

MOUNTAIN AGRICULTURE SUSTAINABILITY— STATUS AND OPPORTUNITIES

Concept and Definition of Sustainable Development

The use of the concept of sustainable development in economic development literature is of recent origin. It gained popularity with the publication of the Brundtland Report, *Our Common Future*, in 1987. As yet, there is no unanimity on the concept and definition of sustainable development; as many as 70 definitions are currently in use (Pezzey 1989, pp 63-71). Nevertheless, since agriculture continues to be the main source of livelihood for a preponderant majority of the population in developing economies, and the prime activity involving direct interaction with the environment, scholars have used the concept of sustainable development and sustainable agriculture synonymously. For instance, Conway defined it as the ability of a system to maintain productivity, whether of a field, farm, or nation, in the face of stress or shock (Conway 1990). Likewise, Jodha views sustainability of an agricultural system as its ability to maintain a certain well-defined level of performance over time and, if required, to enhance the same through linkages with other systems without damaging the ecological integrity of the system (Jodha 1991, p A5).

A more comprehensive and broad-based definition of sustainable development which has become the development paradigm for mainstream thinkers is given by the World Commission on Environment and Development (WCED). It defines sustainable development as development that meets the needs of the present without compromising the ability of the future generation to meet its needs. In essence, sustainable development is visualised as a process of change in which the exploitation of resources, the direction of investments, and the orientation of technological development and institutional change are all in harmony and enhance both the current and future potential for fulfilling human needs and aspirations (WCED 1987, pp 43 and 46).

Indicators of Sustainability

Due to the lack of unanimity over the concept and definition of sustainable development, the efforts to operationalise it have been few and far, and lacking persuasiveness. Consequently, the measurement of sustainable development through quantitative indicators continues to be the main gap in the whole debate on sustainability. Ecologist Gordon Conway has suggested four indicators to measure sustainability of an agricultural system (Conway and Barbier 1990, pp 37-43). First, productivity defined as the output per unit of resource input; second, stability defined as the constancy of productivity in the face of small disturbing forces arising from normal fluctuations in the surrounding environ-

ment (measured by the standard statistical tools such as the coefficient of variation); third, equity defined as the evenness of distribution of the productivity of an agricultural system among beneficiaries, i.e., the level of equity in the distribution of income; fourth, sustainability of the yield or net income that is capable of withstanding collapse of the system under the stress and shock which may arise out of either endogenous or exogenous factors. While attacks from pests and insects, drought, and so on are examples of the former type of stress and shock, the depletion of soil quality, salinity of groundwater, and excessive use of insecticides and pesticides are notable examples of the latter which are generated in the process of agricultural development.

A more pragmatic and practical approach to operationalising the concept of sustainable development, advocated and popularised by ICIMOD, is to approach sustainability by identifying the indicators of unsustainability. According to this approach, sustainability or unsustainability is a match or mismatch between the characteristics of natural resources and patterns and methods of their utilisation (Jodha 1992, p 59). The understanding of factors and processes causing unsustainability, according to this perspective would go a long way towards devising policy measures to restore the process of sustainable development. Viewed from this perspective, unsustainability means the inability of the system to maintain and enhance the natural resource stock, thus jeopardising the prospects of future generations to satisfy their needs. In more concrete terms, the indicators of unsustainability are:

- (i) degradation of the resource base leading to lowering of the groundwater table, reduction in biodiversity, salinisation of soils, and so on;
- (ii) decline in resource productivity and production flows manifested in a persistent decline in yields of crops, biomass, and others; and
- (iii) disappearance of traditional practices of resource management such as keeping land fallow, social sanctions against a certain resource use, and so on.

The Mountain Ecosystem

Mountains occupy one-fifth of the earth's landscape and are home to one-tenth of the human population. An additional two billion people live downstream from the mountains and directly depend on their water, hydro-electricity, grasslands, and timber and mineral resources. And seven of the world's 14 tropical hot spots of endemic plants threatened by imminent destruction have at least half of their area in tropical mountains; among them are the eastern Himalayas and India's western ghats (Denniston 1995, pp 38-57).

The mountains have distinctive features, often called mountain specificities; namely, inaccessibility, marginality, fragility, niche, and human adaptation mechanisms; created by the unique vertical dimensions that distinguish the mountains from the plains. The first three specificities contribute, in varying degrees, to physical isolation, distance, and high transportation costs. Poor mobility, vulnerability and risk, limited input absorption, and limited production capacities, therefore, constitute the objective circumstances. The niches, or comparative advantages,

and human adaptation mechanisms indicate positive features and scope for the development of these areas.

It is unfortunate that the mountain ecosystem, its importance for other ecosystems, and the threat it faces did not receive adequate attention from the World Commission on Environment and Development. Nevertheless, some recent international happenings, such as the origin and establishment of UNSECO's Man and Biosphere Programme, IUCN initiatives, the setting up of the United Nations University and the International Mountain Society Programme on Mountain Ecology, the establishment of the IUCN Commission on Mountain Protected Areas, and the inclusion of Chapter 13 (Fragile Mountain Environments) in Agenda 21 at the United Nations Conference on Environment and Development held in Rio in 1992, have brought to the fore the importance of protecting these areas.

Status of Mountain Agriculture

Field studies and knowledge reviews commissioned by ICIMOD in selected areas of the HKH, namely, India, China, Nepal, and Pakistan, have indicated that sustainability of mountain agriculture faces a serious threat and may worsen unless remedial measures are undertaken immediately. The indicators of unsustainability, both visible and invisible, relate to resource base, production flows, and changes in resource use and management practices (Jodha 1992, Shrestha 1992). Degradation of the natural resource base has contributed to an increase in frequency and intensity of landslides, gully formation, soil erosion leading to abandoned land, reduced per capita availability of and fragmentation of land, and reduced flow of water for irrigation. These, *inter alia*, have contributed to negative trends in the yields of crops and livestock; increase in drudgery, especially for women – in terms of increased time devoted to collection of water, fuelwood, and fodder; low availability of capital to be reinvested in land; and so on.

Concrete manifestation of degradation of the natural resource base, among other things, has led to the adoption of inferior and reduced livelihood options, an increase in the degree of desperation, acceptance of dependency as a normal basis for survival, and reduction in the resilience or capacity to face shock and stress. Mountain people, in their bid to maintain a subsistence livelihood, have responded to the above negative trends by reducing fallowing between crops, extending cultivation on to steep slopes and marginal lands, replacing deep-rooted crops with shallow-rooted crops and cattle with sheep and goats, and substituting water flows with fossil fuels.

The prevailing state of affairs can partly be attributed to the kinds of development strategy being pursued in these areas to improve the standard of living of mountain people and partly due to unyielding demographic pressures and insatiable external demands on local resources (Repetto and Holmes 1983; Jodha 1991). The development strategies pursued so far have tried to integrate mountain areas with the mainstream economies through physical infrastructure and

harnessing of mountain niches, namely, irrigation, hydropower, timber, and tourism. These policy initiatives, besides being totally insensitive to the mountain ecosystem, focus on the symptoms rather than on the basic processes associated with mountain specificities and their interlinkages. In brief, the absence of the mountain perspective from development strategies has led to a paradox in development interventions, leading to their exacerbating rather than ameliorating poverty in mountainous regions.

Opportunities for Sustainable Mountain Agriculture

While the above-mentioned indicators of unsustainability pervade the Hindu Kush-Himalayan region and characterise mountain agriculture, some areas have also undergone rapid transformation thanks to the adoption and implementation of environmentally-benign and mountain-sensitive development strategies. The focus on mountain specific R & D, harnessing niches by focussing on high-value cash crops, and promoting agro-based cottage and off-farm employment are hallmarks of the development strategies being pursued in these areas. The adoption of high-value cash crop-based farming systems, which are compatible with mountain niches, has helped these areas in two ways. First, by converting the abundant marginal land into more productive land and harnessing local niches. Second, maintaining and improving the ecology and environment of the region in terms of promoting soil conservation and increasing soil fertility. Thus, contrary to popular beliefs and notions, the evidence from these areas suggests that the process of development and conservation of ecology and environment can be mutually supportive and reinforcing. In net terms, these areas have increasingly demonstrated the feasibility of minimising environment and development tradeoffs and the possibility of breaking cumulative causation between poverty and environmental degradation and, therefore, enhancing growth and sustainability linkages. The overall result has been the availability of a wider range of higher quality livelihood options leading to a better standard of living (Verma and Partap 1992; Shrestha and Yadav 1992; Koirala 1992).

The recognition and documentation of some important contributing factors facilitating the process of transformation; notwithstanding some essential features, such as understanding of the inter-systemic linkages, the implications of sustainability in terms of quality of life, equity aspects and the natural resource base, and factors and processes triggering the whole process; remain to be empirically studied and examined (Rana 1990 and Tiwari 1990).

Process of Option Enhancement

Option enhancement is a process of diversifying economic activities adopted by a household or a firm in order to improve its access to better living standards. Theoretically, a number of factors contribute towards the process of option enhancement; e.g., the availability of basic infrastructural facilities, levels of skill and knowledge, and environmental and market factors. It, however, is debatable whether the increase in livelihood options is caused by distress conditions or by affluence and an increase in incomes. In mountainous regions, households are

involved in diverse livelihood options such as crops, livestock, forestry, cottage industry, and so on. Many of these options are of low quality and yield extremely low levels of income, forcing the mountain people to adopt a number of activities. The number of activities may also be higher in the transformed areas, while the underlying dynamics are entirely different. For example, in these areas, additional activities are undertaken with a view to internalising the externalities; households specialising in horticulture may also keep cattle, adopt beekeeping and may also raise some crops. In contrast, the diverse activities pursued in the non-transformed areas are motivated by subsistence considerations; in these areas, households do not switch over to more productive livelihood options, hindered as they are by constraints such as the lack of food security, imperfect markets, lack of knowledge, risk associated with the high value cash crops, and lack of measures against the risk. In the absence of insurance against risk, the primary means available to farmers to ensure food security are those of diversifying their sources of income and accumulating assets which can be quickly liquidated (Evans and Nagu 1991, pp 519-545).

A comparison of the above-mentioned two scenarios – transformed and non-transformed – and an understanding of the process of expanding livelihood options, factors, and processes contributing towards this process can provide useful policy insights for devising developmental interventions to improve the quality of life of the mountain people. The factors and processes facilitating this switching over to high quality production options and their implications for sustainability need to be studied and understood more thoroughly. There may be trade-offs, e.g., new options may not only involve the use of chemical fertilizers and reduce the pressure on local resources, but may also cause degradation of soils and, ultimately, result in non-sustainability in the long run. Not much is known about these trade-offs in terms of their impact on natural resources and household decisions and priorities. Also, not much is known concerning how, in the process of decision-making, households perceive the needs of future generations and environmental protection. It is against this background that the present study is being undertaken. More precisely, the objectives of the study are as follow.

Objectives

- (i) To prepare an inventory of livelihood options and to screen these options for their range and quality
- (ii) To assess the above options for their sustainability, their long-term implications for the natural resource base, quality of life, and equity aspects
- (iii) To identify factors and mechanisms underlying a sustainable process of substitution and replacement and addition of livelihood options for mountain farming households with a view to identifying replicable components.

Hypotheses

Consistent with the objectives of the study, it is proposed to test the following hypotheses empirically.

- (i) The poorer the households in terms of asset holding, skills, and literacy, the greater the preference for a large number of livelihood options; the quality of livelihood options vary inversely with the range of options. Subsistence farmers are guided by risk minimisation strategies in the process of replacement, substitution, and addition to livelihood options.
- (ii) Households focus on a minimum range of livelihood options to meet their subsistence needs while adopting higher quality options.
- (iii) Introduction of new and high quality livelihood options and harnessing niche, or comparative advantages, of mountainous regions are dependent on the availability of basic infrastructural facilities such as roads, production knowhow, markets, basic inputs, and so on.
- (iv) In the transformed areas, households endowed with better knowledge, skills, and higher standards of living are more informed about the sustainability issues and the need to protect the natural resource base to meet the needs of future generations. These perceptions vary between different categories of household. Subsistence and resource poor households are primarily concerned with meeting their present needs.
- (v) In the process of transformation, consistent with mountain specificities, some endogenous factors expressly operating on the demand side, such as improvement in human resources, reduction in family size, changes in the composition and number of animals coupled with changes in rearing practices, e.g., switching over from grazing to stall feeding, increasing substitution of natural resources with synthetic resources, and increased occupational diversification in favour of secondary and tertiary sectors lessening the pressure on natural resources. This augurs well for the sustainability of mountain agriculture.

The study runs into seven chapters. The following chapter delineates the methodology applied in conducting the study. The salient socioeconomic features of sample households are described in Chapter Three. Chapter Four documents and screens different livelihood options for their range. It further examines their quality in terms of income, employment, and per day, per worker earnings and their intersystemic linkages. Implications of diverse livelihood options in the context of sustainability vis-a-vis ecology, the natural resource base, quality of life, and equity aspects are analysed in Chapter Five. Chapter Six delineates the factors and processes underlying the ongoing sustainable process of substitution, replacement, and addition to livelihood options. The main conclusions and policy implications emanating from the study are given in Chapter Seven.