Pastoral Adaptation to Risk in Dry Regions: A Framework for Analysis

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Pastoralism, for many, is a profession destined to die. To them the purpose of social enquiry should be to make the process of annihilation less painful and perhaps even slower. Improvement in the conditions of a pastoral way of life may make the transition to sedentarisation more difficult. There are others who argue that there is no linearity between pastoral and sedentary land-use systems. Also, the one does not totally preclude the other. Pastoralists do own land and cultivate in years of good rainfall, in many cases. At the same time, in the given ecological environment any other way of life would not be sustainable because of very low productivity and high variability in the fertility of grazing and cultivation lands. Neither is it correct to assume that cultivation on a large scale would be able to either provide employment or income in a sustained manner in arid environments. The problem of soil erosion has been known to increase with intensive cultivation.

If it is accepted that pastoralism is an appropriate ecological and sociological response of communities inhabiting arid regions, then it is necessary for us to understand how the institution of pastoral nomadism and livestock-based economy has survived over the years. It is also necessary to understand the patterns in resource use and risk adjustments so that strategies for strengthening risk adjustment mechanisms can be identified. Historical studies would provide a useful way of understanding the evolutionary basis of risk adjustment strategies. In this paper I deal with the pastoral adaptation to risk only in the contemporary context. I present an analytical framework, followed by issues for further research.

Analytical Framework

Survival over space, season, and sectors: eco-sociological perspectives

Rural households have to diversify their strategies of resource use in order,

Acknowledgement: I am grateful to Shereen Ratnagar for providing me an opportunity to interact with scholars interested in the historical aspects of pastoralism. I have listed in the second part of the paper several questions which have arisen in my mind after participating in the Workshop, and would appreciate comments on these.

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to survive not just individually, but also collectively, in any high risk environment such as desert or hills. The pattern of diversification is closely linked with the nature of the initial endowment of the family, the historical process through which the portfolio or combination of various resource use strategies has evolved in a given region, cultural and institutional mechanisms guiding individual as well as collective behaviour, access to factor markets like land, labour, capital, and product markets including technological choices, and the nature of the state. Analytically, the relationship between the pattern of diversification in a given ecological context and social exchange relations has to be established in such a manner that the effect of changes in the one can be measured on the other. A causal model of pastoral adaptation is thus needed.

There are three levels at which we can analyse the pastoral adaptation to risk. At the micro level we need to look at the relationships between ecological, technological, and institutional variables. At the meso level we have to understand the relationship between spatial, seasonal, sectoral, and social exchange relations. At the household level we have to link the ecological context with the evolution of the portfolio of enterprises, the emerging perception of risk and response, and consequent feedback on the ecological system itself. In a dynamic framework, such a feedback either constrains or widens household choices over time.

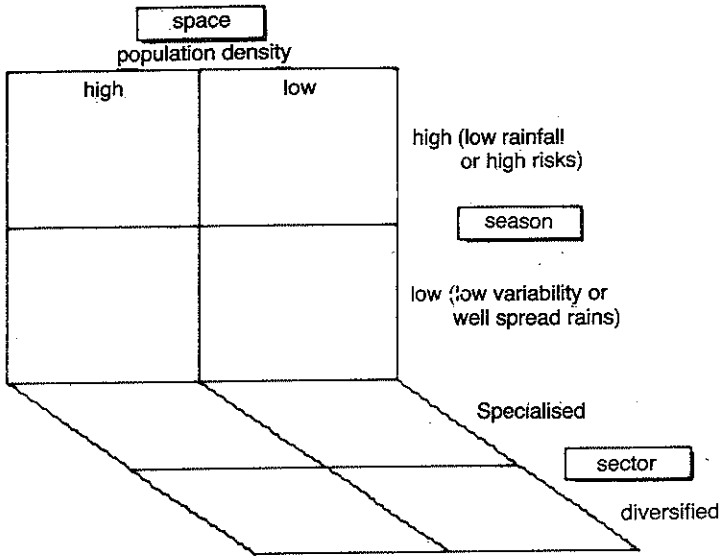
The 4-S Model: Interaction between season, sector and social exchange[1]

As shown in Figure 1, each element of the matrix can be dichotomised in its contrasting dimensions. For instance, space can be seen in terms of lowland or upland, low population density or high population density, lesser or higher slope, and so on. Likewise, seasonality can be contrasted in terms of high or low rainfall, diurnal temperature variations, or any other parameter of climate. The sector can be contrasted in terms of specialised or diversified portfolios, private or public, and single species versus multi species portfolios.

Our contention is that if we know any two dimensions we can speculate about the third. Likewise, if we know three dimensions we can speculate about the fourth, that is, the nature or pattern of social exchange. If we know all four dimensions we can then more carefully explore the type of

[1] Anil K. Gupta, 'Viable project for unviable farmers: an action research enquiry into the structure and processes of rural poverty in arid regions', *Symposium on Rural Development in South Asia*, IUAES International Congress, Amsterdam, 1981; 'Small farmer household economy in semi-arid regions: socio-ecological perspective', Mimeo., I.I.M. Ahmedabad, 1984, p. 452; 'Socio-ecology of grazing land management', in P.J. Jose, P.W. Lynch and D.B. Williams, eds., *Rangelands: a Resource under Siege*, Canberra, 1984, pp. 288–91; 'Socio-ecological paradigm to analyse the problem of poor in dry regions', *Eco-Development News*, Vol. 32, 1985, pp. 71–75.

FIGURE 1
THE 4–S MODEL: INTERACTION BETWEEN SEASON SECTOR, AND SOCIAL EXCHANGE



common property institutions that may emerge to satisfy collective expectations of fair and sustainable collective behaviour.

Let us take a combination of two dimensions, low population density, and low rainfall with high diurnal temperature variations as also high seasonal fluctuations. There is an inverse empirical relationship between the average amount of rainfall and its coefficient of variation. The lower the rainfall, the higher is the variation over time and space. It is for this reason that communities living in such high risk environments diversify their portfolios over time, space, and sector.

The sectoral portfolio would thus be diversified over time, space, and gender, so that different family members would pursue either the same or different occupations in different parts of the year and in different resource markets.

The social exchange conditions will indicate at least three major features: (*a*) generalised reciprocities will dominate over specific ones, (*b*) kinship networks will dominate over atomised households, and (*c*) the books of accounts among family members and between households will be tallied or

settled over a very long period of time as against shorter term settling in more commercialised communities.

The type of common property institution which may emerge here may have both episodic and continuous or concurrent rules. The episodic rules refer to directions of behaviour which become important only in times of crisis. These are actually meta rules which provide guidelines for evolving rules about the use of common property. The specific rules may of course vary from crisis to crisis, and are not often recalled during normal times. The continuous or concurrent rules refer to the ongoing directions for behaviour. Even here the equivalence of returns and fairness of distribution may first be evaluated at the level of the kin group or lineage. Only later may it be evaluated across groups and resource markets. Cross compensation or subsidisation may be practised more on moral grounds than purely economic grounds. For instance, not allowing anyone to fall asleep hungry may be explicitly understood as a collective responsibility only at the level of the small neighbourhood.

Conflict resolution may also be first attempted within sub-groups, although compensations may require adjustments across sectors and moral boundaries. Agarwal[2] provides an interesting example of a village where the punishment for poaching on commons was standing barefoot in the sun and offering grain to the birds. Such a logic cannot be analysed in the classical tradition of institutional analysis. Such sanctions cannot be justified on economic grounds at all. The reciprocities extend here to such claimants of the resources who may not have any vote, that is, the birds. But in the process of suffering in public by standing barefoot in the sun is generated a collective responsibility. It is recognised that the moral appeal may have a longer lasting effect compared with a pecuniary tax or fine. The public display of punishment may also generate guilt.

Institutions in a low risk, high returns environment, where social atomisation is high, may be more specialised with precise rules, boundaries, sanctions, and conflict resolution mechanisms. In some cases commons may be auctioned to private individuals to generate surplus for collective use. The reciprocities may be specific and cross-sectoral linkages weak at the micro level.

It is obvious that the 4–S model provides only a broad approximation of the institutional conditions. One would have to look into more precise dimensions to analyse institutional dynamics.

Commons and Pastoral Adaptation: Illustration

Let us assume that there is a village having three groups of households. Group One owns primarily cattle and land and receives income from

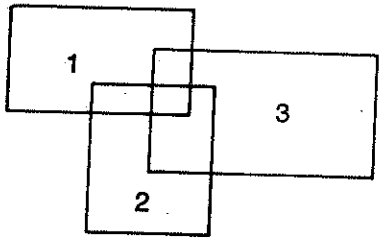
[2] Arun Agarwal, Personal Communication, 1990.

inward remittances (from people employed elsewhere). Group Two owns cattle and sheep and some land; family members are engaged in crop-related activities and labour on others' farms, on public employment works, etc. Group Three has primarily landless people or marginal producers having very small land-holdings if at all; it owns primarily sheep; gets most of its income from labour, and also pursues crafts; and lives in separate settlements outside the main village due to caste and other social factors.

The portfolio of activities of each group is different, and so also their respective vulnerability. The proportion of biomass obtained from the commons, as a function of total biomass requirement will also vary. However, the attitude towards the commons would not be judged merely by the access and assurances available about future returns from present investment and others' behaviour *vis-à-vis* one's own, or the skills or abilities of groups to convert resources into investments. The attitude will also be governed by the timing of the availability of biomass from the commons, and the difference between the threshold quantity of biomass necessary for survival during the lean period and the total biomass available from the commons during this period. The threshold value will be determined differently for different groups, depending on the availability of biomass from private or other open access resources.

The catchment area from which the three groups draw their biomass would also be different:

FIGURE 2



Group Three would migrate much longer distances than Group One, due to technological reasons (sheep-dominant portfolios) and differential access to private resources. The domain from which the two groups will draw the biomass may overlap partly. Thus Group One and Group Three may apply restraint towards the use of the commons for very different reasons. In both cases the critical resource availability over time may not be synchronised. In the case of Group Three vulnerability is high, and

therefore the dependence on a resource regime—in this case the common property resource (henceforth CPR)—which provides only a marginal share of the total requirement, is low. In the first case the vulnerability is low and the dependence is also low. In the case of Group Two the dependence may lie somewhere in between.

Even though the environmental risk and uncertainty may be the same for all the three groups, their response to the commons would be influenced by the importance that the CPR has in their portfolio, besides other background factors influencing their attitudes and expectations.

In the case of Group One, the inward remittances may reduce vulnerability by providing a regular flow of income and thus change the bidding behaviour *vis-à-vis* the commons. The cultural congruence between different groups would act as a background variable insofar as the criticality of availability of biomass from the CPR is concerned. In a drought year everyone may decide to be indifferent to the commons, because the biomass may not meet more than a few days' needs of the three groups. Alternatively, Groups Three and Two may migrate out, leaving behind Group One to use the CPR in the lean season. There is also a possibility that Group One may decide not to violate the sanctity of the commons, either because of religious reasons or concern for future availability of resources to the other groups as well as to the members of the same group. In either case there could be several variations in dealing with risk and institutions may emerge to regulate cultural, economic, psychological, and social expectations of people from one another within the groups as well as between groups.

We have come across instances where village leaders may decide to auction the commons to the highest bidder even though there may be reservations for Group Three persons belonging to the lower castes. The argument may be that the bid price offered by Group Three would be very low, and therefore the collective income of the village would come down. In case the collective income is invested for such common properties which are used by everybody equitably, the inequity of the auction mechanism may be tolerated. On the other hand, if the common good created serves only some groups more than others, there may be resistance. The degree of resistance would of course vary depending on the extent of inequity and intra-group solidarity. There are examples where experience of very strong conflict between Groups One and Three have led to the emergence of very high solidarity within Group Three for managing a group-based common pool institution.[3]

[3] A. Pastakia, 'Technology development and diffusion in tree growers' co-operatives in a coastal saline region of Gujarat', *International Farming Systems Research and Extension Conference*, Michigan, 1990; 'Technological and institutional variables in the evolution of rules for community plantations of a scheduled caste in a backward area of Gujarat', *International Conference on Common Property Resources*, Duke University, Durham, 1990.

There are also instances where Group One, dominating the local *panchayat*, may hand over the commons to forest departments or other public authorities for closure and regeneration. In such a situation, Group One ensures that Group Three will lose access to the CPR in the short term. When resource regeneration has taken place, the usufruct may be disposed of in the market. And the surplus so generated may be used for creating a public or common good in the village which may or may not be of much use to Group Three. Group Three may lose access in the long term also: Groups One and Two may collude because of economic and social reasons. But in some cases Group Two may align with Group Three on caste and cultural considerations. The commons may survive, without necessarily any gain in the livelihood prospects of Group Three.

Risk and Redundancy

The redundant resource will insure the portfolios of different groups differently, depending on the importance of the redundant resources in the respective portfolios. Variability in returns from each enterprise in the portfolios of the three groups would influence their incentives to economise the use of the respective resources. Whether the returns from enterprise dependent on commons co-vary or contra-vary with the returns from other enterprises, would influence the portfolio variance as distinct from enterprise variance. We have suggested that an enterprise may be discounted differently depending on the property regime governing its use. The lower the control over cash flows from an enterprise, the higher may be the discount rate. Further, a negative return enterprise may be kept in the portfolio if its presence (*a*) reduces the portfolio variance by generating externality (as in the case of manure for crops which has no market value say in some hill areas, or trees in some of the agroforestry systems), (*b*) meets certain cultural needs (some varieties of rice though with very low return are grown because they are required for certain ritual and religious occasions, or an old cow is not culled due to the taboo on cow slaughter) and (*c*) provides opportunity for renewing certain skills which otherwise may get lost or weakened.

The trade-off between redundancy in resource use to deal with future uncertainties vis-à-vis optimal scarcity leading to emergence of rules for regulating present resource use has to be made very carefully. Too much redundancy may confuse, too little may cripple.[4] Sometimes scarcity in resource use is compensated by redundancy in the cultural or psychological spheres. Sometimes the regulation of the CPR is done through regulation

[4] Anil K. Gupta, 'Socio-ecological paradigm'; 'Eco-Sociology of household risk adjustments and commons: performance in an uncertain world', *International Conference on Common Property Resources*, Duke University, 1990.

of private resource use as observed by Gills and Gamtgard.[5] In other words, scarcity in one sub-system can influence sufficiency in other systems. In addition to redundancy, randomisation has also been used for regulating collective behaviour in managing the commons.

Buzdar[6] provides an explanation of multi-enterprise, multi-resource, or eco-niche based survival strategies. The interaction between private and common resources across altitudes in northern Pakistan resembles the experience in the Swiss Alps and Bhutan.[7] Agricultural land and animals are owned individually, whereas water and pastures are owned collectively. No single altitudinal level or eco-niche has the potential to provide all the survival needs of the villagers. All families require access to different micro environments to reduce the risk of bad years and effectively schedule resource use over time and space. No single activity is sufficient either. A bundle of rights emerges to manage properties under various regimes or rules; it has been shown that individual strands of this bundle may be distributed between the state, owners, users, creditors, or labourers.[8]

Buzdar provides examples of coordination among various pastoralists who must regulate entry into and exit from the village such that the presence of the animals coincides with the fallowing of the fields. This in turn requires that individual cultivators grow crops that mature at the same time. Fines are imposed for keeping animals too long in the village or bringing them in too early. Agarwal observes a similar practice in Bunakha village in Bhutan.[9]

Cooperation and Diversification

Sahlins has described how pooling and redistribution can continue to function when some rent is extracted by a decision centre for performing this function. Something similar is what Berkes suggests as a rent for society in the form of royalty payment for fishing. The difference is that in the first case the rent accrues to society through indirect taxation or direct taxation with small negative externality to individuals who pay the rent.[10]

[5] J.L. Gills and K. Gamtgard, 'Organizing in pastoral areas: the commons reconsidered', *Sociologia Ruralis*, Vol. 21, 1981, pp. 129–41.

[6] N. Buzdar, 'Property rights, social organization, and resource management in northern Pakistan', Environment and Policy Institute, East West Centre, Working Paper no. 5, Honolulu, 1988, p. 29.

[7] Anil K. Gupta and Karma Ura, 'Blending cultural values: indigenous technology and environment: the experience at Bhutan', I.I.M. Working Paper no. 883, Ahmedabad, 1990, p. 42; R.M. Netting, 'Of Men and Meadows: Strategies of Alpine land use', *Anthropological Quarterly*, Vol. 45, 1972, pp. 132–44.

[8] S.V. Ciriacy–Wantrup, *Resource Conservation: Economics and Policies*, Berkeley, 1972.

[9] Arun Agarwal, Personal Communication.

[10] M. Sahlins, *Stone Age Economics*, London, 1972; F. Berkes, 'The common property resource problem and the creation of limited property rights', *Human Ecology*, Vol. 13, 1985, pp. 187–208.

Runge, drawing on the work of Amartya Sen,[11] suggests that free riding was an option but not an imperative in collective choice situations, particularly if institutions provided opportunities of learning over time, and gaining order and security in an uncertain world by providing assurances. The assurance problem was seen as a zone of possibility raising two issues:

(1) The potential and actual demand for different resources needs to be taken into account while analysing the incentives for cooperative action and

(2) the rules that may co-ordinate the behaviour of groups will vary over size, sector, space, and time. The dynamism of this variance may be difficult to capture, we submit once again, if institutional rules pertaining to one resource (land, labour, water) alone are taken into account. Hence the utility of the portfolio approach.

There are umpteen examples of correspondence between the need for a resource to regenerate and the evolution of customary resource-use patterns which are collectively and individually in conformity with ecological requirements of sustainable resources. There are tribes who do not fish during the period of spawning. Further, high germ plasm variability in regions with the highest degree of poverty generate a cultural requirement for different varieties, of say rice or potato, and for tolerance of low returns with a high variability in different varieties. Survival was ensured because there existed a contra-variance in returns of different local varieties, and some output was available no matter whether rainfall was too little or too much. But with declining demand for the skills of such communities, or inappropriate rewards for maintaining bio-diversity, the income levels of people have declined. Once the portfolio shifts took place in favour of uniform varieties, or some other enterprises, the cultural edifice supporting respect for sustainability through diversity crumbled.

Some other ways in which 'traditional' societies try to manage correspondence between common and private resources are: establishing correlations between one system and another (using proxy variables like the flowering of certain shrubs or grasses to regulate decisions about beginning or ending grazing activity at a given place); generating rituals requiring respect for common properties; and instituting customs or festivals which serve as reminders of individual responsibility for a collective good. Much of the literature on institutions has somehow ignored the rich tradition of cultural mechanisms available for the management of commons. Stocks[12] provides examples of cultural norms that counteract irrational tendencies

[11] Amartya Sen, 'Isolation, assurance, and the social rate of discount', *Quarterly Journal of Economics*, Vol. 81, 1967, pp. 112–24; C.F. Runge, 'Common property and collective action in economic development', *World Development*, Vol. 14, 1986, pp. 623–35.

[12] A. Stocks, 'Resource management in Amazon Varzea Lake eco-system: The Coaamilla case', in B.McCay and J.M. Acheson, eds., *The Question of Commons: the Culture and Ecology of Communal Resources*, Tucson, 1987, pp. 108–20.

of resource use. For instance, a pastoral group could evolve norms of spending most of its time on stretches with the highest rate of return, or evolve norms of mobility even when not warranted by the resource supply.

To summarise, environmental risks are adjusted by various social groups through a combination of strategies that vary over space, season, sector, and social group. Patterns of diversification are evolved over a long period of time, through trial and error, and not necessarily only with immediate economic ends in view. The act is sometimes its own reward: travelling together is given as much (if not more) importance by pastoralists as arriving at the destination.

Eco-Institutional Model: 4-A (Access, Assurance, Ability, Attitudes)

The relationship between the variables on the X and Y axes in Table 1 can be one to one. Or else, each variable on an axis can be related to other variables on the X and Y axes. If we know the parameters of two dimensions on the X or Y axis, we can speculate on the parameters of a third dimension. For instance, if we know (*a*) what type of access exists *vis-à-vis* market resources in a given situation and (*b*) the distribution of skills and abilities among various groups, the type of assurances both vertical and horizontal required to generate sustainable resource-use can be anticipated. The horizontal assurances refer to others' behaviour *vis-à-vis* one's own at a point of time; the vertical assurances refer to future returns from present investments. The attitudes are both result of the experience with resource utilisation, and causal influence on the response to institutions. The attitudes provide a cultural basis of institutional working.

Table 1

The Eco-Institutional Model

	Ecological Resources	*Technology*	*Institutions*	*Culture*
access	xx			
ability		xx		
assurance			xx	
attitudes				xx

Pastoralists need access to grazing land, water, places for night shelter, food, and other necessities like veterinary medicine, during migration. The need for assurance about security of person and livestock in the unknown or lesser known regions generates institutions for collective survival.

Agarwal[13] illustrates how some migrating groups of shepherds in the Dangs have a sort of relay race for night watchman duty. Every person has to guard the herd in the night by moving around the herds (settled in concentric rings, women in the centre, and the animals and men around them). He takes a small stick, to be handed over to the next guard at a fixed time in the night, on the change of turn. If a person falls asleep, it is easy to find out the culprit.

Likewise, there are other mechanisms developed to have other assurances. Villagers in Andhra Pradesh receiving herdsmen from Rajasthan have an informal arrangement for deciding whose fields should be penned in a particular year, by whose herd. An assembly of village elders negotiates with the scout party of the pastoralists about these arrangements. The obligations of payment to the village common fund, or to herdsmen or farmers, are also spelt out. Friendly relations between visiting herdsmen and local settled populations cannot be taken for granted. There have been many cases of violence against pastoralists on the issue of grazing in forests (with or without sanctuaries), private fallows, roadside fallows, or at inter-state borders. There is a Supreme Court judgement acknowledging the unrestricted right of pastoralists to move from one state to another. However, when assurances from the state or host village communities weaken, grazing pressure increases on more marginal uninhabited lands, leading to ecological crisis.

Improvement in access or assurances alone will not help if the skills of pastoralists in the use of available opportunities do not simultaneously improve. Most pastoralists can inject medicines or vaccinate their animals themselves. But there remains a vast range of traditional medicine systems or knowledge about combination of stress fodder and feeds during drought which need to be properly analysed, screened, and diffused.

The Eco-Sociological Paradigm

We make two assumptions. First, ecological conditions define the range of economic choices that can be sustained in a given region. Second, the scale at which different enterprises are selected is nevertheless a function of the access to factor and product markets, kinship networks, public, private, and common institutions, or historical resource reserves.

Earlier we had assumed that in any given ecological niche only certain economic enterprises are feasible at the given level of technology and institutional infrastructure. However, we modify this condition to suggest that ecological endowments of the proximal environment of a community need not be the sole focus. The distant environment where the community

[13] Arun Agarwal, 'The grass is greener on the other side', Study for the IIED, London, 1991.

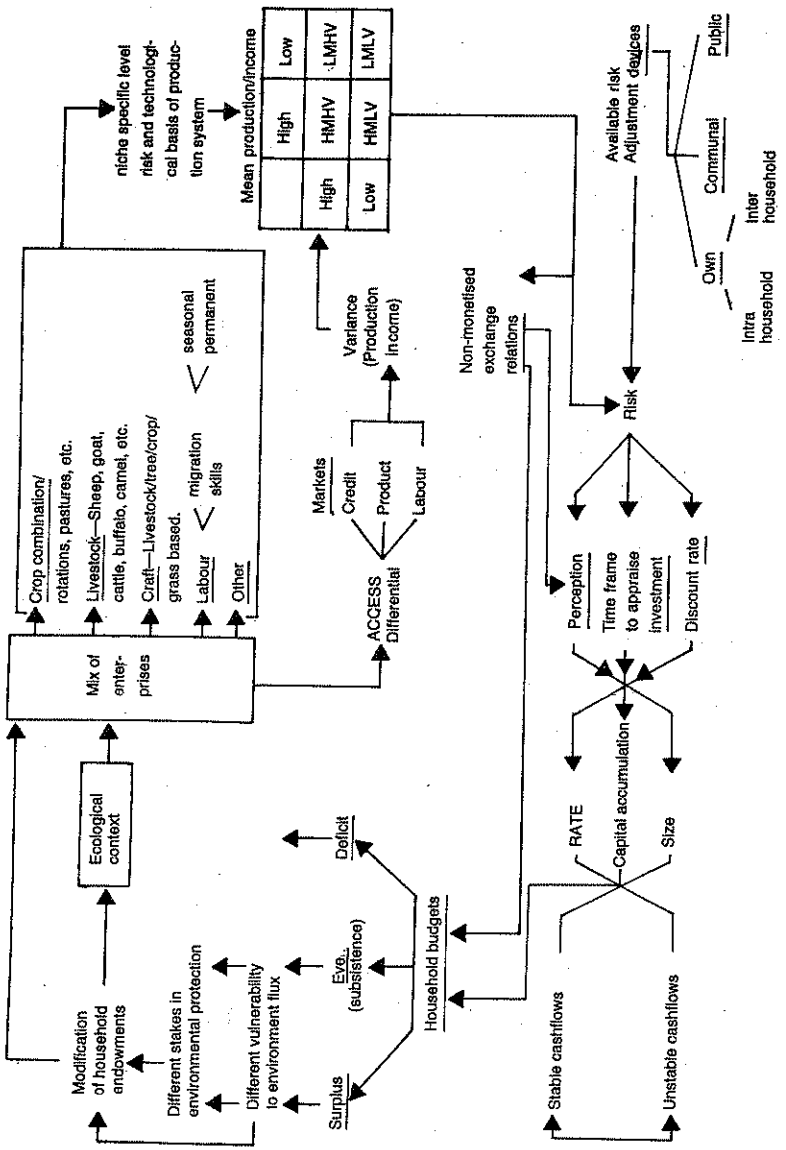


FIGURE 3
SOCIO-ECOLOGICAL FRAMEWORK FOR ANALYSING HOUSEHOLD ECONOMY

has customary or traditional rights through migration (or any other such means) has also to be taken into account.

Thus once a mix of enterprise (portfolio) is selected, drawing upon resources from private, public, and common properties, the nature of risk inherent in these portfolios can be analysed through a matrix of means or average and variance. The high mean and low variance portfolios would obviously be different in their implications for individual and collective behaviour from portfolios with low mean and high variance. Given an initial portfolio and its mean–variance or risk–return characteristics, households may respond to given risk in the environment through the following alternative means: (*a*) household level risk adjustments; (*b*) public risk reducing mechanisms; and (*c*) communal and common property risk adjustments.

Household risk adjustments can be further analysed at intra- and inter-household levels. Intra-household risk adjustments include measures available to a household through negotiations within the household, such as asset disposal or purchase, migration, or reduction or modification of family consumption. Inter-household risk adjustment strategies include tenancy, borrowing, labour contracts, and group ploughing. Public mechanisms imply availability of drought or flood relief, insurance, public employment programmes, and so on. Communal risk adjustment strategies refer to group-based measures which require collective decision-making, either for utilising or preserving private or common property resources.

Once the access to these risk adjustment options is known, households may modify either their perceptions or their response, or both, by changing the discount rate or time frame used for appraising returns from each investment. In turn the cash flows of the households may be in surplus, deficit, or subsistence. In addition, the variability in these cash flows may be evened out over space, season, sector, and social networks. The stakes of different social groups in the management of ecological systems would vary in each resource market.

The trick is to develop a calculus in which unequal stakes of different groups in various resource regimes generate a set of expectations which are equitable or appear equitable (given cultural and social differences in the perception of returns) at the portfolio level of the household. The fairness of these distributions cannot be estimated only from the individual point of view. The group level estimation of aggregate effects of individual portfolios may generate rules that modify the conditions for use of resources, technology, and institutions. Under extraordinary circumstances the cultural norms are also modified to accommodate ecological and social imperatives, as seen in the case of Buddhist Bhutan where eating meat is acceptable despite the religious injunction against animal killing.

The coordination of individual choices through the evolution of portfolios requires (*a*) understanding of risk and returns in each resource

market; (*b*) evaluation of the returns by skills which are calibrated differently for assessing short and long-term returns, economic and social, and individual and collective; and (*c*) differential discounting of returns in times of crisis or scarcity *vis-à-vis* returns in normal times. The spirit of innovation supported by the wealth of knowledge of disadvantaged groups provides better understanding of the institutional dynamics. For those who own very little resources, the reliance on commons or open access resources is inevitably high. Their stake in the preservation of the commons does not necessarily become higher on this account alone. There is a need to link the stakes of individuals in different resource markets with their expectations of returns across these markets. The supply of a resource when it is most needed may make all the difference to its value, just as increase in constraint of a small magnitude but beyond the critical limit can be the proverbial last straw that breaks the camel's back.

Adjustments by pastoralists to risk cannot be studied in isolation from the survival options of other communities. At the same time survival in a normal year cannot be completely distinguished from survival in an abnormal period like a year of drought.

Issues for Further Research

There are several issues which are still not adequately explained. We do not know adequately the combination of resource use conditions which generate positive and negative feedback effects on culture. For instance, we know that the practice of burial of the dead may have emerged among the Muslims because this religion evolved in deserts where the supply of wood for burning might have been a constraint. Likewise, the custom of providing a share of food for birds, ants, or dogs might have evolved amongst Hindus to co-exist with various animal species in a rich biological environment in the Indo-Gangetic plains. However, these are very partial and insufficient explanations of cultural codes. We need rich descriptions of cultural mechanisms to conserve common grazing land and other resources.[14]

Could there be a pattern in the ecological and cultural niches where different religions grew at different times in history, with a bearing on pastoralist adaptations? For instance, Jainism diffused in different parts of the country but especially so in Rajasthan, that too amongst traders. The Bishnoi sect also grew largely in Rajasthan but amongst different ethnic and occupational groups. Both emphasised the restriction on cow slaughter;

[14] See McCay and Acheson, eds., *The Question of Commons*; L.P. Gerlach and G.B. Palmer, 'Adaptation through evolving interdependence', in P.C. Nystrom and W.H. Starbuck, eds., *Handbook of Organizational Design*, London, 1981, pp. 323–84; R. Brara, Shifting Sands: a Study of Rights in Common Pastures, Institute of Development Studies, Jaipur, 1987; P.S. Kavoori, Pastoral Transhumance in Western Rajasthan, I.D.S. Jaipur, 1988.

the ancient Hindu texts did not. Is it possible that with changes in ecological conditions and livestock population dynamics, the pastoral way of life required such institutional interventions?

It is also important to know whether the assurances which were considered satisfactory in the past will continue to be seen as such in future, in the light of increased expectations from democratic populist governments. The distribution of relief during drought and floods has not only made some of the communal survival institutions redundant, it has also weakened the potential for self-help. My intention is not to underplay the importance of short-term relief in the event of natural disasters. What I do feel, however, is that the same relief can indeed be blended with local self-help potential and cultural, ecological and institutional endowments. The learned helplessness among the disadvantaged households in backward regions where CPRs are most critical for survival, generates alienation and sometimes eco-destructive protests. Did the presence or absence of relief during major droughts in the past influence shifts in migration patterns, or in collective institutions for local resource management?

The portfolio of livestock species herded by different pastoral communities is influenced by several factors such as suitability of species, age and gender composition, nature and duration of ownership, pattern of disposal under distress or profit sales, and catchment of dry matter. We need evidence of the long-term changes in these portfolios. For instance, the rate of growth of sheep and goat in the last two or three decades has been far higher than the growth rate of cattle. Many communities like the Rajputs which did not keep goats, have started doing so. There may have been many such shifts in history: what implications did these shifts have for the relative evolution of power of the respective communities? Change in the power base would in turn have influenced the choice of enterprises.

Age affects not only the feeding and productivity of the livestock but also the option for mobility, and vulnerability to mortality. In general infant bovines are found to dominate in the semi-arid regions. These regions are the breeding tracts. Studies have shown that age and species combination is systematically related to locational factors. Agarwal[15] has shown that duration, distance, and flock size are positively correlated; smaller herd may migrate less frequently and to shorter distances. I have recently hypothesised that landowning pastoralists will cover distances at variance from landless livestock owners. The ratio of sheep, camel, cattle varied in different regions, and the species mix of trees, crops, livestock, or grasses also co-varied systematically. For instance, in regions with higher rainfall we would have broader leaf trees and in the more arid environments, we would notice narrow leaf or thorny bushes or shrubs. Likewise, camel and sheep are likely to be far more numerous in the arid environment,

[15] Arun Agarwal, 'The grass is greener'.

and cattle and buffalo in the less arid, more irrigated, environment. Buffaloes are in fact known as water buffalo and found in areas with more water and shade. There are some exceptions such as Kutch where buffaloes have adapted over a long period of time to an arid environment where the relationship between craft production and livestock keeping (both by way of utilisation of time and resources) is also very strong.

The nature of crop variety selected by pastoral communities also varies from the varieties preferred by intensive cultivators. The crop varieties in the case of millets and sorghum are generally taller and have a high straw to grain ratio. Further, these varieties are selected to produce at least some fodder even if no grain, given closer dependence on livestock in adverse climatic conditions. The ecological variability over space is very high, and therefore genetic diversity is also noted to be high. Historically, the exchange of grain and other resources during the period of pastoral migration might have triggered interesting experiments in the introduction of crops, in hybridisation, or in local adaptation.

Various factors such as widespread epidemic, long duration droughts, earthquakes, or other natural calamities have influenced the dynamics of both human and livestock populations. It is known that the population growth rate of pastoral communities is generally very high, possibly because of the fear of higher mortality in bad years. How changes in the species composition of livestock (on account of varying mortality rates) influenced migration patterns over time is not very clear. We also do not know whether the need for social organisation among the pastoralists was as high earlier as it is now, whether on account of security of livestock or of pastoralists. It is also possible that in earlier times the danger of predatory animals was much more severe, and therefore institutions of safety more vibrant. The changes in river courses and availability of drinking water would also have made a difference to the direction and duration of pastoral movements in the past. To what extent can we draw lessons from the evidence of failed adaptations in history? For instance, what were the major mistakes committed, if at all, by pastoral communities which have ceased to exist in a given region? Alternately, if in some regions no communities other than pastoralists have survived, what were the reasons for their survival?

The fears of global climatic change have already pointed attention to the possibility of some of the major pastoral regions receiving higher rainfall, and some of the regions with settled agriculture facing more droughts. In such a case what are likely to be the institutional and technological implications not only for the pastoral adaptation to settled agriculture, but also the transition of settled farmers to pastoral resource management? Will the supply of skills which pastoralists specialise in, increase, thus enhancing their social and political power? The experience of collective grazing land management has not succeeded on a durable basis, because modern institutions have seldom been designed to rest upon traditional institutions.

The lessons available from historical patterns in pastoral adaptation for designing modern institutions have to be drawn, whether from hill areas or desert regions.

Household economies of pastoralists have suffered a great deal in recent times because of the perception of these people as a source of 'unskilled' labour. The Report of the National Commission on Development of Backward Areas (Planning Commission, 1981) went so far as to observe that out-migration of labour from backward regions such as deserts should not be stemmed lest the supply of cheap labour for large infrastructural projects is checked. Lakhs of cattle owners who have to move along with their cattle to cattle camps during prolonged droughts are seen mainly as the target of relief and charity. They are not seen as a repository of immensely useful knowledge about indigenous medicines (for people and livestock), or preservers of bio-diversity (breeds of livestock, shrubs, trees, and grasses; genes for disease and pest resistance) or carriers of the cultural core of any society. The banking system considers pastoral nomadism as a difficult problem for loan follow-up; and the public distribution system is weak, with the result that marginal lands which should not be brought under the plough are cultivated and eroded in the process. The concept of fodder banks has been talked about, but never considered on scientific lines. Political articulation by the pastoralists is weak.

Historical studies can help us in understanding how pastoralism has evolved over a long period of time, when and under what circumstances the ecological balance was disrupted due to natural or human factors such as to impose major restrictions on pastoralism, if ever. Conflict between settled and mobile populations has been known to exist for a long time in different parts of the world: are there some lessons from the way these were resolved in the past, for dealing with such conflicts in the future?

I hope that the pioneering step taken by the Centre for Historical Studies at the JNU in bringing researchers interested in historical aspects of pastoralism together with those concerned with contemporary problems, will generate a productive agenda for more intensive dialogue in future. Pastoralism, I have no doubt, is not dead. It will never be!