

ECONOMICS, ECOLOGY AND THE ENVIRONMENT

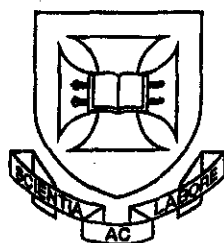
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**Co-Evolution in Asia, Markets
and Globalization**

by

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CO-EVOLUTION IN ASIA, MARKETS AND GLOBALIZATION

Abstract

Economic, social and natural environmental systems are interdependent, and economic systems cannot be assessed in isolation from an interconnected whole. Many parts of Asia face increasing market intrusion and forced changes in economic mechanisms and rights without concomitant social and technological co-evolution. Consequently, serious problems for economic, social and environmental sustainability are being experienced by local communities, especially in remote regions and in peripheral areas such as Northeast India and in hilly regions of China. Rapid Asian economic growth, extension of markets and processes of globalization are generating social tensions and magnifying stresses on natural environments. Many subsistence and semi-subsistence communities have been suddenly confronted by the extension of markets and the backwash of globalization. This has promoted uneven development, loss of community, disintegration of social structures which have supported economic mutualism and which have provided social safety nets. In many cases too, natural resource bases and environments on which local communities depend for their livelihood are under threat, partly because systems of property rights and governance evolve slowly and externally imposed changes in these are often counterproductive. This is illustrated by examples from Northeast India and China involving slash-and-burn agriculture. Factors which may cause regional and social economic divergence in Asia in this globalizing world are discussed. These include differential access to global knowledge and communication networks. Urban and cosmopolitan communities probably stand to gain most from globalization processes.

1. Introduction

The evolution of holistic systems (such as those involving the social, economic, technological and environmental spheres) is complex. If there is a great disparity in the rate of change of the subsystems (for example, if economic or technological change outpaces social or institutional development), this can result in disaster for societies and the natural environment. For instance, rapid expansion in the demand for natural resources (due to increased market access and globalization) can result in their inappropriate exhaustion if they remain open-access property. Or the speedy introduction of new technologies which considerably lower the costs of exploiting such resources can have a similar effect. Disastrous consequences are also possible in other cases, e.g., where communal rules apply but they have not had time to evolve to fit the new circumstance. Even in the case of private property, new technologies can threaten

sustainability if they engender large unfavourable externalities and policy measures are not adopted quickly to control these externalities.

Socio-economic structures undergo continual variation often at differential rates in different communities. Consequently, we find communities in varied stages of socio-economic development and transition from one socio-economic system to another. In the economic development process, communities may pass through a number of phases characterised by the following:

- (1) Hunting and gathering.
- (2) Shifting agriculture.
- (3) Settled agriculture.
- (4) Settled agriculture combined with urbanised and industrial societies, mostly market-based.
- (5) As in (4), but information-intensive economies dominated by tertiary industries and heavily dependent on market systems of a global nature.

While hunter-and-gatherer communities are now very rare in Asia, communities of the above type are all present in Asia, sometimes even within the one country as in India or in China.

Asia has rapidly become enmeshed in the global economy and there are pressures on it to extend its involvement in the globalization process and to increase its use of market systems even further than at present (e.g., through APEC, the structural adjustment policies advocated by the IMF and the World Bank). Such rapid change is generating social turbulence especially in remote communities 'low' on the socio-economic development ladder. Increasing market intrusion and exogenously imposed alterations in economic mechanisms and rights without concomitant social and technological evolution can create serious problems for economic, social

and environmental sustainability of local communities in remote or peripheral regions such as in Northeast India or in some mountainous parts of China, e.g., Yunnan. This is especially so for those agricultural communities which still depend heavily on slash-and-burn agriculture.

This article first of all considers in relation to the Asia economic sustainability and related aspects of sustainability in the light of the endogenous innovation hypothesis of Scherr and Hazell (1994). Scherr and Hazell take a relatively optimistic view of the prospects for sustainable agricultural development on fragile lands when either increased population densities or extensions of markets (which increase market demand) occur. This is discussed generally in the Asian context and then with particular reference to the Mizos in Northeast India and to the Jingpo in Southwest China. Then follows a general discussion of the consequences of rural communities of extension of markets and globalization, giving particular attention to its impacts on income levels and the distribution of income, security, stability of incomes and their sustainability. In conclusion some policy implications are highlighted.

2. The Agricultural Sustainability Hypothesis of Scherr and Hazell

Scherr and Hazell (1994) are relatively optimistic about the prospects for sustainable agricultural development on marginal or fragile lands. They believe that while increasing population densities and rising market demand may initially result in resource degradations, this process eventually induces agricultural innovation and investment in land improvement. Consequently, although the total supply of services and products available from natural resources in land may decline at first, subsequently, it rises and is likely to exceed eventually its initial level. Their typical pattern of agricultural development/natural resource-use is indicated by the curve marked I in Figure 1. They divide this pattern into the four phases indicated in Figure 1:

A - Dependence on naturally-occurring resources (e.g., natural woodlands;

management of natural vegetation).

- B - Resource degradation (e.g. deforestation).
- C - Resource rehabilitation and transition to intensive management (e.g., tree planing on farms, regulation of communal woodlands).
- D - Dependence on human-managed resources (e.g., agroforestry, forest plantations, managed reserves).

While Scherr and Hazell believe that the pattern of natural resources development indicated in Figure 1 is most common, they do not dismiss other possibilities. In some cases, the induced recovery phase (C) may be later than expected or it could even fail to materialize at all, if for example, there were serious impediments to the creation of private property rights in land.

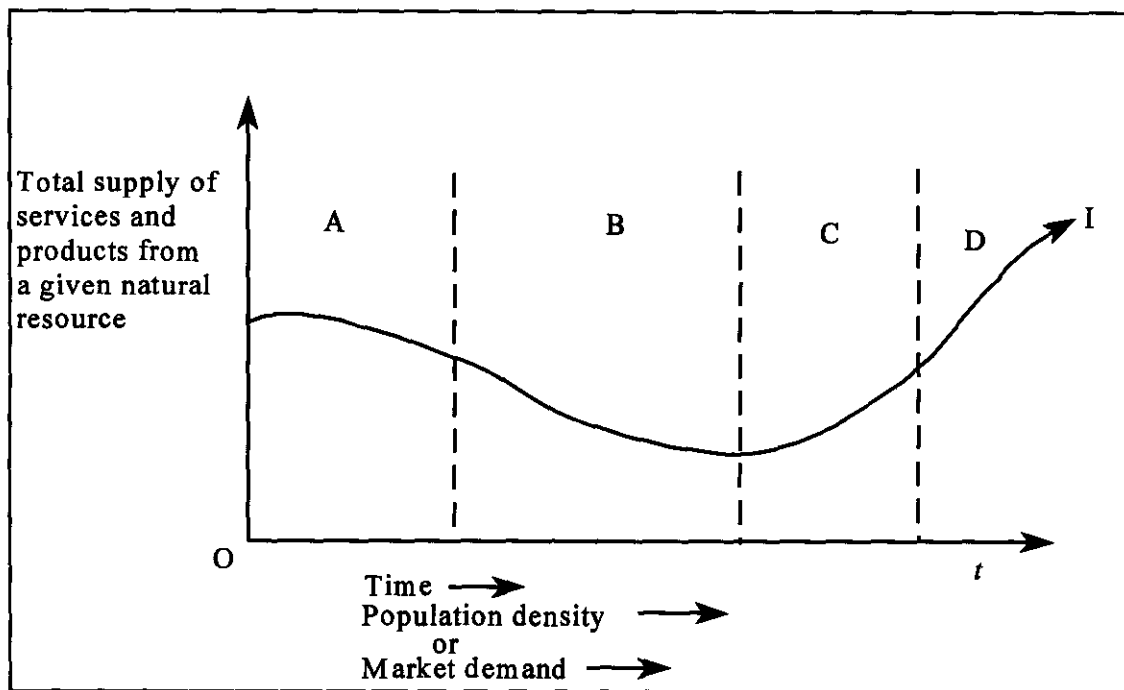


Figure 1 Typical path to the sustainable use of natural resources associated with agricultural intensification according to Scherr and Hazell (1994).

There may, in addition, be other circumstances in which recovery from land degradation

can fail to occur. For example, land degradation may proceed so far that no surplus is available to the local community to invest in natural resource enhancement or the returns to such enhancement after severe land degradation may be very low or even negative. In these circumstances, population density in the marginal agricultural region may be controlled by Malthusian factors or by out-migration, or both. Again, it is possible that induced innovation may not eventuate because the choice of innovations is extremely limited due to lack of research and alternative technologies for the marginal area involved. While induced innovation may not happen because of the ignorance of local communities, this is not the only reason for the absence of the response predicted by Scherr and Hazell.

Failure of property rights to evolve in a manner which permits private investment or innovation to be profitable, can also impede natural resource recovery. Where shifting agriculture is practised and plots of land are communally reallocated each time a shift is made, individuals have little or no incentive to invest in land improvements since they are unlikely to be the beneficiaries of such investment. They can be expected to take a short-term perspective in exploiting land. This is so even though the land is communal property rather than open-access property.

North (1981; 1990), Demsetz (1968), Feder (1987), Feder and Feeney (1991) and others suggest that with increased demand for the produce of land (other things equal) ownership of land evolves towards private property. While this seems to be so, it may only happen slowly and over a long-period of time and with considerable social conflict. Very rapid or shock penetration of market systems into local communities with limited pre-existing market systems can precipitate severe resource degradation from which recovery is impossible, lead to much income inequality and poverty in local communities and block induced innovation of the type envisaged

by Scherr and Hazell.

The speed and nature of change, as well as its direction are important. It is all very well to extol market systems on the basis of the reputed qualities in *equilibrium*, but from the point of view of human welfare and policy, the transition should not be ignored, not only because the nature of transition has important social consequences in itself, but is likely to influence future 'resting points' because of path-dependence.

While very rapid exposure of a local community to markets and globalizing processes may prevent the community from following a desirable development path, extremely gradualistic change might have a similar impact. This may occur because such change does not evoke sufficient challenges to the community at any point to generate adjustment responses which induce appropriate types of institutional change or investment in land improvements. A response is more likely to be evoked by discontinuous but not overwhelming variation. This may enhance community perception of the presence of change¹, may temporarily cause outcomes to fall below aspiration levels and therefore induce search behaviour both for new institutions and for new technologies².

The above suggests that neoclassical economists who mostly rely on equilibrium models are in a poor position to provide policy-advice about the best methods of transition of non-market economies to market economies. Their 'big-bang' policy recommendation is crude and inappropriate and shows a failure to study paths of transition. Nevertheless, it is possible that the extremely gradualistic exposure of a community to markets and globalizing forces would not yield the best results either. Greater study of such issues involving co-evolution is needed.

Returning to the Scherr and Hazell model, the way in which they specify the total supply of services and products from a given natural resource calls for comment. This is because it is

unclear how in fact they specify it. This is a serious problem for their model (Figure 1). Furthermore, even the increase in their market-demand variable may be difficult to specify because with the expansion of markets, the demand for some commodities usually increases and that for others declines.

Certainly stage D of the process envisaged by Scherr and Hazell (Figure 1) may involve retention of few of the original natural resources of an area and the process may exhibit a considerable reduction in biodiversity compared to stage A. Nevertheless, in stage D there could be more tree-cover than in stage A, e.g., irrigated fruit trees on previous desert land. However, in this case there has been considerable substitution of produced capital for natural capital. While this may improve a local environment from a human perspective, on a macro-scale such substitution may be problematical from a sustainability point of view.

3. Experiences of the Tribal People in Northeast India and Jingpo in China

A number of tribal people in India and some in China, such as the Jingpo, practise slash-and-burn agriculture. It is estimated that worldwide about 300-500 million people engage in this type of agriculture. Over recent centuries, slash-and-burn agriculture disappeared in many countries as market economies developed within them. In these cases, either transition to settled agriculture has occurred or previously farmed marginal areas have been abandoned to become wasteland and/or allowed to revert to forest or scrub. This has been a common pattern in Europe. Such changes in Europe were accompanied by outward rural migration to urban centres and migration to overseas countries colonized by Europeans. These variations occurred over several centuries, whereas in Asia, the pressure for change in slash-and-burn communities on marginal land appears to have been telescoped into a few decades.

Here I shall concentrate on the experiences of the Mizos of Mizoram in Northeast India

and the Jingpo, mostly located in Dehong Prefecture in Yunnan. Both practise slash-and-burn agriculture.

The Mizos (the dominant group in Mizoram) are located mainly in the northern section of Mizoram. Mizoram itself forms a wedge between Bangladesh and Myanmar. The Chackmas are located in the south of Mizoram and in the Chittagong Hill Tracts of Bangladesh and also practise shifting agriculture. The Chackmas appear to be under political pressure for control of their resources both from the Mizos and the Bangladeshis. Mizoram is mountainous and deeply dissected by rivers or streams and transportation is difficult. Its soils are of low productivity, and its terrain makes access to markets difficult.

The population of Mizoram has increased rapidly (its exponential growth rate in the period 1981-91 was 3.34%) and with improved road transport and some growth in urbanisation in Mizoram market possibilities for agricultural produce have increased, as well as the range of products (e.g., radios, musical players) available for purchase. The latter (increased range of manufactures) has most likely raised income aspirations. The consequence is that fallow periods for land subject to slash-and-burn have become shorter, often as short as 4-5 years. This has several consequences:

- (1) Annual yields on cultivated land have fallen because the length of the fallow-period has shortened making it less adequate to regenerate the fertility of the soil³. While falling annual yields per cultivated hectare can be compatible with rising total agricultural output, a point can be reached where total agricultural output declines due to the shortening fallow-periods⁴.
- (2) Reduced fallow-periods means that the same land is more frequently subject to soil disturbance and increasingly subject to erosion. This reduces the fertility of

the soil at a site and in the long-term may reduce soil-depth to such a low level that an area can no longer be cultivated.

- (3) In Mizoram, and elsewhere, at the same time as the fallow-period falls, the area under cultivation rises so adding to offsite adverse externalities from soil erosion and altered hydrological balance.
- (4) Landscapes alter and biodiversity loss accelerates due to some extent to extension of cultivation but mainly because the fallow-period is reduced and vegetation is unable to complete its previous biological succession of species.

In situations where the fallow-period is short, settled agriculture might offer better income and sustainability prospects if combined with conservation practice such as hedgerow and alley-cropping, agroforestry or the growing of fruit trees. Present systems of property rights often make transition to such agriculture impossible. Mizos shift from one area of cultivation to another as a village group each year. Land in each new cultivation area is allocated to families by means of a ballot. Hence, no family has permanent rights in any area of land and therefore no incentive to invest in the long-term conservation of land, or to plant perennials which would yield benefits beyond the period set aside for cultivation of an area by the village.

Systems of property of rights in Mizoram are altering slowly. Village councils appear to be reluctant to change the system of rights. Most of Mizoram seems to be trapped in phase B (the resource degradation phase) in the model of Scherr and Hazell (Figure 1). Population increase has not yet resulted in transition to more sustainable phases of agricultural development, and there is a risk of further land degradation occurring without recovery as cultivation cycles involved in slash-and-burn are reduced. Nevertheless, the institutional situation is not entirely static^{5,6}.

Around the capital of Mizoram, Aizawl, *de facto* private property rights in land are not uncommon because of the proximity of this land to the Aizawl market (Nath, personal communication, September, 1995). This land is often cultivated by day-workers trucked from Aizawl. This pattern of property rights is consistent with economic theories of property rights (Demsetz, 1968; North, 1981, 1990). Nevertheless, in remote areas and still in most of Mizoram, 'traditional' property rights in land remain, probably because opportunities for marketing farm produce are limited and insufficient to overcome social barriers to altering property rights.

The Government of Mizoram has introduced a New Land Use Policy (NLUP) in order to reduce shifting agriculture in Mizoram and to encourage forms of settled land use. The policies adopted are along the lines recommended by the (Indian) National Commission for Agriculture⁷. The clearing of forested land is prohibited in selected blocks and subsidies are provided for alternative employment in settled agriculture, animal husbandry and village trades, such as carpentry.

According to Lianzela (1995, p. 61), 'Selection of beneficiaries of NLUP has been done on the basis of household surveys conducted in villages covered by the programme. In the guidelines, precautionary measures are to be taken in respect of household selection and utilisation of funds. As the programme chiefly aims at lifting the rural poor, first priority is accorded to jhumia families [slash-and-burn agriculture in this part of India is called jhum] in the selection of beneficiaries. Households who are partly dependant on jhum cultivation are given second priority'.

In 1993-94, just over three-quarters of the subsidy (income supplements for participants in NLUP) was paid for agriculture and allied settled activities, a fifth for animal husbandry and less than five per cent for village-based occupations. Each family participating in NLUP is

provided with a small area of land (about 2 hectares)⁸ and is provided with an income supplement by instalments for three years. Land-uses and development plans are prescribed. Apart from a main occupation, e.g., wet rice cultivation, each family is allowed to engage in a subsidiary activity, e.g., the husbandry of pigs. Participants are therefore 'guided' by Government authorities.

Such authorities do not always offer economic options to participants in NLUP. For example, many families were encouraged to grow pineapples under NLUP only to find that there was an inadequate market for them. In political protest, they left the pineapples on roads so that vehicles would drive over them. Also one can question whether the emphasis on wet rice production with the aim of Mizoram achieving self-sufficiency in rice production is justified. Mizoram does not appear to have a comparative advantage in wet rice production. The goal of self-sufficiency on a statewide basis in India may make little economic sense, as in China.

Both the market prospects and the initial cash-flow difficulties can be a problem for those who give up slash-and-burn for settled agriculture. Nevertheless, even in the case of a switch to horticulture (tree crops), it is not an insuperable problem. In the village of Sesawng, I met in late 1995 with the village president and his wife, who had taken up land under NLUP to grow fruit trees. They had a mixed stand of bananas, jackfruit and mangoes. The latter had been intercropped with bananas which bear quickly and give an early cash return. Fruit from the other trees will follow on. They said that buyers (middlemen) came from Aizawl to purchase their bananas. They were pleased with the development of their enterprise and intended to develop the plot of the president's brother-in-law in a similar way.

The importance of market access is recognised under NLUP. Lianzela reports (1995, p. 62) that 'provision is made under the NLUP scheme for construction of motorable roads linking

the areas where various trades under agriculture sectors are implemented by the beneficiaries in a compact area for the transportation of their product'. Nevertheless, Lianzela (1995, pp. 62-63) remains sceptical about the NLUP programme because of political interference and shortcomings in supervision and monitoring which provide scope for dishonesty and non-compliance. Furthermore, only a few miles of road have been constructed under NLUP.

On the whole this transitional scheme seems to be gradualistic rather than a big-bang one. By the end of 1994 over 40,000 hectares of land was subject to NLUP assuming that each family involved (see Lianzela, 1995, p. 60) has 1-2 hectares in the scheme. Artificial fertilisers and improved seed varieties are being increasingly used in Mizoram and settled agriculture is becoming more common. Nevertheless, jhumming was still being widely practised in 1995 when I visited Mizoram. The fallow-period had been reduced to 4-5 years making jhumming a relatively unproductive form of land-use.

The agricultural practices of the Jingpo in China (and to some extent their experiences) are not unlike those of the Mizos. The Jingpo are mostly located in China in Dehong Prefecture in Yunnan near the Burmese border, with considerable numbers also being present in Myanmar. They have practised slash-and-burn cultivation in Dehong Prefecture for about six centuries, and probably migrated there from a Tibetan plateau (Yin, 1993). The Jingpo cultivate their land only for one year then shift to another woodland area that has been slashed-and-burnt to cultivate it for one year. Traditionally the land used to be left fallow for 11-12 years but now this has been reduced to 7-8 years because of increased population and because some of the forested land formerly used by the Jingpo has been put under the control of the Ministry of Forestry for timber extraction and for nature reserves. Mizo villagers in India also lost land in a similar way.

The Jingpos rotational agricultural system of slash-and-burn used to be quite economic

and sustainable. Now, however, shorter fallow-periods are making it less economic. Zhuge and Tisdell (1996) suggest that a new system should be developed to substitute for the old one, but good aspects of the existing system should be retained.

Changing property rights have affected the agricultural system of the Jingpo in China. In the early 1950s, the Government of the People's Republic of China nationalised almost all lands, minerals and forests in China. It (1) took over the state lands and forests of the previous government, and (2) nationalised virgin soil and forests and private forests if they were over 500 mu, about 33.3 hectares. Small, broken and scattered lands and forests and forests of landlords were allocated to local communities (Zhuge and Tisdell, 1996).

Thus, legally only very small areas of forested land remained under the control of local communities. It therefore became impossible for the Jingpos to legally continue with their past agricultural practices and they entered the twilight zone of illegality in continuing with these. There were sharp conflicts between the Jingpos and the state authorities with some concessions being made to the Jingpos. Nevertheless, conflict is still present because the Jingpos have insufficient arable land and forest land for slash-and-burn agriculture. Because of uncertainty of property rights and other factors, deforestation in Dehong Prefecture has been severe (Zhuge and Tisdell, 1996, p. 15).

Zhuge and Tisdell (1996, p. 15) state that, 'Adequate land and forest tenures are at the core of community development in the Jingpo areas. The development of the Jingpo community should stress the conscious participation of the local people in the use of such resources. Clearer property rights in land and forest resources and rights or manage these will motivate local communities and villages to take better care of these resources. The present policy of land leasing gives a good beginning for reducing conflicts. According to the new land policy of the

‘Transfer of Four Types of Wastes on Lease’, the wastelands, barren mountains, flood lands and unused water resources, whether state owned or belonging to the collective will be shifted to individual households on lease. That can at least address the claims of the local people partly’.

In the case of the Jingpo, changes in their social institutions and property rights were not gradualistic or evolutionary, but quite sudden as a result of state dogma. The consequence was considerable social conflict and environmental destruction. Only since China’s economic reforms have the problems involved in the shifting agriculture of the Jingpo and their property rights started to be addressed more realistically. Undoubtedly the imposition of state property rights (as was done by the British in India and enthusiastically continued by the Government of (independent) India, and also done by the Government of The People’s Republic of China) has caused serious socio-economic disturbance to many local communities (often consisting of tribal or minority peoples), who depend on forests for their livelihood (Tisdell and Roy, 1997), as in the case of slash-and-burn cultivators. While such local communities might have eventually reached a socio-economic crisis in the absence of external intervention, they might have at least had *their own* governance to deal with it. Past interference from external forces has in many cases, magnified the socio-economic difficulties of local communities. The absence of endogenous co-evolution (self-determination) may have added to environmental problems. The question still remains open of whether and when these local communities will reach the blissful stage D of the Scherr and Hazell model of sustainable agricultural development.

4. General Comments on Markets and Globalization and Rural Communities – Income Levels, Security, Distribution and Sustainability

According to proponents of neoclassical economic theory, extension of markets and globalization will increase economic welfare, in terms of a potential Paretian improvement. At

the same time, however, these processes are likely to alter the distribution of income, the balance of political power and safety nets for social security. However, neoclassical economic theory is essentially static in nature. Dynamic theories of markets and economic growth (including some evolutionary modes) are less prescriptive but probably lean on balance to the view that extension of markets and globalization are likely to raise incomes. The matter is complex. If globalization results in less diversity of business organizations, then in the long-run, less economic growth may occur than would have been the case with greater diversity (Tisdell, 1996). Again, there is a danger that as firms become larger as a result of globalization, they will lose their incentive and innovative capacity due to bureaucratisation; a problem which Schumpeter (1942) foresaw.

In relation to agriculture, farmers are often forced to specialise as a result of market forces, and to use techniques that are not sustainable (Tisdell, 1993a, Ch. 11). This makes their livelihood relatively insecure because market prices can be subject to considerable variation. Regional and person income inequality may increase particularly in the early stages of economic growth when supported by the extension of market and globalisation (Cf. Tisdell, 1993b, Chs 5 and 6).

In Asian countries (and elsewhere) ethnic groups and other groups which have widespread networks and knowledge of markets beyond their community are likely to gain most initially by extension of markets. Usually these are not tribal groups or rural minorities, but members of dominant ethnic groups. In Jingpo areas in China, for example, it may well be the Han group located amongst the Jingpo are in the best position to gain initially from extension of market opportunities. They are in a good position to act as middlemen, and also take advantage of tourism development which requires a degree of cosmopolitanism. The same may well be true in Northeast India⁹. Furthermore, urban areas and urban-dwellers often stand to gain most from

market extension (Tisdell, 1997). Rents can be earned by access to market knowledge and contacts especially in early stages of market extension and globalisation and this affects the distribution of income.

Many communities in Asia have not been able to evolve endogenously. Apart from government intervention, several ethnic groups in several areas have experienced immigration of other groups and this has not infrequently been a source of social conflict. For example, over a period of time Bengalis have migrated to the Barind Tract and other parts of North-West Bangladesh to compete with the Santals (a local tribal group) for the use of land and other rural resources. The Bengalis have brought with them more intensive forms of agriculture and severe deforestation and loss of natural vegetation cover has occurred over a period of a 100 years or so. About 100 years ago, N.W. Bangladesh had about 50 per cent natural vegetation cover and was fairly well wooded, but today it has virtually no forest cover (Zuberi, 1992). Similarly, Bengalis have migrated into the Chittagong Hill Tracts and commenced settled agriculture in competition for land with the Chackmas. This migration has resulted in severe soil erosion because Bengali agricultural practices, well suited to the plains, have not been adapted to the hills. In such cases, co-evolution has been circumvented.

5. Concluding Comments

Market extensions and globalization are creating pressures for socio-economic change in agricultural communities on marginal lands in Asia. Traditional systems heavily reliant on social exchange and obligation combined with a high degree of economic self-sufficiency of communities and communal approaches to productive activities, as in the case of shifting agriculture, are under pressure (Ramakrishnan, 1992). Even without such pressures, these communities may well have reached a stage where old practices were no longer sustainable.

Because of intrusions from outside of local communities, such communities have reached crisis situations earlier than otherwise, e.g., due to expropriation of at least some of their forest resources. Furthermore, rapid market contacts are changing the production patterns of such communities as their income aspirations are raised. This is associated with a desire to earn cash to obtain items such as consumer durables, and willingness to engage in unsustainable agriculture practices to increase cash flow, e.g., the growing of maize on steep slopes in Xishuangbanna in China, increased cultivation of monocultures, and loss of local crop varieties. While it is unrealistic to believe that marginal rural communities, of the type mentioned above, can be insulated from global change, their precarious socio-economic position and their transitional problems require more attention by policy-makers and the international community. At present most consideration seems to be given to communities which are non-marginal and in the centre of economic development in Asia. Those rural communities on periphery, often depending on rainfed agriculture and not belonging to the mainstream cultures, as in the case of various tribal peoples, appear to be relatively neglected.

Peripheral rural communities in Asia and their transitional problems should be given more attention because:

- such communities are often in poverty;
- lack environmental sustainability;
- are often (not surprisingly) a source of political insurgency;
- have a rich and relatively unique cultural heritage;
- often possess valuable local knowledge, and
- their areas frequently contain considerable diversity of biological resources.

However, to ensure more attention to these communities is difficult because national

governments are usually controlled by individuals belonging to dominant ethnic groups and the mainstream culture. As a result, they may have little interest in peripheral communities per se, scant appreciation of their problems and in some cases, may even be prejudiced against them.

Notes

1. Otherwise the change may be so slow as to be subliminal.
2. This supposes adaptive behaviour similar to that presumed in some psychological theories of behaviour.
3. Ramakrishnan (1992) suggests that this happens when the cultivation cycle is reduced below 10-12 years.
4. For example, if the fallow-period is reduced by half and yield per cultivated hectare falls by less than half, total agricultural output from land (cropped plus fallow) will rise. In this case, the area of cropped land doubles and total agricultural output rises if yield per hectare less than halves. Total agricultural output is maximised when the proportionate increase in cropped area equals the proportional reduction (due to shorter fallow-period) in agricultural yield per hectare being cropped. This determines the optimal fallow-period from the above point of view. For instance, if the total area subject to cropping and fallow is A hectares, and if the above conditions is satisfied when B hectares are cropped, $\frac{A-B}{B}$ is the optimal fallow-period in years given that cropping occurs for only one year.

The above *assumes* that the production function does not drift downward with the passage of time. It may do so, and be more inclined to do this the shorter is the fallow-period. Thus shorter fallow-periods may be associated with less sustainability of traditional slash-and-burn agriculture.

5. While village allocation of land for slash-and-burn agriculture in Mizoram has been traditional, significant changes have been made in the rights involved since the independence of India. In 1954, the Union Government abolished chieftainships in Mizoram and thereby the unequal distribution of land. To do this, it passed the Assam Lushai Hills District (Acquisition of Chief's Right) Act 1954 and installed democratically elected village councils. Since then 'the allocation of land is made by those elected village councils through the draw of lots. Under this system every citizen has had equal chance to getting a piece of land without being discriminated [against]. Allotment is now fully based on the draw of lots.

A strict regulation is made by the village council that the allotment of land for jhumming is meant for the actual resident cultivators of the village. The size of the land holding is decided on the basis of family size' (Lianzela, 1994, p. 133). To some extent, the current

property rights system is imposed by the central government of India.

6. The power of the state, at least in legislative terms, is somewhat overwhelming in Mizoram. 'Land ownership is statutorily vested in the government and the government, in turn formulates laws by which it will govern different types of ownership within the state' (Lianzela, 1994, p. 194). Such a situation is not without its dangers and parallels to some extent the situation in China as far as the Jingpo are concerned. In general, the state has undermined communal control of resources and the socio-economic consequences are frequently adverse (Tisdell and Roy, 1997).
7. This may once again reflect the dominance of the central Indian government as compared to local government.
8. Their rights in this land have yet to be clarified fully. Lianzela (1995, p. 135) states: 'Under NLUP, land will be temporarily allotted to the selected families by the village council at the size of the two hectares per family. These selected families will be issued [with a] Land Settlement Certificate (LSC) later on, on a merit basis (how they actually use the land allotted to them temporarily) by the Village Council Court. In this way, on a more permanent basis land will be allotted to the selected people'. At this stage, the rights of those allotted land to assign it or sell it have not been clarified but it is possible that these will be restricted, e.g., to family or village members if the land is assignable.
9. This needs more investigation. Who are the middlemen who come to buy fruit and produce from the villagers? In relation to Sesawng village, the village president and his wife had spent some time in Aizawl before returning to Sesawng, so presumably had increased their networks and knowledge about economic opportunities while there.

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