

The socio-economics of pastoralism: a commentary on changing techniques and strategies for livestock management

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Synopsis

This essay is wide-ranging and deals with nomadic pastoral in the past and present. The author argues the case for programme and policy interventions that are multi-disciplinary, process-driven and focused on a minimum threshold of critical objectives.

Key Points

1. A clearer understanding of the socio-economics of nomadic pastoralism is needed if the application of recent technological advances in rangeland monitoring is to yield maximum potential benefits to nomads and their home countries. To understand and consider viable nomadic pastoralism in the context of a healthy support environment, several distinct features need to be understood, which require going beyond the more traditional control of livestock numbers in terms of a hypothetical concept of rangeland carrying capacity.
2. Stock numbers can continue to be governed by the pastoralists' traditional strategy of enhanced mobility and accessible communications that optimize advantages and opportunities offered by changing climatic and episodic conditions. Grazing systems could remain essentially event-driven. Attention should however be paid to understanding the special needs of pastoral nomads, particularly in terms of cultural values and the need to involve them in the processes of change and development with a potential to affect them.
3. One conclusion which has emerged generally from development activities that impact on the environments is that economy-wide policies, such as policy and programme interventions for the sustainable use of rangelands or for desertification control, help enhance social stability. This, in turn, will yield environmental benefits. Instability, combined with land-use pressures, undermines the sustainable use of natural resources.
4. While the mechanics of information-gathering and enhancing mobility have changed with time, the basic strategies for livestock management and production have remained the same. In recent years, however, a number of complex concerns have emerged that render effective livestock production more difficult and burdensome for the pastoral nomads. These concerns include: a rapid increase in human population in pastoral communities; a more sedentary way of life; an increasing need for technology to deal with pressing problems of management; and rapidly-changing political, economic and social conditions. As a result, policy and programme interventions are required that are multidisciplinary,

process-driven, and focused on a minimum threshold of critical objectives.

5. Man and nature are always in search of a liveable balance, but mishaps are more likely to happen because of the “discontinuous” nature of the relationship between the pressures generated by human activities and the tolerance levels of ecosystems. It is unlikely that damages inflicted on dry rangelands by overgrazing will be irreversible, because even a minor change in rainfall or other climatic conditions will often bring about a rapid response in terms of vegetation and alter expectations. It is, nevertheless, worthwhile when faced with risk and uncertainty with such critical consequences, to follow the precautionary principle and take action on a broad front to ensure that unexpected surprises do not occur.

1. INTRODUCTION

The application of innovative and presently evolving technologies in rangeland monitoring is a critical concern and, quite rightly, a major pre-occupation of this Workshop. Enormous advances have been made in recent years in climate and other environmental forecasting. But for these advances to be of maximum benefit to pastoral nomads the use of the resulting data must be based on a clear understanding of the socio-economic underpinnings of pastoralism. Policy-makers are often not aware of the economic and social management "tools" and the cultural levers available to mobilize community energy and co-ordinated action in terms of economy-wide development programmes. There is a steep learning curve in understanding the role of socio-cultural contexts, but it is a road worth travelling if we are to achieve meaningful progress.

A distinguishing feature of nomadic pastoralism is that the evolution and impact of economic and social change does not necessarily follow a steady state. Nomads often reflect a continuing effort at adjustment between the physical and natural forces on the one hand, and the gradual evolution of deep-seated perceptions, customs and cultural forces on the other hand. It is necessary in this situation to accept periods of little or no change followed by shifts, which could be relatively rapid, towards a new equilibrium (Blench, this volume; Ngaido *et al.*, this volume).

Clearly, the problems of rangeland management and of pastoral development are much more complex than the reduction of land degradation through the control of livestock numbers, based on some ill-defined and unenforceable concept of carrying capacity of the rangelands. There is much to be said in favour of the traditional strategy of stock movements for the maximization of livestock production and returns, based on the spatial and temporal distribution of forage. Such an "opportunistic" movement of livestock can come about in response to rainfall variability or other episodic events, such as rangeland fires or the outbreak of diseases. In reality, the grazing systems in a region are essentially event-driven. Adjustment policies for the pastoral nomads must, therefore, not only take account of the shift between

equilibrium and non-equilibrium dynamics within the region, but they must also be open to evolve with time.

Another distinguishing feature is that pastoral nomads, like other groups of the relatively poor, have special needs that must be specifically recognized and respected (Al-Eisa, this volume). These include access to ownership of natural resources and other forms of capital; an increase in the productivity of capital through improved infrastructure; and accessibility to health, sanitation and social services, a lack of which, for example, is severely felt and which acts as a major impediment to economic and social change as it is the absence of a safety net for the pastoralists and their families. The remedy requires the provision of social investment funds. The cost of the necessary measures is likely to be high in the region, because of a lack of effective environmental monitoring, poor resource management in the past, inefficient extension services, and inappropriate macro-economic policies. There is much to be said in favour of preparing in advance an in-depth analysis of the scale and structure of a full range of identified needs before proceeding with policy and programme interventions (Geerken *et al.*, this volume).

The basic rationale for social investment in nomads comes from the realization that the means and the ends of long-term development, and of economic and social change, requires emphasis in equal measure on the quality of human resource development and the quality of the resources made available for the purpose. Such an approach must consequently focus attention on the distinct steps needed for nomads to diversify and flourish in an enabling environment. The single concept that should cut across all strategic development agendas in this field is the importance of building local-level capacity in natural resource management. It requires both training and organizational arrangements. The latter is a sensitive issue and there is no attempt here to offer advice from outside. But it is also an essential condition for effective and efficient resource allocation. What instruments and policy frameworks are to be considered and eventually used for the purpose are for individual countries to decide.

The ecological fate of desertified, arid and semi-arid lands has tended to fluctuate with climatic variability on the one hand, and the level of interaction by local communities on the other hand. The sustainable use of rangelands and desertification control are critical issues because the means of subsistence for over 20% of the world's population is at risk. Moreover, most of the threatened people are also those who are the most vulnerable of the country's population, namely, the poor and the marginalized. It is estimated that more than 133 million people may be forced to migrate because of land degradation within a short period, but it is impossible to determine how many may have been forced to abandon their lands already (though the figure is expected to be in the millions).

The interaction effected by local communities, however, is not only an economic problem but also a socio-cultural one for which broad-based solutions must be sought. Fortunately this critical aspect of the problem has been recognized, to its credit, by the UN Convention to Combat Desertification (CCD). It is not surprising that more than 100 countries signed the Convention in June 1994 in Paris. According to the terms of the definition agreed by world leaders at the 1992 Earth Summit in Rio de Janeiro and spelt

out by the Convention, desertification is, *"land degradation in arid, semi-arid and sub-humid areas resulting from resource problems, including climate variations and human activities"*, such as, overgrazing, overcropping, poor irrigation, deforestation, and the cultivation of marginal lands. In keeping with this definition, the objectives of the Convention are: (i) to seek an improvement in the management of the ecosystems; and (ii) to ensure that international aid flows are more responsive to the needs of the threatened regions.

Because nomads live or languish according to how well they can assess risk and uncertainty, they are more sensitive - and more sensitized - to natural changes than most other population groups. This is why rangeland monitoring and its evolving techniques are potentially of such critical importance to nomads. Measures for the sustainable development of rangelands, and certainly anti-desertification programmes, must take a close look at both directly-related variables (e.g., changes in vegetation cover, depths of topsoil, species composition) and indirectly related variables (e.g., intensity and distribution of precipitation, prices of agricultural commodities, human migration), as the basis for remedial action. But the authorities must also proceed on the basis of a cost/benefit analysis of how to respond to the perceived threats. A number of decision-making problems arise as we try to balance the costs of early action against delayed or no action. The Climate Change Convention deals with this problem of uncertainty by adopting the precautionary principle. According to Article 3(3): *"when there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures"*.

It is worth reminding ourselves, however, that there are a number of major issues of public policy that have so far not been resolved either in the developing or the developed world. Furthermore, in recent years, large and complex global changes in the perception of social needs have taken place. They involve the ageing of populations. They also involve the gradual dwindling of the capacity of national governments not only to provide for general and individual welfare, but also, and more specifically, to create economic opportunities and jobs and to generate social protection. These changes are still going on and new ones are likely to be in the offing. Eventually, a consensus may arise on the most appropriate role of the state, private enterprise, media, and civil society. Within such a framework of roles and responsibilities, it will become more realistic to explore and develop future policy options on such far-reaching and critical problems of global import as desertification. Further development in the techniques of rangeland monitoring must undoubtedly continue. Climatic variability has so far played a dominant role, but in the light of the global climate change problems and the unprecedented pressures generated by world population increase, the existing patterns may well change. It is worthwhile, in any event, to address far-reaching issues, such as those we are considering today, in a contingent manner.

2. Importance of cultural values

The role of traditional cultural values in the definition of economic and social change has not received the consideration by policy managers it deserves. There is a deeply-rooted conviction in traditional societies that models for productivity and stability, equivalent to sustainable development, must not only generate economic growth, but must also ensure its equitable and just distribution. In the drive towards economic betterment, the imperatives of "modernity" should not override the traditions of society. It is accepted that such an approach would have certain costs. Sustainable growth requires us to minimize these costs to the extent possible and desirable, for example, without sacrificing basic cultural values. Past experience shows that "modernization" strategies, by themselves, could often, at worst, be misconceived; at best, not be based on sustainable targets and objectives. They may come from not fully understanding the multifaceted nature of the problems that face us, or from a lack of focus on the priorities. In any event, much more attention needs to be paid to the manner in which traditional cultural values are treated (or manipulated) in the decision-making process at present.

The balance of available evidence in the region seems to indicate that, if economic change and development of the pastoral nomads is in harmony with their traditional cultural values, there is more likelihood of a rewarding move upwards, (in the continuum of their continuing struggle with nature), towards stability, productivity and growth. These trends need to be studied, their weaknesses and strengths identified, and support for the more dynamic elements strengthened.

Needless to say, a major educational effort is implicit in the introduction and development of such an approach and a broader time-horizon is indicated. But these efforts are more likely to lead to a productive and process-oriented strategy in the long run than the current approaches applied.

A focus of many of the elements of the strategy must be on cost-effective opportunities for improving the status and income of nomads. The favoured strategy must take into account two types of costs involved; the costs of the rehabilitation and regeneration of the pasturelands as such, and the costs of activities focused on the socio-cultural context of the target groups (e.g., in the case of the nomads, to allow them to develop in harmony with their religious beliefs and organizations, manners and customs, and systems of valuation, whether expressed or implicit). The second type of costs could be viewed as an attempt to focus social spending on neglected groups. They could also be regarded as costs of transition but not transition at any cost, i.e., at the expense of primary education, basic health care, and the nutritional needs of children. If it is to answer certain key questions at the outset and broker a solution on the crucial cultural issues, the strategy must be based firmly on the identification, evaluation and effective funding of the second type of costs involved, largely ignored with the plea of budgetary constraints so far, and not merely by paying lip service to them. It is interesting to note how the assessment of essential societal needs, and their reflection in budgetary allocations, have evolved over time. Twenty years ago, expenditures on education, health and social care were considered controversial, much as expenditures on policy and programme interventions for environmental and natural resource concerns are considered

today. It is a moot issue, although likely, that a similar evolution of societal needs would eventually cover ecological concerns.

Many of the current programmes of economic and social change for the pastoral nomads appear to be based more on the symptoms, than the causes, of their underdevelopment and marginalization. A new assessment, new budgetary allocations, and a new regulatory framework are necessary to ensure the proper participation and protection of the pastoral nomads. The models of production and consumption and the values that support them, notably the primacy of the economic over cultural and social ones, are in effect a source of the key problems of underemployment and social exclusion, and not a solution.

Traditional cultural values are viewed as largely irrelevant in the analysis and planning for economic development, and hence often are neglected. But when economic development and growth must take into account environmental and natural resource constraints and opportunities, (as it must if it is to be long-term and sustainable), other dimensions come centrally into play. One of these dimensions is the amalgam of perceptions, beliefs and customs of the people concerned (Blench, this volume; Ngaido *et al.*, this volume). Another is the close involvement and contribution of the people. These essential elements are to be sought in the traditional cultural values of the local communities. For this reason, there is finally an increasing recognition that policy and programme interventions for the sustainable management of dry rangelands and desertification control must relate clearly, and in a primary way, to traditional cultural values, especially when these values are as strongly held as is the case with the pastoral nomads.

3. Involvement of pastoral nomads in development activities

Apart from cultural values, it is possible to identify in the light of recent development experience (largely through World Bank projects), a broad spectrum of policy interventions which could guide the economic change and development of pastoral nomads. In summary, there appears to be two particularly efficient conditions for success. The first is encouragement for a more active involvement of those affected by development activities in the decision-making process, and the second is the establishment of an institutional framework to deal with the major agricultural and natural resource problems of targeted groups. These two conditions constitute what has been called the "social scaffolding for sustainability".

The case for the involvement of those affected by development activities in the decision-making process revolves around a nexus of three basic considerations: (i) an improvement in the purposes of the activity to be undertaken; (ii) an enhancement of national help to the poor and the disadvantaged groups involved; and (iii) an enlistment of their willing cooperation and support in the realization of the objectives of the development intervention. The latter is a critical parameter which depends on strengthening a feeling of identification with the project. When identification is not there or when it is weak, the chances of success for the development intervention are minimal. Identification of this nature will only come when the policy and programme interventions are conceived, as a result of felt needs, by the people affected by them.

There is increasing recognition among experts, both at the national and international level, that it is important to gauge the preferences and priorities of the local communities and to provide an enabling environment for them to realize their objectives. This is based on the gradual realization that much can be gained through an understanding of the way in which local communities, pastoral nomads included, view public services such as health and education, administrative institutions, and infrastructure. In recent times, attempts have also been made to develop techniques to assess the perceptions of local groups, both as to the nature of specific development activities to be implemented and the effectiveness of the proposed operational instruments proposed to be used. These techniques are based, amongst others, on social and beneficiary assessments. But much work still needs to be done on these types of assessments through improvements in their conception, design, and application to practical problems.

What does involvement of this nature mean in practice? There are many ways to proceed and there is no consensus on the nature and content of the process of "involvement". But perhaps it is useful to follow a "best practices" approach, both in terms of the design of integrated conservation and development activities, and training in methods. It is a matter of record that very few projects of rangeland management and pastoral development worldwide have stemmed from the conscious involvement of local communities. This is the net consequence of neglecting to take into account social and cultural considerations, a neglect strengthened by the lack of institutional capacity and of technical expertise.

It is worthwhile, in this connection, to consider the concept of "social capital" and to keep under review, from an early or conceptual stage of policy formulation, its different components; notably, the stock of techniques, inter-relationships, organizational arrangements, beliefs and perceptions, and, above all, the confidence and commitment of the affected groups, like the nomads, to come to terms with their fragile natural resource base. The fact of the matter is that throughout history traditional pastoral cultures have managed, through their own empirically-developed techniques of farming and herding, to wrest a living from unfriendly and unforgiving soils and at the same time to maintain the productivity and resilience of their rangelands. This is no mean achievement, especially considered that it was done without the aid of the sophisticated, recently-developed, technical and scientific tools for rangeland monitoring.

It will be worthwhile for the countries implementing the CCD, and the agencies supporting them, to take a close look at these traditional techniques from the point of view of their potential for transferability. Fortunately, there is a greater willingness nowadays to respect traditional cultural values and to learn from traditional techniques and practices.

In practical terms, institutional capacity-building is concerned not so much with the way in which an institution is set up or with its organizational structure. It is more concerned with its standing and its support within a community, which is expressed in terms of funding, its responsibilities and mandate stated in unambiguous language, and the technical knowledge and skills available to it. Above all, capacity stipulates the ability and willingness to operate effectively over multi-disciplinary issues and across

jurisdictions. In order to play its proper role, institutional capacity-building, especially in terms of the sustainable management of dry rangelands, must focus on the development of a public awareness strategy, (particularly of disaster awareness), and the initiation of contingency planning systems, supported by information and monitoring networks.

4. Changing status of pastoral nomads

A change in the balance between settled agriculture and nomadic pastoralism appears to have been ongoing in the region since the early years of the present century. The process of change has not been due to any perception of ecological damage caused by the pastoral nomads to rangelands through excessive use leading to land degradation, but due to the political reality of governments preferring settled farmers who could be taxed and conscripted to the nomads who are outside the political community and might presumably pose a danger to order.

There has also been a second factor at work. In the interface between agriculture and pastoralism, an increasing sophistication and diversity in the consumption patterns and preferences of the population led inevitably to a decreasing demand for the main products of the rangelands or rather to a shrinking profits from them, as compared to those from agricultural crops. The market for camels began to shrink with the advent of modern transportation (e.g., the coming of railways, network of roads, automated vehicles), which struck a substantive blow at the traditional use of camels for transport. The demand for sheep and goats continued, and may have increased as the population grew, but capital was profitably invested in the growing of crops. In the result, the numbers of livestock in proportion to human population have decreased dramatically all over the region, even though 99% of the pastoral households today own sheep for cash value and to meet their family needs.

The nomads have lived a largely self-contained existence with strict observance of traditional rites and obligations. Nevertheless, during the 1920s and 1930s, according to a noted historian of the region, Albert Hourani, *"nomadic pastoralism virtually disappeared as an important factor in Arab society"*. This does not mean that nomads are no longer to be found or that they have been fully integrated into the mainstream of economic life. The development and management of livestock production continues to be followed through reliance on "opportunistic" stock movements. The techniques utilized for the purpose have evolved with time. A generation ago, the more talented young men of the extended family were sent out to scout for rainfall areas and vegetative cover; today, the young men are working in oilfields or construction sites, sometimes across the border in other countries, and there is a reliance on trucks for transporting livestock and on telephones for tracking climatic and other conditions. In this process, the pastoral nomads are actually settling down to a more profitable existence with a family house in their ancestral village and access to schooling for their children.

Thus, while techniques have changed, the long-standing strategies for livestock management have not changed. These strategies are based on the need to respond as rapidly as possible to changing climatic

and vegetative conditions, through enhanced mobility and such means of information gathering as may be available. Grazing systems cannot be replaced easily by prescriptions to reduce land degradation through the control of excessive livestock numbers. Such prescriptions are usually ignored. Carrying capacity and critical loads are useful concepts in broad scientific analysis.

In 1994, the concept of critical load was very effectively used as the basis for a protocol to a treaty limiting the release of nitrous oxides from large combustion plants, automobiles and other sources in Europe. These are equilibrium concepts, but equilibrium is not the normal state of the ranges in drylands. The key to the success and survival of the pastoral nomad lies in the keenness of his observation of variations in vegetation and precipitation in time and over different parts of the rangelands and on his successful (or unsuccessful) exploitation of the observations. Information exchange and transportation have always been, and still remain the major instruments for rangeland management. For this reason also, there is little doubt that in due course the pastoral communities will become more involved and participate directly in the adaptation and use of the new technologies for rangeland monitoring.

Meanwhile, policy and programme interventions are needed to help pastoral nomads overcome a number of emerging concerns that have made effective and efficient (in the economic sense) livestock management more difficult for them. These concerns include: the rapid increase in human populations in pastoral communities; a more sedentary life on the pasturelands; the increasing need for technology to deal with emerging problems; and changing political, economic and social conditions. These concerns are not static. They are changing in nature and impact as their incidence becomes more burdensome and they interact with one another. Time is not on the side of the nomads and early action is indicated, if we are to avoid an accelerated deterioration in economic and environmental conditions. Bad management decisions stemming largely from the lack of local participation and poor foreign advisory services (through unqualified experts, for example), often contribute to a worsening of these concerns.

5. Environmental impact of human activities

It is commonly accepted that our understanding of the environmental impact of human activities, whether interventions in nature or environmental support for development policies and programmes, remains limited. Some of the impacts could be irreversible, others synergistic. It is necessary, in this situation, to proceed with caution. One conclusion, however, which has emerged repeatedly from development initiatives that impact on the environment is that economy-wide policies (such as policy and programme interventions for the sustainable management of dry rangelands and the control of desertification), help to enhance social stability at the local and national levels. They thus yield substantial environmental benefits because instability undermines the sustainable use of natural resources. In contrast, social stability, based on the maintenance and promotion of cultural values, leads to a longer-term perspective by all users, (particularly the most vulnerable) of the resource base.

One of the main objectives of policy and programme interventions is to improve the income flow of the pastoral nomads over time. But such is the inter-locking nature of the activities involved that in so doing they will also produce other advantages and disadvantages, in reality costs and benefits, requiring a trade-off. Complications may arise, both in the short and long term. In the short term, the impact of adjustments on poverty, and especially on employment and underemployment, may generate pressures on open-access resources. In the long term, public policies, such as those we are considering, would certainly induce changes and also increase pressures on the environment.

It is essential to take these interlinkages into account, at an early stage, and plan to reduce the resulting pressures through a number of specific remedial measures, such as the introduction of a system of livestock marketing that takes account of unpredictable shifts of forage and the financing and infrastructure necessary for such a system; better technology for monitoring; and a new approach to the maintenance of mobility as a critical instrument for livestock management. The latter effort is likely to be the most difficult, and at the same time the most pressing within the region at the present, because it involves the vexing problem of a reform of pastoral land tenure.

But apart from costs, unexpected and very large benefits may also arise with momentous impact on global and regional well-being. It is worthwhile to estimate these benefits and factor them in along with the costs.

6. Conservation of flora and fauna in dry rangelands

A global benefit of great importance that the policy and programme interventions are likely to produce relates to the conservation and sustainable use of biodiversity in the arid and semi-arid rangelands. Arid lands are roughly defined, in this context, as those lands receiving 0.25 centimetres (cm), and semi-arid lands as those receiving between 25 and 50 cm of rainfall annually.

Although there is a consensus that the conservation and sustainable use of flora and fauna in dry rangelands is a priority concern, their continuing destruction through unrestricted hunting and overgrazing is a marked phenomenon of these regions.

The loss of species is a classic example of irreversibility. While conservation and sustainable use of biodiversity may not yield quantifiable results in the short term, they produce substantive social and ecological benefits, including the protection and enhancement of a vital, life-sustaining part of the environment. The loss of the world's unique genetic heritage is compounded by the fact that we have no certain knowledge of what we are losing, at what rate, and at what cost to the present and future generations. Some species are seen to be repositories of key genetic material, others are seen as of marginal genetic significance. But our knowledge in this field is quite limited.

The present approach to conservation through the creation of biosphere reserves and protected areas is both inadequate and unsatisfactory for its purposes. While it is accepted that the cost of protecting all the species, genes and ecosystems could be prohibitive, the present strategy of saving only a select few

on an *ad hoc* basis is discriminatory and unscientific. The present approach is also unsatisfactory because the selection of sites for the establishment of protected areas and biosphere reserves is not based on the latest available tools of technical and scientific assessment and monitoring, and there is no attempt to seek a long-term and practical accommodation between the needs of herders and of wildlife. The establishment of protected areas and biosphere reserves are currently viewed in the great majority of their locations by local communities as outside imports, cultural impositions, from which they seldom benefit. This is a perception which imposes an unnecessarily heavy burden on conservation efforts.

For environmental management - and conservation in particular - to succeed, there is a need for the willing co-operation of all the parties involved - namely: the government agencies; the local "users" of the natural resources, including flora and fauna; and the local communities. The challenge is to get all parties to agree on common paths in which capacities are tapped, responsibilities are shared, and everyone is expected to receive some benefits (and bear some costs) for the conservation and sustainable use of biodiversity.

In reality, the distributional incidence of costs and benefits of biodiversity conservation and sustainable use is seldom shared in a fair and responsible manner. Indeed, one of the major problems facing the implementation of the Framework Convention for Biodiversity Conservation, approved at the Earth Summit in Rio de Janeiro in 1992, has been the lack of an agreed mechanism to correct the present imbalance in the distributional incidence of costs and benefits at different spatial (and temporal) levels.

It is possible to identify three broad spatial levels for the consideration of costs and benefits :

- local
- regional/national
- global.

There arises a difference in interests and incentives from the asymmetry in both economic costs and economic benefits at the three levels.

At the local level, although there are considerable variations from site to site, the overall benefits tend to be somewhat narrow and defined. These benefits are, generally speaking, related to direct consumption use, notably of food, herbs, medicinal plants, supplementary income from tourism or recreational activities in protected areas. At the same time, the economic costs, both indirect costs involving damages arising, in the most common example, from the protected wildlife in the area, and the opportunity costs i.e., benefits foregone (both for direct consumption use by herders and for conversion of areas placed in protection for extending agricultural use or carrying out mining and other profit-making activities), as a result of lost access to the resources of the protected area, are at once concrete, easily-perceived and burdensome.

It is essential to find a resolution of the problem of asymmetry of interests at different levels and particularly at the local level, which requires in essence an acceptable accommodation between the needs of wildlife and those of pastoralists (in their role as herders).

The basic problem that must be resolved is a two-dimensional one. It is necessary to make the need for conservation measures understandable and acceptable to the pastoralists. But that is only one aspect of what needs to be done. According to the findings of a team of eminent biologists studying experimental prairies in the US, which was published in the journal *Nature*, (February, 1997); an increase in the number of species increased the productivity and stability of an ecosystem. The study concluded that the more species an area had the more biomass or plant material it produced and the better it retained nitrogen, the most crucial of nutrients and the basis for long-term growth. The conclusion supports the suggestion made by Charles Darwin in *Origin of Species*, that the more diverse ecosystems were also likely to be the more productive ones. The second aspect of what needs to be done, thus, is to complement the perception of the link between the number of species and the productivity of ecosystems. This requires us to devise strategies and the technical means for the most effective use of rangelands and their resources, such as, sharing the resources on an optimal curve between the grazers (cattle and sheep) and the browsers (camels and goats), keeping in mind the needs of both domestic animals and wildlife.

In order to be successful in these efforts, institutional support will be needed for the nature conservation programmes through the development of an integrated protected areas system, boundary demarcations, ecodevelopment in and around protected areas, and further research.

Empirical evidence suggests that the proper management of natural resources must be seen both from the point of view of "protection" and "production". While the natural resources are being protected, they must also be made more productive. The test of sustainability lies in the proper mix of protection and production. In the final analysis, the effort for accommodation must be made by the pastoralists and they will only achieve it - i.e., share the grazing in an equitable manner with all the claimants including wildlife - if they see a clear advantage in it for themselves. This can only come from a commonly- perceived increase in the productivity of the rangelands.

7. Conclusion

It will be seen that in dealing with the complex and rapidly changing socio-economic problems facing the pastoral nomads, policy and programme interventions should be multidisciplinary in character, and they should be process-driven. They should also attempt to cover a minimum threshold of critical objectives focused on improving the productivity and resilience of the rangelands. Within a broad programme of this nature, the interventions should support the design of planning and implementation procedures in order:

- (i) to slow and, if possible, reverse the worsening of the quality of soil, water and other natural resources;
- (ii) to protect, conserve and restore the genetic density of the targeted regions;
- (iii) to develop institutions of research, reforestation and technology generation;

- (iv) to strengthen environmental legislation and institutions involved in the task;
- (v) to mobilize adequate resources to correct damages, such as erosion and soil degradation caused by the indiscriminate conversion of land for agricultural use;
- (vi) to ensure environmentally-sound investments in the rehabilitation and development of irrigation and drainage schemes;
- (vii) to help in the establishment of soil and water management demonstration centres in agro-ecological zones, where potential problems have been found; and
- (viii) to identify innovative ways of providing pastoral nomads with access to credit to improve the management of their natural resource base, particularly through micro-credit schemes on pastures and rangelands.

In establishing the *inter se* priority of the interventions to be undertaken and their effectiveness, it would have been helpful for us to have available a generalized understanding of the carrying capacity of the dry rangelands. Unfortunately, as already noted, there is no consensus on the use and reliability of the models for estimating carrying capacity, especially in regions of high climatic variability. The policy issue that arises is whether the damage that has already been inflicted on the rangelands is irreversible (i.e. beyond some projected level of carrying capacity) and there is therefore no justification for further investments, or whether they are seen as suffering a temporary setback from which they could recover to produce adequate returns on investment.

Documented evidence suggests that a change in rainfall or other climatic conditions often bring about a rapid response in the dry rangelands. Vegetation cover is often found to switch over considerable distances with even a modicum of precipitation. It appears unlikely, therefore, that an irreversible damage to dry rangelands is a probability within time frames of relevance to us.

As the Desertification Convention makes it clear, action to deal with land degradation in desertified, arid and semi-arid lands is required in two parts. It is necessary to follow climatic conditions closely and to have pastoral nomads involved in the use of the recently-developed technologies for rangeland monitoring. Secondly, and in addition, policy and programme interventions are needed to cope with emerging problems of economic and social adjustment.

From the long-term and ecological point of view, however, the bottom line must be that when faced with risk and uncertainty of such critical consequences, it is worthwhile to follow the precautionary principle and take immediate action on a broad front to ensure that unexpected and unpleasant surprises do not occur. Such mishaps are the more likely to happen because of the "discontinuous" nature of the relationship between the pressures generated by human activities and the threshold levels of tolerance of ecosystems. The actual collapse of ecosystems could be extremely burdensome in both human and financial terms; anticipatory and preventive policies are far more reliable and far less costly than curative ones.

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