

ECO INSTITUTIONAL PERSPECTIVE ON MAINTAINING DIVERSITY

by

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W P No 1060, October 1992

The main objective of the working paper series of the IIMA is to help faculty members to test out their research findings at the pro-publication stage.

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD – 380 051
INDIA

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A b s t r a c t

The global dialogue on diversity particularly mediated by global institutions has been biased against the perspectives and philosophies evolved by the cultures in the developing countries. It is a different matter that seeds of change for sustainable development may exist with in these cultures. It is not that this neglect of local knowledge perspectives manifests only in Western writings or UN publications. The neglect is equally strong even in the formal publications of various governments in these countries. In this paper, I argue that biodiversity cannot be maintained where it exists and enhanced where it is declining without appreciating the institutional context of the cultural, ecological and religious consciousness. The socio-economic factors explain only partially, why some communities maintain biodiversity and others do not. The earlier argument about close linkage between biodiversity and poverty is extended to suggest that economic poverty need not be coterminous with institutional and cultural poverty. There may be lessons to be learnt from the communities which have maintained biodiversity by remaining "poor". However, it has to be strongly asserted that one cannot expect biodiversity to be maintained by keeping people poor or out of the natural habitats as seems to be the strategy in many countries.

The paper is organized in three parts. In part one, I discuss the phenomena of ecological diversity and it's bearing on our learning, living and exchange systems. In part two, I provide examples of the interactions through which Eco Institutional Perspective can be advanced. Finally, in part three, I suggest some puzzles and dilemma which need to be further understood and analyzed. I would not suggest, resolved. A puzzle resolved is a faith broken. Perhaps diversity cannot be maintained by reason alone.

Draft
1992

Eco Institutional Perspective on Maintaining Diversity¹

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Context:

Deriving expectations, consequent incentives and an urge to exchange a good, information or service with another person/s or agency constitutes the essence of an economic exchange. If the expectation of one party merges exactly with that of other, the exchange takes place and often repeatedly. Sometimes the expectations are modified by the conventional norms, values and beliefs which may or may not be shared completely. If these were shared, the need for explicit contracts might not arise. However, the cultural variability in the way in which transition from expectation to incentive and urge takes place implies that economic arrangements cannot be viewed in isolation of the cultural dimensions.

But if cultural dimensions evolved over a long period of time through an interaction with nature, technology and institutions (formal as well as informal), then economic exchanges would have obvious impact on and be impacted by these dimensions. In this paper I explain the bearing these dimensions have on economic exchanges so far as generation and maintenance of ecological diversity is concerned. I submit that the analysis of transaction cost and associated need for assurances be pursued not just in the boundary of economic or organizational sphere of one's existence.

One needs to identify the parameters in the cultural, sometimes spiritual² and of course ecological realms of an exchange which influence the transition costs as well as the assurance granting mechanisms systematically. If I can demonstrate a systematic pattern in above interactions, the case for the Eco Institutional perspective would have been strengthened. Once the phenomena of diversity is analyzed in this perspective, the decline or increase in its extent can be more easily understood and predicted. I am not denying that our understanding of ecological systems is still far from complete (perhaps it always will be). However, as Riedl (1984) suggests drawing upon Konrad Lorenz's work that nature is very parsimonious. It has only few patterns which it keeps on playing with arranging and re-arranging in different combinations. It is this- parsimonious nature of the 'nature proper' which we intend to bring in our socio ecological analysis. The Eco Institutional perspective is aimed at generating the assurances which nature provides but not always and not in exact sequence.

The paper is organized in three parts. In part one, I discuss the phenomena of diversity and its bearing on our

1. Paper presented at the Second Conference of International Society Of Ecological Economics on Investing in Natural Capital, Stockholm, August, 1992.
2. Shri K.M. Munshi, a cabinet minister during 1950-54 of Food & Agriculture, in a lecture to the top agricultural scientists in 1952 termed his philosophy of Land Transformation, 'A Goshal Dirty Hand'. He could see the continuity of empathy, urge and consequent human actions between soil and soul. He strongly suggested that the eco restoration policies be premised on the experiences of civilisation and cultures which failed to reproduce themselves because of eco destructive values and

institutions. The relationship between individual values, professional concerns and organizational arrangements could not be, he asserted, isolated from one another. The spiritual dimension, therefore, needs to be understood as an expectation creating force (Munshi, 1952).

learning, living and exchange systems. In part two, I provide examples of the interactions through which Eco Institutional Perspective can be advanced. Finally, in part three, I suggest some puzzles and dilemma which need to be further understood and analyzed. I would not suggest, resolved. A puzzle resolved is a faith broken. Perhaps diversity cannot be maintained by reason alone.

Part One: Diversity, Complexity, Simultaneity and Learning:

In a separate review, I have drawn the implication of ecological diversity and associated processes for public administration (Gupta, 1989), Intellectual Property Rights of indigenous innovators (Gupta, 1991, 1992). I will only briefly recapitulate the arguments here. I would expand on the relationship between these processes and learning and living systems on which the Eco Institutional interactions are predicated. I am suggesting that the discipline of ecological economics be illuminated by the concepts, categories and heuristics evolved by marginal but more eco friendly communities and cultures such as Amish, Inuits, American Indians etc., in North and Buddhists in Bhutan, some of the tribal and other communities in forest and desert regions in different developing countries.

It is strange but true that in a recent document, ‘Caring for the Earth: A Strategy for Sustainable Living’ published by IUCN, UNEP and WWF in October, 1991, the earliest reference was of 1979. About 90 percent references were post-1985 and majority of these were Western in origin. There was no reference to Vedic, Koranic, Zoroastrian, Chinese, Buddhist, Masai, Inuit and other knowledge traditions and worldview (Gupta, 1991:16). This kind of discourse would neither take the discipline nor the humanity forward in its search for sustainability. Thus to me, it is not enough to bemoan as Herman Daly does that leading text books on macro economics did not deal with environmental issues appropriately (Daly, 1990). The argument would have to be taken to its logical conclusion and references to alternative worldviews, cultures and heuristics would have to be equally keenly insisted in any discourse on ecological economic or sustainable development.

Elements of Diversity:

The physical conditions for generation and maintenance of ecological diversity abound in 20 degree latitude on both the sides of the equator. The mountain ranges, rain forests, niches for speciation and preservation through human mobility and exchange in these regions is well documented (Fowler and Moony, 1990, Gupta, 1991). However, what is less well understood is the rationale for regions of high biodiversity also being regions of high poverty (Gupta, 1991). I have no sympathy for the ecological theories of poverty as suggested by Riggs and others for whom the climate and the context generated indolence, apathy, lack of initiative and consequent poverty. On the contrary, an ethics which justified caring for those who could not vote - the birds, the beasts and the yet to be born- deserves to be respected. If diversity created other conditions for perpetuation of poverty, then we need to understand the assumptions underlying economic theories, organisational designs and political institutions which legitimize such an association. I summarize these features below:

- a) The diversity by definition implies production of different kinds of biological products of varying quality, shape, taste, colour etc., in different quantities over time and space. The generation of market demand for such diverse range of products has been considered difficult in the absence of strong consumer preference for the same. The exception being French wine in which diversity in above attributes has been sustained

by the market.

- b) In whichever products of bio-diverse farming systems the consumer preference emerges either through markets (as in the case of wine) or through culture, rituals and other mechanisms (in case of some of the local varieties of rice and other millets), the diversity is maintained so long as the physical limits do not constrain the transition to standardized, high demand, uniform product. Thus even though market demand for large number of local varieties of crops, vegetables and fruits does not exist, people grow them because nothing else seems to be possible in the given soil physical and micro climatic conditions. Once a community gets locked into low-return and high variance production system, the immiserisation is inherent.
- c) The diversity in nature often is made sense of by generating categories or concepts for comprehension. Thus the language of Eskimos has the largest number of words for snow and that of many fishing communities for sea waves. A community which is dependent for its survival on a resource thus generates a very deep understanding of the variability (and patterns therein) in the given resource. Thus so many different words. Unable to invest in understanding this variability, scientists and technologists often ignore it. The categories of modern institutions and markets are imposed which undermine the coping mechanisms built upon the above understanding of diversity. The progress is measured in terms of the extent and the pace to which the local categories are subsumed under global ones.
- d) The cultural institutions implying need for various kinds of restraints in critical periods of ecological transitions (protection for spawning fish; grazing lands; hillocks grazed by one specie say yak being allowed to regenerate for cattle; prevention of inter-specie transfer of diseases and pests; voluntary quarantine in the periods of outbreak of communicable diseases among livestock and human beings; generation of institution of controlled forest fires to clean the deadwood on the ground lest it harbours forest pests like beetles etc., see for more details, Gupta and Ura, 1990). These institutions take a long time to evolve but can decline very fast by providing economic incentives for destruction rather than diversity preservation.
- e) Once the relationship between biodiversity and cultural diversity is understood, the variability in expectations about basic needs and norms for meeting them has to be appreciated. In a competitive society and an accumulationist culture voluntary deprivation to safeguard natural resources is considered a foolishness. And yet communities and individuals in different parts of the world have been pleading for the same for a long time (recall Gandhi's famous dictum, "there is enough in the world for everybody's need but not enough for everyone's greed"). Assuming that generation of surplus is a necessary condition for participation in market exchange, the processes of generating surplus would have to be analyzed. The choice of technology and cultural approval of the pace and size of extraction would become important determinant of the surplus. Public institutions as well as markets influence the extent to which legitimacy for different styles and scope of resource extraction exists. Uniform design and norms of public bureaucracies directly hit at the variability and diversity of cultures and accordingly of the technologies of resource use (Gupta, 1984,1985,1989). Uniform designs cannot breed, preserve or reproduce diverse systems or institutions.
- f) In any democratic system, the hegemony of ruling elites gets expressed through domination and control. The

communities which on one hand are poor because they inhabit bio-diverse regions and on the other, are denied even the freedom to maintain their own institutional relationships with nature often become restive. The emergence of popular protest among various native communities world over in the recent times is an indicator of the emerging tensions. It is also true that the literacy levels and economic development among these communities is extremely low. It is not surprising that most of the slum dwellers and petty labourers in urban regions come from high risk environments such as drought, flood prone, forest and hill regions. Any society in which a particular ethnic or regional social group has to remain subservient to another group for long time without enough opportunities for mutual mobility cannot remain peaceful. Decline of diversity, therefore, is a direct threat to democracy, peace and survival of eco friendly ethics and cultures.

- g) The choice of technology plays an important role in influencing the rate, size, site, specie (and composition thereof) etc., of extractable resource in a given region. The choice can be endogenously derived or exogenously influenced (recall the recent Film, "The Medicine Man"). The range of choices that are available to a group can also be culture constrained (e.g. taboo on cow slaughter). The range can be influenced by several other factors such as compatibility of a technology with prior tools, techniques, farming systems; local renew ability; ease in use or development of skill; gender preference or bias; capital requirement or risks involved etc. Many of these choices impinge directly on our understanding and appreciation of the available diversity. For instance, weed control is considered a necessary feature of modern agriculture. On the other hand the allelopathic interactions, ability of certain weeds to attract predators of the crop pests, nutritional implications etc., are only being noted and appreciated lately by the formal scientists (though many communities have known these for long time). The design of technology in isolation of local ecological knowledge systems could not be expected to serve the ends of diverse and sustainable resource use systems.
- h) The ecological systems are characterised by complex and simultaneous interactions. The reductionist scientific tools require the assumption of *ceteris paribus*. There is no doubt that for any causal chain of logic to be established, a boundary has to be drawn around a phenomena. Such a boundary by definition renders the analysis partial. However, such an use of reductionist logic can indeed complement holistic perspectives just the way incomplete meanings inherent in any language/communications are complimented by non-verbal cues. The framework of holistic thinking (Pereira, 1991, Pereira and Seabrook, 1990) implies recognition of the boundaries of human wants and needs. This is not the question of economics alone. It emanates in economics but gets resolved in ethics. The complexity in ecological systems doesn't necessarily mean complexity in social systems. The bureaucracies are very complex but the information generation and processing is totally out of step with the similar process in nature. The result is that crisis is seen too late, understood still later and responded when it is hardly of any consequence. The simpler and accountable social institutions (often based on a combination of utilitarian and non-utilitarian logic) often clothed in metaphorical imageries do the trick.
- i) It is understandable that risk and uncertainty should characterize any natural system. To generate certainty in our life we may evolve institutions (formal or informal) that provide assurance. These assurances can be generated through long term guarantees, legal mechanisms or other instruments to ensure that future returns from present investments (vertical assurances) are commensurate with my expectation with reasonable risk. But my ability to realise those returns depends in no small measure on the collective rationality i.e. others' behaviour vis-à-vis my own (horizontal assurances). I can use redundancy to safeguard my interest. Redundancy in the short-run is considered 'uneconomic'(Clark, 1989:484). The components of the modern systems, Clark suggests, are too complex, interact over very long distances, and lack (adequate) redundancy. However, it

must be remembered too much of redundancy can create inertia and too little can cripple (Gupta, 1984). There are several types of redundancy that natural system show. For instance, aerial roots may be redundant till the main trunk of a tree is strong, but once it becomes weak, the props may become the main support. Likewise when main channels of communication get choked, the parallel channels like the stilt roots may perform the same function. However, if an organism or organisation relies too much on the parallel redundant channels, it may, by its very reliance weaken the main line of communication. Redundancy is a double edged sword. Sometimes redundancy may not be in components but in processes. Thus a system does not provide for every contingency (the inventory costs of such an assurance will be prohibitive) but provides rules and norms which help in generation of appropriate response. Redundancy thus becomes a spur for learning. The mechanism of creative learning, Riedl (1984:32) observes in natural systems depends upon two basic peculiarities, "one is its considerable redundancy content; the other is its indefinite constancy. That is to say: in most cases we must expect that the same events will recur, but it remains quite open in what circumstances and in what sequence". In social systems we are not allowed the luxury of leaving the unfolding of possibilities totally to nature. The paradox is that more we try to ensure that future resembles the present or our image of future, the more surprises nature springs on us.

- j) The learning systems in nature as well as societies reflect the cost we are willing to pay to reduce unexpected losses or deviations in our trajectory of progress. The regrettable feature is that we tend to discount those knowledge systems the most which have been tested for the longest period (Majumdar, McNeely, Dharam Pal). For instance, the sustainability of planted forest is nowhere compared to the natural forests. At the same time the decline in the productivity of planted mono-cultures has set in faster than most expected (within 3 or 4 cycles, Yale University Conference on Wood Based Biomass Energies and Sustainable Rural Development, February 1992). Likewise, the productivity of agricultural inputs has declined considerably in India as well as in America (Gupta, 1990). The agricultural research system has not still geared itself to properly understand and build upon organic and other alternative systems of sustainable resource management. The consumer preference shaped by media, legislature and the scientists continues to be lukewarm to the ecological products. Given the price margin, it is not surprising that not all believers in sustainable development buy organic products. The result is a lag between what we think we should do and what we actually do. There is a need to understand the ways in which consumer preference and pressure of that preference can be created to influence the powerful supply side.

It is obvious that the **access** to information and **ability** to use that information to shift investment and consumption patterns would depend upon the kind of **assurances** and cultural **attitudes** that emerge in times to come.

Part Two: The Eco Institutional Perspective: Building upon Local Ecological Knowledge Systems

In separate review, I have provided examples of various indigenous institutions that are sustainable and yet are not amenable to conventional economic or institutional analysis (Gupta, 1990a). The rule making process in common property resource institutions, I have shown built upon a very different logic than following from the game theoretic or marginal benefit costs approaches. Let me first reiterate the relationship between ecology, institutions, technology and culture that emerges from the review of the previous section. I would then illustrate with some of the examples, how this framework can be operationalised.

Eco-Institutional Perspective

| | Ecology | Institutions Culture | Technology |
|------------|---------|-------------------------|------------|
| Access | ***** | | |
| Assurances | | ***** | |
| Ability | | | ***** |
| Attitudes | | | ***** |

The access to ecological resources and ability or skill to convert these resources into investments would serve limited purpose if the households do not have assurances from the institutions. These assurances could be of two types viz., vertical and horizontal. The former refers to future returns from present investments and the latter refers to others' behaviour vis-à-vis one's own. The institutional mechanisms for both the kinds of assurances would be difficult to sustain if the attitudes reinforced by the cultural beliefs and value systems are supportive of these assurances. The cultural variables are both cause and effect of the interaction between access, assurances and the ability.

While each vector on both the axis can interact with all the vectors on the other axis, I have deliberately highlighted only the interactions on diagonal. The purpose is to draw attention to the third dimension of the matrix which is the time or sequence. For instance, if we determine the access mode first and assume that these would remain unchanged. Then the sequence in which institutional, technological and cultural variables may change can be speculated. It is possible that exact sequence varies although the direction resembles the predicted one. To that extent the theory is still and evolving one. Another reason for highlighting the values on diagonal is that if time was kept constant, the nature of outcomes would differ depending upon the vector through which the intervention is begun. For instance, if one intends to modify the institutional arrangements (sharing of forest produce with the communities living on the forest fringe), the limits imposed by access, abilities and attitudes would not operate the same way as it would have if one began with changing the access. Although to some extent each of the vector is influenced by others. For example, the access to resources is a function of the historical assurances an individual or a group has had about the ability to use a resource.

My reason for distinguishing the access from assurances (also see Runge, Sen) is to capture history in the former and future in the latter. Thus how assurances operated in past would determine how the access has evolved in present. But how access would be influenced in future will be governed by how we price the skills/abilities (as given or augmented) of different groups/individuals to use resource in a manner that the cultural norms of sustainability are strengthened. It may be defensible for a local community to cut forest recklessly if the forest department and the outside contractors (on which it fails to have any control) also destroy the resource. However, such a behaviour may not have a cultural approval either by the local norms or the global norms. Under such a circumstance, if the global as well as national polity remains unconcerned about the entire resource allocating mechanisms. And this community remains deprived of a fair share of the resources. Then should one expect an ethics

responsible for sustaining resource to survive when the survival of the community itself is in danger.

Many of the protest movements against dam and other such projects have taken a totally indefensible position that tribal people should be left as such in the forests or other catchments regions to safeguard the resource (and provide cheap labour for the urban and rural elite by remaining poor, illiterate and loosely integrated with the markets). Unless the society is willing to compensate the resource preserving communities appropriately, there is no reason why the poor disadvantaged people should remain content with their role as a 'nature watchdog'.

There are some others who believe that any attempt to compensate these communities would unleash similar accumulationist culture as we want to protect against (Pereira, 1992). My view is that if a particular ethical and ecological knowledge system is worth preserving then society should invest in its augmentation and value addition. There is a need, therefore, to generate institutions that maintain cultural core of a community and yet provide educational, health and other basic needs in a eco compatible manner. This would mean professional experts having competence in analytical scientific tools to become apprentice with the informal experts to observe, analyze and abstract the underlying theories in collaboration with local communities. This would obviously require sharing of the knowledge so produced with the people themselves.

The skills or abilities evolve over time partly through practice and partly through innovation. These skills may become redundant if market cannot price their outputs. The consequence is that with passage of time, the skill or knowledge erosion takes place. Once the skill is lost, the resource ceases to be an utility. A medicinal plant may become a weed.

Valuing Local Skills:

To understand this process better we have organised biodiversity contest among children and adults in drought prone regions with the help of a NGO (Vivekanandan, 1992). In this contest the participants were supposed to bring a sample of all the plants which they knew in the neighbourhood before a judging committee. They were expected to explain the uses of these plants and be prepared for being quizzed. Among adults, many agricultural labourers preferred to forego their daily wage in order to participate in the contest. The prizes were announced by me as a part of a large research project at IIMA on Sustainable Development of High Risk Environments.

The child who came first was 12 years old and a student of class fifth. Having been a shepherd's son he had ample opportunity to spend long stretches of time in the field. He could identify 116 different plants along with their uses. The farmer who came first could identify 240. The most remarkable feature was that this child by the age of 12 years had completed almost half the intellectual journey covered by the most knowledgeable adult.

The regrettable part was that this knowledge was unlikely to be of any use in further life of the student. On the contrary he would have to unlearn this and learn 'a' for apple and 'b' ball. When a skill precious and rare as it is cannot be priced, recognized and rewarded properly, a signal is provided to the rest of the society.

Incidentally as a part of this contest, local community identified 12 plants which had almost become rare. The action plan to conserve these plants did not have to be inspired by outsiders. It spontaneously emerged. They also realised that lot of plant collectors were paying inadequate price for the local medicinal plants. The concern to safeguard diversity directly became related with the issue of IPR and compensation to local people for their skill and institutional arrangements preserving diversity. The economics of these plants cannot be worked out by calculating the opportunity cost of labour. Instead the skill, associated institutional arrangements and inherent rules of access have to be simultaneously viewed while calculating the rate of compensation.

Economics of Respect, Reciprocity and Restraint:

Three examples are given below to highlight how local cultures deal with the issue of collective rationality while dealing with individual incentives or disincentives for resource management.

1. The paradox of parrot
2. Feeding the birds
3. Generating positive externality: The case of voluntary quarantine

Case one: Paradox of Parrot

In a drought year, the crop has suffered very badly. A woman is coming back from the field after picking up whatever grains she could. On the way she meets a parrot. The parrot starts staring at her. She asks the parrot as to why was he looking at her so intently. The parrot replies that he was actually confused after looking at the woman's necklace. The necklace had a green agate stone. He mistook it to be a grain. Only when woman came closer, he realised it was just a stone. Woman asks him had he not got anything for eating. The parrot replies that hadn't she brought all the grains from the field- even the ones which had fallen on ground. The woman realizes that parrot was hungry, and she also needed the grains very badly for her children. She asks the parrot to come home with her and share whatever she gives to her children. But the parrot flies away leaving the woman dumbfounded.

It is also possible that parrot realized that if he delayed search for grains other people would also pick up whatever grains were left in the fields. He remembered his young ones who were waiting to be fed.

The song has several messages. It speaks about a cultural system in which the right of birds are being debated vis-à-vis the right of human beings particularly in the period of food crisis in a drought year. Perhaps there were some reasons why the traditional varieties of millets or sorghum had loose set grain which was easy for birds to pick. At the same time there were elaborate designs of birds scaring devices built to reduce the loss due to bird attack. Perhaps people knew that bird would kill insects some of which harmed the crops. How much of the contribution of birds was negative or positive would be reflected in the (a) technology i.e. selection criteria of local varieties, design and efficiency of bird scaring devices, (b) the spirit of co-existence with other parts of nature, and (c) collective consciousness as well as culturally approved behaviours.

How does one interpret this song would also depend upon how one conceptualised the right of different claimants over natural resources. If birds were also considered as legitimate stake holders in the natural resources, then the viability, sustainability and effectiveness of any institution would have to be interpreted very differently. Many times, resource scientists have taken a very limited view of human nature - a view which excludes the rights of other natural beings. The conservation ethic is seldom anchored on such a view. At the same time, giving primacy to any one constituent over the rest may violate the very foundation of eco-sociological knowledge system as argued by the Alaskan leader in part one of this paper. A knowledge system which generates concern for various parts of eco-system obviously could not have evolved through just the individual innovations. It would have required evolution of cultural norms, folk lore's cemented by various lands of sanctions and rewards for socially approved behaviour.

Case Two

Poaching in the desert: feeding birds as a punishment

In another case provided by Arun Agarwal (1990) a village panchayat (assembly of elderman)

in Rajasthan devised an unique way of punishing person who cut some branches of trees from common land where such poaching was prohibited. The person when caught was asked to stand barefooted under open sun in the hot summer and feed the birds two and a half kilograms of grams from morning to evening. It may be difficult to establish relationship between the cutting of tree branches, reduction of bird arrival, increases in the pest attack or decrease in the bio-diversity because of lack of seeds brought by the birds and the feeding of the birds. This relationships is entirely my speculation. It is quite possible that this punishment would have been interpreted differently by different people in the village with some common meaning but some uncommon meanings too. On the one hand the culprit was punished and on the other, he was supposed to have been blessed by the Gods for having fed the birds in such an hot environment standing barefoot.

An element of ambiguity characterizing such judgments provides a creative ground for exploration and speculation. Institutions are seem to be embedded in the socio cultural and religious world view of the people. It is quite possible that access of various social groups or classes to the same common lands may not have been equitable for all the resources. However, to infer from inequity in availability of one resource, say, wild berries from common lands that inequity or indifference should exist in the institutions for other resources, be they of aesthetic or material nature would be a mistake. In this case the deliberations were guided not just by keeping the interest of human claimants on the natural resources.

The conflict among religious and other identities have to be resolved through open negotiations rather than through authoritarian interventions. Lot of traditional ecological knowledge has been retained through codes legitimized by religious or cultural institutions.

The global concern for sustainable development and conservation of bio-diversity is dominated by the strategies and styles suitable for essentially the degraded environments. Since degradation in environment inevitably is accompanied with the degradation of the institutions, these policies take absence of institutions as given. Much greater reliance is placed on public interventions which in turn mean bureaucratic interventions.

Case: three

Quarantine as a collective institution

In Komathanga village of Wangudi, a very careful arrangement had been worked out to prevent its diffusion. If the village cattle got infected with this disease, two outposts were set up outside the village in the directions from where outsiders usually came. People from the village took turn to man these posts. No cattle from outside was allowed to enter the village lest it got also infected. Even the people visiting the village had to spend overnight at these check posts before coming to the village¹. This was a case where an institution had emerged not to optimize returns to individual or village. But to generate positive externality. It might be possible that if everybody reciprocated such a gesture, the diffusion of disease would of course be much lesser.

The combination of individual sanctions and collective rewards perhaps could be sustained through moral institutions and a bioethics in which long term survival was preferred over short term maximization of return.

The innovation by the peasants whether in the field of technology or institutions requires production of knowledge. But the reproduction of knowledge took place through the institutions which had to be renewed over a period of time.

The first case of parrot helps us understand

the role of culture, folk heritage in shaping the perception of individuals on an issue concerning future generations or sentient living beings. It is difficult to derive such norms through an exchange economics which does not take into account ecological principles.

In the second case, the sanction can neither be generated through public choice framework or game theoretic perspective nor can it be derived through demand and supply equilibrium. This is a good example of how societies generate processes of rule making rather than legislating rules for all possible contingencies. The example also brings up the importance of unsaid, unexplained or implicit meanings. How different people interpret the sanction against the poacher is left ambiguous. But by leaving it in such a manner, the culture also generates tremendous responsibility at the individual level. The process of figuring it out through informal interactions sets into motion a dynamics which no explicit rule book can ever substitute.

In third case, generating a system of quarantine and a positive externality can be justified only in a very long time frame. Otherwise such institutions will fail to invoke commitment and compliance.

These three examples from a large repertory of such institutional solutions for sustainable resource management (Gupta, Capoor and Shah, 1990, Gupta, 1990)) help us in concluding following lessons, paradoxes, concerns and issues.

Part Three: Lessons for Sustainability and Paradoxes for Expanding Disciplinary Boundaries

1. The Eco Institutional Perspective requires looking at all the four vectors of Sustainability i.e. ecological resources, institutions, culture and technology in a manner that short-term calculus can be generated from long-term goals of resource management.
2. While ecological conditions define the range of economic enterprises that can be sustained in a given region, the scale of investment and composition of portfolio is a function of access to factor and product markets, non-monetized exchange relations, kinship networks, cultural institutions, intra and inter-house hold risk adjustment options (see appendix one for a list of risk adjustment strategies).
3. Different categories of households may use different discount rates for appraising their returns in different resource markets (Gupta, 1981) depending upon their control over these resources. The time frame accordingly would co-vary with the extent of control. Thus higher the control, longer may be the time frame. However, in the absence of public accountability and popular control, the time frame can be shortened despite higher control. This is particularly true in an inflationary environment. The mechanisms for reversing this preference would require generation of long term assurances and short-term returns.
4. The excessive emphasis of various popular protest movements on improving access in isolation of generating accountable and participative institutions may result in resource degradation even after conflict is resolved in favour of affected disadvantaged

people. In the process the long term Sustainability of short term improvement in access may be very poor. On the other hand, evolution of sound institutions cannot take place in the absence of totally ambiguous or ill-defined 'rights to resource' (Gupta, 1989).

5. Sound policies and weak institutional capacities are a common refrain in the field of environmental management. Strong institutions can correct weak policies incrementally over a period of time but not vice versa. The institution building process requires recognition of cultural and emotive dimension of our living. Generation of internal command as against response to external demands requires sensitivity to values and personal beliefs.
6. Diversity in nature is preserved through diversity in culture, languages, rituals and belief systems. Unless this diversity is accompanied by institutional diversity, the sustainability in resource management is unlikely to be achieved. The institutional diversity requires recognition of different rules of social organisations being equally valid and ethically sound so long as these rules have legitimacy and sanction. Thus a centralized conference like the Earth Summit would be unthinkable in this framework. Both the arena of discourse and the nature of dialogue were typically similar to the most other international conferences. As if different cultural traditions could not be respected unless they used a centralized arena. I have argued elsewhere that nothing can be termed as a greater paradox than the centralization of the arena of articulation and protest.
7. Institutional rules require observance of a boundary. However, unlike boundaries which are characterised by what they include or exclude, the boundaries of sustainable institutions give more importance to the gates of entry or exit. It is more important as to what distance did one traverse before reaching a gate rather than a person being inside or outside the gate. The legitimacy of sanctions is derived through a process by which institutions are evolved and not by the boundaries they create. This is the most important distinction between my framework and the one proposed by Ostrom (1991).
8. The rules of resource management cannot be appraised only in light of economic basis of exchange, resource extraction and compensation. The rights of those who can't vote (birds, beasts and the unborn) are given equal importance if not in entitlements than through compensation.
9. Search for sustainable institutions has to begin with the study of indigenous ecological knowledge system as being attempted through our Honey Bee network. To understand local knowledge systems, new terms and categories may have to be evolved which can capture the generosity inherent in concern for nature. The study of folk literature become necessary for understanding the local belief systems, values and norms generating restraint in the short term and the reciprocity in the long term.
10. The economic principles of prices, transaction costs and externality have to be enriched by taking into account non-economic considerations that make life worth living. At the same time hesitance to expand the boundaries of the concept may arise because new categories may emerge from non western tradition. Given the citation behaviour already exemplified, new norms may evolve only after considerable struggle.

11. The portfolio of economic and non-economic enterprises has to be appraised in a manner that diversity by itself gets priced. In a study of banks portfolios in a drought prone region, it was noticed that diversification measured through herfindall index was directly correlated with extent of finance. Higher the investment, greater was the expectation of diversification. The data is still being analyzed and results will be reported in future. By using banks portfolio as a measure of institutional response to local ecological diversity, we have developed a measurable method of analyzing sustainability of public investments. We have tried to match household portfolios with those of the commercial banks to study above interface in eco-institutional perspective.

In this paper I have tried to cover a large ground ranging from the principles of ecological complexity, simultaneity and diversity in nature as well as in society. I am conscious of several loose ends which need to be tightened. I will appreciate if the readers would critique these ideas from different stand points. Sustainability is like having one's cake and eating it too. I have merely described the process by which one can do it if one ate slowly, by sharing and over a long period of time.

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