Management of Traditional Resource Systems in Marginal Areas

by

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INTRODUCTION

In their paper on 'The International Potential of Traditional Resource Systems in Marginal Areas,' Ruddle & Grandstaff (1978) point out that development is 'problematical' for marginal areas of the world. They have suggested that 'transformational' development may be most appropriate for these areas. In the present paper, an attempt will be made to elaborate and supplement the ideas and approaches put forward by Ruddle & Grandstaff.

While marginal areas occur all over the world, unless otherwise mentioned, the discussions herein refer to the marginal areas of 'developing' countries.

CONCEPT OF MARGINALITY

What constitutes a marginal area? It is difficult to define precisely. According to Ruddle & Grandstaff (1978), marginal areas are 'generally characterized by dispersed, often culturally heterogeneous, populations that use traditional low-energy transformation technologies to manipulate resources, primarily for their own consumption'. While this definition of marginal areas is probably as good as any, there does not seem to be any universally acceptable definition in the development literature. Development economists tend to consider marginal lands as those where any economic return from using the land is low, owing to its low productivity. But the productivity of land is a function of many parameters—such as fertilizers, pesticides, water, quality of seeds, energy availability, management practices, market for the products, etc. Thus, what at present is considered marginal land under a given set of conditions could well become productive land under a different set of conditions. For example, the reclaimed desert lands of Egypt were marginal prior to their reclamation, but introduction of irrigation following construction of the Aswan High Dam transformed the marginal lands into productive lands. The economic return from the land has increased significantly with the increase in productivity due to introduction of irrigation water.

Ecologists, on the other hand, tend to consider marginal lands as those whose ecosystems are fragile, and hence special care has to be taken in using such lands for farming and grazing. In other words, the carrying capacity of marginal lands is comparatively limited, and unless appropriate steps are taken for their development, irreversible damages to their ecosystems remain a distinct possibility.

Finally, whether we accept the economists' or the ecologists' definition of marginal land, or some form of combination thereof, the concept of marginal land includes also a time-dimension. For example, what is considered good land at present can easily become marginal in the future, and *vice versa*. A common error has been to consider land as a static resource. Soil fertility, water availability, the presence of forest, rangeland, wildlife, and other related resources, are all directly dependent on the management techniques used, and can be increased or decreased practically at Man's will. The magnitude of the increase or decrease will depend on a variety of factors, including the type of ecosystem involved.

Some authors, in the manner of Carter & Dale (1974), have claimed that, apart from three notable exceptions (the Nile Valley, Mesopotamia, and the Indus Valley), historical records of the last 6,000 years indicate that civilized Man has not been able to continue a progressive civilization in a specific location for more than from thirty to seventy generations, i.e. 800 to 2,000 years. The average life-span of a civilization in a particular geographical area has been from forty to sixty generations, i.e. from 1,000 to 1,500 years, 'mainly because Man himself despoiled or ruined the environments that helped him [to] develop his civilization' (*Ibid.*).

CRITERIA FOR DEVELOPMENT

Seven general criteria can be formulated for the development of marginal areas, and will now be briefly discussed. It should be noted that they are not in hierarchical order, as the relative importance of different criteria would be site-specific.

1. *Sustainability*:—Any strategy to develop marginal areas must be sustainable on a long-term basis. There is a very real danger that, in our effort to develop marginal areas on a crisis basis, we may adopt strategies that could be self-defeating in the long run. One can foresee that we may find ourselves in a far more precarious situation in the mid- or late-1980s, when the demand for food and

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other resources will predictably be much higher than it is today—owing to both larger populations and increased levels of affluence. This could occur as there is a distinct possibility that production from the land could level off, or even start to decline, with Man's reliance on short-term, *ad hoc* strategies. History is replete with telling examples of such occurrences from all corners of the earth (Bryson, 1975; M. R. Biswas, 1979).

The situation is even more precarious when development of marginal areas is concerned, as their production is often analogous to the dying flicker of a candle. Furthermore, when once a marginal area has been destroyed, as a rule it becomes more difficult, expensive, and time-consuming, to redevelop it to anything like its former productive capacity. In many cases, its economic value and lasting viability are significantly reduced.

2. *Flexibility*:—It is difficult to forecast accurately the secondary and tertiary effects of project development. Lack of knowledge of some of the important environmental processes, dearth of long-term reliable data, unavailability of adequate analytical methodologies, and lack of technical expertise especially in many Third World countries, mean that some errors—often serious ones—will be committed during the development process. Hence, it is essential that the planning and implementation strategies should be flexible, and not rigid—so that problems, as they surface, can be quickly identified and appropriate measures can be taken to counter them.

It may even be necessary in some cases to change completely the direction of any development, or even to stop further development until more information can be obtained to assess the situation with reasonable accuracy. For major projects, it may be necessary to divide the developments into different phases, as it takes time for some secondary and tertiary 'costs' to develop and thus become visible.

3. *Equity*:—Ruddle & Grandstaff (1978) have discussed the concept of equity. Suffice it to say that it becomes important to consider the distribution of benefits, and the nature of the beneficiaries. Any social system where benefit distribution is markedly askew, and primarily accrues to a select group of elites or others, is bound to be unstable.

Current techno-economic analyses emphasize the nature of the benefits, but contain very little or no information on the nature of the beneficiaries. Yet, for any social and political decision-making, information on who benefits and who pays the cost will inevitably lie at the heart of the decision-making process (A. K. Biswas, 1973).

4. *Appropriate technology*:—Technology by itself is neutral, but how technology is used can make the most profound difference to the development of marginal areas. The type of technology used will depend on a variety of technical, social, economic, and political, factors, and what is the most appropriate technology in one country or situation could be quite inappropriate in another to solve an identical problem. The agricultural history of the recent past is replete with examples in which straight technology transfers from over-developed to Third World countries have created more problems than they have solved. A few select examples are the deep-ploughing of the rice paddies in Java by the Dutch, corresponding operations by the British in Burma, failure of the groundnut scheme in Tanzania and of broiler production in Gambia, and the folly of cultivating marginal lands which should never have been broken in Kenya and in several Latin American countries.

Probably the most spectacular failure was the British plan to develop large-scale groundnut plantations after the Second World War, in what was then known as Tanganyika. The area selected was of 3.25 million acres (1,326,000 ha), 70% of which was uninhabited—for what later turned out to be good reasons. All sorts of 'experts' were recruited for this ambitious project but their advice evidently left much to be desired. Bulldozers were extensively used to remove deep tree-roots. The soil, as in several other similar cases in the tropics, could not stand up to the machines, and there were severe losses due to wind and rain. Artificial fertilizers were used but were not effective because of lack of water, and germination turned out to be difficult in the hard-packed soil. After six years of desperate efforts and capital investment of some $100 million, the project was eventually abandoned.

Technology transfers have often proved unsuccessful because of lack of proper consideration of the social, cultural, educational, economic, and above all ecological, conditions of the local regions to which they were made. But equally dismal has been Man's performance to date in failing to use successfully the technology that is already available. For example, the effects of soil erosion caused by deforestation and flooding were graphically described by the Greek philosopher Plato some 24 centuries ago, and the need for terracing for agriculture on sloping land was pointed out by Bernard Palissy of France nearly four centuries ago (A. K. Biswas, 1972). And yet, anyone who has travelled in Kenya, Indonesia, the Philippines, or any of several other countries, cannot help but wonder why simple counter-measures, such as the use of terracing, are not taken to prevent soil erosion. The technology has been available for centuries, is widely known, is not expensive to implement, and is urgently needed for medium- and long-term conservation measures; yet too often it remains unused.

5. *Environmental constraints*:—It must be stressed that environment and development are 'two sides of the same coin'. It is unlikely that a development process can be sustainable over a major period of time unless environmental constraints have been considered and catered for within the overall planning framework. The thirteenth FAO Regional Conference for Latin America, at its Seventeenth Session (10–29 November 1973), stressed that 'the major environmental problems facing agriculture, forestry, and fisheries, were not only avoidance

of environmental pollution but the ensuring, in the development process, of the maintenance of the productive capacity of basic natural resources for food and agriculture through rational management and conservation measures' (FAO, 1974). It also 'recognized that agricultural development and world food security depended on careful husbandry of living resources, on their biological laws and ecological balances, as well as on the adjustments of production, supply, and reserves, to demands' (*Ibid.*).

6. *Strengthening of local capabilities*:—To paraphrase Abraham Lincoln, planning is 'of the people, by the people, and for the people'. Thus, participation of the people in the planning process is essential, as it is their lives and futures that the planning process is trying to enhance. Furthermore, in the ultimate analysis, resources do not exist as such. Man must use his knowledge and the technology that is available to transform his environment extensively into usable resources. Hence, ultimately one can argue that the resources available are directly dependent on the resourcefulness of the people, and what is considered to be a non-resource or a pollutant at one place or time could be considered an important resource elsewhere, or for another time-scale.

Within this general framework, it is useful to consider the following factors as well:

i) Use of indigenous resources as much as possible on a rational basis;
ii) Generation of employment, and thus of capital;
iii) Production of goods, services, and income, especially for those sectors of society whose basic need is least satisfied;
iv) Development processes that use and build on endogenous technical traditions; and that
v) Encourage local research and development systems.

7. *Information*:—It is difficult, or effectively impossible, to plan and implement the development of marginal areas in the absence of reliable information. In fact, one can define management as the process of converting information into action as shown in Fig. 1. Management success depends not only on the quality and extent of the information that is available, but also on what information is selected for use, and is ultimately channelled into the planning and decision-making processes (A. K. Biswas, 1976).

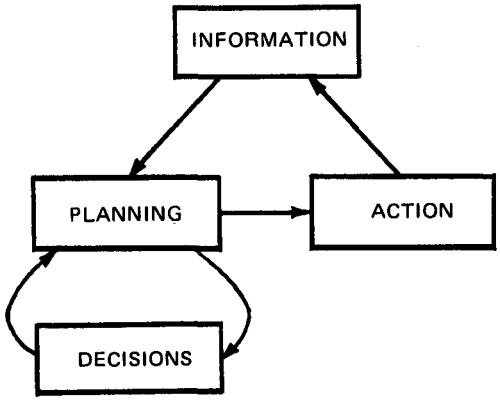

Fig. 1. *Flow-chart of the management process, illustrating the basic components and sequence of events.*

One can argue that, for optimal development to occur, Man should do what he would do if he had perfect knowledge, and if he was completely rational. Perfect knowledge in this context may be defined as information on exact probabilities of each of the alternatives and outcomes and their values to the planners. In other words, information should be available on technological alternatives, their relative costs and benefits to society as a whole, and other relevant data. However, under normal circumstances, various types of information on development of marginal areas in developing countries are hard to obtain, and even if they are available in a few instances, it is not at all unusual to find that those who must make the plans do not have access to the data. In other words, one has to accept that imperfect decisions (i.e. not the optimal ones) have often to be made.

The situation, however, is not as bad as it seems at first sight. In most cases, the projects that are initially started will give rise to new problems, which require new solutions or radical modifications of the ones that are being attempted—which in turn makes planning a dynamic process. Hence, for development of marginal areas, it is important to devise a planning strategy that is flexible and not based on rigid decisions. In other words, planning should constitute a series of successive decisions, and involve the dynamic programming type of approach.

As more information becomes available, and thus the system becomes better understood, the planning process should be flexible enough to enable a change of direction to be taken, at least if this seems necessary. From an environmental viewpoint, such flexibility is not only desirable but commonly essential, as many of the secondary and tertiary effects of actions are difficult to predict at the beginning of the development process. As such side-effects begin to appear, counter-measures need to be taken to alleviate their overall impacts.

DEVELOPMENT OF MARGINAL AREAS

Development of marginal areas in Third World countries, and their continuing management to maintain productive capacity, are difficult tasks under the best of circumstances. During the U.N. Conference on Desertification, its Secretary-General, Dr Mostafa K. Tolba, stated that land degradation has accelerated in recent decades, and that between 50,000 and 70,000 square km of useful land are going out of production every year—largely owing to desertification (Tolba, 1977). He pointed out that it is Man himself who must be viewed as the agent of desertification. It is Man's action that degrades the land by misuse or overuse, as he seeks to wrest a living from fragile ecosystems under unpredictable and often harsh climatic conditions, and under a variety of

social, economic, and political, pressures. If Man is the agent of desertification, he is also its victim (M. R. Biswas, 1978). The degradation of land is invariably accompanied by the degradation of human well-being and social prospects.

Much of the continuing desertification is occurring in the marginal areas of Third World countries. Marginal lands in such countries often have quite different characteristics, involve different ecosystems, and need different management, from those found in more developed regions. It is not possible to discuss the different types of marginal lands in this paper, so let us consider only one type—tropical forests and woodlands.

Tropical forests absorb large quantities of water from the soil and also give out large amounts of water vapour. The closed type of tropical forest, because of its multi-layered structure, successfully intercepts rainfall, and thus protects the soil from direct impact. This contributes to there being very little runoff and soil erosion. Much of the water that infiltrates into the surface soil is absorbed by the dense superficial network of roots, which is approximately three times as dense as in temperate forests (Klinge, 1973). Destruction of tropical forests, and their replacement by grasslands or other herbaceous vegetation, not only changes the ecosystem but also causes the soil to become exposed to the effects of sunlight, heat, and rain, which all increase erosion. Such destruction further reduces any rapid and efficient recycling of water, and also the water-holding capacity of the soil. Greater amounts of surface runoff tend to increase the frequency of floods, and the sediment loads in rivers and streams, as a result of increased erosion (A. K. Biswas, 1979*a*).

Tropical forest ecosystems are thus both stable and fragile. They are stable because, over long periods of evolution, spanning geological time-scales, they have developed resilience which allows them to withstand climatic and other natural environmental hazards. However, faced with modern technology, the ecosystems prove to be quite shockingly vulnerable. The ecology of tropical forests will have to be much better understood before any long-term sustainable development plans for them can be made with any serious degree of confidence.

Tropical vegetation often gives a deceptive impression of soil fertility. Major tropical forests are often on nutrient-poor soils—especially in terms of phosphorus and potassium. During their evolutionary process they have become adapted to such poor soil conditions by developing complex nutrient-conserving mechanisms, so that the loss of nutrients through drainage is compensated by nutrients from rain and dust of the atmosphere, and from weathering of minerals in the soil. Furthermore, as a major part of the total nutrients is usually held in the biomass rather than in the soil, the resulting loss through drainage water is minimal. This nutrient cycle, however, is broken by the destruction of the forest—especially by burning of the trees. The loss of nutrients under such conditions is commonly extreme.

If the forest sites in the humid tropics are to be converted into agricultural areas, repeated inputs of fertilizers often become necessary, as they are rapidly leached away by rain, and thus are somewhat transitory in their effects (Richards, 1977). This creates two problems: agriculture under such conditions is often uneconomic, and leached fertilizers could contribute to adverse environmental effects, as discussed elsewhere by M. R. Biswas (1979). Richards (1977) states that 'in some areas climax forests exist under conditions of nutrient deficiency so extreme that they cannot be replaced by any form of permanent agriculture, e.g. the "campinas" and "pseudopcaatingas" on podzolic sands in the Rio Negro region of Amazonia and the "Kerangas" (heath) forests of Borneo.'

TECHNOLOGICAL TRANSFER AND CLIMATE

It is important to realize that many of the management techniques that have been tested successfully in developed countries cannot be directly transferred to 'developing' countries—for a variety of technical, social, economic, and institutional, reasons. Much has been written on the problems of technology transfer between developed and 'developing' countries in the areas of agricultural and economic development. I shall here discuss one factor that is seldom discussed in the development literature, and yet it could very well prove to be one of the most important issues to consider. The factor is climate.

An analysis of the existing literature on economic development will indicate that very little attention has been paid to the relationship between the level of economic development of a country and its overall climate. This is somewhat surprising when it is considered that most of the countries with tropical or semi-tropical climates are either poor (*per caput* GNP of $100–$299) or very poor (ditto less than $100). In contrast, most of the countries in the zones of temperate climate are either rich (*per caput* GNP over $1,000) or semi-rich (ditto $300–$1,000).

The location factor has attracted some limited interest. For example, Galbraith (1951) pointed out that 'If one marks off a belt of a couple of thousand miles [3,200 km] in width encircling the Earth at the Equator, one finds within it no developed countries... . Everywhere the standard of living is low and the span of human life is short.' Similarly a decade later, a United Nations Department of Economic and Social Affairs report (United Nations, 1961) on the world social situation stated that 'If the industrialized countries are marked on a map, they will be seen to be located as a rule in colder climate than the underdeveloped countries. This correlation with climate is as good as most correlations between non-economic factors and economic development.'

In spite of such statements, location factors have seldon been considered important for analysis, and for all practical purposes have been consistently ignored.

Nearly all macro- and micro-economic-growth models do not explicitly consider climate as a parameter, and most of the world models, except SARUM, do not consider it either (A. K. Biswas, 1979*b*). Neither does Leibenstein (1957) mention climate in his list of the 'characteristics of backward economies' that was developed from a comprehensive survey of the works of leading economists.

Few scientists have considered the problem of climate in this context, most having tended rather to ignore it. Thus, for example, Lee (1957) suggested that 'climate and economic development in the Tropics is a convenient bogeyman to be blamed for psychological difficulties whose real origin is much more personal'. Similarly, Lewis (1965) comments: 'Because economic growth is currently most rapid in temperate zones, it is fashionable to assert that economic growth requires a temperate climate, but the association between growth and temperate climate is a very recent phenomenon in human history', and the 'climate hypothesis also does not take us very far'.

In spite of such casual dismissals, the fact remains that the principal failure of economics, certainly within the last three decades, has been in the area of economic development, and this has occurred irrespectively of the fact that a great amount of resources has been spent in this area. According to Boulding (1970):

> 'The refinements in development theory which have developed in the last generation do not seem to have carried us very far towards a real understanding of the process as a total social process, and we do not really understand what it is that makes the difference between a developing and a non-developing society.
>
> '... One wonders whether culture-boundness may not have something to do with this relative failure. Development, like economics, has been very largely a Temperate Zone product. The complexities both of tropical ecology and of tropical societies are beyond easy access for those raised in essentially Temperate Zone culture. This is not to suggest a naïve climatological determinism, but just as tropical biological ecosystems differ very markedly from those in the Temperate Zone, it would not be unreasonable to suppose that the processes of social evolution would likewise produce marked adaptations to the peculiar rigors and delights of tropical climate and life-style.'

One can argue that the general failure of 'social scientists' to recognize the importance of the possible interconnection between climate and agricultural production, and thus to economic development, is, to some extent, another tragic consequence of technology transfer defined in a broad sense. The situation is somewhat comparable to the failure of several grandiose development schemes in Third World countries based on well-proven and workable models in developed nations. This, however, is not surprising, as virtually all of the developments in economics or economic geography have taken place in the Western World. The fundamental principles have been developed over the years, generally based on the conditions prevalent in the developed countries. Thus, many 'classical' theories are being used in Third World countries, even though they are primarily temperate-zone products, which means that the theories are being used more generally than their validity may warrant.

When these theories are superimposed on a different world, with an alien culture and radically different socio-economic conditions and institutional infrastructures, the risk of fundamental errors, or, alternatively, the magnitude of the errors, is exceedingly high. If, for example, the under-utilization of the labour force—which is a common condition in Asia, Africa, and Latin America—is analysed according to the traditional Western concepts of unemployment and underemployment, the resulting figures and conclusions are generally meaningless, or at best the magnitude of errors is so great that it would be folly to rely on such figures in making any major policy-decision.

Myrdal, in his monumental work *Asian Drama* (1968), consistently criticizes the biases introduced by the use and application of Western concepts, theories, and models, in the study of the economic problems of the South Asian countries. He points out that such analyses seriously distort the results:

> 'The very concepts used in their [theories of classical economics] construction aspire to a universal applicability [which] they do not in fact possess. As long as their use is restricted to our part of the world, this pretense of [universal] generality may do little harm. But when theories and concepts designed to fit the special conditions of the Western world —and thus containing the implicit assumptions about social reality by which this fitting was accomplished—are used in the study of underdeveloped countries in South Asia, when they do *not* fit, the consequences are serious.'

Myrdal further points out:

> 'For, although research, planning, and public discussions that are based on Western concepts, theories, and models, tend systematically to bypass the complicatons arising from attitudes, institutions, and modes and levels of living, the relevance of these to problems of development is at least "accounted for" by interspersed reservations and qualifications and by the habitual admission that development is a "human problem".'

One may legitimately ask: if the Western scientists have not been very successful in developing theories of economic development that are applicable to Third World countries, why have such theories not been developed by scientists from the 'developing' countries themselves? Herein probably lies one of the dichotomies of the whole situation. The majority of the elite in the Third World tend to be trained in the West, and in general, Western thinking is considered to be more 'progressive' and 'scientific'. Because of their training and social attitudes, these intellectuals often produce dissertations that are replete with the traditional theories of classical Western economics. Many of them are familiar with the latest abstract growth-models originating from Harvard or Oxford, and yet very few of them question the validity of their use in the context of the socio-economic and institutional conditions of their own countries.

Such uncritical acceptance of biases of the Western concepts and theories on the part of Academia is not a

monopoly of any one country: it seems to be all-pervasive. In essence, it can be said that there is nothing wrong with living in an ivory tower, provided it is not the only place of residence. Yet this, sadly enough, is often not the case. So biases go undetected and are perpetuated, when at the very least they should be noticed and questioned—or, better still, corrected.

There are other reasons which may have contributed in some degree to the overall neglect of studies of climate as it could affect economic development. Both meteorologists and climatologists have tended to stay within their disciplinary isolation, and consequently very few ventured into work on the fringe-areas analysing the effects of climate on biology, economic development, or other factors that comprise parts of Man's environment. Recent emergence of new study areas, such as biometeorology, aerobiology, or energetics, may improve the situation, and could provide a better and more fundamental basis for theoretical development in such interdisciplinary areas than is currently available. Prior to this development, the study of the interrelations between climate and living organisms was primarily in the domain of physiologists (Tosi, 1975).

Many 'social scientists', on the other hand, have felt that climate can be considered as a 'fixed' parameter, since it cannot be purposively changed to any significant extent. As the climate could not be modified, there was a general tendency to accept climatic considerations as boundary conditions, which were often conveniently omitted from overall analyses.

The conditions discussed above have tended to create a bias—an almost all-pervasive bias—against the consideration of climatic factors within the framework of economic development. Often the mere possibility of considering making such studies has brought forth accusations of subscribing to the naïve and simplistic theory of climatological determinism. Such prevailing conditions, however, have not prevented a few social scientists, such as Higgins (1959), Kamarck (1973), Myrdal (1968, 1974), and Streeten (1971), from pointing out the relevance of climate within the framework of economic development. Myrdal, for example, categorically states that the importance of climate in economic development has been 'grossly underestimated', and insists (1968, p. 2121) that:

> 'Climate exerts everywhere a powerful influence on all forms of life—vegetative, microbial, animal, and human—and on inanimate matters as well... . Every serious study of the problems of underdevelopment and development in the countries of South Asia should take into account the climate and its impacts on soil, vegetation, animals, humans, and physical assets—in short, on living conditions and economic development.'

And Streeten (1971) comments:

> 'Perhaps the most striking fact is that most underdeveloped countries lie in the tropical and semi-tropical zones, between the Tropic of Cancer and the Tropic of Capricorn. Recent writers have too easily glossed over this fact and considered it largely fortuitous. This reveals the deepseated optimistic bias with which we approach problems of development and the reluctance to admit the vast differences in initial conditions with which today's poor countries are faced compared with the pre-industrial phase of more advanced countries.'

Such perceptive observations, however, are exceptions rather than the rule, and yet the correlation between climatic régime and economic development is as good as most correlations between non-economic factors and economic development. This, of course, does not mean that it is implied that there is a one-to-one relationship between climate and economic development, but rather that present development theories for the tropical and semi-tropical countries leave much to be desired. This becomes especially relevant when it is considered that countries in such regions have a predominantly agriculture-based economy and that yields of agricultural products are direct functions of climatic parameters. Considered in such a light, the role of climate in the development process becomes a much more important factor than is generally conceded.

The close linkage between economic development and agricultural production can be easily confirmed by analysing the historical trends in developed countries. It should be noted that, historically, very few countries have managed to industrialize without initially achieving a high degree of self-sufficiency with respect to agriculture. At the risk of simplification, one can argue that an industrial revolution requires a prior agricultural revolution, or, at the very least, a concurrent agricultural revolution. According to Kellog (1963):

> 'Historically, an agriculture able to provide a surplus over the needs of the farm families made possible capital accumulation for industrial development. Industry, in turn, furnished materials and services for a still more productive agriculture. Thus has agriculture initiated the kind of industrial development that characterizes the economic growth of the so-called advanced countries. The levels of agricultural production per man-hour per hectare have steadily increased as the materials of industry have been substituted for direct farm labour.'

The leaders of most countries in the tropics and semi-tropics profess to have understood the importance of an agricultural revolution to expedite the development process of their own countries. For example, Jawaharlal Nehru, the late Prime Minister of India, emphasized that 'the whole success and failure of all our planning hangs by that single thread of our agricultural production and, specially, food production'. The same point was made over and over again by many leaders of the developing countries at the World Food Conference, held under the aegis of the United Nations at Rome in 1974 (A. K. Biswas & M. R. Biswas, 1975). A critical analysis of their past performances, however, indicates that very seldom has adequate priority been given to much-needed land and agrarian reforms. Moreover, much of the emphasis has often been only in lip-service.

I have argued elsewhere (A. K. Biswas, 1979*a*) that differing climatic and socio-economic conditions make direct transfer of agricultural techniques from developed to Third World countries a most difficult and hazardous process. Such direct transfers could have particularly serious consequences for the development of marginal areas in Third World countries, as the potential for

making errors is so great, and the consequences of such errors can even be far graver for marginal than other areas as the resilience of the ecosystem tends to be much lower in marginal areas than elsewhere. In other words, the factor of safety of marginal lands for absorbing errors tends to be very low.

CONCLUSIONS

Development of marginal lands in the less-developed countries needs careful planning. Analyses of past practices indicate that, in many instances, serious errors have been committed in their development and management. Too frequently, Man has acted in such ways because no better alternatives were apparent to him.

What is necessary is to review our past performances to determine which practices have been good and which have been poor, and why a specific alternative was chosen. From such analyses, we must make a determined attempt to maximize the benefits and minimize the costs. Without such efforts, we shall continue to make the same mistakes again. As Omar Khayyam noted more than 800 years ago:

Myself when young did eagerly frequent
Doctor and Saint, and heard great argument
About it and about: but evermore
Came out by the same door wherein I went.

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SUMMARY

With an ever-increasing world population and the resultant pressure to grow more and more food, marginal areas in many Third World and other countries are coming under intensive pressure towards expanding agricultural production. The ecosystems of marginal areas are often fragile, and thus particular care has to be taken in developing such lands for farming or grazing.

The paper defines the concept of marginality, in both economic and ecological terms. The major criteria that need to be considered for the development of marginal areas are outlined. Among these are substainability, flexibility, equity, appropriate technology, environmental constraints, strengthening of local capabilities, and information. The problems of development of marginal areas are discussed, along with an example of the environmental problems arising in the tropics owing to deforestation in order to use the land for agricultural or grazing purposes.

The management theories successfully tested in developed countries cannot be directly transferred to Third World countries for a variety of reasons. One of the reasons, which is seldom considered, is the climatic differences between temperate (developed) countries and tropical and semi-tropical ('developing') countries, which make direct technology transfer, in many cases, inappropriate—especially for agriculture.

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Grass Carp: A Threat to Our Amphibia?

For the biological control of aquatic weeds, the Grass Carp (*Ctenopharyngodon idella* Val.) is under consideration for widespread introduction in The Netherlands. The efficiency of this fish in controlling weeds is high, the costs are low, and no severe side-effects are expected (Zon, 1977). In a field experiment in 1978, Grass Carp were introduced in 200 different places in The Netherlands. Of these, the largest introduction covered a total area of 60 ha of water (Anon., 1978).

In the literature, no remarks have been found about the effect of Grass Carp on the amphibian fauna. In The Netherlands, 14 species of amphibians occur, of which 11 species attach their eggs to water-plants. The biotopes of these amphibian species are suitable for the use of Grass Carp. The egg-masses remain attached to the water-plants for at least two weeks before hatching, following which the tadpoles often hide in the vegetation, feeding on Algae. As Grass Carp consume the plants almost completely, loss of eggs (and possibly larvae) may be expected. The gelatinous nature of the egg-mass might hamper the fishes' eventual capacity to discriminate between plants and eggs, which could result in direct predation on the eggs.

Fig. 1. *Ditch containing more than 70 Grass Carp.*

In a series of equivalent ditches used by the Common Toad (*Bufo bufo* L.) for breeding, Grass Carp were introduced in the beginning of 1978. In that area the application of herbicides was given up in order to avoid pollution of the near-by drinking-water reservoirs. In June 1978, tadpoles were still found in every ditch, as in the previous 15 years. In the early summer of 1979, however, the effect of the Grass Carp on the vegetation could be seen clearly in a ditch containing more than 70 Grass Carp (Fig. 1). In a near-by ditch only few Grass Carp were observed and the aquatic vegetation appeared normal (Fig. 2). In June 1979 no tadpoles could be detected in the first ditch (containing numerous Grass Carp and measuring about 80 m long), whereas 90 tadpoles were counted in the other ditch (about 100 m long). Due to toad-protection measures (Leeuwen, 1977) it was known that *ca* 140 toads had entered the first ditch, which was about the same number as in each of the previous 4 years.

It is strongly believed that further investigations on the effect of Grass Carp on amphibian fauna are urgently needed before large-scale introductions of this fish are effected for the biological control of aquatic weeds.*

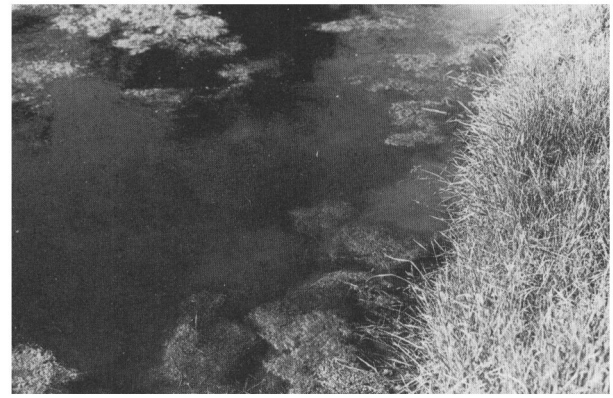

Fig. 2. *Ditch near that shown in Fig. 1 but containing few Grass Carp.*

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