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# Alternative approaches to enhancing small-scale livelihoods and natural resources management in marginal areas in monsoon Asia: A synthesis

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## Introduction

Marginal areas are distinguished by extreme environmental stresses (e.g., extreme climate, highly dissected terrain and fractured rocks, steep slope, depleted soils, recurrent drought/flood), poor infrastructure and government services, lack of modern technologies and poor access to market. Looked in terms of socio-economic indicators of development, communities inhabiting marginal areas are invariably much less developed as compared to the mainstream

communities. However, marginal areas may be substantially richer in terms of natural resource capital and ecosystem services as compared to the mainstream regions.

Monsoon climate (derived from the Arabic word *mausim*) which is largely confined to the Indian subcontinent and east and south-east Asia, is distinguished by a characteristic reversal of high winds and precipitation during the year. This reversal, expressed as wet summer and dry winter season, results from three physical mechanisms: (a) differential heating between the land and oceans (b) cariolis forces due to the rotation of the earth, and (c) the role of water which stores and releases energy when it changes from liquid to vapour and back. Though annual rainfall in monsoon climate is not very high, cloud-burst during a short spell of time may cause severe damage to human life and assets. Dry periods during some years may be such that crop and livestock productivity are drastically reduced. Uncertainty, variability and extreme climatic events associated with monsoon are an important factor contributing to marginality in a vast region of Asia.

Improving livelihoods in marginal area is pressing, but application of the conventional development models may not be feasible. In addition, marginal areas are so diverse and complex that conventional developmental models are not likely to succeed. Designing and implementing innovative approaches, which enhance local livelihoods together with conservation and sustainable use of natural resources, is a challenge to scientists as well as development practitioners.

This article provides a synthesis of presentations and discussions on potential approaches to livelihood development in the marginal areas, including livelihood options, management of biological diversity and forest resources, and upscaling farmer' technology, and institutional innovations in an international symposium with special reference to Monsoon Asia.

**Land use –land cover dynamics - global change**

Land use –land cover change is a global change phenomenon with significant ecological and socio-economic consequences. Spatio-temporal patterns and implications of such changes are determined by a complex interaction of environmental, social, economic and

policy factors. Two broad categories of land use – land cover change could be distinguished: (a) very prominent/radical changes commonly referred to as land use-land cover conversion, e.g., deforestation, urbanization, industrialization and, (b) less prominent or finer changes commonly referred to as land use-land cover modification, e.g., changes in cropping pattern and management practices within agricultural land use or species composition within forest ecosystems.

*Deforestation*

Deforestation has been a widespread land use – land cover change in marginal areas. Thailand and Lao PDR lost more than 30% of their forest cover during the last forty years (Ando - Chapter 9; Bounthong et al. – Chapter 17). Differing from the common trend of continued deforestation in many countries, a country like Korea has been able to reestablish forests in areas deforested in the past (Kim and Kim – Chapter 11).

Deforestation in uplands has severe adverse consequences not only for the upland people but also for many more living in the adjoining lowlands, which receive run-off and sediments from the uplands. If land use intensification fails to set off with increase in human population, conversion of forests for agricultural land use is bound to occur to meet growing food demands. As scope of extension of agriculture in lowlands is very limited, conversion of forests to agricultural land use is likely to be concentrated in the hilly region (Doanh and Tuan - Chapter 16). Significant social, economic and environmental costs could be incurred in attempts for extending intensive agriculture into these sensitive areas.

Population pressure is an important driver of deforestation but socio-economic and policy factors seem to be equally or even more crucial in determining the rates of deforestation. In uplands of Thailand, conversion of forests to agricultural land use seems to be largely because of policies providing financial support for farming (e.g., subsidy for construction of irrigation ponds), granting cultivation/property rights on forest land cultivated by people without seeking any legal permission and excluding farmers from paying any tax for agricultural land use (Ando – Chapter 9). Maharjan (Chapter 18) argues that restrictions on traditional community participation and weak institutional settings during 1957-1990 period seem to have encouraged unsustainable ways of forest resource uses

in Nepal. Stress on shrimp farming resulted in significant loss of mangrove forests in south-east Asia (Tabuchi – Chapter 12).

Factors restraining conversion of forests to agriculture do exist. The presence of American unexploded ordnance (UXO) on about half of the land surface, the legacy of 1964-1975 conflict, is a fearsome deterrent to expansion of agricultural land use in Lao PDR. Yet, more than 200 people lose their life because of ordnance remains every year (Bounthong et al. – Chapter 17). Policies restricting agriculture in forest land have been adopted but are likely to succeed only if such restrictions do not have negative impacts on local livelihoods (Bounthong et al. - Chapter 17). Restrictions, such as that on fuelwood collection from forests may force marginal farmers to burn dung-cakes to meet their energy needs which implies depletion of soil fertility in agroecosystems over a period of time (Maharjan – Chapter 18). Thus, restricting forest resource uses may promote forest conservation but at the cost of environmental degradation outside forest ecosystems. Restricting uses of forest resources together with providing alternatives to forest based traditional requirements of people can only ensure conservation/enhancement of forest resources (Kim and Kim – Chapter 11).

**Changes in agroecosystems and crop diversity**

Traditional farming systems are invariably characterised by a high level of diversification in terms of both agroecosystem diversity (i.e., the variety of agroecosystems maintained by a household or in a village) and crop/cultivar diversity (i.e., the number of crops or cultivars grown by the farmers). Farming system types very often differ more in terms of relative proportion of different agroecosystem/ natural ecosystem types than in terms of presence or absence of a given type of agricultural practice. Thus, home gardens are common to practically all kinds of farming systems in marginal areas but are not as conspicuous in forest-rich areas as in forest-poor areas (Bounthong et al. – Chapter 17). Diversification is viewed as a mechanism of coping up with environmental heteorogeneity and uncertainty, and isolation. Biodiversity is considered as an asset by the traditional communities. Changes in domesticated biodiversity since recent past is a widespread, but magnitude of the changes, driving factors and impacts vary depending upon the ecological,

technological, socio-economic and technological factors. The changes could be induced by policy interventions such as restrictions on opium cultivation and shifting cultivation, encouraging highlanders to settle in lowlands (Bounthong et al. - Chapter 17; Hoshikawa – Chapter 7) and government subsidy on inputs required for cash crops (Yakoyama and Gauchan – Chapter 14 ) or socio-cultural forces or both. Saxena et al. (Chapter 6) explain expansion of cash crops in Indian Himalayan mountain region due to multiple factors including a socio-cultural change from subsistence to market economy, comparative ecological advantages for cash crops in hills, changing food habits and supply of food grains at subsidized price by government.

**Land use – land cover change: implications for natural resources and livelihoods**

Land use-land cover changes over a period of time accompany changes in other spheres, which may not be desirable from the point of environmental sustainability or socio-economic equity. By and large, farmers substantially benefit economically by agricultural land use expansion and/or replacing traditional food crops by cash crops but at the cost of increased vulnerability to climatic and market uncertainties. Abandonment of traditional crops/cultivars means a loss of agrobiodiversity that remains 'lesser known' or 'unknown' to wider communities and associated indigenous technologies and knowledge.

As illustrated by Shigeki Yokoyama and Gauchan (Chapter 14) orange cultivation promoted by the government in Nepal increased labor productivity but at the cost of increased inequity within village communities and increased dependence on hired labor. Replacement of traditional staple food crops by cash crop sugarcane in Thailand accompanied an increase in dependence on external inputs driving majority of farmers into debt and forcing outmigration of some family members far away in urban areas to get cash required for procuring agricultural inputs (Ando- Chapter 9).

Stress on cash crops and market seems to have depleted environmental and social capital in some cases. Studies carried out by Goto in Indonesia reveal (Chapter 8) that Gotong royong, the traditional system of mutual help (labor exchange without payment), vanished following expansion of cash crops and maximization of profit

motive. Changes in crop diversity in the Indian Himalayan region are such that fodder yield from farmland has reduced and rate of manure input increased which implies more threats to forests arising from higher rates of removal forest biomass with fodder and manure value. There are a few isolated pockets where a change from subsistence to market economy progressed without any significant loss of crop diversity or depletion of social and environmental capital (Saxena et al. – Chapter 6).

A change from subsistence to market economy brings in new kinds of human relations such as Green Sale Contract (small farmers selling their sugarcane crop to large farmers who arrange all external inputs). As farmers, on their own, have very little information about technologies and marketing related to cash crops, they become a part of human network to gain new knowledge and to successfully supply the farm produce in the market. In a network, the merchant may be viewed as a manager who makes strategic decisions, while the farmers more like laborers. Yet, this relationship provides some security to resource poor farmers (Ando – Chapter 9; Saxena et al. - Chapter 6). Goto concludes that market-oriented farming was certainly not an ideal solution for every household to improve its income (Chapter 8). This is supported from the fact that in spite of significant expansion of area under highly valuable rice cultivars in north-east Thailand, rice accounts for only 2% of income of farmers and monetary input-output relations are such that paddy system is sustained with support from off-farm jobs to farmers (Miyagawa – Chapter 5).

**Indigenous technologies**

Marginal farmers through trial and error experiences have evolved a variety of technologies enabling their survival in difficult areas. Agricultural technologies such as terracing, manuring, mulching and rotation of cereals/millets-legumes in time and space are common among ethnically/geographically isolated communities. Nevertheless, some innovations seem to be restricted to specific communities or specific regions.

Age-old traditional practices have often been neglected in this modernizing world. Yet, many traditional practices have been sustained as such or improved by people themselves over generations and hence may provide insights for developing sustainable practices

in the present scenario (Maharjan – Chapter 18; Saxena et al. – Chapter 6). The potential of indigenous practices is reflected from the reports on higher yields under low input- traditional agriculture compared to the high input-modern agriculture (Verapattananirund - Chapter 13; Saxena et al.- Chapter 6). However, this strength of indigenous knowledge cannot be generalised too far. There are many marginal areas like north-east Thailand where yields of traditional crops are quite low. Nevertheless, farmers here developed technologies adapted to the environmental constraints (Miyagawa – Chapter 5). Doanh and Tuan (Chapter 16) illustrate how Vietnamese farmers get some yields from cat-ear rock region where soil is almost absent and rock-pieces are so sharp that people, if not very careful, could be easily injured.

Farmers in Lao PDR evolved a shifting cultivation system that provides useful products not only during cropping period but also during fallow period. While rice was the major product of cropping phase, farmers benefited from *Styhrax tonkinensis*, a dominant species of fallow phase, by way of selling benzoin available from this tree (Takeda - Chapter 10). Some upland farmers in Thailand maintained small patches of 'agroforest edges', which are so species rich that farmers get one or the other product(s) throughout the year. This suggests that much of biodiversity could be conserved in agricultural landscapes without any trade-off to crop yields (Rerkasem and Rerkasem - Chapter 4). Even at present, instead of waiting for government agencies to "give or improve livelihoods," people are evolving their own development strategies, though frequency and success of such efforts are very limited (Bonuthnong et al. – Chapter 17). Realising the inappropriateness of shifting cultivation in the present circumstances, some local communities have resorted to permanent agricultural system by themselves (Rerkasem and Rerkasem – Chapter 4)

Yet, traditional practices like slash and burn agriculture or rainfed settled agriculture are not the 'best options' in the present socio-economic and environmental conditions. Realizing the adverse consequences of global warming, it becomes pertinent to stop burning and make the best use of crop and natural vegetation residues to improve soil fertility. As pointed out by Morinaga (Chapter 15), traditional citrus cultivation is a highly laborious occupation and it is

on decline because of the emerging tendency of getting away from the labor intensive production system in the younger generations. Traditional lopping and manuring practices observed in the Indian Himalayan region have been found to be inappropriate to some extent (Saxena et al. - Chapter 6)

Seemingly, traditional agriculture was sustainable till population pressure was low and ultimate goal of agriculture was to achieve local production based food security. With progression of integration of marginal communities with the mainstream market, profit maximization gets more and more attention compared to other social and environmental developmental goals. The overall outcome of this change is visible in terms of land degradation and decimation of both domesticated and wild biodiversity in spite of some bright spots where the trade-off is avoided.

**Introduced technologies**

Technologies introduced in the marginal areas to accelerate the pace of environmental and socio-economic development have, by and large, met with limited success. This failure stemmed from incompatibility between the introduced technologies and environmental and socio-economic conditions prevailing in marginal areas. For example, mechanical and engineering techniques of erosion control have been widely promoted in the mountain regions but have, by and large, failed. Measures for reducing soil erosion and maintenance/improvement of soil fertility should be such that food production, animal husbandry and forestry sub-systems are properly integrated in the landscape (Doanh and Tuan - Chapter 16). Even some of the classical explanations about soil erosion need to be revised. Differing from the common concept, Doanh and Tuan pointed out that soil erosion could be more because of detachment of soil particles caused by kinetic energy of raindrops than by run-off (Chapter 16). Large pebbles, whose dominance is viewed as an indicator of low soil quality conventionally, may be advantageous in that they tend to reduce soil erosion (Hoshikawa – Chapter 7)

A significant area of land has been degraded in the past because of various reasons. Rehabilitation of degraded ecosystems is urgently needed. However, to ensure flow of benefits from rehabilitation over a long period of time, it is necessary that

rehabilitation is viewed as a component of landscape management rather than as an independent task and it satisfies the needs and priorities of the people (Kim and Kim – Chapter 11; Saxena et al. – Chapter 6). As pointed out Tabuchi (Chapter 10), mangrove plantation technologies were so efficient that average tree height of 8-10 m was achieved over a ten year period. However, as there were no plans for sustainable use and conservation of rehabilitated areas, rehabilitated areas were again degraded because of unsustainable extractions by local people. Biotechnology also offers immense scope of improving agricultural and forestry production system but its application has yet to take off in marginal areas in developing countries (Zakri – Chapter 2).

**Appropriate technologies**

Traditional technologies and management practices have very often been assumed to be deficient in all respect without any evaluation and this perception often leads to attempts that tend to replace traditional practices by altogether new ones. Looking at the impacts of new technologies, it seems more logical to improve and not replace traditional practices (Bounthong et al. - Chapter 17; Verapattananirund - Chapter 13; Saxena et al. - Chapter 6). The poor people are often drawn more towards their rapid economic development than towards global benefits from environmental conservation. Appropriateness or suitability of a given technology needs to be determined by an integrated consideration of efficiency, economic viability and environmental suitability of the technology within the context of people's needs, preferences and capacity. Overcoming the weaknesses of indigenous practices with appropriate scientific and institutional inputs would be one approach to development of appropriate technologies. An appreciation of positive dimensions of indigenous knowledge and practices can drastically reduce the cost of introduction and replication of technology in marginal areas. Huge variation in environmental and socio-economic features in the mountains demands location specific rehabilitation packages.

Rehabilitation of degraded ecosystems will be a prerequisite to arrest the ongoing environmental degradation and its adverse consequences on livelihoods. Tabuchi (Chapter 12) gives an example

of successful plantation raised by Charcoal kiln owners in Samut Songkhram Province near Bangkok in degraded mangrove ecosystems. However, rehabilitation is a costly and risky affair and external support will be essential for successful rehabilitation in marginal areas because of limited scope of indigenous people and their capacity to identify and implement appropriate technologies. Rehabilitation strategies built on local capacity and needs in mountain region are dealt in Chapter 7. Morinaga (Chapter 15) illustrates how technological solutions to people's problems could improve traditional citrus production system and local livelihoods in uplands of Japan.

Isolation and poor communication among local communities have restrained spread of 'the best practices' in marginal areas. Crop-legume combination adopted by a given community might not be the 'best' one. Facilitation of communication among traditional isolated communities and scientific evaluation of different crop-legume combinations may improve productivity and sustainability of traditional agroecosystems. This is exemplified by a very significant increase in plum yield and quality as result of introduction of a legume of south American origin (*Arachis pintoi*) in Vietnam by Doanh and Tuan (Chapter 16). Similarly, highly productive homegardens in Sri Lanka and Java could provide ways of improving productivity of home gardens elsewhere (Bounthong - Chapter 17).

**Policies**

Policies seem to be the ultimate factors determining spatio-temporal patterns of natural resource dynamics in relation to livelihoods. Policy interventions in marginal areas are relatively recent as compared to the mainstream developed areas. Switching over from small scale subsistence economy to large scale commercial/ market economy is perhaps a natural change with humans but policies very often regulate the rate of this change.

Development interventions are mostly introduced through time-bound projects and rarely continue/expand after project period. Policies should be such that development interventions should get internalized as a component of people's way of life. This demands active participation of local communities in policy formulation, implementation and monitoring process (Maharjan – Chapter 18; Goto

– Chapter 8). Verapattananirund has brought out the untapped potential of farmer's knowledge and capacity in agriculture sector (Chapter – Chapter 13) and Maharjan in forestry sector (Chapter - Chapter 18).

Winarto (Chapter 20) has very elegantly brought out that policies should ensure that appropriate knowledge is also transferred to the people whenever new or improved technologies are provided to people. Policies should empower farmers to move from a marginal position to a stronger position in the society by improving their capacity and not be depending exclusively on development agencies or grants. Amalgamation of the new knowledge with the existing cultural (shared) knowledge may foster its quick and wider dissemination.

In marginal regions, crop husbandry, animal husbandry and forests are interlinked production systems influencing livelihood of local communities. Policies, which do not address the social-economic-environmental linkages in the landscape, may fail to promote equity and environmental sustainability together with economic development in the long term. To illustrate, Maharjan points out that since the policy of providing subsidy for tree plantation did not take into account the opportunities and constraints of planting trees with different caste groups, all socio-economic groups within a village community did not benefit equally from this policy (Maharjan - Chpater 18). Small-scale farmers in Asia are now confronted with problems arising from policies restricting shifting cultivation to achieve the goal of conservation of forests. Forest land-allocation policy of the government of Laos is such that shifting cultivation cycles longer than 4 years are not feasible. As growth and regeneration of benzoin producing tree, a source of supplementary income, is not feasible under such short cycles, the land allocation policy seems to have contributed to forest conservation but not to enhancement of local livelihoods. A change in policy that enables income to people from shade loving species yielding economically important non-timber forest products is likely to be appreciated by people (Takeda - Chapter 10). Restrictions on traditional forest resource uses will achieve the goal of forest conservation only when alternatives to traditional uses are provided to the people (Kim and Kim – Chapter 11; Takeda - Chapter 10).

China stands out in that rural economic reforms beginning in the late 1970s in this country have drastically reduced percentage of people living below poverty line in the country. With decrease in area available for farming and disadvantages faced by small farmers, scope of increasing household income form agriculture is getting more and more limited. Zhang (Chapter 19) argues that policies favoring migration from rural to urban areas in China enable improvement in rural household income such that farmers' dependence on land and natural resources is reduced. Such a scenario is likely to contribute to conservation and sustainable use of natural resources in the long-run. This argument, however, needs to be tested. Environmental services such as recreation, air purification, water conservation, soil outflow prevention, soil collapse prevention and wildlife habitat provision are getting more and more attention in policy making process. Korea stands out as an example which has succeeded in recuperating forests in degraded lands at a very fast pace, has adopted a policy of undertaking economic valuation of forest ecosystem services at regular interval and promoted ecotourism such that environmental conservation was promoted outside national parks (Kim and Kim - Chapter 11).

**Conclusions**

Deforestation, loss of biodiversity, declining farm productivity, hydrological imbalance and soil erosion are interconnected problems related to natural resources, with significant implications for sustainable development. Livelihood problems in marginal areas may be because of natural resource or severe constraints in realisation of potential benefits from the natural resources. Poor economy in marginal areas may lead to environmental degradation and conversely environmental degradation may aggravate poverty. This vicious circle of environmental degradation and poverty is a threat to the potential global environmental benefits from many areas which happen to be marginal from the point of view of socio-economic development but very rich and crucial in terms of natural resources (e.g., megadiversity countries, biodiversity hotspots, headwaters and inaccessible mountain regions).

It is because of interconnectedness of several problems that sectorial approaches to mitigate a given problem aggravate other

problems or creates new problems. The holistic approach thus looks for analysis and resolution of a 'problem-complex' or multiple problems. Local communities traditionally tuned to subsistence economy inhabiting marginal areas, with passage of time, are getting more and more integrated with the market. This integration provides new livelihood or economic development opportunities but at the same time new problems. The challenge in all marginal areas is to develop and implement technologies and institutions that foster enhancement of local livelihoods, improvement in economy, equity and environmental conservation as an integrated goal. The synthesis given above brings out that, while depletion of natural resources and deterioration of livelihoods in marginal areas are widespread, examples, though isolated and less common, of environmentally sound socio-economic development do exist. Such 'win-win options' need to be improved and disseminated by improving upon the related scientific and technological knowledge base together with an improvement in institutional arrangements for promoting environmentally sound socio-economic development.