Agriculture

Five

Top Land use in Yunnan, China
Cai Yunlong

Bottom Abandoned water reservoir and channel, Yunnan, China
Cai Yunlong

Chapter Five
Agriculture

Agricultural Policy–Environmental Links

Agriculture is by far the most important of all human activities that shape the environmental future of the Hindu Kush–Himalayan region. There is an already extensive literature on hill agriculture, its technology, systems, and its social and economic aspects. However, there is little written on the impact of agricultural policy on the environment in terms of ex post studies based on the evidence. There is much more on what future agricultural policy should be. This important body of literature emphasises the specificities of mountain agriculture (fragility, diversity, remoteness, niche, and so on; see Jodha et al. 1992) and the technical options open to agricultural policy. It is also a main research output of ICIMOD. However, there is virtually no secondary material about the environmental impacts of agricultural policies as implemented on the ground. It is not difficult to see why. There are formidable methodological problems in identifying the policy effect and seldom do researchers, government departments, and project designers carry out a baseline environmental survey at the beginning of policy implementation.

It is quite easy to identify potential links between agricultural policy and the environment. There are components of agricultural policy that may be assumed to have environmental impacts, such as livestock policy (numbers, type, grazing/stall-feeding); pasture rehabilitation; reclamation policy on degraded land; pricing policy and subsidies on agricultural inputs; technical and economic aspects of engineering works (terrace upgrading, conservation works); extension policy on environmentally sensitive practices (e.g., promotion of agroforestry, new crops, planting time and density, rotations, and so on); water harvesting; legal aspects of forbidding certain land-use practices (e.g., shifting cultivation); and soil and water conservation techniques, both agronomic and engineering. All these aspects of policy generate potential impacts upon the environment. To this list of possible direct linkages between agricultural policies and environment may

be added other important but indirect policy decisions to support other agricultural development; and this includes road construction, agricultural credit, pricing of agricultural inputs, domestic electrification, marketing, and storage facilities.

Whatever the strength and weight of hypotheses linking the potential effect of a policy to environmental outcome, there is a marked lack of policy-related and empirical evidence. Therefore, only summary attention is given to the environmental impact of agricultural policy per se in different countries, because there is no empirically verified linkage. This project found only three clear-cut examples of where an agricultural project did have environmental impacts, or where policy-makers identified an existing agricultural practice that was considered environmentally harmful. These are the issues of shifting cultivation, environmental problems of mono-cropping potatoes, and the development of the horticultural industry, particularly apples. These cases are discussed in detail later in this chapter.

National Agricultural Policies

This section provides three illustrative examples of national agricultural policy insofar as they have clear linkages, either by intention or otherwise, to the environment. However, there is an important disjunction between national agricultural policy and actual impacts on the ground. There are two reasons for this that have validity across all agricultural policies. The first is that the prime goals of policies in the region are to boost food production and to encourage the production and sale of agricultural products for which there is a demand (usually in more densely populated non-hilly areas of higher potential demand), and for which the region has a comparative advantage. Environmental considerations are sometimes mentioned, but it is difficult to follow the operationalisation through of these general environmental concerns. Secondly, with some exceptions, agricultural policy does not have a strong impact on what farmers actually do. Even in successful cases of agricultural development, the process is a complex mixture of individual entrepreneurship and largely private organisational capability, in which official assistance is often tangential and opportunistic. Once again, this is how the policy process unfolds on the ground, making it difficult to identify a 'policy effect'.

Bhutan

The mandate of the Ministry of Agriculture is to improve the well-being of the people of Bhutan, to improve national self-reliance, and to conserve the natural environment through the sustainable development of the arable, livestock, and forestry resources of the country. Based on this mandate, the following have been the core sector policies in successive five-year plans.

- National food security

The objective of national food security has three aspects: maintaining broad, national self-sufficiency whereby the export of crops for which Bhutan has a comparative advantage provides sufficient foreign exchange to cover the costs of food imports; achieving a minimum of 70% self-sufficiency in food-grain production compared with the current level of around 65%; ensuring household food security whereby the population has assured access to food at all times.

- Conservation of natural resources

An over-riding objective of the government is to protect Bhutan's fragile mountain environment and its unique flora and fauna for future generations. This means that natural resources have to use in a sustainable way and involves trade-offs between short-term economic gains and sustained long-term economic development. The protection and management of forest areas and improved land husbandry practices in agriculture are essential to achieving this objective.

- Sustainable economic production and enhancement of rural income

At the farm level, production has to be both economic and sustainable. Government will therefore aim to ensure that appropriate, viable, and ecologically sustainable agricultural technologies are available; rural communities have access to the benefits provided by the market; and, an enabling regulatory framework is in place that allows economic activity to flourish while ensuring the conservation and protection of the natural resource base.

- Social and regional balance and equity

The support and services provided by government in the renewable natural resources' sector will be available and accessible to all without discrimination, while reflecting differences in local, natural and economic conditions.

In pursuance to the national food security policy, the 'chhuzhing' (paddy land) in Bhutan is protected by government because rice is the nation's staple food. No construction of building or development of orchards, and so on, are allowed on chhuzhing. This protection is applied to all chhuzhing, irrespective of the area concerned. The ultimate goal of the policy is that the chhuzhing throughout the country should be maintained and used only to grow paddy as the main crop; it can be used to grow second crops, which may not necessarily be paddy, during winter.

The government has reinforced its position on the protection of chhuzhing recently by calling for more concerted cooperation and by strengthening the legislation to curb illegal conversion. A Land Conversion Committee has been instituted under the chairmanship of the head of the ministry to decide whether conversion is to be allowed or not. The committee is assisted by a field investigation team that conducts field verification and submits the technical findings to the committee for final decision. The government has also instituted an inter-ministry Land Acquisition Committee with the responsibility of identifying and acquiring land required for government purposes. The emphasis is again to minimise the disturbance to chhuzhing.

The Land Act provides the legal framework for using agricultural lands. The following are some of the provisions that have implications for chhuzhing.

- In 1989, the cabinet passed the following resolution and the Land Act was amended. Chhuzhing will not be allowed for conversion to other uses. However, the Ministry of Agriculture and the 'dzongkhag' administration will investigate and identify those areas that cannot be used as chhuzhing and allow conversion. Conversion can also be allowed if there is an approval from the government. In addition, no construction of buildings will be allowed on those areas recorded as chhuzhing in the 'thram'.
- All family members have equal rights over all registered land of the family.
- A household is entitled to 10 ha of agricultural land for each family.
- A member of a family possessing 10 ha of registered land cannot purchase any other land. Nobody can buy land from a family possessing only 2 ha of land. Conversely, a family member having only 2 ha of land cannot sell the land.

With respect to conservation of agricultural land, there is a need for a stronger legal framework. Firstly, there is a need for a legal provision to take up structural conservation measures on private farms. This provision would require mandatory conservation measures of soil and water on private land. The Forest and Nature Conservation Act 1995 now has this provision; however, it is yet to be operationalised by formulating and implementing the required rules and regulations. Secondly, there is a need to identify the upper slope limit beyond which farming is prohibited. Most of the tseri (shifting cultivation) areas and some of the dryland farms are on steep slopes and are vulnerable to severe soil erosion. Further, conservation measures are not taken up on these farms. Bhutan is one of the few countries that has not outlawed shifting cultivation.

Government interventions to achieve food security according to policy are many and varied. The following are some of the major programmes that have been implemented throughout the country and have direct impact on land use and the farming community.

- Marketing and distribution system — This programme is to provide assured markets to the farming community to sell their cash crops and other surplus products. Several auction yards have been established in the border areas with India. Also, an export scheme organised by the government has been arranged for cash crops such as apples, oranges, potatoes, and cardamoms. Further, Sunday markets have been established in almost all dzongkhags to facilitate the sale of local produce. There is a nation-wide agricultural input supply system. This system ensures that new varieties of seeds and seedlings, chemicals, and fertilisers are made available to the farmers on time.
- Rural credit programme — This programme provides both short-term and long-term loans for investment in agriculture, livestock and forest operations. Credit offices are decentralised in all 20 dzongkhags.
- Promotion of improved farm machinery — Through the Agricultural Machinery Centre at Paro, the Ministry of Agriculture is able to develop or identify appropriate farm tools, procure or produce these tools, and sell them to farmers. Since labour shortage is a major constraint in Bhutan, this programme promotes labour-saving technologies which, at the same time, should increase farm production. The mechanisation programme has been taken directly to the farmers by establishing regional centres.
- Promotion of high-yielding varieties of seeds and seedlings — This programme aims to identify and develop a package technology to increase agricultural production. The programme aims to provide cash income through promoting cash crop cultivation and also to achieve self sufficiency in food. Some high-yielding varieties of rice, maize, citrus, apples, and potatoes have already been distributed and widely adopted by farmers.
- Research and extension network system — The Ministry of Agriculture has established a network of extension centres throughout the country in order to support the implementation of its various development programmes. At the end of 1997 there were 159 agricultural extension centres and 35 renewable natural resource centres. Also four renewable natural resource research stations have been established and are in full operation. These stations are backed up by six substations. The mandates of these centres include the development and provision of better seeds and technologies for the farming community.
- Irrigation development — Irrigation development is an important element of the Ministry of Agriculture's strategy towards greater self-

sufficiency in food grains. Therefore, this programme aims to provide technical and material inputs to farmers to construct irrigation channels. Once the construction is completed, it is the responsibility of the farmers to maintain these channels. Water users' associations are formed for every irrigation channel constructed under this programme. The objective of the associations is the most cost effective use of the water.

The database on crop production and crop areas is far from complete and reliable, as there as been no systematic attempt to collect such data on a regular. For the present paper, trade statistics of the Ministry of Trade and Industry have been used for cash crops and estimates of the Central Statistical Organisation have been used for cereal crops.

The main cash crops in the country are apples, oranges, potatoes, and cardamoms. The production of these crops has increased considerably over the last few years. This is indicated by the average increase in apple exports by 23%, orange exports by 273% and potato exports by about 22% from 1991 to 1997. Oranges and potatoes are being grown throughout the country by a large number of farmers. Therefore, the increase in orange and potato production has contributed to the cash income of a wide section of farmers.

The average yield increase of major food crops (rice, maize, wheat/barley) over the last 16 years is approximately 87%. Rice production has increased by about 49%, maize by 113% and wheat/barley by about 99%. Punakha, Wangdue Phodrang, and Paro Dzongkhags now produce surplus paddy, which is mostly sold in Thimphu market. The increase in the maize production is mostly from eastern Bhutan; some surplus maize is bought by the government and supplied to educational institutions.

There is a noted change in farming practices for both dryland and chhuzhing. Improved paddy varieties and maize varieties have gained in popularity. Double cropping of paddy has also contributed to the increase in paddy production. Also, cash crops such as oranges have become the main source of cash income after the establishment of trade relations with Bangladesh.

This increased production of cereals, cash crops, and intact forest cover indicates that the food security policy is being implemented effectively.

China

One of the most important aspects of agricultural policy, as well as of other sector policies is the 'contract responsibility system' based on remuneration linked to output (CRSBRLO). The CRSBRLO is the guiding management

principle in all community agricultural organisations. The system is based on the assumption that the main factors of production remain public property, but that production should remain the responsibility of the individual or institution that undertakes to fulfil the contract. There is another variation of CRSBRLO that involves payment linked to output and is the contract responsibility with farmer groups. The most common contract is with the family (household contract responsibility system), which makes all major production decisions. Agricultural products are first grown to satisfy the county and the community. Excess agricultural products over and above the contract can be sold freely by the farmer.

Another important organisational aspect of economic activity that profoundly affects land use, and therefore the environment, is the village and township enterprise (VTE) system. The VTE attempts to address the problem of conflicts between excess labour in the countryside and limited capability of urban areas to absorb any further labour. The VTE system attempts to fuse the binary economic structure of countryside and city, industry and agriculture. It has contributed much to the improvement of farmers' living standards. Since 1979, the VTE initiative has developed rapidly. In 1990, total output value from the VTE accounted for 30% of national output by value. However, VTE also causes a lot of problems such as resource waste and environmental pollution due to poor technology, lack of environmental awareness, and poor management. The main problems caused by VTE are as follow.

- Development of VTE has resulted in extensive use of large areas of cropland that intensified population pressure on the remaining land.
- Lack of technology and skills mean that VTE such as excavation of coal, minerals, sand, stones and construction materials industry are often conducted in a primitive and wasteful manner, polluting air and water and degrading the environment, often seriously. After excavation, there is a failure to reclaim land, so erosion is heavy. However, these enterprises managed to obtain a lot of preferential treatment and relaxation of regulations. The comprehensive legal provision for the conservation of the environment has often been bypassed and has had no impact whatsoever.

At the same time as economic growth emphasised above all else, a contradictory policy of ecological agriculture is also promoted. The aim of ecological agriculture is to achieve optimum economic, ecological, and social benefits. It emphasises increasing efficiency in use of inputs, so that costs can be lowered and dependence on inputs become less (in western parlance, low-input agriculture). It expressly excludes chemical fertiliser. In

1984, the State Council advocated ecological agriculture and drew up a document that indicated that environmental agencies at different levels should cooperate with other government agencies to spread ecological agricultural technology and prevent environmental destruction. Agricultural development should be low input, low-energy cost, high efficiency, and sensitive to environmental protection.

The Agricultural Law stipulates that 'the state forbids anyone to burn mountain land for cultivation, land reclamation from lakes, and to cultivate steep slopes'; 'the state forbids anyone to denude protected forest'; 'special protection for basic croplands'. The Grassland Law stipulates that the 'grassland plant community must be protected strictly and forbids anyone to reclaim or destroy grassland'. There are many other stipulations similar to these. The issue here is their effectiveness on the ground. While the laws have played a positive role in protecting agricultural resources and environment, at least in principle, the pressures for fulfilment of contracts, and from poor people who are virtually obliged to break many of these laws in order to survive, have forced officials to turn a blind eye to many infringements. The breakdown of social capital to ensure livelihood security, and the removal of the political structure on accumulation of wealth, have led to the undermining of property regimes and an increase in speculative 'mining' of natural resources.

Nepal

Agriculture is by far the largest sector of the Nepalese economy contributing 40.5% to the total GDP (1995/96) (MOF 1998) and 81.2% to the employment of the 'economically active' population (CBS 1994b). About 20 years ago, these proportions were 71.6% in GDP (1974/75), 94.4% in employment (1971), and 82.5% in export earnings (1974/75).

The top priority was given to agriculture in terms of actual financial resource allocation from the Sixth Five-Year Plan. This was in recognition of the predominant role of the agricultural sector and the potentials it offers for broad-based sustainable development and poverty alleviation. Concurrently, a number of new institutions in the form of government departments, parastatals, schools, colleges, and other educational institutions were created and expanded. Many bilateral and multilateral agencies contributed to this process.

The other aspect that is rarely reflected in national accounts or the government budget, but which is an important factor affecting development, including agricultural development and land ownership and management, is the legal instruments. Several laws, rules, and regulations

have been promulgated to provide a legal framework for various institutions and entities to operate.

Persistently lagging growth in the agricultural sector has prompted the government, often with donor encouragement, to prepare a number of plans and sector strategies, apart from the routinely formulated five-year periodic plans. These are briefly described below.

- Perspective study of agricultural development for Nepal (1970-90)

The Food and Agriculture Organisation (FAO) of the United Nations initiated the first comprehensive perspective plan for the agricultural sector for the period from 1970-90 (FAO 1974). This twenty-year plan, consisting of a central policy paper and twenty-one appendices, each dealing with different subsectors, commodities, and policy issues, emphasised increasing cropping intensities and crop yields.

The plan recommended expansion of horticulture and livestock in the hills and mountains and field crops in the terai. The recommended policy package included improving north-south linkages through the development of growth axes that would better integrate the terai, hills and mountains; reducing pressure on land by transferring excess people from the hills and mountains to the terai through planned resettlement; launching land reform and institutional changes that would allow local communities to play a greater role in managing resources, discourage land fragmentation, and encourage consolidation; subsidising rural public works in order to generate employment; improving soil fertility through the introduction of fertiliser and new production technologies; emphasising the development of feeder roads; and mobilising resources through local institutions.

The 1974 study, however, was neither endorsed nor implemented by the government although it was prepared with the latter's participation.

Perhaps influenced by the FAO study, the government published a policy document called the Agricultural Development Policy 1972. Accordingly, Nepal was divided into 12 agro-ecological zones (three ecological regions mountains, hills and terai in each of the then existing four development regions East, Centre, West and Far-West). Each zone was then prioritised for specific enterprises (field crops, fruit, and livestock). The mountain belt was, in general, recommended for livestock production, the hills for horticultural crops, and the terai for cereals and cash crops. The actual programmes that were implemented, however, were only remotely congruent with this official policy.

- Ten-year agricultural development plan

Concurrent with the FAO study, a Ten-Year Agricultural Development Plan was prepared by the government in 1973 (MFAI 1973) and put into effect with the start of the Fifth Five-Year Plan in 1975. In order to give an initial thrust to the implementation of this plan, fiscal year 1974/75 was heralded as the Year of Agriculture. As a preparatory exercise, the then Ministry of Food and Agriculture was restructured in 1972. That year, the Department of Agriculture was established by merging the existing five departments (Agricultural Research and Education, Agricultural Extension, Horticulture, Livestock Development and Veterinary, and Fisheries). The then Department of Irrigation, Hydrology and Meteorology, under the Ministry of Water Resources, was transferred to the renamed Ministry of Food, Agriculture and Irrigation. The Department of Food and Agricultural Marketing Services was newly created (and subsequently dissolved in 1992). Four (later five) Regional Agricultural Directorates were established.

Apparently, the Ten-Year Plan saw the main problem area in organisational structure, and hence these major changes were made. The plan again emphasised regional specialisation (animal husbandry in the mountains, fruit production in the mid-hills, and field crops in the terai). Policies were laid out in general terms for each major subsector, treating agricultural credit, marketing, pricing, food distribution, and soil fertility as essential ingredients. Ten-year targets were specified for the major products, inputs, and production of trained manpower. Implementation of the plan lost impetus in subsequent years and irrigation affairs were eventually transferred back to water resources.

- Nepal agricultural sector strategy study

In 1982, the Nepal Agricultural Sector Strategy Study was prepared with technical assistance from the Asian Development Bank (HMG/AsDB 1982). The study concluded that "a well-defined operational strategy for agricultural development is missing." It stated that the lack of growth in agriculture was mainly due to weaknesses and deficiencies in Nepal's organisational and institutional arrangements. The strategy study had five key objectives: to increase food production and improve nutrition; to increase income and employment by generating an additional 75,000–100,000 jobs annually; to promote import substitution and increase exports so as to improve the balance of trade; to undertake massive afforestation and development of hydroelectric power; and to begin emphasising environmental protection. Major areas of emphasis included land-use planning and environmental protection; development of irrigation and power; improved crop production technologies; development of livestock,

forestry and fisheries; strengthening and integration of agricultural support services; land-tenure reforms; pricing and trade policies; macroeconomic policies; and management capabilities. This study was not endorsed by the government, nor was it implemented although it was prepared jointly by the government and the bank.

- Perspective plans

Yet another series of perspective plans was commissioned by the government in 1985 for the period from 1985-2005 (APROSC 1986a, b, c) through the Agricultural Projects' Services' Centre for three interrelated areas: land use, agriculture, and food grains. These plans were not taken up for serious implementation.

- Basic needs' programme

Soon after the preparation of sector strategy sponsored by the Asian Development Bank and the perspective plans initiated by the government, the government launched the ambitious Basic Needs' Programme in 1986 to meet the minimum basic needs of all Nepalese by the year 2000. Six key elements of the basic needs' basket included food, clothing, shelter, primary health, basic education, and security. Separate programmes were prepared for agriculture and irrigation, envisaging double cereal production by 2000 (NPC 1986). Its hallmark was emphasis on decentralised planning and implementation and strengthening of service centres at the subdistrict level for enhancing local-level institutional capacity. Despite the inherent shortcomings of the programme, such as its overly ambitious targets, there was an unusual seriousness in its implementation since it was started on the initiative of the King of Nepal, the absolute ruler at the time. There were indications of commitment to increasing significantly the budgetary and human resources in favour of the agricultural sector. However, the programme was completely abandoned with the restoration of democracy in 1990.

- Master plans

In addition to the various plans described above, five separate master plans have been prepared: forestry, irrigation, horticulture, dairy, and livestock. Since these master plans were prepared with the support of various donors, they have received high levels of support from the donor community.

- Agricultural perspective plan

The Agricultural Perspective Plan (APP) (APROSC/Mellor 1995) is the latest in the series of long-term plans and strategy studies. Major aspects of the plan

are summarised below. The APP stipulates that a dynamic and commercially oriented agriculture has the potential to have a significant and positive impact on both increased income and the environment. This is possible mainly in three ways. Firstly, a highly productive and competitive agriculture implies intensification of cropping systems and input use in order to optimise economically the existing resource endowments at the household and community levels. Such optimisation attempts would make it economically less attractive for farmers to continue cultivating unproductive marginal lands. Once farmers start applying expensive purchased inputs to their fields, the expected returns from the poor quality land become unattractive.

Secondly, commercial and high-growth agriculture would be able to generate enough employment and income opportunities within the sector itself so as to absorb a growing number of hitherto unemployed or underemployed in the rural labour force. More intensive, both in terms of cropping intensity and application of purchased inputs, farming operations would require not only increased supply of better quality inputs and ancillary services such as extension and equipment repair, but it would also demand more labour.

Thirdly, a vibrant and growing agriculture means continuously rising rural household incomes, which are spent on goods and services provided from outside the agricultural sector. There would be more demand for manufactured products and processed agricultural goods, triggering and augmenting a multiplier effect in the rest of the economy. The APP states that, when agriculture grows at a respectable rate, the multiplier value has been empirically established to be 1.5. This means that, with each percentage point growth in agriculture, the non-agricultural sector will grow by 1.5%. Hence the strong case for agriculture to play the lead role in the overall transformation of the entire economy.

Considering the subsistence trap in which the agriculture of Nepal is currently caught, it will not be possible to set the growth process in motion if 'business is conducted as usual'. Rather, it would require a complete reorientation and redirection of the strategy combined with the identification of a small number of priorities and corresponding reallocation of resources. The APP specifically prescribes such a strategy and priorities, namely, focusing on a few inputs and outputs and policy and institutional interventions that could have a significant aggregate impact across the entire country.

The APP is a prioritised plan of action in which a small number of key priorities is carefully packaged together. Accordingly, there are four priority

inputs (irrigation, fertiliser, technology, roads, and power), four priority outputs (livestock, high-value crops, agribusiness, forestry), three targeted areas of focus for impact (poverty reduction and food security, environment, regional balance), and a number of policy interventions, institutional arrangements, and investment decisions.

The following six points summarise the APP strategy.

- A technology-based green revolution in agriculture becomes the initial engine of accelerated growth.
- Accelerated agricultural growth creates a demand-pull for the production of high-value commodities in agriculture, as well as for non-agricultural commodities, with consequent large multiplier effects on other sectors of the economy.
- Broadly-based high employment growth then becomes the mechanism for achieving societal objectives.
- Public policy and investment focus on a small number of priorities, building on past investment in human capital and physical and institutional infrastructure.
- A package approach to development is introduced, and in Nepal's case this would be differentiated for the terai, hills, and mountains, and would recognise the powerful complementarity between public and private investment and priorities and ensure their coordination.
- To achieve broad participation, the strategy is regionally balanced and explicitly ensures the participation of women.

The APP differs from past plans in that it focuses on a small number of priorities so as to produce a tangible impact and to realise economies of scale essential for commercialisation. Nepal's agricultural research has historically harboured a misconception about what constitutes agricultural research. Research has been treated in a restricted sense to include biological, physical, and mechanical sciences as these apply to plants and animals. Farmers' knowledge and awareness, resource endowment, the culture and the community lived in, the economic environment that determines farming practices and resource utilisation, and the constraints that prevent farmers from realising better returns are issues that shape and influence their behaviour. These concerns fall in the realms of social sciences that have conspicuously been excluded as relevant areas of investigation. True, some institutions within the larger agricultural bureaucracy (viz., the now dismantled Department of Food and Agricultural Marketing Services) were set up to address some of these areas (farm management, price analysis, and marketing), but they could not become effective because they were isolated from 'mainstream' research.

The APP focuses on limited inputs and envisages increasing agricultural productivity and employment and reducing poverty. However, it does not give adequate attention to issues related to land ownership, tenurial arrangements, and potential impacts on soil fertility as intensive farming expands in the hill and mountain areas. Since the APP is another in a series of sectoral plans, it is hard to tell how effectively it would succeed in achieving its objectives. Its impact on land management and land degradation is similarly uncertain. One likelihood is that, given the resource constraints and mass poverty, such a policy relying on purchased inputs and intensive agriculture could be more suitable to resource-rich farmers and the majority of the poor may still be left behind.

Nepal's agricultural extension service is the oldest of all the public services targeted at rural people. The historical reason for this is that the first external assistance (received from the United States in 1952) was in the agricultural sector and went to the establishment of the 'Tribhuvan Gram Vikas' (Village Development) Service for extension. Several village development centres were subsequently established across the country to deliver extension services (Skerry et al. 1991). Until the 1970s, emphasis was placed on extending the organisational network as far as possible so that larger sections of the rural population could be reached and 'taught' to improve their livelihood by adopting recommended modern and improved technological packages. Junior technicians and junior technical assistants (JT/JTAs), who symbolised the ultimate harbingers of progress, were deployed at the local level and had to cover several thousand households in a cluster of villages. Obviously, their ability to respond to the specific needs of farmers in different socioeconomic and agroclimatic conditions was severely limited, and hence they remained largely ineffective.

The next stage of extension, initiated in the 1980s with the assistance of the World Bank, took the form of the 'Training and Visit (T&V)' system, in which the focus was on requiring JTAs to deliver one message at a time, depending on the most important agricultural practice in a given area. This required the establishment of a subdistrict-level network of service centres, through which JTAs could be given a new message at fortnightly intervals. As expected, such a mode of technology transfer was possible only in the accessible terai districts, and hence the T&V system was applied only in those districts. A variant of this system was also tried in the hills, but it was largely ineffective. Evidence suggests that it was essentially ineffectual even in the terai. As Jha et al. (1994) state this approach was introduced through the support of many donor agencies (Swiss Development Corporation, USAID, Asian Development Bank, Japan International Cooperation Agency, World Bank). Often, this resulted in the operation of multiple approaches in the same district at the same time, confusing programme implementors

and reducing the clarity of the objectives, roles, and targets of extension. The bureaucracy regards this as a wide gap between policy and implementation, but the real problem seems to be the absence of a clear and coherent policy.

The current mode of extension relies on the so-called group approach. Accordingly, farmers' groups are constituted according to the main commodity they grow or species they keep, e.g., rice group, dairy group, goat group, and others.

The past 40 years has thus observed several experimentations and the adoption of a number of extension approaches, but concrete achievements remain as elusive as ever. 'Extension models' tried so far include the following: (a) a traditional approach based on the conventional diffusion model in which the JTA is expected to provide assistance to anybody for any problem; (b) the T&V system, applied mostly in the terai; (c) the IRDP approach, followed in areas covered by various integrated rural development projects; (d) tuki (a Nepali term for the widely used typical kerosene lamp) approach, followed in the Swiss-assisted districts of Dolakha and Sindhu Palchok, in which the JTA acted both as a source of information as well as a commission agent for the purchased inputs he/she supplied; (e) block production programme, concentrating extension services in 28 selected districts; (f) farming system approach, further concentrating service delivery in selected sites of districts rated as having high potential (Jha et al. 1994); and (g) the current group approach.

All these approaches suffer from various weaknesses (Jha et al. 1994). One of the prominent problems often cited by farmers is that of 'political interference', meaning ad hoc tampering with the system by political workers from central to local levels. Various donor-supported studies have suggested alternative approaches, such as a combination of group and outreach approaches, and the involvement of NGOs, women, and the private sector. The present group approach is justified since it is regarded as being cost-effective, participatory, potentially demand-driven, broad-based in terms of taking care of all sections of the rural community, and consistent with the 'one umbrella' policy adopted by the government in the 1990s. Similarly, the outreach approach has been justified on the basis of farmer-based, clientele-oriented research, potential for immediate technology transfer through direct demonstration effect, and better interaction between the researcher, extensionist, and farmer.

There is a general admission of the past failure of extension to give attention to the real constraints and opportunities faced by farmers. A strong case has been made for a more relevant and responsive extension service with an

increased role for subject-matter specialists (SMSs), together with a more interdisciplinary approach involving extensionists, research scientists, and farmers. Women farmers have been particularly neglected by all past programmes, except by the current group approach. However, the cadre of women extensionists remains extremely meagre. The emphasis all along has been on treating all farmers (rich and poor, large and small) equally.

The low quality of the JT/JTAs makes them professionally inadequate to be of relevance in the existing realities of the country's rural areas. The World Bank recommended, in 1994, the gradual phasing out of the JT/JTA cadres through natural attrition and the requirement that all field extension workers be agricultural graduates at least (Jha et al. 1994). No initiative has been taken thus far in this regard.

Agricultural development efforts are still target oriented and based narrowly on increasing production, without much attention to market potentials. A generalist approach is followed without regard to the diverse peculiarities of different agro-ecological regions and farmer categories. Technical service and input delivery mechanisms are weak. Beginning with the Eighth Five-Year Plan, a more expanded and definitive role is emphasised for the private sector. The underlying justification seems to be that the private sector has an inherent motivation to carry out most of the production, processing, transportation and marketing functions more efficiently than the public sector.

The contemporary agriculture-related polices, elaborated on in the APP and reiterated in the Nepal Environmental Policy and Action Plan (EPC 1993), are summarised in Table 5.1.

Nepal's agricultural development strategy has historically emphasised the promotion of so-called improved farming practices, dominated by the promotion of high-yielding varieties of crops, crossbred livestock, chemical fertiliser, and irrigation. The seed/fertiliser technology suitable to the irrigated flatlands has also been pushed in the hills and mountains where the fragile ecological conditions and resource endowments are quite different. Crop-dominated farming systems have not proven effective in these areas, in terms of both increased food production and maintenance of soil-fertility. Crop yields have declined consistently over time, threatening the food security particularly of small landholders and marginal farmers. These trends have a direct relationship with the deteriorating fertility of soil (Shrestha and Katwal 1992, EPC 1993). Intensive cultivation and insufficient application of nutrients in the soil have led to situations where farmers are forced to abandon their land completely because of extremely low yields. Carson (1992) estimates that 10–20% of such land may have been abandoned.

Table 5.1. Agricultural land management policies and action plan		
Policies	Action Plan	Responsible Agencies
Improve soil fertility management by increasing supplies of farmyard manure and reducing the stock density of livestock on arable land	Encourage planting of trees, shrubs, and grasses on private land to provide an additional source of fodder for livestock	DOA, DLS
	Where appropriate, encourage stall-feeding of livestock using fodder from trees on private land	DLS, NARC
	Promote low-cost, vegetative and cultural soil conservation measures to reduce soil erosion	DSC, DOA, NARC
Promote policies to increase soil fertility directly	Encourage modification of farming systems to include nitrogen-fixing species to enhance nutrient cycling	MOA, NARC
	Remove constraints to greater private sector involvement in the purchase and distribution of chemical fertilisers to improve their availability	DOA, NPC
	Develop recommended fertiliser applications, including the use of agricultural lime on acidic soils, based on particular agro-ecological conditions	DOA, NARC
Develop an extension system capable of responding to farmers' needs	Improve participation in agricultural extension through the use of the 'group approach'	DOA, DLS
	Finalise arrangements for pilot schemes for contracting out extension services to the private sector	MOA, NPC
	Promote the use of adaptive research techniques on farms as a method of rapidly disseminating information	DOA, DLS, NARC
Source: EPC (1993) (Meanings of abbreviations are given in the abbreviations' section.)		

Citing evidence from a hill village in the central hill region of Dhuskun in Sindhu Palchok, Shrestha and Katwal (1992) report that "cropping intensity is already considerably high (172%). Due to the lack of soil nutrients, stones and rocks have begun to surface on cultivated land. The supply of compost materials, from both private and public land, and manure from livestock has decreased significantly over the past 20 to 30 years."

On the other hand, work carried out at the Lumle Agricultural Centre (LAC) supported by the British in the western hills demonstrates that significant progress was possible with respect to vegetable-seed production, rice production, and cattle- and buffalo-rearing on a sustainable basis when the research and extension system properly integrated five key elements: namely, a strong institutional foundation; a comprehensive understanding of farmer's conditions; the participation of farmers in all stages of research and dissemination; the interdisciplinary interaction of all sections of LAC; and, the synergistic effect of having research, extension and training under one organisation (Pound et al. 1992). Similar experience is reported from the Pakhribas Agricultural Centre in the eastern hills (Chand and Thapa 1992).

All periodic plans, strategic documents, and action plans have invariably emphasised the need to give high priority to maintaince of soil fertility, particularly in the hills and mountains. However, continually declining crop yields and ever-worsening land degradation indicate that these policies have failed. Major indicators of unsustainability and declining trends in Nepal's hill and mountain agriculture are summarised in Table 5.2.

Partap and Watson (1994) elaborate on the important contributing factors and issues among the range of causes and symptoms of decline. Two critical problems commonly faced by mountain farmers, in general, and Nepalese farmers in particular are degradation of land and the extent of land degradation. The area of degraded lands in Nepal is estimated to be 1.8 million ha. Similarly, estimates on the magnitude of soil erosion from the hill and mountain areas of Nepal are compiled from various sources and presented in Table 5.3.

A study conducted by Banskota (1992), cited in Partap and Watson (1994), indicates that the total amount of nitrogen lost from level terraces (365,000 ha) and sloping farmlands (816,00 ha) is about 27,000 tonnes, whereas the total amount of nitrogen fertiliser used in 1987/88 was only 24,320 tonnes. The total loss of combined nutrients exceeded the level of inputs used in 1987/88. The value of nutrient loss has been estimated at over six million rupees for paddy and over 54 million rupees for maize at 1987/88 market prices. The implications in terms of equivalent loss of food grains are even more

Table 5.2: **Indicators of unsustainability/decline in hill and mountain agriculture (time frame: approximately four decades spanning the period 1954-91)**

Indicators	Rates of Change	Indicators	Rates of Change
I. RESOURCE BASE		II. PRODUCTIVE FLOW	
1. Landslides	100-300%	18. Fall in average crop yields on sloping lands:	
		(a) maize and wheat	9-15%
		(b) millet	0-72%
2. Gully formation on sloping lands	High-Medium	19. New land under cultivation	5-15
3. Soil erosion rates on sloping lands	20-30%	20. Human population	60-65%
4. Abandonment of agricultural land due to decline in fertility	3-11%	21. Decline in the application of compost (organic manure)	25-35%
5. Appearance of stones/rocks on cultivated land	130-200%	22. Additional labour demand due to falling land productivity	35-40%
6. Decline in the size of livestock holding per family	20-55%	23. Forestry-farming linkages	Weak
7. Decline in the area of farm land per household	30-10%	24. Food-grain purchases from shops	3-50%
8. Decline in forest area	15-85%	25. Need for external inputs for crop production	High-Medium
9. Decline in pasture/grazing area	25-90%	26. Fuelwood and fodder scarcity in terms of time spent in collection	45-200%
10. Decline in good vegetative cover on common property lands	25-30%	27. Fodder supply:	
		(a) decline from common land,	60-85%
		(b) increase from private land	130-150%
11. Fragmentation of household farm land (in number of parcels)	20-30%	III. RESOURCE MANAGEMENT	
12. Decline in the size of land parcels per family	20-30%	28. Emphasis on monocropping	High
13. Distance between farm land parcel and home	25-60%	29. Cultivation expansion on steep slopes (above 30 %)	10-15%
14. Decline in food-grain production and self-sufficiency	30-60%	30. Use of weeds and herbaceous crop products as fuelwood	200-230%
15. Permanent outmigration of families	None-5%	31. Conversion of marginal lands into cultivation	15-40%
16. Seasonal migration	High	32. Decline in fallow periods	From 6 to 3 months
17. Conversion of irrigated land into dry farming due to water scarcity	7-15%		

Source: S. Shrestha (1992) cited in Partap and Watson (1994)

Table 5.3: Soil erosion from different land-use types	
Type of land use	Soil erosion (t/ha/yr)
Grazing lands (support lands)	100
Rainfed terraces (slopping terraces)	5
Irrigated terraces (level terraces)	0
Sloping farmlands under farmers' practice	38
Source: Partap and Watson (1994)	

significant. The total losses were equivalent to about 75,000 tonnes of paddy and 747,000 tonnes of maize. These large losses indicate the difficulties experienced in sustaining food production when soil fertility is being depleted at massive rates.

Declining crop yields

A large body of literature cited in Partap and Watson (1994) identifies several causes of land degradation. Farmland productivity in upland areas measured in crop yields has either remained steady or declined. For instance, average crop yields declined within the range of 5–30% during the past few decades in a number of mountain watersheds in Nepal, in the Indian Himalayas, and in the Tibet Autonomous Region of China.

Increasing food insecurity

An ICIMOD study in the mid-hills of Nepal (Panday 1992 cited in Partap and Watson 1994) highlights the increasing food insecurity situation among mountain farmers in resource-poor areas. The study revealed that 86% of households in Bhardeo village were experiencing food deficits to varying degrees. Among them, over 50% suffered food deficits for at least six months each year. It further concluded that the production of adequate amounts of food on small landholdings, with ever-declining farm productivity, is almost impossible. Bhardeo depicts the worsening trend of food insecurity in resource-poor, heavily populated mountain areas.

Gaps in the demand and supply of biomass

The decline in productivity is not limited only to farmlands. Acute shortages of biomass production are widely reported, in the form of fodder, fuelwood or other forest products on which the sustenance of mountain people depends. Keeping in view all the basic requirements of farm families, Wyatt Smith (1982) cited in Partap and Watson (1994) calculated that about 3-4 ha of support lands (forests and grazing land/pastures) are required to maintain one hectare of cultivated land for normal production in the middle mountains of Nepal. Studies indicate that in many areas, the ratio of support land to agricultural land has gone down to 0.5 ha from 4 ha (Shrestha 1992 cited in Partap and

Watson 1994). Further, assuming that an average of 2.5 ha of supported land is needed to maintain 1 ha of agricultural land, the degradation of 1.5 million ha of agricultural forests will affect more than 0.5 million ha of agricultural land. If this is further calculated in terms of food-grains, the magnitude of loss is likely to be enormous (Partap and Watson 1994).

Trends in chemical degradation are also appearing in Nepal. Among others, some of the important processes include the following.

Soil acidification

Evidence of increasing soil acidification is found in the soils of hill and mountain areas. It is mainly caused by the use of pine needles for bedding materials for livestock. The used bedding materials are subsequently used for manuring the fields. The practice of using pine needles for compost is quite common in high mountain areas where it is abundantly available (Joshy et al. 1997).

Siltation

Land degradation resulting from siltation has also been noticed in the country especially in the Pokhara Valley. This is mainly caused by irrigation water drawn from the Seti River that carries heavy loads of fine sediment. Both the water and sediments are calcareous in nature and this has brought changes in both the physical and chemical properties of the soil, thereby causing the degradation of cultivated lands in the valley (Joshy et al. 1997).

Flooding

While the heaviest incidences of flooding occur in the *terai*, low-lying areas in the hill valley bottoms are also affected. The total area affected by floods in the country is estimated roughly at 9000 sq.km (NPC 1994).

Land affected by erosion, landslides and floods

Data on lands affected by erosion, landslides and floods have become available over the last few years. They are presented in Table 5.4.

The Soil Science Division of NARC has made a soil resource inventory of the country. This inventory shows that, in general, the soils of Nepal are deficient in nitrogen, phosphorous and sulphur. Potassium is on the high side. Results from long-term fertility experiments have shown indications of response to potassium after 15 years of continuous rice-wheat cultivation. Deficiencies of micronutrients (zinc, boron and molybdenum) have been increasingly observed to be widespread in high-yielding varieties of rice, wheat and maize crops, as well as vegetables. Thus soil-fertility resources of the country are not

Table 5.4: **Total land area affected by erosion, landslides and floods**

Year	Land Affected (ha)
1984	1,242
1985	1,355
1986	1,315
1987	18,858
1990	1,132
1991	283
1992	135
1993	5,584
1994	392
1995	41,867

Source: HMGN (1996) cited in Wagley (1997)

rich enough to sustain the increased agricultural productivity if not properly managed.

Despite the rather pessimistic scenario described earlier, various researchers (Joshi 1995) report some positive impacts from livestock and tree crops. A rough estimate provides a figure of employment generated by the fodder sector (some 1.2 million persons per year). The benefit of this opportunity is derived mostly by smallholder farmers. In addition, fodder and tree crops have intangible values as well. These include soil conservation and watershed protection, protection of biodiversity, and stabilisation of slopes. Fodder and tree crops also provide tangible benefits. Marginalised and smallholder farmers plant fodder and tree crops for multipurpose usage. Recently, plantation of tree crops such as chyuri (*Bassia butyracea*), lapsi (*Choerospondias axillaris*) and amala (*Emblica officinialis*) has become common for cash income. Their fruit has market value. Producing ghee from chyuri fruit has been a traditional source of income for the people of Baitadi, Doti and Dadeldhura in the far-western mid-hill districts. A total of about 600,000 chyuri plants are estimated to be in productive phase in different parts of the country. At present, local farm families can earn Rs 6000–10,000 annually by selling chyuri products (NCS Nepal 1995 cited in Sharma 1996b).

The characteristics of high-value crops are considered important from the perspective of sustainable use and management of soils in the mountain ecosystems of the country. These characteristics include the following.

- Ability of the crops to grow in harsh conditions — In many instances, fruits, legumes, herbs, cardamom, tea, coffee, ginger, turmeric, niger and companion trees are mainly grown in wastelands and are found well developed. Partap (1995) reports a productive use of marginal lands through the use of various kinds of horticultural cash crops. Some

micro-watershed areas such as Kapurkot and Sejwal Takura (Salyan District) present success stories of productive use of degraded lands through the introduction of high-value crops (Shrestha et al. 1996 cited in Sharma 1996a).

- Ability to protect and maintain the properties of soil — The characteristics of tree crops, plantation crops, herbs and legumes are highly favourable for soil conservation and watershed management. They are deep-rooted and they normally return high amounts of biomass to the soil. Moreover, some high-value crops prefer companion plants for their growth and development. For instance, cardamom, coffee, and tee (in the initial stages) perform well with other companion trees. Utis (*Alnus nepalensis*) is found commonly grown with cardamom in the eastern hills of Nepal. It not only provides shade to the cardamom, but adds essential plant nutrients to the soil. For example, the quick decomposing leaf litter of *Alnus nepalensis* adds as much as 249 kg of nitrogen per ha per year to the soil in agro-ecological zones where cardamom is grown (Singh *et al.* 1989 cited in Sharma 1996). Likewise, chiraito covers bare land and conserves soil and water (Khadka et al. 1994 cited in Sharma 1996a).
- Favourable to maintaining a sound environment — The high-value crops provide an environment conducive for integrated plant-nutrient management. High-value crops with their companion trees add organic matter in situ that increases the humus content of the soil. High levels of organic matter and humus in the soil create favourable conditions for the growth of earthworms. These organisms play a valuable role in the improvement of soil texture and structure. Unlike the plantation and tree crops, legumes possess different types of ecological characteristics that support integrated nutriment management. The commonly grown leguminous cash crops in the mid-hills include soybean (*Glycine max*), lentil (*Lens culinaris*), and black gram (*Vigna umbellate*). These legume crops have a symbiotic nitrogen-fixing ability. They add atmospheric nitrogen to the soils through a symbiotic process (Sharma 1996a). Suwal et al. (1991) state that, although a new crop in the western hills, lentil has been found attractive even in the higher hills. Under the farmer's management conditions, this crop contributes a substantial amount of nitrogen to succeeding crops. Likewise, intercropping of soybean is also gaining popularity in the western hills. Such an integrated plant-nutrient management system helps to maintain the soil biological dynamics with living micro-organismic activities (Sharma 1996a).
- Integrated insect pest and disease management system — Combination of high-value crops with other tree crops maintains a protective environment by protecting crop plants from insects, pests and diseases,

and predatory birds and animals. As a result, the whole system functions as an integrated insect pest and disease management system and plays an efficient role in preserving biodiversity and maintaining a pollution-free environment (Sharma 1996a).

- Preservation of biodiversity — Combination of a large number of tree and plantation crops offers a diverse ecology that protects biodiversity by allowing many other valuable niche-products to emerge in various agro-ecological conditions. Partap (1995) inferred that the best sustainable land use is horticultural farming, which can provide better production and incomes from marginal lands.

In summary of the environmental impact of Nepal's agricultural policy, national strategies have addressed environmental matters from time to time — the dominant position of international agencies in drafting national documents has seen to that. However, they have had little effect, and many of them have not been operationalised in terms of detailed planning, nor have they been implemented. However, there is a great deal of relevant applied research going on which has been carried into the field under the auspices of some donor-driven projects. It is not that donor-driven projects have a particularly good record, but the successes in terms of environmental rehabilitation and conservation have either been entirely carried out without outside help and knowledge at all, or have been the result of donor-driven projects. In the latter case, the issue of sustainability after the withdrawal of funds and personnel remains problematic.

Pakistan

By and large, the National Agricultural Policy, which is primarily concerned with fixing support prices for major food and cash crops, is not relevant to the subsistence-based agriculture practised in the region. The Directorate of Agriculture for the Northern Areas (DANA) has not, however, issued any policy document per se that could be used to chart the development of the sector in the region. The directorate functions primarily by implementing a series of short- to medium-term projects, either funded by donor agencies or from funds allocated to it in the annual development plan. Although the officials of the directorate profess not to follow a broad-based policy, an appraisal of the projects currently being implemented, as well as those that have been implemented in the recent past, does indicate that the growth and development in the agricultural sector in the region has followed a fairly typical path with a shift in emphasis from food crop to cash crop production following the development of marketing opportunities.

The Northern Areas are deficient in cereal production and are dependent on grain transported from the plains in the summer months. In 1997, the

estimated food-grain deficiency in the region was in the order of 43,000 t (DANA 1997). The federal government, which has long followed a policy of providing cereals to the area at highly subsidised rates, provided 20,000 t of cereals to the region in 1997 to meet this deficiency, while the remaining was met through supplies arranged by private dealers (DANA 1997). The subsidies provided by the federal government to the region mainly take the form of subsidy on transportation costs. The additional cost of freight to the Northern Areas from the Rawalpindi market is not charged to local merchants in the region.

In spite of the availability of subsidised cereals in the region, traditional agricultural practices dictated that households concentrate primarily on production of cereal crops not only to partially fulfil their food needs, but also to ensure supplies of fodder for cattle. Fruit and vegetables were produced almost entirely for home consumption, as costs of transportation to markets were high, and the commodities are extremely perishable. The opening of the Karakoram Highway, however, proved to be a catalyst in the transformation of the local economic structure from a subsistence economy to one with strong linkages with the mainstream cash-based economy in the plains. The Karakoram Highway provided the means to transport crops, for which the Northern Areas had a comparative advantage in terms of production, to the markets in the plains thus earning cash that could be used to purchase cereals at subsidised rates from the local markets. The Aga Khan Rural Support Programme started a marketing programme in its first year of operations that aimed at organising village communities to transport farm surpluses, mainly fruit, to markets in Gilgit. Thus, agricultural policy in the Northern Areas and North West Frontier Province do not have land management as a priority at all. All policies, therefore, may have unintended environmental consequences.

The Case of Shifting Cultivation

Shifting cultivation has been practised for at least 9,000 years in the Hindu Kush–Himalayan region. Nomadic people cleared the forests, slashed and burned it, dibbled seeds, and raised a variety of crops. The family would return to the original cultivation site after 30–40 years; the site would have rejuvenated back into forest ready to be cut and burned once again. While many sociologists believe that this age-old practice is not harmful to ecology and the environment, most foresters and scientists hold a different opinion. With growth in population, the land:man ratio has progressively decreased, and the fallow of 30 years has been reduced in many areas to two to three years. This reduced period has led to large-scale deforestation, soil erosion, and destabilisation of the ecology.

There is a great deal of controversy concerning the environmental impacts of shifting cultivation (jhum in Bangladesh and most of northeast India, tseri in

Bhutan and khoriya in Nepal). Official attitudes have been almost universally hostile from the British period onwards, although there are a number of commentators and researchers who qualify their condemnation. Writes Mr Thangam of shifting cultivation in the northeast of India, for example:

"In the interior areas, the shifting cultivators depend solely on shifting cultivation, and follow the traditional and ritualistic integral shifting cultivation with colourful ceremonies. Such shifting cultivators care for their land and consider themselves as part and parcel of the agro-ecosystem as a whole. They have no other alternative to shifting cultivation to eke out their livelihood."

On the other hand, it is said that:

"the lowland cultivator and the landless labourer who migrate to the accessible hill areas for shifting cultivation adopt it in a manner, and consider it as one income source besides others such as road-working, quarrying, etc. These partial shifting cultivators do not care for the land and cause land degradation in the short and the long run. Though it is only the partial shifting cultivators who cause degradation to land, often the integral and the partial shifting cultivators are clubbed together and blamed for the ill effects of shifting cultivation."

There are two main points in this controversy. The first is that the term covers an enormous variety of cultivation practices. Secondly, the ground realities are usually that the fallow period has drastically shortened over the past half century. While population growth has been a factor, others are important too. These include the marginalisation of cultivators by hydroelectric schemes, forestry policy that diverts land degradation elsewhere (and also impoverishes the people involved), and a process of privatisation of lands by both the local elite, and by outsiders and immigrants. Here are some representative illustrations of official policy towards this type of agriculture.

Chittagong Hill Tracts, Bangladesh

According to the official policy pursued for at least a century, it is assumed that the great enemies of forest conservation are the practice of jhum over the greater part of the forests and the wasteful manner in which timber has been cut. The account below is based on official documents and views.

"Although the jhumias may not cut many large trees in the areas to be cultivated, they cut and burn periodically all seedlings, saplings, and young trees, consequently there is little regeneration, whereas mature trees are removed year after year. Besides the above, enormous quantities of saplings and young trees have been destroyed annually through the practice of

cutting so-called dug-outs (boats) and their sliding down from the hill tops to the nearest water course, requiring construction of a track covered with wooden rollers about three feet apart, about 1,000 to the mile (1.6 km). No species of tree is spared; they are all felled by the axe under this wasteful system. Furthermore, it has hitherto been the practice of bamboo cutters to cut saplings and young trees of all kinds and to remove them for use as house posts. In short, there can be no doubt, that the forests are on the road to ruin and, in fact, valuable timber trees are, in many areas, only found high up the valleys and in many cases in inaccessible places."

In framing proposals for a change of management, it had to be borne in mind that the hill people have to depend, for a long time to come, on jhum cultivation, and that they also seemed to rely to some extent on the money earned by the removal of timber. The Conservator of Forests offered the following suggestions.

- Two classes of forests are to be formed: reserve and district forests.
- The reserves will be entirely under the management of the Forest Department and the district forests under that of the Deputy Commissioner of the Hill Tracts.
- No jhum or cultivation of any other kind should be allowed in the reserves, no other forest produce should be cut or removed from the reserves without the permission of the Forest Department. The area should be managed for forest purposes only.
- The people of the district may supply themselves with forest material for their domestic requirements from the district forests, with such restrictions as the Deputy Commissioner may impose from time to time.
- With a view to discouraging the preparation of dug-outs and the excessive consumption of 'jarul' (wooden rollers), the tax rates for dug-outs and from jarul timber now levied should be enhanced by 50%, and the export of dug-out and jarul prohibited altogether.
- The management of the revenue stations should be under the Forest Department as hitherto.
- The Divisional Forest Officer should be under the orders of the Conservator of Forests, Bengal, instead of under these of the Commissioner of Chittagong. (Note the political significance of this suggestion.)

One of the typical policy solutions is to resettle (sedentarise) the jhumias. One of the major dangers of this policy is that, once the farmers are persuaded to leave, and the main conservation objective of the programme is achieved, the resettlement part is forgotten, funds allocated for this part of the programme somehow do not materialise, and the unfortunate cultivators are left to languish. The Integrated Jhumia Rehabilitation and

Afforestation Programme was one of the components of the Chittagong Hill Tracts Multisectoral Development Project, executed by the Forest Department. The programme encouraged planting of bamboo and agroforestry practices. The project arranged equitable distribution of income from harvesting timber from afforested areas between the government and the settlers as well as supporting cottage and rural industries. Overall, the strategy was as follows.

- Settle jhumias in villages with land allotments of 1.6 to 2.4 ha.
- Establish forest plantations where jhumias are allowed to use the taungya or agroforestry method to produce food crops.
- Develop infrastructure to facilitate transportation.
- Establish market channels for agricultural products.

The project rehabilitated 3245 jhumia families in seven forest divisions in the form of villages (at least 50 families in each village) in hilly arable lands between 1984 and 1989 (Chakma 1994). Each family was given title to five acres (2 ha) of land: 0.5 acres (0.2 ha) for homestead and agriculture, 0.5 acres (0.2 ha) for bamboo and cane cultivation, 2.7 acres (1.1 ha) for horticulture, and 1.3 acres (0.5 ha) for cultivation of miscellaneous plants. Social and community facilities such as school, prayer centre, approach road, and internal road/pathways within the villages were developed by the project.

The programme of afforestation could not achieve the desired level of success, and suffered from inadequate participation of the target group mainly due to political unrest. Lack of motivation, education, extension, infrastructure, marketing facilities, and, above all, the lack of material/financial incentives were also constraints (FMP 1993). Most of these projects were expensive, since adequate resettlement that might give the ex-jhumia some incentive to stay sedentarised requires such a high level of funding per family that they can never hope to be replicated on a scale that would make any substantial environmental difference. Other projects that have involved resettlement, following the displacement of local people from their irrigated paddy lands following the construction of the Kaptai dam, have been characterised by callous indifference, repeated evictions, and broken promises. Since a reversion to jhum has been the only alternative livelihood, the criminalisation of jhumia begs some important ethical and political questions.

Northeast India

In 1976, the National Commission on Agriculture stated that shifting cultivation could be considered as a balanced part of an ecosystem, and that both from the point of view of forest development and economic well-

being of the tribals, shifting cultivation should be regulated, contained, and replaced as expeditiously as possible. However, the biggest impediment in the path of any planned systematic programme to contain shifting cultivation in northeast India is that most of the area under shifting cultivation is unsurveyed as yet. Basic information regarding it, such as actual location, the exact extent, and population dependency, is lacking. However, the strategic decision to control and regulate remains prior and paramount. Various conflicting estimates have been made from time to time. The statistics for the two states is an estimated annual area of 703 sq.km in Arunachal Pradesh and an estimated annual area of 760 sq.km in Meghalaya.

According to the State of Forest Report (1997), Arunachal Pradesh suffered a loss of 75 sq.km of forest, while gain of forest cover due to natural regeneration was 56 sq.km. The net loss of forest cover was 19 sq.km. Similarly in the state of Meghalaya, 75 sq.km of forest was lost to shifting cultivation and 20 sq.km gained through natural regeneration. The net loss for Meghalaya was 55 sq.km.

In Arunachal Pradesh, shifting cultivation is not practised throughout the state as the terrain conditions and climate limit it. As altitude increases, shifting cultivation practices diminish. Generally, shifting cultivation is not practised beyond 2,000m. Of the many tribal groups in the State, the Adi tribe is the largest tribe in the state practising shifting cultivation. Once the land is allotted to a family, they enjoy usufruct rights over it. The land is cultivated for two years and then left fallow for 10–12 years for regeneration.

In Meghalaya, shifting cultivation is practised, but is not uniform throughout the state. People have taken to terrace cultivation on gentle slopes in the high rainfall areas. A varying form of shifting cultivation is the 'bun' cultivation that is practised in the Khasi Hills and parts of the Jaintia Hills. Shrubs are cut in November/December, and the slashed materials are laid in rows along the slopes in bunds, locally known as bun. The soil surrounding the bun is then hoed and placed on top of the bun during December/January. Burning of buns is done in late January, followed by planting in February and March. This method of cultivation leads to heavy soil erosion. The cultivators use manure and fertilisers on the crop on the buns. The main crops are potato, sweet potato, banana, and citrus fruits. Crops are again raised in the second year and then the land is left fallow for three years.

Various control measures have been suggested and implemented from time to time to control and contain the 'evils' of shifting cultivation. In 1960–61 the Scheduled Tribes' (Dhabar) Commission covered a whole range of tribal

problems and recommended measures of scientific management to control and limit it. In the Fourth Plan Period (1969–73), the Tribal Sub-Plan (TSP) laid emphasis on micro-level planning and integrated area development. The Task Force on Development of Tribal Areas set up by the Planning Commission of India (1973) recommended that shifting cultivation should be made more productive through better agricultural practices such as terracing and growing horticulture crops. The National Commission on Agriculture (1976) also suggested similar action.

In 1978, the FAO and the United Nations Fund for Population Activities (FAO/UNFPA) sponsored a study project on shifting cultivation in five countries — including India. The various recommendations made to tackle shifting cultivation were through integrated area development programmes and watershed management. A pilot project was taken up in Arunachal Pradesh. Note the Malthusian assumptions of this policy. Other factors causal to a reduction in fallow periods (marginalisation, flooding of prime land, forest policy, and privatisation of communal land) were ignored.

During the Fourth and the Fifth Five-Year Plans, the North-Eastern Council (NEC) for Shillong also took up programmes for control of shifting cultivation. In 1980, the Indian Council of Agricultural Research (ICAR) complex for the North-Eastern Region based in Shillong recommended development of hill slopes under shifting cultivation by planting the upper third of the slope with fuelwood and timber species, the middle third with horticultural crops, and the lower third with agricultural crops.

The National Forest Policy 1988 envisages social forestry and energy plantations to rehabilitate areas damaged by shifting cultivation and to provide alternative avenues for income generation to the cultivators with right land-use practices.

The problems that face the control of shifting cultivation in the northeast are both political and practical. State forestry departments control little forest, there is widespread shifting cultivation and many areas are characterised by insurrection. Indeed, attempts at suppressing jhumia are often seen as part of an unwarranted cultural and economic intervention by the state. Thus the environmental impact of most of these schemes tends to be slight. It is clear that, unless local communities develop or maintain institutions for collective action, the maintenance phase of many activities will fail. For example, the Forest Department in Meghalaya planted a number of single species' forests on degraded land for watershed management purposes. The village had little participatory role in designating areas to be planted or selecting tree species. The department proposes to hand over the plantation to the community after 15 years but

already the local community are threatening to cut the forest and sell the timber in its twelfth year.

In conclusion, the issue of policy towards shifting cultivation remains contested both within professional and political arenas. It has a long history and one cannot expect closure as a result of new research findings or overwhelming rational argument. This report suggests that the environmental impact of shifting cultivation is highly variable, on both watershed and commercial forestry grounds. Therefore blanket bans should be examined anew, and a more flexible and local basis for negotiation established. Also the implementation of bans on shifting cultivation is politically and administratively not feasible. There are also ethical considerations in attempting to close off environmental entitlements without successfully providing alternatives. Banning is easy — compensation is not.

Environmental Impact of a Potato-growing Project in Pakistan

One example of a clear-cut environmental impact of a change in land use in which the policy component was considerable is one in the Northern Areas of Pakistan. In the 1980s, following the construction of the Karakoram Highway, attention was focused on programmes that encouraged commercialisation of production. Initially horticulture was attempted, but the emphasis quickly shifted from fruit to potatoes with the initiation of the FAO/UNDP-assisted project on 'Production of Seed and Planting Material in the Northern Areas'. Fruit is a highly perishable commodity and transporting fresh fruit down-country is expensive and risky. Potatoes, on the other hand, can be readily transported over longer distances and are less susceptible to damage from careless handling. The production of seed potatoes was the central component of the project; its other components included orchard development and seed production for other commonly grown vegetables such as tomatoes and carrots.

The seed-potato component was established with the objective of raising farm incomes and contributing towards the development of a seed-potato industry in Pakistan, thus saving the country the foreign exchange spent on an estimated 5,000t of seed potatoes annually (FAO 1992a). The project was built on the premise that yield per hectare could be increased substantially if disease-free seed was made available to farmers. The crop cycle in the Northern Areas made the production of seed in this region particularly favourable; seed potato could be harvested by August, thus reaching markets down-country in time for autumn planting. The arid climate in the Northern Areas also makes the region most suitable for seed production as the incidence of disease and pest attacks are relatively low.

A seed-potato unit was established in the Directorate of Agriculture that aimed to produce 20t of basic seed in five years. The project identified contract growers who provided training to farmers on producing seed potatoes. The training was conducted through lectures and on-farm demonstrations. The pre-basic seed was developed into basic seed in the field in the high altitude valleys of upper Hunza, Hopper, and Yasin.

Initially, the project operated a marketing component and tried to form growers' associations that would take the responsibility of supplying the seed potato to the market. This component of the project had to be abandoned in 1989 after these associations were found to be racked with disputes and disagreements amongst members. Thereafter, the project provided for the establishment of linkages with private seed companies that would liase with the contract growers supported by the project to obtain the pre-basic and basic seed potato for marketing down-country and in other regions of the Northern Areas.

Since 1993, private seed companies have been operating independently and have established links with seed producers who have not been associated with the project. By 1997, they had produced nearly 3,500t of certified seed potato (DANA 1997). According to some government officials, the sale of seed potato may have reversed the traditional trade deficit of the region with the rest of the country.

The project wound up in 1996 after ten years of operation. By then, it had facilitated a dramatic change in cropping practices in the Northern Areas, in general, and in the high-altitude valleys of Hunza and Gojal in particular. Potatoes had been cultivated in the Northern Areas for decades, but the land devoted to potato cultivation by an average household had rarely exceeded half a kanal (0.02 ha) (Whiteman 1985) — now the average cultivated area per household is 8–10 kanal (about 0.5 ha). By 1997, potatoes had overtaken wheat as the main crop produced. Field visits suggest that on the small landholdings (maximum 0.8 ha) of the Hunza and Gojal valleys, which are the main potato-growing areas, potatoes now occupy 75–80% of cultivable land. This is a significant change from the cropping practices that existed up to a decade ago when 55% of the farm area would be devoted to cereal crops (ACO 1990a).

The introduction of a cash crop with a significant earning potential in a traditionally subsistence-crop economy is bound to have a notable impact. The growth in area cultivated for the potato crop is not confined to the high-altitude valleys. Indeed, potatoes have become the dominant crop in the entire Northern Areas. As the demand for seed potatoes down-country

increased and seed companies became more active, the production of table potatoes also increased significantly. Commercialisation of the production process led to an influx of companies producing fake seeds and flooding the market with uncertified seed brought in from the plains.

The economics of potato production are too attractive to be ignored. The potato crop is harvested in the Northern Areas from late July through August, and reaches markets down-country at a time when potato stocks from the Punjab and Sindh are being depleted. The crop from the Northern Areas typically fetches higher prices down-country than winter and spring crops from the plains (Rs 1,000 per 40 kg compared to Rs 800 per 40 kg). Estimates suggest that the yield per kanal is about 600–800 kg. A kanal, the standard measure for measurement of agricultural land in the Northern Areas, is equivalent to about 600 square yards. There are eight kanal in an acre. Seed companies or dealers pick up this produce from the farm-gate at Rs 600–800 per 40 kg giving an income of over Rs 9,000–16,000 per kanal. The Directorate of Agriculture prepared similar estimates and concluded that, on average, the potato crop earned Rs 11,250 per kanal, fresh fruit Rs 10,680 per kanal, and wheat Rs 3,000 per kanal (DANA 1997). It is thus quite practical for a typical farm household to grow potatoes and use the funds generated to buy the cereals and fodder crops that have been displaced by potato production.

The potato crop was, until recently, relatively free of disease, and its cultivation is less labour intensive than most cereal crops. The latter characteristic is an important consideration in an evolving economy where the service sector is rapidly gaining ground and agriculture may not remain the primary source of employment. The Hunza and Gojal valleys, where the majority of the population belongs to the Ismaili community, are also enclaves of relatively high literacy rates and there is significant out-migration of educated youth from the area. All these factors have contributed towards the transformation of agricultural practices. Livestock holdings per household, for example, have reportedly decreased appreciably in the last decade as the availability of manpower for herding has decreased. Transhumance cycles have been disrupted as more people opt to look for work in the service sector or in the tourist trade. The decrease in livestock population also has important implications for the demand for fodder, particularly wheat straw. As herd sizes grow smaller, the need to grow cereal crops for fodder is also decreasing. A host of factors thus seem to have contributed to the popularity of this new cash crop.

The potato crop has obvious benefits and is well suited to the changing needs of the local economy. However, the cultivation of the crop without practising rotation has serious effects on agricultural soils.

The Pakistan Agricultural Research Council (PARC) has lately carried out two studies on the prevalence of potato diseases in the region (PARC 1994; 1995). The most significant discovery was the identification of potato cyst nematode (PCN) in the Hunza–Gojal area. PCN is generally acknowledged to be the most damaging nematode that can attack potatoes, and has been held responsible for productivity losses of up to a 100% the world over. Most diseases identified in the area are seed or soil borne.

The increase in seed-borne diseases has been concomitant with the increase in trade with the plains and with the unchecked movement of seed distribution companies who do not necessarily follow prescribed procedures of seed production. Data on seed imports are hard to obtain and are not reliable, but government officials and NGO workers acknowledge that local markets have been flooded with uncertified seed. While the production of seed is now an established activity in the Northern Areas, there is no programme for certifying seeds. The Directorate of Agriculture has prepared a feasibility report for a project on seed certification that would authorise the setting up of checkposts on major road and air entry points to check the influx of uncertified seed. The project has been waiting approval for the last four years. However, a recent conference on seed certification held under the aegis of the federal government suggests that it may now be taken up for financing.

The incidence of soil-borne diseases is associated primarily with an absence of crop rotation with other cereals or vegetables. The typical rotation period recommended is two to three years to ensure that soil re-accumulates essential nutrients. In the first few years of the seed-potato project, government extension workers were active in ensuring that growers followed these guidelines. The Aga Khan Rural Support Programme's extension services have also been fairly active and field agriculturists have repeatedly stressed the importance of crop rotation in meetings with local farmers. In the high altitude valleys of Hunza and Gojal in particular, however, this message does not seem to have had the desired impact. Interviews with local farmers and with the Aga Khan Rural Support Programme field teams suggest that rotation is not being practised and, in some cases, the potato crop has been planted in the same soil for almost a decade. Farmers have been known to use chemical fertiliser far in excess of recommended limits to coax a crop from the damaged soil. Although awareness of the need for rotation is fairly high, and farmers have experienced the effects of loss in soil productivity, the returns accruing from the reduced potato crop are still substantially higher than traditional alternative crops. Landholdings in the high-altitude, single-cropping valleys are rarely over 10 kanal (0.5 ha); too small to warrant rotation. Soil

degradation is a slow process and farmers know that it may take over two decades for the soil to be degraded to the point where any sort of cropping becomes difficult. The time horizon is too long for this generation to adapt its behaviour. Interviews with farmers and other members of the community reveal that the next generation is not expected to work the land in any case, as farming is not viewed as a viable means of earning a living. Meanwhile, the allure of the only major cash crop to be produced in the Northern Areas continues unabated.

Study of Horticulture in Northwest India

Himachal Pradesh has become a major producer of temperate fruit. In 1950-51, the area under fruit was 792 ha and production 1,200t; by 1991-92, the area was 170,768 ha and production was 342,303t. Further gains in both production and productivity have been made since. Estimate of production for 1994-95 was 587,000 t. More than three-quarters of total fruit production is apple; the rest is nuts, citrus, pears and other pomes. Area under vegetables has gone up from 8,000 ha in 1974-75 to 24,000 ha in 1993-94, and production from 90,000 to 385,000t. Mushroom production has grown (600t) and, amongst spices, ginger is an important crop (3,200 t). Hops are also grown. Potatoes are grown on nearly 17,000 ha, production being about 160,000t. Post-harvest technology has many gaps. Packing and transport of fruit is problematic. In order to reduce pressure on hill forests, eucalyptus and other types of wood brought from the plains are also now being used in increasing quantities for making packing cases. Corrugated paper-board packaging and transportation in plastic bins is also being adopted. Value additions to horticultural produce are inadequate and the potential of off-season vegetable growing and marketing remains to be realised. Efforts are being made to introduce modern methods in orchard management such as drip irrigation, glasshouse technology, and protected cultivation systems. The possibilities of higher production and incomes (and employment) through horticulture are immense.

This brief case study is one of the more successful outcomes of agricultural policy in the region, although how much of the long process of specialisation, rising incomes, and environmental recovery was due to policy and how much to other factors, is difficult to disentangle. Certainly the other factors involved were the construction of roads and a good public distribution system that reduced the risk factor for farmers in substituting a commercial for a food crop. The extension agencies were sometimes proactive (e.g., in providing apple stock and advocating planting on degraded and sloping lands) and later reactive to ensuing environmental problems due to a shortage of packing materials.

Case Study of a Favoured Location for a Donor-funded Agricultural Project

Nahar is one of 13 villages of Sectla Rao subwatershed in Sahaspur block of Dehradun District. The total area of the village is 72 ha of which 20 ha are reserve forests, 39 ha are agricultural lands, and the rest is either uncultivable fallow or other miscellaneous types of land. About 56% of the agricultural land is irrigated. The village comprises 45 households with a total population of 249. Nearly two-thirds of the population is literate. Most of the landholdings are small and scattered. The animal population was about 235 before the village was brought under a watershed management project supported by the European Commission. At the beginning of the project in 1995-96, villagers met about four-fifths of their fuel requirements from adjoining reserve forests while the rest came from agricultural lands and other alternative sources. There was an annual fodder shortage of about 240t.

The strategy of the project was additional plantations, introduction of high-yielding varieties of agricultural crops, improvement of biomass production and promotion of alternative sources of energy such as biogas. It also included reducing the number of animals of low productivity and replacing them by high-yielding, stall-fed buffaloes. Training was an important component and village planning was attempted essentially through participatory rural appraisal. Villagers voluntarily agreed to reduce the number of goats. Once consensus of villagers had evolved through participatory rural appraisal, the project selected entry point strategies in the form of financing biogas plants, providing mini-kits and better implements for agriculture, and repairing terraces. Also, the irrigation system was improved. Eight water-harvesting tanks were built. For the animal husbandry programme, a high-quality breeding facility was provided, fodder mini-kits were distributed and chaff cutters and feed troughs were introduced. In the adjoining reserve forest, plantations were undertaken with the involvement of villagers. On more than 10 ha of land, silvi-pastoral development was carried out. On about 2 ha of land, private orchards were established. Vegetable mini-kits were distributed. While inputs were provided by the project by way of a gap-filling strategy, important achievements were in the area of community organisation and institution-building. Firstly, a Gramin Resource Management Association (GAREMA) was established with membership of all 45 households. Eleven executive members were elected and a revolving fund was begun which, at the time of the case study visit, contained about Rs 90,000. From the revolving fund, the GAREMA had made a number of productive consumer loans and loan recovery was 100%. Loanees were willing to pay interest at the rate of two

per cent per month. Loanees preferred to pay this higher rate of interest because disbursement was hassle free, and they found it convenient to repay the loan instalments locally. A women's self-help group has also been established. This group consisted of 27 women, who contributed Rs 10 a month. It had provided loans to 17 women for knitting sweaters and growing mushrooms.

The story of Nahar is one of success, although it is a most favoured village in the first place, and there was 'room for manoeuvre' since there was enough grazing land to carry the reduced stock upon the partial closure of the forest. At the time of the case study visit, the project had practically withdrawn its active phase from the village; project people were trying to encourage sustainability of institutional arrangements. The main results of community mobilisation were in the following areas.

- Village people had set up their own institutional arrangements for resource management and generated resources in the form of a substantial revolving fund. This had reduced their dependence on other sources of credit such as banks. In the maintenance of accounts, a certain degree of transparency prevailed. The revolving fund is used with consensus of all the members of the GAREMA and recovery experience was highly encouraging.
- The number of animals was brought down and low-quality cows were replaced by buffaloes that were stall-fed.
- Out of 45 families, as many as 30 families have installed biogas plants to meet domestic energy needs and obtain better quality manure for their fields.
- The area under improved varieties of agricultural crops increased, increasing productivity as well as production.

The strategic conclusions from this case study are as follow.

- The sustainability of the project after withdrawal of donor funds was supported by commercial viability of new activities, a simple and transparent accounting system, and an able and entrepreneurial leader.
- The project was located in a village with relatively abundant resources. While there were 'losers' in the grazing scheme, they were largely compensated by other income-earning opportunities.
- A local market for the use of common-property resources (although, at the time of the inception of the project, these had become virtually open-access resources) was established with appropriate institutions for its

operation. Undoubtedly, this is an example of a neoliberal approach to the environment of which the World Bank would be proud.

Conclusion

In conclusion, these diverse examples of agricultural policy show how few policies explicitly link environmental concerns to agriculture. While most national environmental strategies do this, the detail of agricultural policy usually does not, with the exception of China. India's agricultural policy, not included in this selection, certainly does take seriously the environmental impacts of agricultural policy in terms of formal statements, institutions, and laws. However, as with almost all agricultural policy statements in the region, there is an enduring metaphor that comes to mind. Policies are control switches in a power station. Each is carefully labelled, and they can be switched on or off by a flick of a (policy) finger. The fact that the level of lighting may not change much may encourage the observer to wonder whether the switchboard is actually connected to the power supply at all. Why is this? In all the countries studied, there are legal stipulations concerning environmental conservation, and the outlawing of practices that are considered as damaging to the environment. China is the prime example of a sophisticated and environmentally aware policy-making body enacting an almost endless stream of enactments, none of which is taken seriously at the local level. Nepal, in rather a different political setting, has plans in which agriculture and environmental concerns are sometimes linked, but they again fail to have any impact. Clearly, the problem is not one of making better policy — except where unintended consequences of policy are particularly harmful — but how policy is made, and the expectations attached to it. This topic is again taken up in the concluding chapter.