr>
<tr>
<td>Beans, soya beans/peas</td>
<td>80</td>
</tr>
<tr>
<td>Vegetables (mainly radish)</td>
<td>50</td>
</tr>
<tr>
<td>Potato</td>
<td>30</td>
</tr>
<tr>
<td>Chilies</td>
<td>25</td>
</tr>
<tr>
<td>Fruit crops</td>
<td>10</td>
</tr>
</tbody>
</table>

Wetland (chushing): Paddy rice is the major summer crop grown in wetland and the main winter crop is wheat; buckwheat, potatoes, maize, pulses and vegetables are also grown as minor winter crops. The terrace networks are well constructed although the maintenance is poor. Gravity irrigation drains from upper terraces down to the ones below, but there is hardly any provision for excess water drainage and uncontrolled movement of water has given rise to formation of gullies.

Rain-fed or dry land (kamshing): Maize is the major rain-fed summer crop, representing almost 62 percent of annual crops. Buckwheat is widely grown in areas too cold for maize. Wheat, barley, mustard, pulses, buckwheat, and potatoes are common winter crops in maize growing areas. Dry land is found all over the sloping areas in the district irrespective of the slope gradient and the soil depth. Slope gradient in the dry land varies from 0 to 65 percent and although the soil depth ranges from 10 to 90 cm, the depth of the topsoil is generally very shallow (5-8 cm) in spite of widespread composting. There are some situations where slopes exceeding 80 percent and soils of less than 10 cm depth are being converted into rain-fed cropland.

Intensive cropping, poor management practices and the fact that commercial fertilizers are not being used allow little buildup of organic matter. Soil sample tests indicated deficiency in nitrogen, fair to average potassium and very low phosphorous. Compost produced from farmyard manure, crop residue and leaves collected from forest areas is commonly used to fertilize the rain-fed fields. Cattle are coveted for their production of manure more than anything else, and when pigs are kept, that manure is also put into the compost pit. The land preparation standard in dry land is low and crop husbandry is also minimal. Due to the shortage of labour, farmers can afford one weeding at the most. Harvesting and post-harvesting operations are entirely manual.

Potential for the irrigation of dry lands is almost negligible. Less than 5 percent of the dry lands are terraced scientifically. While several years of cultivation have reduced the original natural slope, giving an appearance of outward sloping terraces, substantial erosion occurs during the pre-monsoon rains. The soil moisture content varies depending upon the application of mulch. Where humus and compost are applied regularly, the intensity of erosion seems surprisingly low. Recently farmers have started contour bunding by placing branches and twigs and other plant matter in bundles along contours to arrest downhill soil movement. They have also started planting hedges for the dual functions of protection against grazing and reduction of erosion. Some of these hedge plants are also suitable for fodder.

Fruit orchards: Oranges at lower altitude and apples at the higher altitudes are the principal fruits grown. Fruit-trees are raised in terraces, which are more gentle than most of the dry land. Orchard terraces are better maintained and erosion problems are found to be minimal. Since all the orchard terraces are rain-fed, rainwater is a valuable input. However, optimum use of rainwater is lacking. The terraces are outward sloping and mulching is not practised so most of the rainwater
Defining shifting cultivation

Among most land use planners such as foresters and soil management specialists, shifting cultivation has long been considered a poor system of land utilization, and worse, a cause of permanent deforestation. In the Asia-Pacific region some 73 million ha are classified as “forest fallows,” the term generally applied to any area of farmland that is created by shifting cultivators when they clear forests. Nearly all countries in this region have indicated that they consider shifting cultivation to be the primary cause of deforestation (FAO, 1986).

Shifting cultivation is an elusive term to define, since it is perceived and used by different people in different contexts in widely differing ways. A definition produced at a seminar held in Nigeria in 1973 seems appropriate for this study: “The essential characteristics of shifting cultivation are that an area of forest is cleared, usually rather incompletely, the debris is burnt, and the land is cultivated for a few years - usually less than five - then allowed to revert to forest or other secondary vegetation before being cleared and used again” (FAO, 1984). A common term frequently used is “slash and burn” cultivation; another is “swidden” agriculture. The same is described in Bhutan by the term tsheri, which refers specifically to the montane type of shifting cultivation on steep slopes that is practised in this country.

Researchers of shifting cultivation have identified the criteria considered crucial for distinguishing shifting cultivation from other land use practices. Some of the more tangible factors are described below.

- Cultivation is interrupted by a period of natural fallow; cultivation is neither permanent nor continuous.
- The duration of the fallow period and of the cultivation period may vary in length, but the fallow would be relatively long (usually more than five years).
- A wide variety of vegetation may grow on the fallow, but it would typically be some type of forest.
- The fallow period may or may not be sufficient to restore soil fertility since the minimum period required is extremely variable.
- The population density associated with sustainable shifting cultivation is relatively low, since there must be enough land per farmer to leave a portion of it to fallow for long periods.
- Due to increasing distance to reach cultivated plots during the fallow periods of the nearest fields, housing may be semi-permanent, or farmers may have permanent homes in villages and temporary shelter near their fields.

Two types of shifting cultivation can be observed in Bhutan. The first is largely practised in subtropical and tropical broadleaf forests and is called tsheri, and the other type can be found in subtropical and tropical grasslands and is locally known as
**Shifting cultivation in Bhutan**

As mentioned earlier, shifting cultivation is a major cultivation practice in many areas of Bhutan, accounting overall for about one-third of cultivated area nation-wide. Distribution of the practice is uneven, however, being partically predominant in the eastern region.

**Districts with critical shifting cultivation problems**

Negi’s (1983) area statistics on district land use have been used to develop supporting criteria for the classification of districts into critical, medium and minor problem areas (see Map 4). Areas whose ratios of tsheri land to (a) permanent cultivated land, (b) forest land and (c) total area exceed the national average have been considered as critical problem areas. Out of 18 districts, 10 qualify as critical districts, including Pema Gatshel - the case study district.

**Government policy on shifting cultivation**

The review of the policy documents in the agricultural sector reveals that the first attempt to discourage tsheri in Bhutan was made by promulgating the Bhutan Forest Act in 1969. The provision in section 8(b) of this act states that:

> Nothing shall be deemed to prohibit the practice of shifting cultivation in the areas where it was practiced prior to issue of this Act. His Majesty’s Government reserves the right to withdraw this concession if such land endangers the safety of the highways and public property. Fresh clearance for shifting cultivation is strictly prohibited and the offender shall be punished...

Despite these measures designed to discourage tsheri cultivation, encroachment inside the forest land continued to occur, so again in 1974, the government promulgated the National Forest Policy Act, which among other things states:

> the practice (tsheri cultivation) has therefore to be abolished if forests have to be conserved. In order to avoid hardships to the present population dependant on this practice of cultivation within forest areas, appropriate compensation will be given to the dispossessed who can take up alternative vocations or adopt intensiv forms of cultivation. The Agriculture Department will extend necessary assistance and cooperation in this respect.

When formulating the Fifth Plan, the government decided to phase tsheri out completely by the end of the plan. It was expected that the suitable tsheri land would be converted to alternative uses such as dryland cropping, or reverted back to forest. However, by 1982-83, several district offices raised problems with respect to this policy, asserting that the redemption of tsheri land would create considerable hardship for many families, a significant number of whom were dependent solely on tsheri for their livelihood. Many requested that the government allot substitute land. Thereafter, although the policy was left intact, the government objective of phasing out tsheri cultivation was not actively pursued.

During the formulation of the Sixth Five-Year Plan, a decision was taken to initiate a more rational approach to phasing out tsheri cultivation following an in depth study of the situation in at least one district. Following this decision, the government in 1986 asked FAO to assist in carrying out such a study on the alternatives to shifting cultivation in Pema Gatshel, and the study was begun in February 1987.In 1993, due to the government’s continued concern, the study was updated.

The policy of the Department of Agriculture during Sixth Plan Period was to encourage farmers to reduce tsheri cultivation. The planned strategy to achieve this end was to concentrate on the follow-up activities recommended by the present government-sponsored study on alternatives to shifting cultivation. The Home Ministry reported to the National Assembly in 1993 that “there are 25126 house holds who were slashing and burning over 200000 acres of tsheri land to eke out a hand-to-mouth living.” Officials expressed the view that alternative livelihood for these households have to be found to wean them from tsheri cultivation. Resettlement of the households in more fertile areas was considered as one of the main solutions to the perceived problems associated with tsheri cultivation.

**The shifting cultivators of Pema Gatshel - Historical background**

The population in Pema Gatshel district consists predominantly of the Sharchop people. As an ethnic group they are considered to be the earliest inhabitants of present-day Bhutan. They are also believed to be of Indo-Mongolian origin, and appear closely related to inhabitants of northeast India and northern Burma (though attempts to correlate shifting cultivation practices in Bhutan with similar practices in northeast India and Burma did not reveal any particular relationship). Shifting cultivation in Bhutan, as in many other countries of the world, appears to be one stage in the natural progression of agricultural development through which farming communities pass en route to productive sedentary agriculture. According to elderly people in different villages of Pema Gatshel, 50 years ago there were very few permanent households. Then, shifting cultivation was practised in its true sense; farmers used to shift from one place to the other. Population density was lower and there was abundant land to allow long fallow.
Recently, two forces have combined to force shifting cultivators to settle in permanent homes and combine shifting cultivation with sedentary agriculture. The first is population growth, which has significantly restricted availability of land for extensive shifting cultivation by the new generation of households. Second, increased awareness of the advantages of permanent cultivation in suitable areas has triggered the conversion of appropriate tsheri land into permanent rain-fed cropland. This process is slowing down in villages where appropriate tsheri land is no longer available. However, in areas where population pressure is increasing and land is available, conversion is continuing.

The farmers in Pema Gatshel practising shifting cultivation, like all rural Bhutanese, tend to live in isolated clearings, hamlets and villages, have low levels of literacy and lead a daily life that is governed by tradition. There is a heavy consumption of ara (local liquor distilled from maize), which farmers believe gives them strength to work. Most rural people above the age of 12 consume substantial amounts of alcohol, and 30 - 50 percent of the maize in every household is converted into ara.

**Local farmers' attitude towards shifting cultivation practices**

Shifting cultivation in the form of fallow agriculture is strongly embedded in the farming heritage of Pema Gatshel. Farmers are very uneasy about the phasing-out of this practice for the simple reason that there is hardly any other alternative if they do not want to move away from their locality. The shifting cultivators in Pema Gatshel are small farmers with limited capital and almost no access to credit or training in better farming practices. The agricultural development efforts undertaken in Bhutan over the last 20 years have been concentrated in the most fertile valleys in the middle hills and easily accessible sloping lands in the south. Pema Gatshel is located in a remote, inaccessible and less productive area. Shifting cultivation continues here because the practice does not need a high level of management or external inputs.

The farming community is very much aware of the impact of uncontrolled shifting cultivation practices. This awareness, combined with their religious beliefs, is the driving force that has resulted in surprisingly ecologically sensitive shifting cultivation practices in many villages in Pema Gatshel. For example, several patches of forest are left intact to protect the watersheds that supply their drinking water. They adhere strictly to criteria developed through generations of experience to determine the maturity of tsheri land for cultivation (see below). They do not allow uncontrolled grazing in tsheri land because excessive grazing reduces the regeneration potential of preferred species, those that will enrich the soil's fertility. Consequently in many villages where population pressure is reasonably low, shifting cultivation is so efficiently practised that the adverse environmental impacts are quite low.

Despite this strong awareness, there is a trend towards more damaging practices. Area coverage, number of farmers practicing shifting cultivation and recurrence of cultivation in the same area are all increasing, resulting in progressive destruction of the ecosystem. The farmers, however, express the belief that the problems of shifting cultivation cannot be isolated from overall rural development constraints, and that only a conscious and determined effort that considers the situation of the traditional farming community can ultimately resolve this national problem.

**Area covered by shifting cultivation practices in Pema Gatshel**

Estimates of the extent of shifting cultivation in Pema Gatshel vary significantly. The land registration figures from the district office indicate that the total area under shifting cultivation is about 1 560 ha. This figure is not based on actual field measurement but reflects the judgement of the officials responsible for initial land allotment. The figure reported by Negi (1983) for total tsheri land is 8 685 ha a huge discrepancy. Negi's estimate accounts for 57 percent of the total cultivated area and represents 17.7 percent of the total geographical area in the district. Farmers interviewed on this subject suggested that on average tsheri area in the field is more than four times the land registration records. Field measurements of wetland, dry land and tsheri land of a few selected farmers indicated that land registration records could be underestimated by a factor of five, giving an estimate for total tsheri land of 8612 ha, which is very close to Negi's estimate.

**Field practices in shifting cultivation**

Field practices in shifting cultivation in Bhutan are characterized by a minimum application of external inputs and the least modification of the natural environment. A typical shifting cultivator in Pema Gatshel, in addition to the produce from his tsheri fields, still obtains a high proportion of his family's basic needs such as food, shelter and clothing from the wild. Tools are simple and usually consist of implements for cutting (machetes, sickles, axes) and digging (hoes, digging sticks). There is no mechanization, draught animals, ploughs, fertilizers, irrigation facilities or any other inputs typical of more modern shifting cultivation.

The calendar of operations in the fields is greatly influenced by the natural rainfall regime, and by experience. The cultivators are experienced observers, taking full account of natural events in determining how, when and to what extent certain operations are to be carried out. The following paragraphs outline the main aspects of the cultivation cycle.\(^1\)

**Site inspection**: During the months of November and December, landowners visit their potential sites for cultivation in the following year. If they decide to cultivate (or rent out) the land, they will contact other farmers willing to form a group. The members of the group accompany the owner for a site inspection. The primary reason for this advance inspection is to make sure that the tsheri land is matured for cultivation. If the group finds that the proposed land is ready, they delineate the boundary in order to enable clearing and cutting in the absence of the landowner. The criteria used by farmers in Pema Gatshel to determine the maturity of tsheri land are described below.

- The crown cover of the standing vegetation is dense and sunlight does not penetrate to the ground, so that grasses and shrub undergrowth are almost absent.
- The colour of the topsoil is very dark (almost black) and the ground feels spongy when walked on, confirming sufficient
accumulation of humus.

- Height and diameter of the predominant trees are sufficient to release enough nutrients during the next fallow period. (The main trunk of the trees, generally saplings 3 to 12 years old, is not burnt but left to decompose to recycle nutrients).

In areas where the farmers strictly follow these guidelines, land degradation is surprisingly low. Many tsheri areas visited in Dungmain, Khar and Chimong blocks at different stages of fallow, gave an impression of being compartments in a well managed forest.

**Group and individual cultivation of tsheri land:** More than 78 percent of the households have less than 1 ha of tsheri land (Table 6). In many cases farmers find it very difficult to divide their tsheri land into several small compartments and cultivate annually in rotation. Therefore, they prefer to cultivate tsheri land by forming a group. As a result, the use of and access to tsheri land is more equitable than for other cultivated land and the landlord/tenant relationship is almost non-existent in many villages; landlessness is not a big problem in this context. The person whose tsheri land is ready for cultivation selects the participating group members well in advance. He himself (or she) may or may not work in the tsheri.

In Shumar and Zobel blocks, farmers prefer to cultivate their own tsheri on an individual household basis. In Chimong block 50 percent of the farmers cultivate individually and the rest prefer to work in a group. In Dungmain, Khar and Yurung blocks, farmers prefer to form groups. Some of the reasons for forming groups are presented below.

**TABLE 6: DISTRIBUTION OF TSHERI LAND**

*Percentage of households*

<table>
<thead>
<tr>
<th>BLOCKS</th>
<th>% WITH &gt; 1 HA</th>
<th>% WITH &lt; 1 HA</th>
<th>% WITH NO TSHERI</th>
<th>% LANDLESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimong</td>
<td>17</td>
<td>70</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Chon.Borang</td>
<td>8</td>
<td>81</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Dungmain</td>
<td>16</td>
<td>76</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Khar</td>
<td>17</td>
<td>76</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Shumar</td>
<td>5</td>
<td>79</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Yurung</td>
<td>3</td>
<td>82</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Zobel</td>
<td>3</td>
<td>74</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>DISTRICT TOTAL</td>
<td>9</td>
<td>78</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

*Source:* Based on 10% household sampling from the land registration records available in the district.

- Farmers no longer shift their homesteads to cultivate tsheri land but operate from their permanent settlements. The distance between the tsheri and the village is sometimes more than a day. Therefore, villagers would like to operate in a group for security reasons (e.g., security from wild animals).
- With the increase in population, the division of household holdings has been reduced to such an extent that rotational fallow is not feasible on an individual household basis. It has become more economical to join tsheri land of several households and operate in a group.
- The shortage of hired labour is becoming more acute due to an increase in public works such as roads, irrigation, water supply and other activities. Young and able workers tend to migrate to urban areas in search of employment. As a result, the big landholders are facing difficulties in cultivating tsheri land on their own.
- The penalty for fire damages and encroachment inside the national forest is high. Increased monitoring of such damage by the authorities in Pema Gatshel has increased farmers' preference for group cultivation, since any violation is a community offence and the penalties are shared by all participating house-holds.

Group formation is normally done during the months of November or December the year before a particular area of tsheri land is cultivated. Villagers are always aware of the status of matured tsheri land in their village and which household owns it. They express their desire to the landowner and he/she makes the final decision about the participating group members. The size of the group generally varies between two and five households. It is not necessary to have the same composition in a group every year. The participants in the group are free to shift from one group to another. In some cases, the households in
a group remain together until all the *tsheri* lands of the participating members are cultivated in turn and left fallow. In general, households capable of working together very well continue as a group for several years. The size of the group is determined by the extent of *tsheri* land to be cultivated in a particular year. The larger the area, the bigger the group. The field survey reveals that, on average, one household can handle 0.5 ha. If a household consists of an expanded joint family, the household members can join several groups in the same year. Thus, *tsheri* cultivation promotes equitable distribution of community resources in many villages in Pema Gatshel.

**Renting arrangements:** In the Zobel and Shumar blocks, renting of *tsheri* is common and, landlord/tenant relationships are strong. The block headmen and members of the National Assembly are helped by the villagers to cultivate their *tsheri* because of their busy schedule in administrative works.

There is not much variation in the rate of rents. If the landlords do not work but provide seed and labour for harvesting, they get half of the harvest. If they participate in all the work and provide the seed, they get two-thirds of the harvest. Payment of rent in cash is not a usual practice in Pema Gatshel. In a group, the harvest is divided into shares according to the number of participating households. If the landowner works together with the participating group, he gets two shares. For example, in a group of five, the land owner receives two out of six shares if he works in the field. If he does not work, he will be entitled to only one share, but he still has to provide the seed and is responsible for harvesting. The landlord is also responsible for preventing fire hazards while burning *tsheri*.

**Cutting and drying of vegetation:** After the site selection, the standing vegetation is cut and left to dry for at least two months before burning and sowing. At higher altitudes (1500 m) the cutting starts during December because it takes a longer time to dry. In the lower altitudes *tsheri* is cleared during January and February. The cutting will involve tree felling and trimming of branches. In the majority of cases the site is clear-felled. Some farmers retain economically valuable timber trees.

**Burning and clearing:** Burning is one of the critical elements of *tsheri* cultivation. Farmers pay maximum attention while burning the dried vegetation to avoid fire hazards outside their *tsheri* land and to achieve maximum burning. If the fire spreads more than 137 m (150 yards) inside the forestry boundary, the *tsheri* owner is punishable by law. If the fire damages life and property of the villagers, the owner has to pay heavy penalties, including imprisonment for up to three years, depending upon the seriousness of the damage done. Villagers are therefore very careful while burning *tsheri*. They have developed very scientific and organized systems for burning. In each village there are several fire specialists called *mesungpa* who lead the whole burning operation, and each household in the village has to participate. Scientific fire lines are established around the *tsheri* before burning. According to villagers, the fire hazard has been reduced in recent years owing to increased precautionary measures. It is believed that if burning is successful, grass growth will be minimal and production will be higher. The unburnt wood is left in the field for slow decay. Fuelwood is collected for home consumption.

**Sowing, weeding and protection of the crop:** Sowing or seed broadcasting is done immediately after burning with no soil preparation. Farmers believe that the heat of the ash helps fast germination. The seeds are sown in stick holes or broadcast over ash. Weeding is carried out only once with machetes and sickles. The seeds are protected from birds until they germinate and seedlings are established. In the case of maize, the farmers watch for one month from morning until evening. The germinating crop has to be protected from wild animals such as monkeys, porcupines, parrots and wild boars. Protection against birds and wild animals is one of the major labour inputs in *tsheri* cultivation. Villagers reported that the damage by wild animals is increasing every year.

**TABLE 7: CROPPING MIXES FOR TSHERI FIELDS IN PEMA GATSHEL**

<table>
<thead>
<tr>
<th>CROP</th>
<th>PERCENT OF COVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>70</td>
</tr>
<tr>
<td>Buckwheat</td>
<td>15</td>
</tr>
<tr>
<td>Millet</td>
<td>10</td>
</tr>
<tr>
<td>Paddy, Soya bean, Barley, Wheat, Potato, etc.</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Crops grown: Maize is the principal crop grown, followed by buckwheat and millet. Based on village meetings and farmer interviews in different villages, the cropping mixes shown above are estimated for Pema Gatshel (see Table 7).

Maize is grown in higher as well as lower altitudes, while buckwheat is mainly grown in higher altitudes and millet is grown on lower altitudes. Recently, potatoes have been introduced in *tsheri* land as a cash crop. Rain-fed highland rice is also grown in Khar. Pumpkins, soya beans, cucumbers and radishes are intercropped with the main crops.
Fallow period: Until recently, farmers used to strictly maintain a standard fallow period between two cultivations. In lower altitudes the fallow period used to be 6 to 10 years and in higher altitudes it used to be 10 to 12 years. With increasing population, combined with several other factors such as the growth of markets, transportation facilities and various aspects of infrastructural development, shifting cultivators are tempted to change their traditionally stable production system. There has thus been a steady decline in fallow periods, which have been reduced to three to five years in lower altitudes and seven to eight years in higher altitudes. The only use of fallowed land is for livestock grazing during the first two years of fallow. Farmers are aware of the impact on crop production if grazing is extended for more than two years.

Labour requirements and returns in shifting cultivation

The work needed for 1 ha of tsheri from site inspection to harvest storage has been estimated from field interviews to be from 304 to 473 person-days (average 402) at higher altitudes, and from 264 to 421 person-days (average 382) at lower altitudes. The most labour-intensive activities are watching seeds against birds just after sowing, and protecting the crop from wild animals and birds before harvesting. The production of maize from 1 ha of tsheri land is estimated to be 3550 kg in higher altitudes and 3025 kg in lower altitudes. In monetary terms, a high altitude farmer invests 402 person-days to harvest a crop with a value equivalent to Nu. 10650 and the lower altitude farmer devotes 362 person-days of labour to harvest a crop having a value equivalent to Nu. 9075. Converting the cash return into daily cash wage, a farmer in the high altitudes receives Nu. 26.50 per day, and in the lower altitudes Nu. 25.06. This return is significantly higher than district wage rates of Nu. 10 to 20 (depending upon the type of work).

Factors influencing continuation of shifting cultivation practices in Pema Gatshel

Three factors have influenced the continuation of shifting cultivation practices in Pema Gatshel. They are (1) the biophysical setting, (2) availability of social and institutional support and (3) economic viability. They are discussed below.

Biophysical limitations to expansion of permanently cultivated land: The primary reason for the continuation of shifting cultivation by the farmers in Pema Gatshel is due to biophysical limitations of the land system. The land form, geology, climatic and edaphic situations in the district do not favour the expansion of cultivated area. Permanently cultivated lands are so limited that farmers have a difficult time even for subsistence living. In places where conditions are favorable for permanent cultivation, the acute shortage of drinking water sources restricts the expansion of sedentary agriculture. The potential for irrigation development is low, soil fertility is poor and adoption of conservation practices is constrained by the shortage of labour.

Social and institutional support available for shifting cultivation: The social and institutional reasons for the widespread practice of shifting cultivation are several.

- Shifting cultivation has been approved and promoted by the government authorities, provincial chiefs and religious leaders for many decades. Thus it has established itself as a traditional farming practice for many communities, and the majority of the farmers would not give it up easily.
- Farmers, particularly in eastern Bhutan, prefer to work in communal farming groups. Shifting cultivation provides that opportunity.
- Many families who served the country during difficult times were awarded large areas of state land for their service to the country. These lands are the only resources for the members of their growing families. Therefore, tsheri land is a source of economic security to many households.
- The Forest Act of 1969 has prohibited fresh clearances for shifting cultivation but has not discouraged the practice of it where such cultivation dose not endanger the safety of the highway and public property. The Land Act of 1979 has placed the status of tsheri land on the same footing with wetland and rain-fed land.

Shifting cultivation is thus socially accepted and institutionally supported.

Economic profitability of shifting cultivation: The economic justifications for the continuation of shifting cultivation practices in Pema Gatshel are many. A few examples are: (1) crop production per unit area from tsheri land for a single crop is higher than rain-fed land; (2) no external input other than labour and seeds are required to produce the crop and enrich productivity; (3) the crop is not affected by marginal variations in climate; (4) between 10 and 75 percent of the annual family food requirement is produced from tsheri and (5) production from tsheri converted into wages provides a better wage per person-day than any other work.

The importance of shifting cultivation in Pema Gatshel

Proportion of households practicing shifting cultivation: A 10 percent random sampling of the registration record reveals that about 84 percent of the households own tsheri land, 4 percent are landless and 12 percent own only dry land. During the study mission’s visit to different blocks, the meetings with large numbers of villagers indicated that almost every villager participates in shifting cultivation.

The frequency of participation in shifting cultivation has been found to be a function of the availability of land in the village, the number of able members in the family and the size of the rain-fed landholding of the household. In general, farmers having more than 2 ha of dry land do not have time to participate in tsheri cultivation. In villages where land is abundant, willing farmers participate every year. The big landowners not having enough working members in their family rent their tsheri land to their neighbors. The landless participate almost every year. Households with severe labour constraints, however, cannot participate every year. They participate in tsheri cultivation only when their debt of loans in kind (crop) taken from their neighbors becomes very high.
Proportion of family food harvested from shifting cultivation: The proportion of family food derived from shifting cultivation is a function of quality and quantity of dry land owned by the household. In general, a household of seven members having more than 1 ha of good dry land can maintain a subsistence living without tscheri. Farmers having less than 1 ha of dry land compensate with between one and three months of food from tscheri land. The landless and those totally dependent on tscheri manage for about six to nine months. The shortfall is compensated for either by casual employment or, where employment opportunities are limited, by food from the forest.

Impact of shifting cultivation practices

Positive impact on the environment: The delicate farm environment found in most parts of Pema Gatshel would require significant amounts of capital and improved management capability in order for continuous cultivation practices to increase production. In the absence of capital and management capability, which is the case of most of the small farmers in the district, any attempt to suddenly change the present production system would be disastrous. In general, shifting cultivation has reduced the rate of potential environmental degradation.

Evidence of the positive impact of shifting cultivation practices can be observed throughout the district where dryland farming and tscheri cultivation are being co-currently practised in similar farm environments. Erosion of topsoil, and differences in the physical properties of soil are noticeable. Farmers reported that many areas of tscheri land that had been converted into rainfed land were reverted back to tscheri due to lower yields and incessant weed growth. In fact, tscheri cultivation has helped to retard the rate of environmental degradation in Pema Gatshel. Tscheri cultivation has also absorbed the rising local population, preventing out-migration in search of wage work and minimizing resultant social disruptions.

Adverse environmental impacts: Some adverse environmental impacts were found to be a consequence of prolonged shifting cultivation in the study area.

- According to the elderly farmers in the villages, the composition and growth of the natural vegetation is gradually declining after each cycle of cultivation. Leguminous and nitrogen-fixing plants are the victims of recurrent burning.
- The productivity of tscheri land is declining. According to elderly and experienced farmers, the production from tscheri land is highest during the third cycle (the first cutting of natural vegetation for tscheri cultivation is considered as the first cycle), and thereafter productivity gradually declines even if fallow periods are maintained. The trend to reduce the fallow period and heavy grazing for an extended period during the fallow have accelerated the process of declining productivity.
- The farmers all reported that the damage to crops from growing populations of wild animals and birds is increasing every year, which could be the result of ecological imbalances created by shifting cultivation.
- Sheet, rill and gully erosion are common, especially in lower altitude tscheri land where there is high intensity rainfall just after clearing, burning and sowing. The scars of such erosion are conspicuous in all villages.
- Despite the fact that there is no monitored evidence, interviews with local farmers revealed diminished availability of water. They have observed that the minimum water flow is decreasing and the length of the dry period is increasing in the local streams and springs supplying drinking water.

Impact on permanent cultivation: Compared with the people in central, southern and western Bhutan, the farmers in Pema Gatshel are investing a smaller proportion of their time and labour in the management of their permanent land. The Voluntary Labour Contribution to the district development activities is one of the factors contributing to the neglect of permanent land, and tscheri cultivation is the other major factor. Tscheri cultivation can be practised with much ease compared to less flexible farming practices required in permanent cultivation. As a result, permanent land is not being utilized to its capacity. It was noted that farmers do not practice minimum conservation requirements to sustain productivity. There is reluctance to adopt improved practices and increase the production from permanent land due to the cushion provided by tscheri land for food production.

Farmers' perception of alternatives to shifting cultivation

During village meetings and farmer interviews, the study mission tried to acquire feedback from the farmers on alternatives to shifting cultivation. While there was widespread awareness in the local community about the possible adverse impact of shifting cultivation on the local environment, the idea of phasing out shifting cultivation caused concern to the majority of the farmers. They clearly indicated that shifting cultivation is one of the major activities in the family system and they cannot imagine their livelihood without it. Any alternatives will have more damaging environmental impacts since the farmers are practicing shifting cultivation with great care. They feel that a change in the present production system will disturb their traditional self-sufficient lifestyle. However, the farmers are willing to cooperate with the government in the case of reasonable policy changes that will help them use the land according to its capability. In general, farmers are willing to adopt alternatives but they are of the opinion that there are no shortcuts. While shifting cultivation can be phased out gradually through demonstration extension and education, the alternatives should not be radically different from their present farming practices.

Chapter 4 End notes

1. See also the activity calendar in Table 17, Appendix D
Chapter 5

Developing a Model for the Gradual Phasing-Out of Shifting Cultivation

Policy considerations

The overview of the existing land use issues in Bhutan (as well as in many other countries) reveals that until now, land use goals have striven to attain certain short-term objectives only. In order to deal with the phasing-out of shifting cultivation, it would be useful for this focus to be widened to include long-term objectives likely to result in sustainable and prosperous agricultural development. Hence, the following goals could be integrated into national land use policies:

- maximum production per unit area from all categories of land on a sustainable basis;
- minimum environmental degradation;
- minimum socio-economic dislocation of the farming community;
- increased labour efficiency in agricultural activities to divert rural labour into other development activities;
- increased capital formation from land-based activities to supplement investment requirements for other development needs; and
- a scientific and efficient administrative and institutional framework capable of promoting rational land use in the country.

An integrated inventory of land resources and a socio-economic survey should become standard design factors of any agricultural development project.

Some suggested policy improvements

Long-term land use planning is crucial to help achieve the goals described above. Integrated land use planning is a necessary component of future agricultural development strategies both in Bhutan and in other countries that have evolved similar shifting cultivation practices, and where the farm environment is characterized by a fragile biophysical setting and a complex socio-economic situation.

It has been observed that, at present, Bhutan’s land use policy does not have any criteria to control land use changes from less intensive to more intensive use. Here as in other countries, it would be very useful to develop treatment-oriented land capability classification criteria to control ad hoc land use changes. Policy that promotes development and application of such criteria is highly desirable if productivity is to be raised and environmental degradation is to be minimized.

The biophysical features and socio-economic situation in Bhutan and its neighbours demand land use strategies that combine the positive features of both traditional and modern resource conservation and utilization techniques. The multiple-use land management concept offers a good avenue to achieve such a goal.

The land tenure policy of a country greatly influences land use. In Bhutan, reviewing the land tenure policy (1) to help achieve sustainable agriculture development was a necessary step. This review helped determine that future policy initiatives should be aimed at:

- providing each farm family a minimum land area that will enable it to meet its basic needs;
- adjusting the land ceiling according to the productive potential of different kinds of land as against gross holding of land irrespective of its quality;
- legal measures that promote the motivation of farmers to improve and maintain physical qualities of their land;
- helping farmers to increase production on marginal land for forestry or pasture development; and
- encouraging farmers to adopt conservation practices on marginal land for sustainable production and the protection of such land.

The present marketing and production policies of the government have been developed without consideration for their effects on land use. Such policies can create adverse effects on a farm family’s income, land use and ultimately on the environment. It is therefore necessary in any system that marketing and production polities be coordinated with the land use policies.

The case for a gradual reduction of shifting cultivation

The major observation that emerges from this study regarding the problems associated with shifting cultivation is that drastic measures to eliminate it are not effective. In attempting to diminish the negative impact of this practice, the following points should be kept in mind.

The total phasing-out of shifting cultivation is not desirable. The commissioning of this study was prompted by the existence of two diverse schools of thought among land use practitioners in Bhutan. One school strongly believes that the total phasing-out of tsheri cultivation is a prerequisite for the progressive promotion of appropriate land use practices. The other believes that combining shifting cultivation practices with sedentary cultivation is the only way to allow subsistence farming with minimum damage to the environment in a biophysical and socio-economic context such as that in most parts of Bhutan.
Based on the diagnosis of the problem in Pema Gatshel district, this study suggests that satisfactory alternatives to the present system of shifting cultivation are essential and immediate positive action is required to avoid a larger environmental crisis in the future. The study also reveals that the continuation of shifting cultivation as a predominant land use practice for an extended period of time is not going to be helpful in the provision of adequate livelihoods for the farmers now in the study area. On the other hand, the consequences of phasing out shifting cultivation in one fell swoop would be extremely serious. The families who would no longer be able to sustain their livelihood would present a great social problem, far greater than any now experienced. Rather than take radical action in an attempt to stop shifting cultivation, an incremental and phased intervention is necessary.

A moderate beginning with gradual reduction in shifting cultivation is preferable.

The phasing-out and modification of tsheri is best accomplished by a moderate beginning, dealing with the most threatened areas first and then gradually progressing towards the removal of shifting cultivation from the remaining areas. This is combined with the in situ improvement of tsheri cultivation while gradually phasing it out. Improvements would include more systematized tsheri cultivation practices for increased productivity, better managed crop fallow systems, and extension of fallow times to maturity before preparation and planting of the next crop. There should also be observation of good conservation practices, including contour bunding and mulch cover of newly opened/planted fields.

The ultimate aim would be to establish an efficient sedentary farming and livestock system that will maintain the soil and provide continued, stable production for an indefinite period of time, consequently raising the standard of living in the community.

A proposed model for a three-stage programme to reduce shifting cultivation

Effective means for implementing any planned changes from a traditional system such as that in Bhutan must be carefully thought out, successfully demonstrated on the site, and implemented by an interdisciplinary team well trained in the field of rural development. Such planned changes must be consistent with the overall economic development of the country and should be proportionate to the speed of development on other fronts. In addition, the phasing-out of shifting cultivation cannot be achieved in isolation. The proposed programme needs to be implemented together with integrated land use development activities. For the reasons stated above, it is recommended that the phasing-out of shifting cultivation be planned in three stages. They are:

1) the pilot demonstration and infrastructure development phase;

2) the consolidation phase; and

3) the expansion phase.

Years 0-5: the pilot demonstration and infrastructure development phase

The justification for a pilot demonstration and infrastructure development phase in Bhutan derives from a series of observations, many of which are applicable to situations found in other countries with similar problems.

First, the mountainous terrain, difficult communications and diversity of farming practices in various districts where shifting cultivation is predominant, mean that there is no single alternative that can address all the problems of shifting cultivation. Therefore, different approaches should be implemented on a small pilot scale at first. The impact of each approach, single or in combination, would be evaluated until a promising approach or approaches can be demonstrated. After the success of the approach is demonstrated and staff are trained, it can be extended to larger areas.

Second, there has been little time to accumulate experience with modernization of Bhutanese agriculture. However, the need for increasing production per unit area from all categories of land is great. Similarly, there are many unknown socio-economic forces that influence the rate of production. Therefore, several aspects of agricultural development need further study, and this could be accomplished through the use of a pilot demonstration area.

Third, the successful implementation of any shifting cultivation alternative is dependent on the active participation of the community. At present very little is known about the best mechanisms for motivating the subsistence farmer to participate in implementing scientific land use practices. Therefore, this phase is required to design, test and demonstrate several approaches to mobilizing community participation.

Fourth, any alternatives to or options for phasing out shifting cultivation require active cooperation among several district agencies. The pilot demonstration approach will provide the opportunity to train several extension staff on different aspects of land use planning, such as integrated land resources surveys and land use capability classification.

The lack of trained labour and of supporting infrastructure like soil laboratories or cartographic support precludes the implementation of the programme all over the country simultaneously. Adequate time is needed to train required labour and establish a minimum level of infrastructure.

For these reasons, the implementation of a pilot demonstration project on alternatives to shifting cultivation would appear to be an excellent means for initiating a larger-scale effort aimed at reducing this practice. In the case of Bhutan, the study team recommended setting up such a phase in the Uri Chu watershed in Pema Gatshel district, initially for a period of five years.
Years 5-10: the consolidation phase

The ultimate objective of the first-phase pilot demonstration activity is to develop ideas and experiences for solving different types of land use problems associated with shifting cultivation. Such a practical, solution-seeking strategy will help refine future policies and plans of the government. Some time will be required to consolidate the experiences gained and integrate them into revised national plans, policies and activities.

The arrangements for additional institutional and organizational capacity will require some planning time before an expanded programme can be implemented. Demonstrations of practices selected in phase one will need to be carried out in every district to the gain confidence of local communities before entering into a large-scale programme.

Therefore, a consolidation phase covering the next five-year period is advisable in order to complete the activities mentioned above. This phase is also useful to begin spreading an intensive programme to improve land use management in areas outside the pilot project. In this case, this would be implemented in all the blocks in Pema Gatshel. It could be a time for initiating demonstration activities in a selected watershed in each of the other districts with shifting cultivation problems.

Years 10-15: the expansion phase

If all goes well, the previous two phases would provide enough policy framework and required infrastructure to expand progressively into a large-scale project covering the whole of Bhutan. However, activities that have proven successful elsewhere should be demonstrated in each district for at least two years before entering into the large-scale programme.

Essential elements for design of the pilot project - Criteria for site selection for the pilot demonstration project

The study recommended the implementation of a pilot demonstration project on alternatives to shifting cultivation in the Uri Chu watershed (Map 5), located in the Bhutan’s Pema Gatshel district, initially for a period of five years. This project was intended as a supplement to, and not as a substitute for, the many other activities required to improve overall land use in the country. Pema Gatshel was selected as lead district because it is a small district where a study team can physically cover the whole area in a limited period of time. In addition, this district represents almost all agro-ecological regions where shifting cultivation is practised in the country, and it is in the middle of six eastern districts where shifting cultivation is most intense.

The Uri Chu watershed was selected for pilot demonstration activities for similar reasons. One of the leading criteria for site selection for pilot demonstration activities is high visibility. Uri Chu watershed is located right at the Pema Gatshel district headquarters. Farmers from all the blocks have to pass by the watershed area and visitors from Thimphu and adjoining districts can easily observe the project activities. It is easily accessible, since most of the watershed area is approachable by motorable road. Uri Chu watershed covers almost 25 percent of the district, and is representative of all the various conditions that are found in Pema Gatshel. The altitude varies from 1000 to 2550 m, representing subtropical to temperate agro-ecological regions. The blocks covered by the watershed have a wide range of physical, biological, social and economic characteristics. The district development infrastructure, including agriculture, animal husbandry and forestry extension agencies, already exists in these blocks and is representative of other areas of the country.

Objectives of the pilot demonstration project

The main objective of this type of pilot demonstration project is to determine ingredients that will foster the balanced and optimum use of the land, paying particular attention to the growing demands on land for cultivation, grazing, forest products, watershed protection, wildlife protection, social needs and benefits, as well as for other development needs such as road construction, irrigation development, industrial development, etc.

This particular project, the Uri Chu watershed pilot project, is expected to promote the participation of local farmers in the implementation of policies and programmes leading to appropriate land use throughout the country. The project activities are expected to strengthen the institutional framework of the Royal Government of Bhutan through the application of multidisciplinary rural development efforts supported by scientific land management practices. The immediate objectives of the project are presented below.

1. The development of appropriate land use practices for sustainable production as an alternative to the shifting cultivation system, to be used for demonstration. The emphasis will be on improved conservation and agronomic practices. This will include in situ improvement of shifting cultivation practices and the agroforestry system, integrated livestock farming, horticulture development and small-scale income generation schemes.
2. The introduction of several incentive schemes to motivate farmers to adopt alternative land use systems and progressively abandon shifting cultivation practices.
3. The development of monitoring systems to chart the impact of the above changes on the socio-economic conditions of the community and on the natural environment.
4. The development of skilled human resources in the district administrations of six eastern districts of Bhutan (those with the highest levels of shifting cultivation) to enable them to carry out a treatment-oriented land capability classification survey and to prepare a land use map.
5. The organization of a public awareness campaign and conservation education activities to sensitize the rural community to the adverse impact of uncontrolled shifting cultivation and the need to adopt appropriate alternatives.

Programmes and activities for immediate implementation under the pilot project

The alternatives to shifting cultivation identified need to be tested and demonstrated in an appropriate project area. In
addition, in the particular case of the Uri Chu project, several preparatory activities will be required to achieve the objectives listed above. The most important ones are:

- updating of the existing land use map with the help of SPOT imagery and aerial photographs;
- preparation of a handbook on soil survey and treatment-oriented land capability classification survey;
- demarcation of 5800 ha of national forest land;
- undertaking of a cadastral survey of 4800 ha of cultivated land including tseri land; and
- preparation of an integrated natural resources inventory and an integrated watershed development plan.

Activities recommended for demonstration in particular areas as determined by the land capability classification survey could be agroforestry, gradual conversion into fruit orchards, conversion into dryland terraces and forest plantation of fast growing species.

Activities that could be demonstrated for the improvement of existing shifting cultivation practices are improved land husbandry techniques, improved crop management practices, improved soil management and the introduction of cash crops. Further demonstration of soil management practices and improved crop management practices are also required for permanently cultivated land.

**Benefits and outputs expected from the pilot project**

The pilot demonstration is the first phase of a long-term programme recommended to control the transition from shifting cultivation practice to more sustainable and permanent land use. Among the anticipated major outputs of the project in Uri Chu is a field-tested manual on soil surveys and treatment-oriented land capability classification surveys, with recommendations on appropriate land use practices for sustained production of goods and services from each category of land.

A pilot demonstration project in a watershed of regional importance will be capable of offering another major output in the form of training and education opportunities for several target groups including students, farmers and middle-level technicians. This training would cover the following subjects:

- land use planning and appropriate land use practices;
- strengths and weaknesses of different alternative land use models, initially conceived and tested as alternatives to shifting cultivation;
- improved crop and land husbandry practices in rain-fed land;
- terracing and bunding;
- cash crop cultivation;
- techniques for improving soil fertility using traditional methods;
- erosion control practices; etc.

The project should also supply study reports on the feasibility of establishing an integrated forest industry complex in eastern Bhutan. Studies on ways and means of improving agricultural marketing procedures and on the economics of different land use models conceived and tested as alternatives to shifting cultivation.

The pilot project in Uri Chu should also aim to provide research results on different aspects of agricultural production and practices. It will be a source of agroclimatic information and help to establish an agroclimatic monitoring network. The studies carried out under the project will be useful in the establishment of a socio-economic benchmark for impact assessment. The preparation of all these materials will also result in the creation of a trained cadre of multidisciplinary staff in Pema Gatshel district.

Physically, the project will undertake the actual site rehabilitation of the 100 ha of critical watershed area presently under shifting cultivation, the implementation of a management plan for 58 km\(^2\) of forest area, the protection of 20 km of road against erosion and farm development of several households.

The major share of the projected investment during this pilot demonstration phase is expected to be used in institution building, awareness campaigns, training, special studies, adaptive research and natural resources inventories. All these activities require skilled and specialized human resources. For this reason, almost 60 percent of the allocated funding is expected to be used to procure the services of skilled in-country staff, expatriate experts and consultants.

Therefore, this project and other pilot demonstration projects are not expected immediately to produce remarkable direct economic benefits in the project area.

One of the important study aims during the development of demonstration projects is to conduct comparative cost-benefit analysis of different models proposed as alternatives to shifting cultivation. In the next phase, the implementation phase, the investment pattern would be expected to favour production-oriented activities, since the basic institutional infrastructure would already be in place to organize expanded activities covering larger areas.

**Chapter 5 End notes**
1. In Bhutan, the land tenure system was reviewed and changes recommended in mid 1993.

Chapter 6
Discussion and Conclusions

The previous chapters have broadly covered different aspects of shifting cultivation in Bhutan, including some details on the status of contemporary land use practices in the country and problems associated with them. This background was needed because the problems of shifting cultivation cannot be isolated from overall land use and agricultural development problems prevailing in the country. Chapter 5 gave a proposal for a programme aimed at resolving some of the problems deriving from the extensive practice of shifting cultivation through the gradual replacement of this practice with viable alternatives.

Owing to the need to cover such a wide area, the findings and conclusions pointed out or implied in the earlier discussion have remained vague and indirect. The objective of this study calls for much more focused analysis of land use problems in general, and shifting cultivation in particular. The following discussion presents a more clearly defined analysis to enable the identification of realistic alternatives to the problems presented by montane shifting cultivation.

Factors influencing evolution of present land use

Four factors have greatly influenced evolution of land use in Bhutan. These are the biophysical setting, population dynamics, the history of land allotment and access to public land, and the level of economic development of the farming community. In addition, several issues are emerging as important influences on the future development of agriculture in the country. The main ones are inefficient land utilization and low production per area, environmental degradation, the difficulties associated with intensification of agriculture and the diversification of rural labour into non-agricultural activities.

The biophysical setting: the principal factor in land use

It can be concluded from the background information that the principal factor contributing to the evolution of the present land use is Bhutan’s particular biophysical setting. Less than one-tenth of the total area of the country is cultivated land. This unfavorable biophysical setting has restricted the expansion of permanently cultivated land and slowed down the elimination of shifting cultivation, which now accounts for one-third of the cultivated area.

The distribution of the prime cultivated land type (wetland or chushing) is highly skewed: 92 percent of it is located in the southern and the western regions of Bhutan. This uneven distribution renders the eastern region more prone to shifting cultivation, for lack of alternatives. The eastern districts have rugged terrain, steep terraces, comparatively less rainfall and the lowest potential for irrigation development. This adverse biophysical setting has led to a situation in which almost 66 percent of the land under shifting cultivation is located in the six eastern districts.

Shifting cultivation practice in the Pema Gatshel district is a representative case, where the biophysical situation has restricted the expansion of sedentary cultivation and the farmers are forced to continue this practice for their subsistence. Almost 79 percent of the gross cultivated land in this district is still under shifting cultivation.

The influence of population dynamics

Compared to its neighbours in the Hindukush and Himalayan ranges, Bhutan’s population pressure is not significantly threatening the country’s landed resources. Owing to low population density, Bhutan has the majority of its land under forest cover (64 percent). For the same reason, however, shifting cultivation is still being practised in 16 out of 18 districts. Therefore, while population pressure is still not a big threat in Bhutan, population dynamics have played a role in the evolution of the present land use. The demographic pressure caused by the 2 percent population growth rate has been responsible for an 18 percent increase in cultivated land between 1966 and 1983 (FAO. 1986).

The impact of population on land use is more pronounced in the southern region, where 42 percent of the country’s population is residing in 17 percent of its geographical area. Almost all the suitable areas in the region have been brought under permanent cultivation and potential for further expansion is limited. Apparently, as a consequence of this scarcity of land, farmers are forced to continue shifting cultivation. This causes a creeping expansion of agriculture into marginal forest land.

Land allotment practices and access to public land

Past policies of the government on different aspects of land administration have greatly influenced the evolution of present land use, such as land distribution policy, rights and privileges defining access to public land, land reforms, land tax, land tenure and land use policy.
Before the promulgation of the Land Act in 1979, public land was distributed by officials of the theocratic government to individuals, religious bodies, communities or government organizations (before 1907), by His Majesty in the form of royal gifts (after the establishment of hereditary monarchy in 1907), and by districts, the Ministry of Home Affairs or the Ministry of Trade, Industry and Forests to landless families that applied for cultivable land or to any religious body or government organization. During this process, the best land was distributed to the religious institutions and influential persons who served the country during difficult periods, as well as to personalities close to local power. These land distribution practices gave rise to the expansion of rain-fed cropland and shifting cultivation practices at the cost of forest land.

Uncontrolled access to public forest land has facilitated the conversion of forest to shifting cultivation and grazing use. Productive cultivated land was also converted into fruit orchards during the agrarian reform, with the result that tenant farmers were displaced and pushed into less productive marginal forest land. The growth of cash cropping has also triggered the illegal conversion of forest land to grow permanent crops such as cardamom in the south.

**The influence of economic development on land use changes**

The level of economic development greatly influences the evolution of land use. A higher level of economic development normally helps to stabilize the rapid land use changes by absorbing the surplus of rural labour in other forms of off-farm employment. It also restricts the conversion of public land into cultivable land by increasing the production per unit area. However, in Bhutan the rate of economic development has remained low and has had little visible impact on traditional land use such as shifting cultivation.

**Issues related to inefficient land utilization and low production per unit area**

The concept of appropriate land use for the prudent exploitation of land resources is fully recognized in the recent development policies of the government. The development initiatives of the last 20 years have underscored the importance of increasing the production per unit area from each land use type. As a result, issues such as inefficient land utilization and low production per unit area are being addressed in the government’s new policy documents and in the sectoral studies conducted by international and bilateral agencies.

In light of the information in the previous chapters regarding land use practices in Pema Gatshel, it can be observed that in terms of optimum land use in the case study district, most of the land presently under permanent cultivation would be considered suitable only for forests or pastures. Major conservation work would be required before considering the presently cultivated land to be appropriate for sustained agricultural production.

The field observations and farmer interviews in Pema Gatshel district clearly reveal that absolute crop yields from the cultivated land are in decline, sources of animal feed and fodder are subject to increasing competition, and the forests adjoining the villages are being degraded due to the combined effects of overgrazing and timber extraction. This declining land productivity can be directly linked to the lack of improved resource conservation and utilization practices and the absence of scientific land use planning. Extension programmes for improved technologies in crop husbandry, land husbandry and soil management are still being carried out only on an experimental basis.

**Issues related to environmental degradation due to inappropriate land use practices**

There is environmental concern in Bhutan as a result of inappropriate land use and poor land husbandry practices. In spite of this, however, the degree of environmental degradation in Bhutan is not as alarming as its neighbors in the Hindukush and Himalayan ranges, and there is no reason to panic. Contributing factors to this comparatively better natural environment in Bhutan are the low population density and less intensive natural resource utilization (i.e., the predominance of subsistence rather than market farming).

In the absence of adequate infrastructure and institutional arrangements, as is the case in Bhutan and many other countries, intensification of land use based on a land use capability survey is not equivalent to environmental protection. Very often, intensification of land use without adequate supporting infrastructure has resulted in adverse impacts such as depletion of soil fertility due to loss of soil nutrients and substantial soil erosion. In a fragile environment like Pema Gatshel district, where supporting infrastructure is poor, the present land use practices are less damaging than high-intensity crop production practices without management. The present practices rely on natural processes such as nutrient cycling to maintain soil fertility.

**Resource management and conservation are key requirements for successful long-term economic growth.** In Bhutan, the rate of forest land degradation due to uncontrolled grazing has been documented, as has soil erosion from wetland (chushing) and rain-fed (kamshing) farming. Siltation and other physical resource problems have been reported in several watersheds in the country. Early preventive action leading to appropriate land and water management practices is highly desirable if the mistakes committed by neighboring countries are to be avoided.

**Difficulties related to implementing intensive agriculture**

To raise the living standards of farming communities in countries like Bhutan, it is vital that land use practices be improved and upgraded to achieve the necessary goals of conserving forest, soil and water resources and to create opportunities for economic development. This route to prosperity involves releasing marginal land from subsistence agricultural production and reverting it to productive forest or watershed protection, maximizing income from minimum land and labour, and diverting part of the rural labour force into other profitable activities. The study highlighted some of the difficulties associated with these goals.
Policies aimed at replacing extensive subsistence agriculture with intensive agriculture tend to ignore the real needs of small farmers. Agricultural development programmes under such policies have a tendency to concentrate on bigger farms and those in accessible areas. Bhutan’s farming communities, like those in most countries, are made up predominantly of small farmers. The majority of these are located in remote and hard to reach areas. The well-being of this majority of farmers can be better served by pursuing a simple approach that increases labour productivity and farm output.

The chances for an immediate change to intensive cultivation practices in the isolated rural areas of Bhutan are very small. The prerequisites for this transformation are many, including appropriate technology, adequate financial resources at farm level, marketing infrastructure, inputs, extension, education and training, and a progressive attitude on the part of the farmers. In a biophysical setting like that of Pema Gatshel, intensification of agriculture will also demand higher inputs of labour, since mechanization has only marginal scope at present.

Intensive agriculture does not necessarily result in the release of marginal lands. In the absence of appropriate land use and equitable land tenure policies, it may push poorer sections of the farming community off the newly profitable agricultural land and into more marginal areas.

Despite these constraints, however, intensive cultivation practices cannot be ruled out as a long-term goal to improve land use practices in countries like Bhutan. Land is a primary resource of the country, and increased income flows from land-based activities are both possible and desirable. Maximum cash flow may not necessarily be achieved through crop cultivation: animal husbandry and forestry may provide better cash flows in many parts of Bhutan. A National Land Use Survey, such as the one being implemented in Bhutan at present, is a prerequisite to determine the appropriate land use policy.

Issues related to diversification of farm labour from land-based employment to other productive employment

Existing land use practices in Bhutan are very labour-intensive and are absorbing the bulk of the rural work force. Based on the analysis of the situation in Pema Gatshel district, some observations can be made on this subject.

The farming community in the district reported that there is an acute shortage of labour in the villages. Despite the awareness that conservation farming is a prerequisite for sustained agricultural production, farmers have not been able to apply the practices because of labour constraints. However, farm labour is inefficiently utilized: traditional techniques for ploughing, harvesting and post-harvest storage are inefficient. Improvements in these and other land husbandry practices could contribute to labour saving and increased production. A time-and-motion study can be made to find ways to increase the efficiency of labour.

The required household labour contribution for district and local development activities has also been reported by farmers as a significant constraint to adopting more intensive agricultural practices. In addition, at present wage rates, shifting cultivation is economically more rewarding than any available off-farm employment (see below).

The economic productivity of shifting cultivation

The commonly held view is that shifting cultivation pays back low remuneration when the production per unit area is converted into market value, and that this practice also involves extensive and systematic destruction of the forest and its produce, which constitutes a tremendous loss of valuable resources to the country. Shifting cultivators, this view continues, can never enter into the cash economy since they are isolated from the market and they can hardly build surplus. Thus, shifting cultivators have limited financial resources to invest for increasing productivity, which instead remains low. Therefore, shifting cultivation is an economically inefficient land use practice. This argument is quite appealing, and to some extent cannot be denied. However, the present study in Pema Gatshel district reveals several contradictions.

In this district, it was calculated that a high altitude shifting cultivator harvests a crop worth the equivalent of a net daily wage amounting to Nu. 26.50, while a lower altitude cultivator harvests the equivalent of about Nu. 25 per day of labour. These returns compare very favorably to the average district wage rate, which varies from Nu. 10 to 20 per day depending on the type of work.

In Pema Gatshel, most families combine sedentary agriculture with shifting cultivation. The result is a complex set of farming systems in which farmers are diversifying production to satisfy cash income needs from permanently cultivated land and subsistence needs from shifting cultivation. If the present trend continues, many subsistence farmers may become commercial farmers in a few years time.

It is undoubtedly true that there has been significant damage to national resources due to the conversion of natural forest for shifting cultivation in Pema Gatshel. On average, about 186 m$^3$ of growing stock is cut and 5.4 m$^3$ of net annual yield is lost for every hectare of land prepared for shifting cultivation (DOF, 1986). How-ever, in return, the land under shifting cultivation provides fuelwood for many families, has a food production value equivalent to Nu. 890-1 500/ha/year, and provides grazing opportunities for a number of cattle.

Environmental concerns often associated with shifting cultivation

Shifting cultivation is often perceived as a destructive practice leading to accelerated environmental degradation, and previous policy documents of the government reflect this belief. It is believed that this practice has led to the destruction of forests, soil erosion and loss of soil fertility. It is also believed that it contributes to degradation of watershed conditions and
the overall natural environment. A strong negative association linked to local religious traditions includes the belief that shifting cultivation is a “sinful act” since it leads to the death of many insects during burning. Again, the study findings and conclusions on these issues somewhat contradict these views.

The delicate farm environment found in most parts of Bhutan is characterized by very limited land for permanent cultivation, a scarcity of skilled farm labour for adopting mechanical conservation measures and a shortage of capital to acquire external inputs or labour. Shifting cultivation has been adopted to circumvent all of these constraints. The practice is ecologically more stable than existing permanent cultivation practices. It has produced relatively less environmental impact where the farmers have strictly followed the traditional norms developed through generations of indigenous experience.

In similar environmental conditions in neighboring countries, forests have disappeared where sedentary cultivation practices have been adopted. As a consequence, serious problems of soil and environmental deterioration have occurred. Therefore, traditional shifting cultivation practices in Bhutan should probably not be qualified as “destructive.”

Observation in the field confirms that traditional shifting cultivation is an ecologically stable cultivation practice in Pema Gatshel, where the farm environment, among other things, is mainly at subsistence level and characterized by a non-monetized economy. However, owing to recent socio-economic changes, such as demographic pressures, incentives for cash cropping, changes in the traditional systems of shared communal labour and many others, the traditional norms for shifting cultivation are falling out of use. As a result, adverse environmental impacts are emerging.

Most serious problems in soil and environmental deterioration occur where shifting cultivation and long-term fallow systems have been replaced either by drastically shortened fallows or by continuous cultivation. The problems are the result of the removal of vegetative cover and longer or continuous periods of cultivation without adequate fertility regeneration or application of soil conservation techniques (FAO, 1984).

The present rate of socio-economic change in Pema Gatshel district suggests that it will be extremely difficult to maintain the traditional norms used for cultivating tsheri land. Development of alternatives to shifting cultivation has become inevitable if the natural resources are to be used on a sustainable basis. However, such alternatives cannot be developed overnight. A moderate beginning to seek alternatives has become urgent.

Practicability of retaining shifting cultivation

The Forest Policy of 1974 states that shifting cultivation practices have to be abolished if the forest is to be conserved. This study has looked into the ramifications of abolishing shifting cultivation in the farming system in Bhutan and makes the following observations.

Shifting cultivation in Bhutan has evolved out of the combined effects of the bio-physical setting, the social and cultural beliefs and the long isolation of the country from external economic activity. Therefore, if shifting cultivation is a problem, it is part of the total economic development problem. It cannot be isolated from the other development issues, and any attempt to abolish it in isolation will have ramifications on the whole development sector.

Shifting cultivation provides the best possible solution for subsistence production to the majority of farmers. The practice, with or without simultaneous permanent cultivation, cannot be completely abandoned for a few more years. In Pema Gatshel, almost every household cultivates tsheri. Therefore, any ad hoc changes in policies affecting shifting cultivation practice may affect the lives of more than 80 percent of the farmers. They may face heavy food deficits for up to nine months (depending upon the size of the holding of the permanently cultivated land) if the policy interventions and associated programmes fail to address the problem.

This study endorses the spirit of the concern expressed by the government in its Forestry Policy of 1974. However, the findings from the field situation lead to the conclusion that abolition of the present practice all at once is not a viable solution. A gradual improvement in management of the existing shifting cultivation system is more desirable, in order to postpone ecological degradation. Such an approach will provide adequate time to progressively phase out tsheri cultivation through the creation of alternatives such as off-farm employment and increasing production from permanent cultivation.

Alternatives to shifting cultivation

The following models are identified as possible alternatives to shifting cultivation that could be gradually introduced in the course of a programme for phasing out this practice. The advantages and disadvantages of each model are presented and its potential for implementation is also discussed.

Nationalization of all land under shifting cultivation

This alternative was conceived by the government during the development of the 1974 Forest Policy. This document identified shifting cultivation as one of the major causes of the depletion of forest wealth. It maintained that the practice should therefore be abolished if the forest were to be conserved. In order to avoid hardships to the present population dependent on this practice of cultivation within forest areas, a payment of appropriate compensation to the dispossessed was recommended. This concept contains several implicit assumptions. It was assumed that:

- farmers who are solely dependent on shifting cultivation will automatically adopt alternative vocations by utilizing cash
compensation paid to them by the government;
- farmers with permanently cultivated land will invest the compensation paid to them to increase production from dry land and wetland; and
- the degraded land presently under shifting cultivation will automatically stabilize as soon as it is reverted back to forest after nationalization.

This alternative is a direct and short-cut approach to phasing out shifting cultivation. A prerequisite for this method is the preparation of a master plan to resettle the displaced farmers, which is a very complex and expensive project in itself. This alternative, therefore, is neither economically feasible nor socially desirable to implement on a large scale. However, limited application of this approach may be desirable for rapid protection of strategic watersheds, road slopes and other places of particular importance from further deterioration.

**Improvement to the existing shifting cultivation system**

The concept behind this alternative is that, under the present technological, socioeconomic and institutional conditions, shifting cultivation as a farming system must remain: it is socially accepted, economically rational and scientifically sound. However, owing to emerging socio-economic transformations, the present practice requires certain changes and modifications.

This model would lead to an increase in the production per unit area from shifting cultivation without a substantial departure from traditional fallow cultivation. Since the concept does not depart significantly from the present practice, it would be acceptable to the majority of small farmers practicing shifting cultivation. The appropriate technology envisaged in this approach is not readily available and all activities that have been proved successful elsewhere need to be tested on a pilot demonstration scale.

It is expected that changes to traditional shifting cultivation would increase the carrying capacity of tshei lands by introducing better levels of control and management. Use of improved soil management to improve soil fertility would permit farmers to increase the period of cultivation and decrease the fallow period, and the introduction of tree crops and new crop varieties besides maize would increase the productivity per unit area.

If selected for implementation, this alternative will involve preparatory activities such as the survey and demarcation of all the land under shifting cultivation, including identification of ownership. It would necessitate land evaluation, treatment oriented classification of all the land under shifting cultivation and the preparation of guidelines for the improvement of each category of land.

Since 1984, the government has encouraged the farmers to convert tshei land into kumshing (rain-fed cropland). In response to the government’s encouragement, several farmers have applied for conversion of their registered tshei land into kumshing. To avoid uncontrolled land use changes, the government issued a policy paper outlining a process for this conversion. This paper provided guidelines for the evaluation of tshei land for alternative uses. A simplified version of the evaluation criteria in the guidelines is shown in Table 8.

**TABLE 8: LAND EVALUATION GUN DELINES FOR CONVERSION FROM TSHERI TO KAMSHING**

<table>
<thead>
<tr>
<th>SOIL DEPTH</th>
<th>GENTLE SLOPE (&lt;12%)</th>
<th>MODERATE SLOPE (12-26%)</th>
<th>STRONG SLOPE (26-45%)</th>
<th>VERY STRONG SLOPE (45-55%)</th>
<th>VERY STEEP (55-65 %)</th>
<th>STEEP (&gt;65 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep (D) &gt;90 cm</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>FT/FC</td>
<td>F</td>
</tr>
<tr>
<td>Moderately Deep (MD)</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>FT/FC</td>
<td>F</td>
</tr>
<tr>
<td>50-75 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shallow (S) 20-50 cm</td>
<td>PC</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
<td>F</td>
</tr>
<tr>
<td>Very shallow (VS)&lt; 20 cm</td>
<td>FC</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

**LAND USE KEY:** PC = Permanent cultivation, FC = Fallow Cultivation, FT = Fruit Trees, P = Pasture and F = Forests,

**Treatment-oriented land capability classification:** Along lines similar to these guidelines for land conversion, the following land capability scheme for pilot demonstration activities is based on experience gained under a project in Jamaica. The application of the system in Jamaica has produced positive results. Table 9 represents a summary of the classification
scheme followed in Jamaica, slightly modified to suit the conditions in the study area. It appears that the proposed scheme suits the environmental or socio-economic requirements of Bhutan and may also suit neighboring countries. It can be further modified after some experimentation.

This land capability classification system is provisional, subject to further modification to suit the local conditions. However, the classification scheme has several important features.

**TABLE 9: TREATMENT-ORIENTED LAND CAPABILITY SCHEME FOR MOUNTAINOUS AREAS**

<table>
<thead>
<tr>
<th>SOIL DEPTH</th>
<th>GENTILE SLOPE (&lt;12%)</th>
<th>MODERATE SLOPE (12-26%)</th>
<th>STRONG SLOPE (26-45%)</th>
<th>VERY STRONG SLOPE (45-55%)</th>
<th>VERY STEEP (55-65 %)</th>
<th>STEEP (&gt;65 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep (D) &gt;90 cm</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
<td>FT</td>
<td>F</td>
</tr>
<tr>
<td>Moderately Deep (MD) 50-90 cm</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
<td>FT/P</td>
<td>F</td>
</tr>
<tr>
<td>Shallow (S) 20-50 cm</td>
<td>C1/P</td>
<td>C2/P</td>
<td>C3/P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Very shallow(VS) &lt; 20 cm</td>
<td>C1/P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

**KEY (most intensive tillage or uses):**

**Cultivable lands:**

- **C1:** Type 1: <12% slope, few conservation measures: contour cultivation, strip cropping, vegetative barriers, rock barriers and on larger farms, broad-based terraces.
- **C2:** Type 2: 12-26% slopes, MD soils, more intensive conservation with medium to small bulldozer: bench terracing, hexagons, mini-convertible terracing for tractor farming.
- **C3:** Type 3: 26-45% slopes, small bulldozer; bench terracing, hexagons and mini-convertible terracing on deep soil; hillside ditching, individual basins on shallower soil. Mechanization: small tractor or walking tractor.
- **C4:** Type 4: 45-55% slopes, treatment only with manual Labour, cultivation by walking tractor and manually.

**Non-cultivable lands:**

- **P:** Pasture, improved and managed. At near 55% slope and when the land is too wet, zero grazing should be practised; otherwise, rotational grazing is recommended.
- **FT:** Fruit-trees and other food trees. On slopes of 55% to 65%: orchard terracing, contour planting, diversion ditching, mulching and interspaces under permanent grass cover.
- **F:** Forest land, slopes over 65%, or over 55% where soil is shallow.

Land that is too wet, occasionally flooded or too stony for tillage and treatment is classified as Pasture below 55% and Forest above 55%.

Gully-dissected land that prevents normal tillage is Forest.

1) It is a "treatment-oriented" scheme, which means that land is categorized according to the types of major conservation treatments to be recommended for erosion control.

2) It is a simple classification scheme. Land is divided mainly according to the two major factors: the degree of slope and the soil depth, although stoniness, wetness and gully dissection are also considered. The two major factors can be easily measured in the field.

3) It is easy to understand. Plots of land are classified directly by their most intensive use rather than in numerical classes.
The capability map can be easily understood by farmers and field workers.

4) **It is a practical scheme.** This new scheme classifies more lands as cultivable than others, through adoption of the appropriate conservation treatments. In most countries, what is really needed is the creation of more cultivable land for agricultural crops rather than the imposition of stricter limits. This scheme does this by considering the land resources from both the food production and erosion control points of view. The results of land classification for any particular area will also show clearly the conservation needs of that area.

**Local solutions to conservation problems:** Not all types of conservation treatment would fall into the categories of the scheme. Local conditions and experience might dictate modifications to the classification system. For example, in Bhutan, conservation treatment could be based on regulation of the methods for clearance of vegetation under shifting cultivation. It could be mandated that the vegetation in *tsheri* land may be cleared only along the contour instead of up and down the slope, as is the case in the present practice, or that it is mandatory to receive official certification that a sufficient fallow period has been respected before clearing.

Another example is that of substituting artificially established woody legumes for natural bush fallow vegetation, an idea of proven value for edible varieties of pigeon pea, but with great potential for other woody legumes that yield fuelwood and other by-products while at the same time contributing to the restoration of soil fertility (Raintree, 1981). Other practices may result in improved use of cleared vegetation. At present, the unburnt timber and twigs are left haphazardly for decomposition after clearing. They could be better utilized to construct log bunds to control surface erosion. The unburnt logs can be placed along the contours to act as a contour bund to arrest eroded soils. Other twigs and unburnt vegetation can be spread along these logs to serve as a mulch to conserve moisture.

The techniques for improving shifting cultivation without burning are not fully known. Adaptive research needs to be conducted in this field. If the research proves, as some maintain, that burning does not necessarily enrich the soil and improve the productivity, demonstration of optimum use of cut vegetation would become necessary. This technique involves extraction of cut-over vegetation for use as sawn lumber, charcoal, fuelwood, and supplies for small local industries like carving and basket weaving. The remainder, the small branches and leaves, would be used as green mulch for crops.

**Combining forestry and food production**

The agroforestry model: Foresters in several countries have sought improved forestry systems for local communities after the legal and punitive approaches to address the problems of shifting cultivation failed to achieve their objectives. Instead of imposing a ban on shifting cultivation or nationalizing the land under shifting cultivation, forestry departments in the governments of many countries have designed and implemented projects based on a participatory approach to natural resource management. The basic idea behind these projects is to engage in agroforestry, combining tree crops with food crops. Different systems have been developed and several others are being tested. Important agroforestry systems that are commonly known are: *Taungya*, alley cropping, multistory inter-cropping, etc.

This approach is based on several assumptions. First, it is supposed that in a situation of limited availability of permanent cultivation land, farmers will give equal priority to tree crops and food crops. Second, it is assumed that the surplus production of tree crops is usually readily marketable. Third, farmers are presumed to have alternative activities to survive until the tree crop is harvested. Implementing the agroforestry alternative will involve identification of suitable tree crops and food crops, including the establishment of tree nurseries to distribute seedlings to the farmers. It will also be important to establish or expand forest produce markets, as well as promoting rural forest industries.

This alternative would be socially acceptable to the shifting cultivators in Bhutan if their *tsheri* land can be registered in their names. Departmental agroforestry has only remote chances of acceptability, while private or even block-level agro-forestry, as well as private forestry, would probably be acceptable. Alley cropping and multistory intercropping may be very attractive to the farmers if they can be demonstrated in the field. While this model is technically sound, its economic feasibility is doubtful if markets cannot be created. At present, in a farming environment similar to Pema Gatshel, there is no market for forest produce.

The pasture/livestock development model: This alternative has been recommended by the an existing highland livestock project for implementation in the shifting cultivation areas of eastern Bhutan. It envisages the use of successfully demonstrated techniques of undersowing pasture mixtures into maize or buckwheat crops on *tsheri* land. This grass/legume pasture would not only provide high quality forage for livestock, but would be more effective in increasing soil fertility for the next crop than the present practice of fallingow the land. Under the existing project, seed and fertilizer have been applied and fencing constructed. *Luecaena* spp. was used for hedging wherever practical (MPW, 1986).

To apply the model from the project, the average farmer on *tsheri* land should occupy a total area of 2 ha, of which 20 percent is cultivated at any time. The main advantage is that grazing pressure inside the forest area will be reduced. The biggest drawback of this model is the high cost of fencing, fertilizer and seeds. During the large-scale extension of such a model, farmers may not be able to fence and fertilize. The success of this alternative ultimately depends on whether fertilizer and seeds can be highly subsidized.

**Horticulture development:** One of the most attractive alternatives to shifting cultivation can be the development of fruit orchards where soils and slopes are favorable and the location is close to market. A fruit orchard does well under rain-fed conditions if optimum utilization of rainwater is achieved by introducing soil management and land husbandry practices. This alternative assumes that the government would provide subsidies to convert the area into terraced orchards, providing grass
and legume seeds and some chemical fertilizers during the initial years. Government would also need to extend adequate extension follow-up to improve fruit-tree management and support the creation of adequate marketing to absorb the increased production of fruits.

Initial investigation on the economics of fruit orchards reveals that it is a highly profitable enterprise. However, in the absence of detailed agro-economic information in all aspects of the industry it is difficult to predict economic feasibility for a larger scale horticulture operation. Horticulture works best as a relatively high-tech production system using intensive inputs. It is doubtful that subsistence farmers such as shifting cultivators could easily implement this model. Therefore, to start with, this model should be limited to pilot demonstration activities.

Conversion to permanent cultivated land

This alternative stems from the need to open up new land for permanent cultivation in Bhutan. In many areas of the country, it is clear that if additional land is not brought under permanent cultivation, the ecological balance in the environment will destabilize soon due to excessive crop production from the present shifting cultivation areas. However, this alternative obviously requires the existence of appropriate land capable of supporting rain-fed cultivation in areas currently under shifting cultivation.

For it to work, the government must be in a position to extend subsidies, if required, to improve the land and maintain the productivity. Enough forest must remain to support the various needs of expanded agriculture (such as watershed protection), and there must be sufficient labour to take up the additional land development needs.

Experience in several countries has demonstrated that conversion of marginal land for permanent cultivation is not always economically feasible. Therefore, this alternative needs to be carefully studied in a pilot demonstration activity before expanding into larger areas,

Chapter 6 End notes

1. For a list of suggested woody legumes for Bhutan, see Appendix E.

Appendices

APPENDIX A

Rainfall, Temperature and Cropping Calendar

TABLE 10: MEAN MONTHLY RAINFALL AT SOME SELECTED STATIONS

(in millimetres)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2540 M</td>
<td>2260 M</td>
<td>230 M</td>
<td>230 M</td>
<td>1200 M</td>
</tr>
<tr>
<td>January</td>
<td>0.1</td>
<td>1.9</td>
<td>3.6</td>
<td>28.7</td>
<td>10.6</td>
</tr>
<tr>
<td>February</td>
<td>3.3</td>
<td>1.5</td>
<td>7.7</td>
<td>60.4</td>
<td>8.0</td>
</tr>
<tr>
<td>March</td>
<td>18.6</td>
<td>25.0</td>
<td>22.2</td>
<td>107.5</td>
<td>28.0</td>
</tr>
<tr>
<td>April</td>
<td>22.3</td>
<td>21.5</td>
<td>54.1</td>
<td>183.5</td>
<td>53.7</td>
</tr>
<tr>
<td>May</td>
<td>44.9</td>
<td>28.0</td>
<td>67.4</td>
<td>315.2</td>
<td>62.3</td>
</tr>
<tr>
<td>June</td>
<td>107.5</td>
<td>31.3</td>
<td>118.6</td>
<td>669.1</td>
<td>135.0</td>
</tr>
<tr>
<td>July</td>
<td>171.0</td>
<td>131.2</td>
<td>166.7</td>
<td>866.4</td>
<td>163.2</td>
</tr>
<tr>
<td>August</td>
<td>181.0</td>
<td>107.1</td>
<td>175.7</td>
<td>691.0</td>
<td>120.0</td>
</tr>
</tbody>
</table>
Determinants of the cropping calendar

The monsoon is the determining factor of the summer crop calendar in terraced cultivation. The winter cropping calendar is determined by temperature differences, and both the length and severity of winter. The number of sunny days after the cutting of vegetation determines the cropping calendar in tsheri land. If it rains just before burning, it is postponed, resulting in delay for the whole calendar of operation.

Farmers are still using the same crop rotation that has evolved out of limited experience. No evidence exists that the farmers are making an effort for the development of crop rotation as a means of spreading labour, maintaining fertility, reducing the risk of buildup of specific crop pests and diseases, and reducing erosion hazards. Little, if any research/experimental work has been carried out to develop rotations that would achieve the above aims and make best use of the agro-ecological conditions in specific locations (Acres International, 19X.5). For example, paddy rice is grown universally throughout the country as a summer crop in almost all the valley cultivation irrespective of soil suitability. The usual winter crop is wheat.

### TABLE 11: MAXIMUM AND MINIMUM TEMPERATURES AT SELECTED STATIONS

(degrees Celsius)

<table>
<thead>
<tr>
<th></th>
<th>THIMPHU</th>
<th>PARO</th>
<th>BUMTHANG</th>
<th>PHUNTSHOLING</th>
<th>TASHIGANG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAX.</td>
<td>MIN.</td>
<td>MAX.</td>
<td>MIN.</td>
<td>MAX.</td>
</tr>
<tr>
<td>JAN.</td>
<td>11.6</td>
<td>-4.6</td>
<td>14.7</td>
<td>-3.1</td>
<td>21.8</td>
</tr>
<tr>
<td>FEB.</td>
<td>12.2</td>
<td>-2.4</td>
<td>16.1</td>
<td>1.7</td>
<td>22.4</td>
</tr>
<tr>
<td>MAR.</td>
<td>14.5</td>
<td>0.4</td>
<td>18.3</td>
<td>1.8</td>
<td>24.8</td>
</tr>
<tr>
<td>APR.</td>
<td>17.1</td>
<td>4.1</td>
<td>19.6</td>
<td>7.0</td>
<td>27.9</td>
</tr>
<tr>
<td>MAY</td>
<td>20.5</td>
<td>8.0</td>
<td>24.0</td>
<td>10.1</td>
<td>27.8</td>
</tr>
<tr>
<td>JUNE</td>
<td>23.1</td>
<td>12.2</td>
<td>25.7</td>
<td>15.1</td>
<td>27.8</td>
</tr>
<tr>
<td>JULY</td>
<td>22.6</td>
<td>13.5</td>
<td>24.3</td>
<td>16.5</td>
<td>28.2</td>
</tr>
<tr>
<td>AUG.</td>
<td>23.0</td>
<td>12.8</td>
<td>25.4</td>
<td>16.1</td>
<td>28.5</td>
</tr>
<tr>
<td>SEP.</td>
<td>21.0</td>
<td>11.4</td>
<td>23.3</td>
<td>13.1</td>
<td>29.9</td>
</tr>
<tr>
<td>OCT.</td>
<td>19.7</td>
<td>5.6</td>
<td>21.6</td>
<td>8.4</td>
<td>29.5</td>
</tr>
<tr>
<td>NOV.</td>
<td>16.1</td>
<td>0.6</td>
<td>19.6</td>
<td>2.3</td>
<td>27.7</td>
</tr>
<tr>
<td>DEC.</td>
<td>13.0</td>
<td>12.9</td>
<td>16.1</td>
<td>-0.1</td>
<td>23.9</td>
</tr>
</tbody>
</table>

SOURCE: Acres International Ltd., vol. 1, Main Report, 1986
Recently potato cultivation has become popular. However, for various reasons, land remains fallow in most places in winter.

**Yields and cropping intensities**

Farming intensity ranges from a low of 110 percent in Pema Gatshel to 166 percent in Thimphu. Summer intensity is universally 100 percent in all districts and the winter intensity ranges between 10 percent and 66 percent. The regional and country means are as demonstrated in Table 14.

**TABLE 12: YIELD OF MAJOR CROPS**

<table>
<thead>
<tr>
<th>CROPS</th>
<th>YIELD (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy rice</td>
<td>2.04 to 2.12</td>
</tr>
<tr>
<td>Wheat and Barley</td>
<td>1.07 to 1.14</td>
</tr>
<tr>
<td>Maize</td>
<td>0.78 to 1.98</td>
</tr>
<tr>
<td>Buckwheat and Millet</td>
<td>0.68 to 0.88</td>
</tr>
<tr>
<td>Mustard</td>
<td>0.55 to 0.65</td>
</tr>
<tr>
<td>Pulses</td>
<td>0.60 to 0.67</td>
</tr>
<tr>
<td>Potatoes</td>
<td>4.91 to 7.69</td>
</tr>
</tbody>
</table>

*SOURCE: Department of Agriculture, Ministry of Agriculture, RGOB.*

**TABLE 13: YIELD OF MAJOR HORTICULTURAL CROPS**

<table>
<thead>
<tr>
<th>CROPS</th>
<th>YIELD (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oranges</td>
<td>4.12</td>
</tr>
<tr>
<td>Apples</td>
<td>2.20</td>
</tr>
<tr>
<td>Cardamoms</td>
<td>0.47</td>
</tr>
<tr>
<td>Others</td>
<td>0.80</td>
</tr>
</tbody>
</table>

*SOURCE: Department of Agriculture, Ministry of Agriculture, RGOB.*

**TABLE 14: CROPPING INTENSITY BY REGION**

<table>
<thead>
<tr>
<th>REGION</th>
<th>SUMMER %</th>
<th>WINTER %</th>
<th>TOTAL %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Region</td>
<td>100</td>
<td>42</td>
<td>142</td>
</tr>
<tr>
<td>Central Region</td>
<td>100</td>
<td>9</td>
<td>109</td>
</tr>
<tr>
<td>Eastern Region</td>
<td>100</td>
<td>30</td>
<td>130</td>
</tr>
</tbody>
</table>


**KEY:**

WESTERN REGION: Gasa, Haa, Paro, Samchi, Thimphu;

CENTRAL REGION: Bumthang, Chirang, Dagana, Gaylegphug, Shemgang, Tongsa and Wangdiphodrang;
Cropping intensity is high in four districts. These districts are Paro, Thimphu, Punakha and Wangdiphodrang. The reason for higher cropping intensity in these four districts is probably the availability of most intensive support services.

The cropping intensity in tscheri land is increasing due to the increasing popularity of potatoes. Traditionally, only one crop used to be grown in tscheri land, however there are a few villages where they grow two crops consecutively for two or three years.

APPENDIX B

Livestock Husbandry

There are several varieties of cattle in Bhutan, predominant amongst them is the siri cattle, a slow maturing animal of quite small size. Mithun cattle are raised to cross breed with siri to produce Jatsam (female) and Jatsa (male). Jatsams are more productive than siri varieties and adapt very well to hard conditions. Mithun bulls are in very high demand because of the adaptability of Jatsa and Jatsam to the local conditions.

Exotic breeds such as Jersey and Brown Swiss are being raised on government farms for breeding purposes. However, these breeds have not established their credibility among farmers due to delicate management needs in terms of feed supply and health care.

Yak represents a prized livestock in higher altitudes. They produce meat, milk and cheese - a principal source of food for upland people. They also provide manure, as well as wool, hair and hides for clothing. They are multipurpose livestock and are used as pack animals,

Sheep are raised mainly for wool, while goats are raised for meat mainly in southern Bhutan. Exotic breeds of sheep have been introduced into Bhutan and have proved to be more productive.

Raising pigs is growing in popularity in Bhutan. They are mainly raised for household meat consumption. Management is easy and requires very little investment, making this activity very popular among small farmers. Poultry also are raised for self-consumption. They do not add much to the farm income. It is difficult to buy poultry produce in rural areas. Eggs are imported from India for the urban sector.

Recent census results completed by the Department of Animal Husbandry (1990) give the following figures for the livestock population: 308300 cattle, 33000 yaks, 5000 buffaloes, 44000 sheep, 36900 goats, 26000 horses and donkeys, 59000 pigs and 2180000 poultry.

As a result of the increased population in recent years, the animal population densities in pastures and grasslands in different parts of the country are estimated to be on the high side.

Pasture composition

Grazing land can be divided into four vegetation zones: subtropical zone, temperate zone, subalpine zone and an alpine zone.

Subtropical zone: In the drier region of this zone extensive grassland of *Cymbopogon flexuosus* is found in association with *Heteropogon contortus*. Other grasses commonly found in the zone are *Apluda mutica*, *Arundinella nepalensis*, *Crysopogon spp.*, *Cynodon spp.*, *Panicum spp.*, *Steria spp.*, *Themeda spp.* and *Sporobolus spp.* This type of grassland can be found in and around Punakha, Wangdiphodrang and Tashigang. Productivity of pasture in this zone is not known. However, DAH’s estimate on carrying capacity of animals in the 1985 Draft Pasture Policy reveals that productivity can be increased several times. For example, present carrying capacity can be increased by a factor of 10 by introducing better pasture management.

Due to periodic burning and heavy grazing, the condition of grassland in this zone has deteriorated. Many of the preferred forage species have been replaced by brush and weeds. Review of the stocking rate in districts predominantly located in the subtropical zone reveals that the rate is high and grasslands are heavily grazed.

Temperate zone: Grasslands in the temperate zone are in various stages of succession depending upon the grazing pressure from livestock. Much of the temperate zone, especially the drier areas, is dominated by *Andropogon thristis* associated with *Arundinella hookerii* and *Eragrostis nigra*. In some places *Themeda spp.*, *Helicodrichon* and *Pennisetum spp.* are found to be associated with *Andropogon*. Heavy grazing pressure has replaced natural *Andropogon* grassland by *Arundinella hookerii*. This type of grassland is located in Bumthang, Thimphu, Gasa, Lhuntsi, etc.

It is reported that dry matter production for temperate pastures can range between 2400 and 2 800 kg/ha. Productivity can be increased to 10 times current productivity from 4 ha/Lu to 0.4 ha/Lu. Over-use of grassland is a serious problem in many
grassland areas near the villages and around migratory trails. The upper temperate areas are subject to heavy grazing pressure from cattle during summer and yak in winter. Surprisingly large areas of temperate grasslands are still in very good condition throughout the country (MPW, 1986).

Subalpine zone: Depending upon aspect, altitude and grazing pressure, the following main grass species are found in this zone: *agrostis* spp, *amopyron* spp, *bromus* spp, *danthonia* spp, *festuca* spp, *poa* spp, *stipa* spp, etc. This type of grassland occurs throughout the northern belt of Bhutan and mainly in Bumthang, Gasas, Mera and Sakten in Tashigang districts, Laya in Gasa district, and Lhuntshi. Roder (1982) estimated dry matter yield for native grasslands at 2600 m to be 800 kg/ha. Much of the grassland in the subalpine zone is still in good condition. However, in places there are degraded grasslands owing to periodic burning by herders and excessive use for grazing by cattle in summer and yak in winter.

Alpine zone: The grasses found in the alpine zone are almost the same as in the subalpine zone. Higher up sedges and forbs become more dominant. *Festula ovina* is an important grass in the alpine zone. Its occurrence is found in Paro, Gasa, Bumthang and Lhuntshi. It is estimated that the production of grass in the alpine zone has a dry matter yield of about 13 kg/ha (Roder, 1982). Carrying capacity can be increased five times, from 10 ha/Lu to 2 ha/Lu by improving the pasture. In general, alpine grasslands are in good condition, though there are overgrazed pockets. Yak herds and flocks of sheep utilize this zone in the summer months.

APPENDIX C

Forest Productivity and Sustained Yield Estimates

TABLE 15: FORESTCOVER DISTRIBUTION IN BHUTAN

<table>
<thead>
<tr>
<th>TREE TYPES</th>
<th>AREA(^1) (Km(^2))</th>
<th>% OF TOTAL FOREST ARE</th>
<th>FORESTS AS A % OF TOTAL LAND AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir</td>
<td>2956</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Mixed Conifer</td>
<td>4854</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Blue Pine</td>
<td>755</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Chir Pine</td>
<td>1292</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Hardwood/Conifer Mixture</td>
<td>2193</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Upland Hardwood (temperate)</td>
<td>8725</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>Lowland Hardwood (tropical/subtropical)</td>
<td>3514</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Degraded forest</td>
<td>1416</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Plantations</td>
<td>27</td>
<td>-</td>
<td>.2</td>
</tr>
<tr>
<td>TOTAL FORESTED LAND</td>
<td>25732</td>
<td>100</td>
<td>64</td>
</tr>
<tr>
<td>TOTAL LAND</td>
<td>40250</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: Negi, 1983

1 Area rounded off to nearest square km.

2 Insignificant Area amounting to 0.7% of total land area.

Production and productivity

According to the forest resource inventory of 1974/79, the estimated resources and sustained yields are as follows:
The information provided in Table 16 reveals that net annual allowable cut is almost 14 m$^3$. The present annual harvest is only 200 000 m$^3$, which is 70 times lower than what can be harvested annually.

### APPENDIX D

The Calendar of Activities for Shifting Cultivation

#### TABLE 17: ACTIVITY CALENDAR FOR SHIFTING CULTIVATORS

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>NOV</th>
<th>DEC</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
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</thead>
<tbody>
<tr>
<td>A ALTITUDE.&gt; 1500 M</td>
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<td>1 Site inspection</td>
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<td>2 Cutting, clearing &amp; drying</td>
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<td>3 Burning &amp; sowing</td>
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<td>4 Watching against wild</td>
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<td>5 Weeding</td>
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<td>6 Watching against wild animals</td>
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<td>7 Harvesting</td>
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<td>8 Threshing</td>
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<td>9 Transporting</td>
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<td>B ALTITUDE &lt; 1500 M</td>
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</table>
APPENDIX E

Woody legumes for Trial on long-fallow Land

The knowledge on appropriate woody legumes for introduction in fallow tshe?ri is poor. The following woody legumes are recommended for trial:

TABLE 17: LIST OF WOODY LEGUMES FOR POSSIBLETRIAL

<table>
<thead>
<tr>
<th>GENERA/SPECIES</th>
<th>HABIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia auriculaeformis</td>
<td>tree</td>
</tr>
<tr>
<td>Albizia lebbeck</td>
<td>tree</td>
</tr>
<tr>
<td>Alnus nepalensis</td>
<td>tree</td>
</tr>
<tr>
<td>Cajanus cajon</td>
<td>shrub</td>
</tr>
<tr>
<td>Calliandra calothyrs</td>
<td>small tree</td>
</tr>
<tr>
<td>Desmodium spp.</td>
<td>shrub</td>
</tr>
<tr>
<td>Desmanthus spp.</td>
<td>shrub</td>
</tr>
<tr>
<td>Leucaena leucocephala</td>
<td>shrub/tree</td>
</tr>
<tr>
<td>Mimisa scabrella</td>
<td>tree</td>
</tr>
<tr>
<td>Robinia pseudoacacia</td>
<td>tree</td>
</tr>
<tr>
<td>Sesbania grandiflora</td>
<td>tree</td>
</tr>
<tr>
<td>Probopis juliflore</td>
<td>tree</td>
</tr>
</tbody>
</table>

Glossary

Ara A local liquor made from maize
Borang Forest land
Chimi Elected members of the National Assembly
Chushing Wetland
Chunidom Form of obligatory labour for public works
Dasho Title granted by His Majesty the King to distinguished citizens, usually civil servants
Currency

The currency unit is the Ngultrum (Nu.). It is tied to the Indian Rupee.

Exchange rate in 1986          Exchange rate in 1993
US$ = Nu. 12.60                US$ = Nu. 30.85
Nu. = US $.079                 Nu. = US $.032

Abbreviations and Acronyms

BHU  Basic Health Unit
DAH  Department of Animal Husbandry
DOA  Department of Agriculture
DOF  Department of Forests
DYT  Dzongkhag Yargye Tshogchung (District Development Committee)
FAO  Food and Agriculture Organization of the United Nations
GDP  Gross Domestic Product
GNP  Gross National Product
ha   Hectare
IFAD International Fund for Agriculture Development
LSU  Livestock Unit
MHA  Ministry of Home Affairs
MOA  Ministry of Agriculture
References


**COMMUNITY FORESTRY PUBLICATIONS**

**Community Forestry Notes**

1 Household food security and forestry: an analysis of socio-economic issues, 1989 (E/F***/S/Ar)

2 Community forestry participatory assessment, monitoring and evaluation, 1989 (E/F/**S**)

3 Community forestry: rapid appraisal, 1989 (E/F/S)

4 Community forestry: herders’ decision-making in natural resources management in arid and semi-arid Africa, 1990 (E/F***)

5 Community forestry: rapid appraisal of tree and land tenure, 1990 (E/F/**S**)

6 The major significance of ‘minor’ forest products: the local use and value of forests in the West African humid forest zone, 1990 (E)

7 Community forestry ten years in review, 1991 (E/F/S)

8 Shifting cultivators: local technical knowledge and natural resource management in the humid tropics, 1991 (E/F/**S**)

9 Socioeconomic attributes of trees and tree planting practices, 1991 (E/F***/S**

10 A framework for analyzing institutional incentives in community forestry, 1992 (E/F)

11 Common forest resource management annotated bibliography of Asia. Africa, and Latin America, 1993 (E/F**)

12 Introducing community forestry: annotated listing of topics and readings (E)

**Community Forestry Field Manuals**
1 Guidelines for planning, monitoring and evaluating cookstove programs, 1990 (E/F/S)

2 The community’s toolbox the idea, methods and tools for participatory assessment, monitoring and evaluation in community forestry, 1990 (E/F/S/Viet)

3 Guidelines for integrating nutrition concerns into forestry projects, 1991 (E/F/S)

4 Tree and land tenure: rapid appraisal tools (E/F**)

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5 Social and economic incentives for smallholder tree growing. A case study from Murang’s District, Kenya, 1993 (E/Viet)

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7 Peasant participation and community reforestation. Four communities in the Department of Cuzco, Peru, 1993 (E)

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10 Tree and land tenure: using rapid appraisal to study natural resource management. A case study from Anvirano, Madagascar, 1995 (E)

Community Forestry Guidelines

1 Women in community forestry: a field guide for project design and implementation, 1989 (E/F/S)

2 Integrating gender considerations into FAO forestry projects, 1994 (E/F/**/S**)

Community Forestry Audio Visuals

1 Forests and food security, 1993 (E/F/S)

2 Gender analysis and forestry development planning, 1993 (E/F)

3 What is a tree?, 1994 (E/F)

Community Forestry Cartoon Booklets

1 Food for the Future, 1990 (E/F/S/Hindi/Malaysian/Portuguese/Sinhala/Viet/Lao)

2 Our trees and forests, 1992 (E/S)

3 I am so hungry I could eat a tree, 1992 (E/F/S)

4 Fabulous forest factories, 1993 (E/F/S)

Other Community Forestry Publications
1. Restoring the balance: women and forest resources, 1991 (E/F/S)

2. Forests, trees and food, 1992 (E/S)

3. Women and community forestry in Sudan (slide booklet), 1991 (E)

4. Fruits of our work women and community forestry, Tanzania (slide booklet), 1991 (E)


6. Working Paper 2: participatory approaches to planning for community forestry, 1995 (E)

E - English

Ar - Arabic

F - French

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s - Spanish

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