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Conservation of Gir Ecosystem: Assessment of Benefits and Costs under Alternative Management Systems

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Conservation of Gir-Eco System: Assessment of Benefits and Costs Under Alternative Management Systems

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Contents

List of Tables

Appendix Tables

Preface

Valuation of an eco-system is a complex task, much beyond the reach of a researcher like me trained in conventional economics and research tools. Despite this, the issues pertaining to sustainable management of natural resources have attracted the interest of a large number of economists and social science researchers who face similar constraints. Protected area development offers one such field of research, which of late, is gaining significant research interest and policy relevance. But, the conventional training both in terms of theory and applied economics do not permit a meaningful analysis unless, equipped with appropriate concepts and tools of measurement as well as valuation of the economic and ecological services. I got an opportunity to learn and appreciate the growing relevance of this relatively new stream of Environmental Economics under the EMCaB in India. In the process I got to read a large body of literature pertaining to the various aspects viz; theory, ecology, valuation methods, laws and regulations, and last but not the least, the alternative perspectives on Protected Area Management in different parts of the world. This has been an immensely enriching and refreshing experience though, difficult at times. I don't really know how much I have accomplished in terms of learning the hardcore environmental economics at this stage, but I am reasonably sure that during the course of the study, I have acquired sufficient amount understanding of the broad contours of issues, concepts, and methodology for research in environmental economics. This is of great value to me as a practicing economist in the field of natural resource management and development. I am grateful to EERC for providing me this opportunity.

During the course of the study, I have received academic support from a number of leading economists in the country. I express my gratitude to Prof. Jyoti Parikh, Prof. Kirit Parikh, and all other members of EERC as well as fellow researchers. I am specially grateful to Dr. Vijay Paranjpaye for his detailed comments on the draft and also for his insightful suggestions for improvement. The Research workshops provided opportunities for learning and sharing. Special thanks to Raghu Ram for organizing these events and making them not only fruitful but also cheerful! We are also thankful to officials of the Forest Department, Government of Gujarat for their support. Especially I would like to express my gratitude to Shri Bharat Pathak (IFS) and Sri H.S. Singh (IFS), for sharing their valuable insights on Gir-management. Dr. Madhu Verma helped me out in clarifying

several doubts, provide relevant material and also extended a friendly support during my visit to IIFM for the study. I am grateful to her and to the other faculty members at IIFM.

I share these feelings of gratitude with the other team members Chandresh Borad and Hasmukh Joshi, without whose support it would have been difficult to conduct the study. Thanks are also due to the members of the field team Jairam, Govind, Siraj, Ramesh and Rohit for helping in primary data collection. Bharat Adhyaru helped in data processing and Vasanthi V. A. took up the painstaking efforts of typing various versions of the report, often at short notice. I am thankful to both of them. Finally, I thank the Prof. Sudarshan Iyengar, Director, GIDR for providing moral and academic support at various stages of the study, and also to the staff of the library as well as administration at GIDR for their cordial help.

I would feel rewarded if the study would help in further improving the status of the ecology, wild life, and people of Gir - together they make every Indian feel proud of the unique home of Asiatic Lions and rightfully so.

November 28, 2002

Amita Shah

Executive Summary

The policy discourse on PA-management has come a long way from purely conservationist strategies to participatory approaches. In between these two there is a wide range of options that combine different elements of resource sharing, market regulation and privatization. Ideally, the choice of PA-management approach has to be in tune with the location specific situation-ecological, socio-economic-political and financial. Also, the choice is time specific; it may undergo changes along with the different stages of PA-management. Exploring options and evolving new approaches therefore are important aspects of policy formulation on PAs.

Gir-PA represents one of the successful cases of design and implementation of a management plan. This has been achieved through effective protection and habitat development practices. As a result, it has succeeded in reviving wildlife population, especially lion, up to a level, which is fairly close to its 'optimum size'. The next stage therefore, is to evolve sustainable strategies for regeneration and conservation of vegetation and bio-diversity. Given a large number of local stakeholders, sharing of the regenerated resources might help both conservation as well as people's participation in PA-management.

It is in this context the present study tried to examine the status of Gir-ecology, people's dependence, and alternative approaches that might be more relevant for the next phase of management in the PA. Valuation of economic and environmental services has special relevance in this process. The study focused on the three main objectives:

i. Identification as well as Valuation of Economic and Environmental Services from the PA.

ii. Assessment of the Dependence of Different Categories of Households within and out side the PA. And Estimation of Cost Under Alternative Management Practices especially, for Regeneration of Community Pastures, Wasteland, and Reserved/ Protected Forest.

iii. Drawing Implications for a Management Strategy, which Incorporates People's Stakes while Ensuring Ecological Sustainability of the PA.

The study is based on secondary as well as primary data collected from a sample of villages, neses and forest settlements in the region. Since Gir is one of the well-researched PAs, assessment of benefits and costs has been done mainly by using secondary data. This has been supplemented through primary data, which also captured people's perceptions on three important aspects viz; non-use benefits, expectations from the PA, and alternative management practices. Primary data have been collected through various methods such as houselisting, detailed survey of sample households, focus group discussions, informal interactions, and participant observations.

In what follows we present a summary of the major findings:

I. Status of the PA

- Spread over an area of 1412 sq. kms, Gir-PA is a source of various economic as well as ecological services.

- About 34 percent of the area is degraded or highly degraded due to climatic factors, human interference and slow or inadequate efforts for regeneration.

- Management interventions are constrained by financial resources especially, in absence of a well-developed tourism sector or other mechanisms for resource generation. The average expenditure of PA-management during 1995-96 to 2000-2001 was Rs. 868 lakh per year. Of the total budgetary provision, about 52 per cent is allocated for activities that are related to regeneration measures.

- Enhancing investment at this stage is crucial not only for its regeneration but, also for its effective protection in the long run.

- Being the last home of Asiatic Lion, the PA offers a significant value in terms of rarity. Projecting this, along with a sustainable management plan, may go a long way in mobilizing resources-locally, nationally, and globally.

II. Benefits and Costs of PA-Conservation

Monetary benefits in terms of selected economic services from PA is estimated to be Rs. 47, 705 lakhs per year. This is significantly higher as compared to the average allocation of Rs. 1,191 lakh per year under the management plan. Even if we compare the value of direct–use benefits, the estimates are fairly higher i.e. Rs. 9,669 lakh against the budgeted expenditure. A comparison of Benefits and Costs has been summarized as follows:

Summary Benefits and Costs (Rs. Lakh at 1995-96 Prices)

Value of Benefit		Value of Cost	
Details	Value	Details	Value
Direct Use	9669.14	Average Budget for Management per year	1191.40
Indirect Use	37883.00	Crop Damage	419.80
Opportunity Cost	39524.98	Loss of livestock	143.16
Loss of Crops to replace the fodder	2592.00		
Potential loss of fodder	1170.33		
Soil Loss	9793.25		

III. People's Dependence on PA

- Local stakeholders consist of a human population of 3-5,000 and livestock population of about 14,000 within the PA. The periphery consisting of 99 revenue villages has an estimated population of about 1,80,000 persons and 95,000 livestock.

- People within the PA have rights for grazing their livestock and depend entirely on PA for their livelihood. The total economic benefits accruing to Maldharis within PA amounts Rs 1,035 lakh per year and Rs. 2.87 lakh per household per year. Against this, the major cost incurred by the Maldharis is in terms of loss of livestock, which is estimated to be Rs. 112 lakh per year

besides the difficulties arising due to lack of basic amenities like education, roads and electricity etc. While the present size of livestock inside the PA is well within the carrying capacity of about 22, 000, there are other costs due to human settlements within PA. These are infiltration of outside animals, faulty grazing practices, damaging the regeneration process, selling of FYMs outside the PA, extraction of fuel wood for commercial purpose; and offering less productive livestock as easy prey, and thereby distorting the genetic characteristics of lions.

- More than 50 per cent of the households in peripheral villages access fodder from the PA. Similarly, a large proportion (i.e. about 80 percent) of the households obtain fuel wood from the PA-directly or indirectly from the markets. These constitute about 74 per cent of the total requirements for fuelwood in the peripheral region.

- There are no systematic estimates of fodder production nor about its requirement in the peripheral villages. Ascertaining the actual extraction of fodder by the people is difficult because it is illegal. However, assuming an average fodder yield at the national level, i.e. 3000 kgs/hectare, the surplus fodder (after meeting requirements of the livestock and herbivores within PA) can support about 21,000 adult milch cattle in the periphery. Another 19, 000 can be supported by the crop-residue. This still leaves a large number of adult milch cattle plus other small livestock, which need to be supported through regeneration of pastures within and in periphery of the PA.

- Since landless as well as small farmers without irrigation can hardly afford to keep milch animals, they tend to depend mainly on agriculture of the large-farmers with irrigation, and also on collection of MTFP+ fuel wood from the PA. Nevertheless, increased irrigation leads to depletion of ground water resources at the expense of soil-moisture and availability of water inside the PA. Reducing the use of irrigation for growing water intensive crops may result into stagnating/declining demand for labour on farms. But, this could be compensated by increased availability of fodder and MTFP from pastures possibly by applying irrigation within and outside the PA.

- Enhancing the livestock base among landless/small farmers without irrigation thus, needs to be preceded by a realistic assessment of livestock population in the periphery and carrying capacity of the PA. The reported livestock population of about 95,000 in 1991, appears to be an over estimation. With an average of 2- 2.5 livestock per household, the total population among approximately 30,000 households in the periphery may work out to be around 60-75,000. The recent droughts in the late nineties might have further reduced the number closer to the lower end of the range i.e. around 55-60,000. A realistic estimate of livestock in the peripheral villages is therefore quite crucial for assessing the requirement as well as pressure on the PA.

- Against the various economic services, people in the periphery have to face several difficulties especially, for protecting the crops and livestock from wild life. While the actual incidence of crop damage is not very significant, the efforts and the risk involved in protection is fairly high.

- A large proportion of people recognize the present level of dependence on PA as non-sustainable. While they consider conservation as necessary, they don't endorse the present system of protection and restrictions, which in their opinion leads to corruption and over exploitation of the PA-resources.

- People's expectations from PA-management are availability of fodder through a regular supply system, limited grazing rights, fuel collection, and employment in PA-management activities. Settlement of the issues pertaining land-acquisition is also an important concern; absence of which leads to non-cooperation among a large number of villages having lost a part of the community pastures or private land to the PA.

IV. Alternative approaches for PA-Management

Given the need for regeneration of vegetation within and outside the PA, and the critical role of soil-moisture and water thereof, we have tried to explore alternative land + water use planning for the region. This is based on three basic principles: First, soil-water conservation assuming a top priority. Second, a more balanced allocation of water-resource within and outside the PA. And, third, using a part of

regenerated resources from the PA as incentives to reduce the pressure by checking the haphazard and 'illegal' use of the forest-resources on the one hand, and over exploitation of ground water on the other.

We have identified alternative approaches for land-water use and the requisite resource sharing mechanism as well as other subsidies/support to compensate the loss of income in the short/medium term. Subsequently implications of each of these alternatives have been mapped out for the three sets of stakeholders viz; farmers with irrigation, landless households and farmers without irrigation, and Maldharis. This, of course, is an indicative planning for regeneration, conservation and sharing of resources.

Since SWC is a resource intensive activity with a long gestation period of says 7-10 years, the initial investment has to be funded by external resources. Convincing funders (national or international) would require a realistic assessment of the impact of resource regeneration, and sharing a part of the regenerated resources with the local stakeholders, so as to mitigate the future loss in terms of continued pressure and degradation within the PA. Lessons from Eco-Development Project in Gir and other PA-sites should get integrated into the fresh planning. Some of the important suggestions for the next phase of the PA-management have been highlighted as follows:

Components	Costs	Benefits
SWC to be given a top priority	Average cost Rs.15-20000/ ha including the cost of water harvesting structures	Triggers a chain of improvement in terms of : Availability of soil-moisture Improved vegetation in PA Providing fodder +fuel through regulated operations Reduced illegal extraction and grazing Saving of the value of soil-loss Employment generation
Regenerating vidis with-in PA through additional inputs to be used as incentives to reduce irrigation and grazing	Average cost of Rs.10,000/ ha (including seedling, water, manure, labour)	Replenishing groundwater Reallocating water to CPLRs and vidis Reduced damage due to illegal grazing within PA
Regeneration of	Fodder +plantation	Better employment +income to

CPLRs in periphery	Rs. 35,000/Ha	small farmers +landless Reduced dependence for fodder, fuel-wood, illegal felling Reduced risk of fire
Institutional arrange-ment for collection of fodder, fuel and NTFP	Involving a professional developmental agency to arrange supply and distri-bution at a reasonable price	Saving of cost of drought relief programmes Reduced impact of droughts Reduced pressure on PA Reduce conflicts with FD-staff and better cooperation Improved quality of livestock Reduced pressure of grazing Stopping of outside animals
Mobilisation funds	Loan from national govts. Grant from environmental groups and donor agencies Credit support to people	Evolving a mix of incentives through: Increased availability of resources, cost-sharing, and subsidies rather than subsidies and compensation alone

V. Policy Implications:

While the present Management Plan has already recognized the critical importance of regeneration of pastures within and out side the PA, the interdependence between the two and its implications for mobilizing people's commitment towards protection of the PA need to be clearly spelt out. As of now, the management plan (including Eco-Development Project) does not adequately focus on the fact that feasibility as well as effectiveness of regeneration of village pastures in the periphery is essentially dependent on efficacy of soil-water conservation in the upper catchments of watersheds i.e inside the PA. Similarly the plan does not seem to visualize that sorting out of the issue of people's stakes in the PA-resources might help a lot in mobilising co-operation or participation of people in protection of the PA. This is reflected by the fact that apart from fodder supply during droughts, people in the periphery do not have any direct stakes in the PA-resources. This suggests a rather strictly conservationist approach where people especially, in the periphery do not have any legal rights. But, as argued earlier, not recognizing people's stakes (if not the legal rights) leads to greater exploitation because of the tendency of overlooking illegal extraction by the people and times also by the protectors. The next phase thus, needs to go beyond this strictly legal framework pertaining to the people's

stakes and involvement in the PA-management. The basic proposition is that: if people's stakes for subsistence needs are taken care of on a sustainable basis, rather than merely as drought relief measures, it can help reorganizing the livelihood system and also improve compliance of protection measures by the people. It is in this backdrop, important implications emerging from the foregoing analysis have been identified. Of course, the policy suggestions listed here are not entirely new; rather they are crucial points for fine-tuning some of the existing practices mentioned in the management plan.

Recommendations

(i) While regeneration of vegetation should primarily look into the requirements of the wild life, it should at least for next 10-15 years, also provide a stable supply of fodder, fuel, and MTFP through a regulated management system adopting `cut and carry' method. Improved vegetation and habitat management should thus, ensure that incidence of attack on crops and wild life is reduced. A professional agency might be involved to help organizing the supply system. At present the allocation for soil-water conservation accounts for only 3.85 per cent of the total budget. This needs to be increased significantly

Soil-water conservation measures should take a lead in the process of regeneration of the ecology. This should be done by adopting ridge to valley approach, covering the entire area of the major watersheds in the region. This is critical for reducing the frequency as well as impact of droughts. In turn, it should also result in improving the soil-moisture profile and, promoting a more sustainable use of ground water resources in the periphery.

(ii) While the management plan has already envisaged development of irrigated fodder plot in the periphery, its actual implementation is found to be difficult. The experience of the Eco-Development Project is also not so encouraging with respect to regeneration of CPLRs in the peripheral village. Hence, development of pastures within and outside the PA should be undertaken as an integrated activity with people's participation and reciprocal commitment for protection. The later should also involve defining carrying capacity of the

PA in terms of live-stock population. This can be done if, access to fodder is ensured on a sustainable basis. The next phase of the Eco-Development Project focusing mainly on community pastures and other resources, should therefore be closely interlinked with the plan for regeneration of pastures within the PA.

(iii) Given the high cost of an effective resettlement package, the present approach of relocation of Maldahris within the PA-boundary appears reasonable. Nevertheless, Maldharis within the PA should be made to adhere to the norms of a `sustainable' size of livestock and replenishment of FYM for regeneration of the PA. Against this, some the basic amenities like housing, school, electricity, drinking water, and health services should be provided to the households which shift close to the PA-boundary. For the Maldharis already shifted outside the PA, a comprehensive plan for their effective rehabilitation on various land based activities should be worked out. This is essential not only for checking further deterioration of their livelihood base, but also for mitigating the problem of `illegal' re-entry of human as well as livestock population into the PA.

(iv) Recognising the cultural importance of the PA, a large number of visitors coming to the PA for pilgrimage could be reoriented towards eco-tourism by involving environmentally conscious leaders/ organizations for a sustainable development in the region. This could also help strengthening the institutional base in the region.

(v) The management plan needs to be strengthened by filling up some of the crucial information gaps. These include assessment of vegetation and changes over time; carrying capacity in terms of wild life as well as livestock; dependence of human and livestock population within and out side the PA; size and status of CPLRs in the periphery of the PA; and interface between regeneration of vegetation and habitat management. These are some of the crucial aspects on which information is not readily available in the public domain. It is pertinent to recognize that filling up of this information-gap is an essential pre-condition for designing of a management plan for the PA. This

is particularly important at this stage of the PA-management when the initial objective of conservation of wild life is more lo less achieved, and the task ahead is to strengthen the process of ecological regeneration.

Given the large area of the PA and also in the light of the perspective plan for a still larger home range for its core wild life specie, i.e. lion, it is essential that the next stage of the PA-management is much more interactive and inclusive rather than exclusive of people in the region. The above suggestions should thus, be appreciated in the context of the long term goal of a sustainable management of the PA.

Chapter 1: Conservation of Gir Ecosystem: Assessment of Benefits and Costs Under Alternative Management Systems

1.1 Introduction

Valuation of ecosystem is an important area offering scope for innovations in approaches and methodologies. This is particularly important in the case of an eco-system where valuation of both costs as well as benefits have significant implications for convincing local communities who directly get affected by the conservation measures. Given their dependence on the protected areas (PAs), these communities may stand to lose in terms of private benefits that flow to the individual households, whereas the gains of conservation largely accrue at the societal level.

There are of course, various approaches for management of protected area and also the peripheral regions, which in turn, can ensure better conservation of the ecology. Choice of the specific approach however, would depend essentially on the location specific situations on the one hand and the nature of conflicts between private and societal benefits (in the short run) or economic and environmental benefits (in the long run) on the other. Assessing the costs of development of peripheral regions thus, becomes important in this context. Gir Protected Area in the western part of Gujarat (India) represents a situation with a large population of wild life surrounded by about 100 villages in the periphery. *Prima facie*, protecting this eco-system should take into consideration both- ecological as well as economic benefits given the extent and nature of the trade-off between the two.

The present analysis tries to assess the benefits and costs of conservation of Gir Protected Area so as to derive implications for future policies. The PA area has already received significant attention in terms of protection and conservation of the ecosystem especially, its core specie i.e. lion. In turn, it has earned a worldwide recognition for successfully increasing the population of lion as well as ungulates, which were almost on verge of extinction. The next stage of the PA-management however, is to focus on some of the larger issues pertaining to regeneration of vegetation, reducing man-animal conflicts, and also supporting the peripheral economy on a sustainable basis. All these, ideally, have to be achieved in a manner that it does not adversely affect the carrying capacity of wild life.

I.2 Approaches for Conservation

Evolving an effective management plan, though crucial, is often a very complex process. This is particularly so because of the three important features: First, conservation and regeneration of eco-system involves a wide range of activities, often fairly intensive in nature, depending on the extent and the nature of degradation. Second, by virtue of being a Protected Area, direct use value and revenue generation assume a lower priority over the non-use values of bio-diversity. This leads to an imbalance between the financial costs and the potential income from the eco-system. In fact, it can be viewed that lower the income generation (including that from tourism) better would be the value of bio-diversity conservation. This kind of an imbalance leads to a challenging task of resource mobilization-locally, nationally, and globally. And third, like most of the eco-systems in developing countries, PAs are also subject to substantial pressures from local communities, which depend on natural resources within the PA for meeting their livelihood needs. This often gets manifested in terms of conflicts between conservation and use-value and thereby lead to mutual distrust between people and conservators.

Prima facie, three types of approaches could be visualized for management of Protected Areas. These could be broadly described as conservation oriented, participatory, and market-linked regulatory approaches described briefly as follows.

(a) Conservationist Approach

According to this approach, the Forest Department (FD) having complete control over the PA, develops a management plan within the legal boundaries of the Wild Life (Protection) Act, 1972. Here, the central focus is on conservation of eco-system with the least possible intervention from local communities and lowest priority attached to direct-use value of the forest resources, including tourism. The approach does not envisage any involvement of the local communities in management nor in sharing of costs and benefits. Instead it focuses almost entirely on promoting non-use values from the eco-system. This kind of a purely conservationist approach may have a fairly high financial cost especially, for physical protection, compensation to the communities for giving up their traditional rights as well as the resultant loss of

use value, and maintenance of the increased stock as well as diversity both- floral as well as faunal due to conservation.

Since the approach does not anticipate any significant revenue from the PA, it would ideally, bank on mobilizing resources from various categories of non-users national as well as international. Assessing and highlighting the existence as well as future values of the PA should therefore, take the center stage for mobilization of resources under this approach.

(b) Participatory Approach

Recognising the importance of the direct use-value and the stakes of the local communities, this approach takes a rather pragmatic view where protection of the PA could be ensured by involving the people whose livelihoods depend on sustainable management of the forest resources. Unlike the first approach the emphasis here is more on reconciliation rather than on exclusion and protection. It is envisaged that the best way of ensuring effective protection is by assuring a sustained flow of economic services to the people, who in absence of such assurance, might try to over-utilise the resources [Pimbert and Pretty, 1995]. Thus, in order to overcome the situation of `Tragedy of the Commons', the approach may tend to explore elements of privatization. A wide range of alternatives could be explored with different degrees of privatization ranging from private ownership (like that in the case of a park in New Hampshire) on the one hand, and joint forest management on the other (Munasinghe and McNeely, 1994). This kind of an approach is likely to have greater appeal where tourism has significant potential and revenue generation is a strong possibility. It could also work in situations having significant conflicts between the local communities and the Forest Department.

Privatization or participatory PA-management thus appears to be a workable solution as a mechanism for conflict resolution, which eventually may result into effective protection of the PA. Eco-Development Project (EDP), by and large, falls into this category of PA-management. The central idea of the EDP is that: it is essential to develop the periphery in order to protect the core'. This philosophy essentially, combines the elements of compensation along with recognition of the people's livelihood needs on a sustained basis. The approach therefore, seeks to create alternative sources of meeting the livelihood needs so as to obtain a `reciprocal

commitment' from the local communities to reduce/stop exploiting resources within the PA. In that sense, it involves a bargaining process where `effective protection' is obtained against the actual benefits extended to these communities. It may be noted that unlike the mechanism of compensation, this process by and large, is voluntary in nature. However, it warrants a proper institutional mechanism to ensure compliance of the `reciprocal commitment at least in proportion to the benefits received.

Joint Forest Management (JFM) is yet, another variant of a participatory approach whereby responsibility of regenerating forest-land, at least in the periphery of PA, could be shared by the FD and the communities. In turn, both receive additional benefits in terms of forest resources, which eventually, might reduce pressure on the PA.

This approach though appears fairly convincing, has to face a number of practical difficulties, especially those pertaining to institutional aspects. Besides this, it requires a continuous support hence resources to make these institutions adapt and grow under the changing conditions with respect to resource availability. This implies additional costs over and above that required for protection and conservation of eco-system within the PA. Given the significant amount of uncertainty about the outcome especially, in terms of effective protection, the approach has often met with certain apprehensions concerning its applicability for the PA-management (Chopra, 1999). Nevertheless there has been a growing recognition that the approach does offer a sustainable solution, at least where conditions pertaining to institution-building are generally favourable [Kothari, et.al, 2000; Marothia, 1998; Pimbert and Pretty, 1995;].

This in turn has led to the idea of Joint Protected Area Management (JPAM) in India and elsewhere. While there is no official policy for JPAM in India, there are informal collaborations between communities and the official agencies towards PA-management. These initiatives might show the way in evolving a package of good practices for JPAM in the long run (Kothari, 1995; 1996).

(c) Market-Linked Regulatory Approach

This approach seeks to blend the two approaches discussed above. Basically it involves regeneration of ecology under the existing management system while incorporating people's livelihood needs/stakes as a legitimate component of the

regeneration strategy. This would imply that the PA-management recognises people's livelihood stakes as an integral part of the ecology, which is being managed through a regulated management system, without direct involvement of the people.

Of course, this kind of approach has not been actually tried out in many places, certain elements of the approach might have been incorporated in the existing practices of PA-management in India and elsewhere.

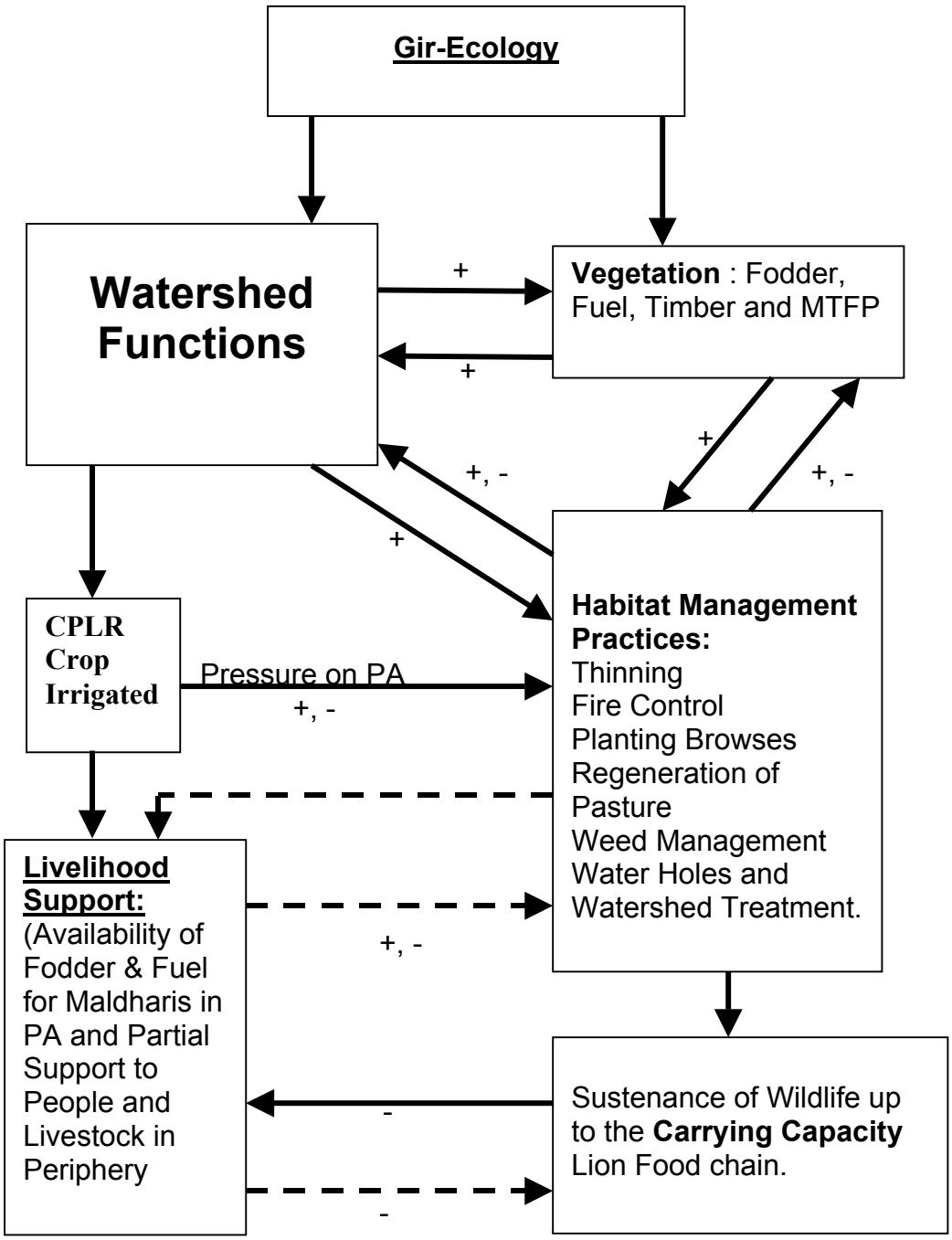
Conceptually the approach offers a fairly practical solution for reducing people's pressure on the eco-system by making adequate provision for the supply of resources like fodder, fuel wood, Non Timber Forest Produce (NTFPs), water and silt, on a sustainable basis. The major difference between this, and the conservationist approach is that, it recognizes, at least to limited extent, economic services (in terms of direct use value), as part of the objectives of PA-management. But, unlike the participatory approach discussed above, this approach does not get into the complexity of directly involving people in the management of PA; rather it envisages multi-stakeholder professional organizations to look after the resource management and sharing of responsibilities. The approach therefore renders some kind of a supply management system with technological interventions of resource regeneration and market development.

To an extent, the approach represents a modified version of the erstwhile commercial orientation of forest management. Here instead of trying to maximize forest revenue through market processes, the management-objective would be to meet people's basic requirements for the resources listed above, at a reasonable price. The major tasks involved under this approach however, would be management of production and distribution in a manner that it achieves social equity, economic efficiency, and ecological sustainability. Another important feature of the approach would be a `reasonable' timeframe within which the results should be achieved. Essentially the approach would call for a sizeable amount of investible resources, technical expertise for ensuring resource regeneration, and proficiency in supply/marketing management. If properly executed the strategy may turn out to be cost-effective (i.e. requiring relatively lower amount of subsidies) and at the same time, ecologically more effective (i.e. reducing degradation within a `reasonable' time frame).

It may be noted that the approach resembles a typical and much criticized technocratic or `positivist' interventions. Nevertheless, in actual practice its successful implementation would require a people focused management in terms of proper assessing the needs; incorporating the local knowledge, skills, and labour to achieve effective regeneration; and smooth as well as transparent practices for financial and marketing operations. It is likely that some kind of a professionally managed cooperative structure might help achieving a management structure described above. Since the approach has generally not been applied in the case of protected area, little is known about its strengths and weaknesses. Nevertheless, the approach, *prima facie*, provides a good case for a field trial under suitable conditions.

The above approaches to PA-management however, represent only a broad typology within which a number of alternative models could be explored. Ideally, the PA-management strategy should pick and choose from these broad strands of approaches to suit the location specific situations especially with respect to the following important parameters:

- Nature of the eco-system in terms of economic and ecological services
- Size and status of the eco-system
- Extent of people's dependence and conflicts
- Scope for development of tourism and thereby revenue generation
- Availability of funds.



+ : Positive Impact
\- : Negative Impact
– – – : Possible Links
——— : Interaction

Note: For details see Table 1.1

The experience from a large number of developing economies suggest that none of the pre-conceived, `blue-print' solutions may work across different PAs though, it might have worked in the past in the situations of wilderness without much of human

activities around (Chopra, 1998). The message therefore, is clear. That is: "the value of bio-diversity lies first and foremost in its role in the production of directly or indirectly useful goods and services" and that "the cost of such eco-system services are mediated by particular combination of species which vary across environmental conditions". This implies that "the analysis of the cost of bio-diversity loss and the development of appropriate institutions and incentive is primarily a local exercise"(Perring S, ibid, p.3).

Given this backdrop, the present study examines the nature of the eco-system, its interface with the people, and the management practices in the case of Gir Protected Area in Gujarat.

I.3 The Context: Ecology and People

Gir eco-system is the last surviving habitat for Asiatic lions. Spread over an area of 1412.1 sq.kms, Gir is one of the largest compact tracts of dry deciduous forest in semi-arid regions in the country. Apart from being the only home of the Asiatic Lion, the eco-system assumes special significance because of its tremendous regenerating, self-supporting and sustaining capacity for the rich and diverse fauna and flora (Singh and Kamboj, 1996). Recognising the special ecological features of the region it was first notified as a sanctuary in 1965 and subsequently as National Park in 1975 under the Wild Life (Protection) Act (1972). Over time there has been some changes in the delineation of the PA-boundary. At present, the PA has 258.7 sq. kms. of area under National Park and 1153.4 sq.kms under sanctuary totaling upto 1412.1 sq. kms. Ever since then the Protected Area (PA) has been governed by the specific schemes and management plans prepared by the State Department of Forest in consultation with the Ministry of Environment Government of India. The future plans thus have to be explored by reflecting on the existing legal boundaries for PA-management in India.

Gir forest represents an important ecological formation in the western India. Apart from being the only home of the surviving Asiatic Lion it constitutes catchments of the seven major rivers thus, providing ecological security to the surrounding drought prone region (See Map 1 (a&b). Flow Chart on Gir-Ecology provides a brief description of the PA. Conserving this ecosystem therefore would serve some important functions listed as follows (Singh, M., undated):

Conservation Values

- Largest compact tract of dry deciduous forests in the semi-arid western part of the country.
- Last home of `Asiatic lions', Panthera leo persica, last surviving gene pool' in nature on earth.
- Rich biodiversity area supporting large number of species including several endangered species.
- Highest concentration of top carnivores-lions and leopards (over 500), and possibly the single largest population of marsh crocodiles in the country.
- Catchment area of seven major rivers which sustains economic prosperity of this drought prone region.
- Ecological security and environmental amelioration for the region, climate, water, salinity prevention and pollution absorption.
- Important biological research area with considerable scientific, educational, aesthetic and recreational values.
- Mother of cultural and religious evolution in Saurashtra.

However, over the past two centuries, Gir forest has undergone significant changes leading to drastic reduction in the forest area as well as its resources (Singh, 1997). The rich ecological resources of the region are surrounded by densely populated human settlements spread over 7 talukas in two districts viz; Junagadh and Amreli. This includes 99 revenue villages in the radius of 5-7 kms (See Map 2). Together these 99 villages had a population of about 1.52 lakhs in 1991. By now, the human population would have increased to about 1.8 lakhs using the average growth of 2% per annum.

To a large extent, this population (human + livestock) seems to have been dependent on the various ecological and economic services provided by the PA. The most important among these are water (i.e. the seven rivers originating from Gir) and fodder (with high degree of bio-diversity and quality) which sustains a large number of faunal diversity species including milch animals. Together these resources have acclaimed a special agro-ecological significance to the region, known in the local parlance as `Lili (Green) Nagher', which is the green only fertile

patch in the dry/semi-arid region of Saurashtra in the western part of Gujarat. In turn, this has been reflected by the relatively higher productivity of land as well as livestock, cultivation of high valued crops like sugarcane as well as mango (and other horticulture) plantation, and scenic beauty with a number of religious places.

What is more important is that the region including the PA has been viewed as a fodder bank especially during the drought years, attracting a number of places like the rest of Saurashtra, Kachchh, North Gujarat and even Rajasthan. While there is no systematic estimate of intrusion of people from other regions – seasonal, occasional and permanent, there are evidence which suggest that the region has been performing as an important drought proofing function both formally as well as informally (Sinha, 1967). Regeneration of ecology should therefore, essentially be based on development of the major watersheds comprised of the seven rivers. In that case, the regeneration plan should also cover those areas of these watersheds, which lie out side the PA. Integrating these areas in the periphery would amount to incorporating people and their economies as integral components of the ecology. The peripheral region and their people thus, become important stakeholders though; their stakes may assume a relatively lower priority in the management of the PA (see the flow Chart on Gir-Ecology).

Hamlets (Neses) within the PA:

Besides these villages, there are also clusters of human settlements within the PA. At present, there are about 54 hamlets (Neses) and 14 Forest Settlements in Gir-PA. While these people living inside Gir draw upon the natural resources such as fodder, fuel, land, water, MTFP, timber etc. for satisfying their livelihood needs, they also seem to be contributing towards sustenance of the ecology. Two important aspects are often noted in this context. First, grazing of livestock with a well laid out seasonal rotation helps sustaining bio-diversity of grasses; also this helps reducing the incidence of forest fire, which generally has a high probability of occurrence in dry-hot weather like that Gir. Another ecological function performed by these people is that of keeping up the chain of herbivorous species, in absence of which, damage to the peripheral agro-economic system might get increased.

Of course, both these are highly contested issues. While some ecologists as well as social activists perceive these people and their domestic livestock as parts of the

ecology of Gir, there is however, some differences of opinion among the PA-managers. For, it is often argued that the people (especially, Maldharis i.e. cattle herders) living within the PA are recent settlers and, are largely responsible for degradation of floral bio-diversity as well as for forest fire. It is also felt that the domestic livestock, providing easy prey for the lion, has led to distorting the genetic characteristics of this core wildlife specie. In turn it forces lions to go out of the PA in search of the domestic animals and thus results into increased damages to the property and people in the peripheral region.

People and the PA:

The perceived conflicts between wild life and people inside the PA has led to a policy approach, which seeks to relocate these people outside the PA as noted in the special scheme prepared for Gir-Sanctuary way back in the early seventies, and subsequently in the management plan prepared in the mid-nineties. In the same vein, the management approach is to tighten the protection of the PA from any kind of interference by the people as well as other vested interests from industry, mining and other developmental activities. Together this has led to a typical situation of conflicts between people and the PA or between conservation and livelihood. These conflicts become severe especially during droughts. The situation becomes particularly acute because of the `inappropriate' use of land as well as water resources in the peripheral region. This is reflected by the fact that 33 per cent of the forest area in and around the PA are degraded and/or highly degraded [Singh and Kamboj, 1995]. Apart from these, the PA has a network of about 600 kms. of road length and 15 kms of railway tracks. More than 2 lakh vehicles pass through Gir every year causing problems of noise as well as air pollution on the one hand and damages to wildlife on the other. Presence of a number of religious places adds to these problems.

Moreover, agricultural pattern on the peripheral villages also seems to be somewhat problematic. For instance better availability of ground water and soil moisture in the region has led to increased extent of water intensive crops like sugarcane and cotton. This has resulted not only in depletion of ground water resources but, also creating additional risks for the wildlife due to digging of large number of wells and water holes (Ramachandran, et.al, 2001).

Overall therefore, it is noted that "encroachment and destruction of natural surroundings of the PA, increasing population of carnivore and herbivore and increasing disturbance to wild animals force them (i.e. lion) to move outside and to cause crop damages and killing of livestock. Hence the man-animal conflicts are increasing, threatening the wildlife in turn" [Singh and Kamboj (1996); also see Sinha, (2001)].

Droughts and Degradation:

Finally, natural disasters like cyclone and droughts have also affected the balance between ecology (including wildlife) and human requirements. For instance, a devastating cyclone in 1982-83 had destroyed about 28 lakh timber trees besides other shrubs and plants. Similarly, frequent droughts and the resultant water scarcity in the region have led to stunted growth and sparse vegetation in large tracts of degraded (345.5 sq.kms.) and highly degraded areas within the PA (122.2 sq.kms). Besides this, there are evidences of degradation within and in the periphery of Gir as follows:

I. About 33 percent of the forest area is degraded or highly degraded and above 44 per cent of the area with trees has a density of less than 0.2.

II. Proportion of teak in the total timber tree has declined from 45 to 38 per cent.

III. A large part of the PA belongs to the category of moderate to severe soil erosion.

IV. Water table in peripheral region has declined.

V. Fodder collection though, increased over time, is subject to very high year-to-year fluctuations.

Recent Approach to PA-Management in Gir

The PA-management thus, is poised with a number of challenging tasks such as:

(i) Regeneration of forest and degraded pastures within PA.

(ii) Regeneration of pastures and agricultural land in the periphery

(iii) Management of fodder pool for coping up with drought conditions in the region

(iv) Soil-water conservation and water-use management within and outside PA

(v) Fire control and fencing to protect wildlife and minimize the damage caused by them to the people in the surrounding region.

(vi) Reduce negative impact due to developmental interventions like roads, mining and other infrastructure, pilgrimage and tourism.

(vii) Managing the collection of MTFPs (including fuel wood) and linking it up with people's livelihood and protection.

(viii) Promote awareness generation and research

(ix) Reduce direct pressure by shifting people from the PA.

Since this is a Herculean task, the official approach for the PA-management has been fairly comprehensive (Singh and Khamboj, 1996). It is envisaged that the management plan should encompass not only the legal but, also the ecological boundary of the PA. Ideally, this should incorporate following dimensions:

I. The complete ecology including what Barth (1976) describes as "Cultural Landscapes" (Panwar, 1984).

II. Integration of PA-management with regional planning

III. People's participation in Conservation and Protection

Keeping these tasks in view, the action Plan being prepared by the Department of Forest, Government of Gujarat has envisages enlargement of the home range for sustaining a population of 500 lions in the region. This would encompass a significantly large part of the periphery of the PA, based on the territorial movements of the core wildlife specie. There could however, be some debate about the carrying capacity of the PA, the management plan is poised to target a 400 lions in an idealistic situation (Singh, 2001; p.50). According to this, the plan should be extended to parts of 16 talukas vis-à-vis 3 talukas covered by the Management Plan at present [Singh and Pathak (2001); Singh, H.S. (2001)]. Linking up the management plan with the multi-sectoral developmental plan of the region therefore becomes essential.

It is in the backdrop of this larger context of the policy approach for PA-management, the present study tries to assess benefits and costs of Gir Protect Area and explores policy options for future management. The focus is more on identification of a

sustainable management system, which would ensure both ecological regeneration as well as economic support to the people who directly/indirectly depend on the ecology of the region. Interestingly, this approach coincides with the objective of a Regional Planning being incorporated in the recent thinking of Gir Management Plan. Awareness generation and people's participation form important components in this approach, which in turn, necessitates understanding of people's dependence as well as their perceptions on the alternative management system.

Two considerations are important while defining the objectives of the study: First, Gir-ecology has a vast tract of degraded and highly degraded areas hence vegetative regeneration is crucial. Since much of this is attributable to a complex-mix of factors related to: (a) natural (climate and disasters); (b) human (increasing pressure due to growth in population and people's greed); and (c) management system (resource availability, efficacy, and conflict resolution), the strategy for vegetative regeneration has to simultaneously take into consideration all the three sets of factors rather than taking a purely technical-conservationist approach. The second aspect pertains to involvement of people in the periphery for effective conservation or protection of the ecology. Together these considerations bring to the core the issue of land regeneration and land-use planning. Assessment of benefits and costs in Gir-PA will thus center round this critical issue. This would imply that besides estimating use as well as non-use values of the eco-system, which is essential for identifying the need, scope and approach for conservation, the study also needs to focus on issues like: effective regeneration of pastures within and in the periphery of the PA; nature and extent of conservation efforts undertaken in the recent past; people's dependence on the ecology and incidence of conflicts with the PA-management; alternative management system especially for land regeneration and land-use planning; access and distribution of fodder and other MTFPs; financial costs; and appropriate incentive structure for people's participation in conservation. Examining these issues thus, would help estimating the cost of effective protection and management, which in turn could be treated as at least the minimum value of conservation of ecology within the PA. The analysis is to be carried out in the light of the important postulations emerging from the above description of the ecology, people and the management approach adopted for the PA. These postulations are:

i. Given the large size of human population in the periphery, there is an inherent trade-off between conservation and livelihood requirements of the people. However, the trade-off could possibly be resolved by taking into consideration the carrying capacity, which has been estimated to be around 300 lion. This is the maximum population of lions that had ever existed in Gir.

ii. Maldharis are a part of the Gir-ecology hence the carrying capacity should also be defined in terms of human as well as livestock population of this community within and in the periphery of Gir.

iii. Conservation efforts over the past two and half decades have improved the wild life habitation especially by enhancing vegetation (or restocking) in the core area and effective punitive measures. This however, has left a large part of the pastures within (and also out side) the sanctuary in degraded conditions.

iv. Whereas the protection measures have resulted in reducing poaching of wild life, illegal grazing continues to prevail though, on a significantly lower scale than before.

v. Nevertheless, continued degradation of pastures is a combined effect of (a) illegal grazing; (b) climatic conditions (i.e. frequent droughts); and (c) inadequate measures for regeneration.

vi. Intrusion of wild life on crop fields in the peripheral region has increased mainly due to degraded conditions of forests especially, during droughts.

vii. The problems of water and shelter (i.e. vegetation) within the PA could be mitigated by proper measures for soil-water conservation within the PA. This in turn, might also help promoting sustainable use of water for agriculture in the lower reaches of the watersheds

viii. Regeneration of vegetation within the PA could be help reducing the pressure from outside provided (a) pastures in the periphery are developed; and (b) management of fodder supply is streamlined.

ix. Development of pastures both within and outside the PA requires substantial resources- financial, (i.e. land, water, manure etc.) natural and institutional. Given the budgetary support, these aspects so far, have received a lower priority despite the recognition of their critical importance.

Given these postulations the present study focuses on the following main objectives.

1.4 Objectives and Analytical Framework

i. Identification as well as valuation of Economic and Ecological Services from the PA

This has been done by using secondary information available from the Gir-management plan and also from other literature covering wildlife as well as vegetative density and genetic diversity within the PA. While economic services mainly cover availability of fodder, fuel, MTFC, farmyard manure, water and last but not the least drought proofing; ecological services include cleansing of air, reduced soil erosion, ground water recharge, and diversity of flora and fauna.

ii. Assessment of People's Dependence on the PA Across Different Categories of Households viz; Farmers with and without irrigation, Landless, and Traditional Herder Communities.

This has been captured through a primary survey of households within and in the periphery of the PA. This has been supplemented by evidence from the existing studies. While economic benefits have been assessed by using the market prices for obtaining these commodities or services, ecological benefits have been captured through a perception-based inquiry.

iii. Estimation of Costs Under Alternative Management Practices Especially for Regeneration of Community Pastures, Wasteland, and Reserved/ Protected Forest.

Each category of land could be put to different uses depending upon the regeneration efforts, technical-financial inputs, and institutional mechanisms. In turn, each of the land use practice will have different ecological as well as economic implications at both at individual and societal levels. For instance, community pastures have been brought under cultivation through distribution of land under the resettlement package for the residence of the forest as well as the landless. Similarly, community wasteland and/or pastures could be brought under horticulture plantation. The reserve grassland (vidis) could be developed for fodder or plantation. All these may have different impact on costs as well as benefits. Assessment of alternative management system will be based on the status of the PA-resources and people's preferences about their management. The central focus of an alternative management scenario should be to improve economic benefits to the people such that they help conservation and restoration of ecological system in the region.

The analysis of cost of conservation would involve detailed examination of the financial outlays for different components of the PA-management plan, including eco-development project, and identify major gaps due to budgetary resource constraints. This may have implications like delay in the regeneration efforts. Such delays may have serious impact on ecology, leave aside the increased financial costs and economic loss. Similarly, the on-going Eco-Development Project may have certain constraints with respect to adequate incentives for preventing the households from over utilization of forest resources. A detailed examination of the expenditure pattern and the gaps therein may be quite useful for improving the management of the PA within a short/medium time frame.

The assessment of benefits and costs covering the above aspects thus, would involve detailed mapping of: (i) land resources; (ii) present status of use and conflicts; (iii) cost of treatment under alternative management practices; (iv) distribution of benefits across different categories of households; (v) coverage of eco-development project and impact in terms of reduced pressure on forests; (vi) identification of alternative incentive structure for ensuring effective conservation; and (vii) budgetary constraints in implementing the PA management plan. This

would be accomplished by collecting primary as well as secondary information from the informed persons in villages as well as the forest department.

Long Term Objectives

The above analysis will help contributing to certain long-term objectives such as:

(a) Getting a clearer understanding of the interface between development of the core and the peripheral regions which may lead to evolving a sustainable strategy for PA- management; and

(b) Identifying effective mechanisms for protection and also sharing of resources through development of markets, institutions and community participation.

1.5 Approaches for Valuation

Estimating the full opportunity cost (or the total economic value) of the depletion or conservation of the PA would involve the valuation of a range of ecosystem function (Perrings 2000). Coustanza (1997) has listed 17 such functions, some of which having significant bearing an economic services. Prima facieses, the benefits flowing from a PA could be classified into five major categories (Dixon and Sherman 1990). These are:

Chart I.1 : Economic and Ecological Services from PA

1. Watershed Protection
   - Erosion control
   - Local Flood reduction
   - Regulation of Stream flows
   - Ground Water Recharge and Revival/ Regeneration of Natural Streams

2. Ecological process
   - Fixing and Recycling the Nutrient
   - Soil Formation
   - Circulation and Cleansing of Air and Water
   - Global Life Support

3. Biodiversity
   - Gene Resources
   - Species Protection
   - Ecosystem Diversity
   - Evolutionary Process

4. Non – Consumptive Benefits
    - Aesthetic/ Spiritual (Ethical/Religeous)
    - Cultural / Historical
    - Existence
    - Option/ Quasi- Option Value

5. Consumptive Benefits
    - Recreation
    - Education and Research
    - Use of forest Resources
    - Increase in Farm and Livestock Productivity
    - Employment and Income Generation
    - Drought Proofing
    - Health Impact

Of these, the first four represent ecological services leading to the non use values whereas, the last indicates economic services in terms of direct and indirect (or induced) use values. Against this, the cost of conservation could be assessed through actual or direct cost of conservation measures including cost of compensation for the damages caused by wildlife as well as the incentives for reducing human / livestock pressure on the forest resources.

Alternatively replacement cost could be estimated for regenerating/ restoring the ecological and economic services like watershed, biodiversity and ecological process on the one hand, and recreation as well as consumptive use values on the other.

Finally, the opportunity cost approach involves standard economic analysis of market values to determine the net economic benefits associated with the alternative uses of one or more resources. By determining recent land- use in and around the park and projecting the future land use in the absence of the park, one can estimate the cost to villagers from loosing the opportunity to exploit the park area for agricultural or forest products (Munasinghe and Mc Neely, 1994, p 193). Of course, this effort may not be so much relevant in the case of PA where ecological functions assumes special significance.

A simple presentation of valuation approaches for benefits and costs of PA has been presented in Chart I.2

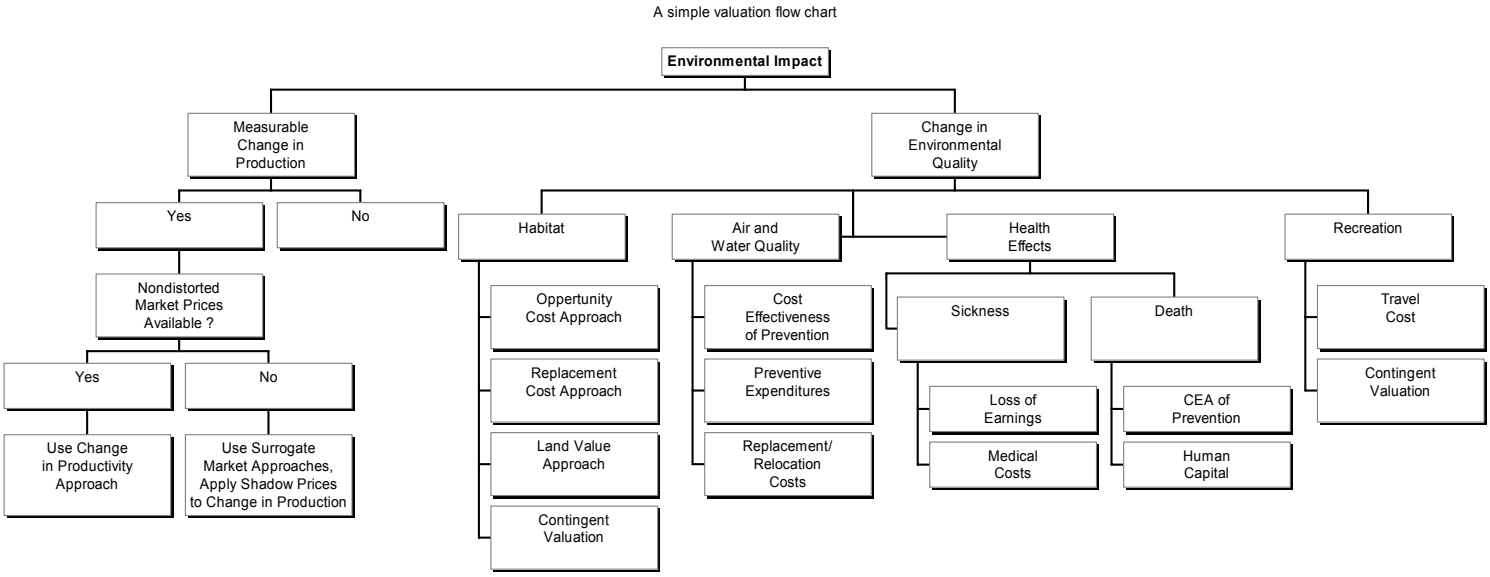


Chart I.2

Analytical Approach

Given the specific context of Gir, a wide menu of valuation methods, and feasibility of data collection, the present exercise will attempt assessment of various benefits and costs as listed in Chart I.3.

Chart I.3

Benefits			Cost		
Environmental and Economic Services			Of Conservation		
Direct Benefits	Loss of Potential Benefits	Benefits Under Alternative Management Plan	Direct Cost	Opportunity Cost	Replacement Cost
Actual Use as well as Non use Values	Untapped potential of Use as well as Non use Values due to incomplete Conservation Efforts	For Alternative Systems of Land Use, Incentives and Institutional structures	Actual according to the Manage-ment plan for Mitigation of Forest Degradation	Under Alternative Land Use Practices	For Ensuring Effective Conservation through Alternative Management Plan

1.6 Coverage and Methodology

The study has been based on data collected from both secondary as well as primary sources. The assessment of the value of economic and ecological services (benefits) has been done by using the estimates of various indicators viz; intensity and diversity of vegetation across different areas within PA, availability of irrigation, FYM and other MTFPs, conservation of soil-nutrients, carbon sink function and wildlife diversity etc. from the various studies on Gir-PA and/or other comparable situations in India. The estimates of costs are based mainly on the norms used in the official management plan. However, these sets of secondary information have been supplemented by primary data collected from: (i) a complete house listing in 8 revenue villages; (ii) a detailed survey of 162 households in four revenue villages; (iii) meeting with key informants which included group discussions on the status of common property resources in 29 villages; (iv) a series of focus group meetings with various stakeholders viz; people, members of the eco-development committees and functionaries of the forest department; and (v) informal discussions with policy makers.

The four villages where the detailed survey of sample households has been undertaken were selected from the West and the East divisions within the PA– two in each division. Of these one village is on the boarder i.e. within the periphery of 2 kms. and the other at a distance of 2-7 kms. from the PA-boundary. After completing the house-listing exercise in the four (out of the 8) revenue villages selected for detailed study, a sample of households was selected from five categories viz; large farmers with irrigation (LI); small farmers with irrigation (LI); farmers without irrigation (UI); landless (LL); and traditional herder communities (LH). The sample households were selected by adopting a stratified random sampling procedure. Table 1.2 presents distribution of the sample households in different categories.

The basic purpose of the primary survey was to ascertain (a) dependence on the PA households across different categories; (b) people's perceptions about the relative importance of non-use values; and (c) preferences about alternative land-use, and their implications for alternative management systems. Together, the secondary and primary data provide a comprehensive picture of the ecological status, prevailing management practices, and implications on alternative system for regeneration and

conservation of Gir-PA in a sustainable manner. It is expected that the analysis would provide inputs for further fine tuning of the issues and policy alternatives for management of Gir and therefore, would be a useful addition to the rich set of existing literature on various aspects of the ecology.

The analysis is divided in five sections including this introduction. The next section maps out the economic as well as ecological services, estimates benefits of some of these services, and also examines the costs of management of the PA. Section 3 looks into the nature and the extent of interface between the PA and the people in periphery. This is followed in Section 4 by analysis of people's perceptions about future management of crops and pastures within and out side the PA. The last section 5 summarizes major findings and discusses policy implications.

Table 1.1Major Features of Gir Forest (1994-95)

1	**Protected area (sq.kms)**	1412.1
1.1	National Park (sq.kms)	258.7
1.2	Sanctuary (sq.kms)	1153.4
2	**Forest Resources 1993**	
2.1	Forest cover with crown density above 10 % (sq.kms)	906.4
2.2	Degraded, grasslands with scattered tiles	345.5
2.3	Highly degraded forests, grasslands and blanks	122.2
2.4	Waterbodies	18.2
2.5	Cultivated land (In forest settlement)	
3	**Wildlife**	
3..1	Mammals (No. of species)	32
3.2	Birds	300
3.3	Reptiles	24
3.4	Insects	2000
4	**Human population (within PA, 1995)**	
4.1	No. of Neses	54
4.2	No. of Forest settlement	14
4.3	Human population (1991)	7034
4.4	Livestock population (1991)	14064
5	**Peripheral Region (Within a radius of 5-7 kms)**	
5.1	No. of villages	97
5.2	Human population	1,52,724
5.3	Livestock population	94,582
5.4	Pasture land vidis (No.)	56,536
5.5	Peripheral forest (Sq.kms)	470.5
5.6	Estimated requirement of fuel wood (MT per annum)	20,000
5.7	Requirement of fodder	50,000
5.8	Production of fodder in vidis (MT)	4,320
6	**Water Resources**	
6.1	Rivers (No.)	7
6.2	Water bodies (No.)	4
7	**Major plant species**	
7.1	Comman tree (No.)	81
7.2	Herb and shrubs (No.)	48
7.3	Climers (No.)	18
7.4	Grasses (including bamboo) (No.)	14

Source: Singh and Kamboj (1996); Singh, M. (1995).

Table 1.2 Broad Features of Sample Villages

Sr. No.	Village	Distance from PA Boundary	Adjacent vidis in the PA		Distribution of Households					
			Name	Area (Ha)	LI	SI	UNI	LL	AH	All
	Gir (West)									
1	Kenedipur	2	Kenedipur	146.7	7	11	10	15		43
2	Madhupur	4	Madhupur	76.3	5	10	10	10	5	40
	Gir (East)									
3	Govindpur	5	Govindpur		4	10	10	10	5	39
4	Dadli	2	Dadli	146.7	5	10	10	10	5	40
5	All (No.) (%)				21 (13)	41 (25)	40 (25)	45 (28)	15 (9)	162 (100)

LI = Large irrigated; SI = Small Irrigated; UNI = Unirrigated; LI = Landless; AH = Animal Herder

Chapter 2 : Economic and Ecological Services and Cost of Conservation of Gir-PA

2. 1 The Focus

This section deals with mapping of economic as well as ecological services rendered by Gir eco-system and tries to assess benefits from the economic services vis-à-vis the cost of PA-management. In doing so, it moves away from a comprehensive valuation exercise involving a detailed assessment of the ecological services and valuation of non-use benefits such as existence, option and future (bequest) values of bio-diversity. Assessment of these services and benefits is a challenging task because it requires understanding of ecological functions of the existing bio-diversity on the one hand, and anthropogenic assessment of the various non-use values for different stakeholders on the other. This is particularly so because Gir eco-system, being the last surviving home for Asiatic lions, has a well acclaimed value in terms of rarity with a potential risk of extinction.

In fact, it is the recognition of the `uniqueness' of the eco-system and its bio-diversity that Government of India, way back in the mid-seventies, had taken a decision of its conservation by notifying the area as National Park and sanctuary. Ideally, effective conservation (or protection) should lead to regeneration of ecology to its `original' state at some point in time in future. This would primarily imply restricting any kind of human interference with the eco-system. But as noted earlier this kind of an ideal `conservationist approach' is difficult to adopt because of dependence of the people on most of the PAs in developing countries. The relevant issues therefore would be to identify: (a) a `reasonable' level of ecological regeneration and the requisite conservation efforts that the society can aim at; (b) the corresponding opportunity cost of achieving the `reasonable' level of conservation and regeneration, which includes the loss of livelihood and cost of compensations; and (c) a cost-effective mechanism to achieve the targeted level of conservation and regeneration.

It is generally difficult to decide what level of ecological regeneration could be considered as `reasonable', if not ideal. Given the fact that Gir eco-system especially, its core wildlife specie i.e. lion, had already faced a serious extinction risk; and that the overall ecology, particularly its vegetation and other natural resources

like land and water, have been fairly degraded, defining a reasonable target for regeneration becomes essential.

In the case of Gir eco-system defining a `reasonable' level of regeneration seems to have been critically linked with enhancing and stabilizing the lion population at a level, which can meet the `standard for extinction risk' (Haight, R. 1995). Subsequently, when the lion population started increasing, it brought-in a notion of `ideal population size' or carrying capacity of the eco-system (Berwick, 1996). A number of studies have gone into examining the carrying capacity of Gir PA in terms of number of lions and ungulates, domestic livestock, and human population. While the notion of `carrying capacity' is complex and problematic as it reefers to some kind of a static view of an `optimum' state of eco-system, it however works as a handy tool for defining the reasonable levels of bio-diversity conservation as well as regeneration, and designing a requisite plan for PA-management. This kind of a pragmatic approach is essential because of the costs (both in terms of welfare as well as subsidies) attached to conservation efforts (Chopra, 1998). The present exercise therefore focuses on examining the benefits and costs of conservation with reference to a regeneration goal whereby (a) wildlife population is maintained at the level of its estimated carrying capacity i.e. around 300 lions with a requisite ungulate-ion ratio; and (b) density and diversity of vegetation is continuously enhanced. Given these objective functions and the broad contours of a `reasonable' conservation and regeneration plan, the analysis should lead to identifying a strategy which could maximize livelihood support on the one hand, and minimize the cost of conservation and regeneration on the other. In other words, the objective function of a management system should be to maximize livelihood support subject to the condition of (a) meeting the standard carrying capacity; and (b) ensuring continuous improvement in vegetative cover and its diversity.

It may be reiterated that regeneration is very crucial in the case of Gir where degradation is quite high despite the conservation efforts. But, the positive feature is that regeneration of eco-system, especially vegetation will also help enhancing livelihood support to the people and thereby (ideally) reduce the cost of protection as well as compensation. Thus, alternatives of a cost-effective approach could be obtained by exploring the mechanisms, which instead of focusing mainly on

`protection', also pro-actively supports `regeneration' of the degraded land, and thereby supports people's livelihood.

2.2 Multiple Objectives of Valuation and Choice of Appropriate Methods

There has been an increasing amount of literature discussing the problems and offering new approaches for valuation of an eco-system. While it is relatively easy to estimate the value of economic services rendered by an eco-system, there are insurmountable difficulties in attributing monetary values to ecological functions and bio-diversity. We do not propose to get into the details of this rich discourse on the problems as well as methods of valuation of ecology and bio-diversity [Pearce and Turner (1990); Randall, A. (1991); Pearce and Moran (1994)]. It may however, be pertinent to note that "it is extremely difficult to measure fully the functions and processes of an ecological system or to predict the ecological impacts of disturbances to those complex systems. Furthermore, even where relatively simple eco-systems are fairly well defined, it is difficult to determine causal relationships between human actions, eco-system functions and processes" (Bingham, Gail, et.al, 1995).

The complex nature of the eco-system thus, makes the task of valuation very challenging. First of all, eco-systems are dynamic and have attributes that occur at different temporal and spatial scales. Hence one needs to know what is important to measure and why. The attributes that are generally considered for valuation include: food, wild medicinal plants, flood and erosion control, carbon sequestration, wildlife habitat, biological diversity, nutrient recycling, detoxification of chemicals, and recreation (Bingham, G. *ibid*). These attributes are relatively easy to comprehend in terms of their impact on human life. Also various methodologies have been developed for assessing their impact or value in a manner that helps decision-making within the realms of economics. However, an important point, which needs to be noted in the context of ecological valuation is that, what is being captured through the various measures is `economic value of biological resources' rather than their diversity' (or ecological systems) (Pearce and Maran, 1994).

Apart from these, there are serious objections to attaching monetary values to bio-diversity. To a large extent, the objections are raised on a philosophical level where use of money as a universal equivalent for making a rational choice is contested on

the ground of `incommensurability between ethical commitments and monetary values'. It is argued that there is no unit through which different values can be placed upon a common scale --- there is no substitute for good practical judgment that is informed by the debate amongst practitioners and citizens (O'Neill, J. 1997).

There are some critical issues, which caution the practitioners of economic valuation against its direct use in decision making. The important lessons that emerge from the existing literature are: (i) valuation of selected ecological functions should not be mistaken for a complete assessment of the existence or presence of an ecology; (ii) monetary valuation should be seen in conjunction with the insights that came up through discussions and dialogues with the stake holders; and (iii) monetary values should form an integral part of the process of arriving at a `good practical judgement'. Given this backdrop, the subsequent analysis tries to capture economic as well as ecological services of Gir eco-system by highlighting specific attributes at three different levels viz; global, national and local.

- At global level, the attributes that need special emphasis are rarity (or uniqueness) and extinction risk of wildlife especially, lion. This should address three important groups of people/ agencies viz; international funders, tourists and researchers. The main focus could be on policyc debate, information sharing, and mobilization of funds.

- At national level, the emphasis should again be on rarity and also on the loss of potential benefits that continue to take place due to inadequate funds as well as legal and administrative framework for protection and regeneration of the PA. The expected out-come is reformulation of the legal framework and at the same time better allocation of funds for conservation.

- At local level, the emphasis should be more on the direct and indirect use-values especially, drought proofing effect of a regenerated ecological system, which traditionally, has been functioning as a major source of water and fodder in the region.

The following analysis will try to capture these specific attributes of Gir-eco-system so as to help evolving appropriate management strategies and obtain requisite policy support at all the three levels mentioned above.

2.3 Choosing Appropriate Valuation Methods

A rich and a rapidly growing body of literature exists on mapping and valuation of protected areas in different parts of the world. Among these, the study by Dixon and Sherman (1990), provides a fairly comprehensive review of different methods of valuing benefits and costs of conservation. Prima facie, they suggest eight broad categories of benefits and the corresponding methods for valuation of these benefits as presented in Chart I in Section 1. Similarly, other scholars have also suggested different groupings of benefits and their valuation [Munasinghe and MacNeely (1994); UNEP (1995); Pearce and Moran (1994)]. Based on these various approaches we have tried to identify the major streams of economic and environmental benefits from and costs of conservation of Gir-PA as depicted in Chart II.1.

Chart II.1

Mapping of Economic and Environmental Benefits and Method of Valuation in Gir-PA

A. Ecological Services	**Method Used**
Direct Use	
Fodder* Fuelwood* NTFP* Medicinal* FYM* Irrigation* Recreation*	Market price Market price Market price Market price Market price Market price Income from tourists
Indirect Use	
Timber* Education and research	Market price
Non-Use	
Aesthetic*-Cultural Existence* Bequest	Perception ranking Perception ranking
B. Environmental Services **Watershed Function**	
Erosion control*	Based on soil-loss equation

Regulation of stream flow*	Change in ground water table
Bio-Diversity	
Gene resources Species protection Eco-system diversity Evolutionary processes	Change in bio-diversity due to conservation measures

Of course this is not a complete list of all the economic/ecological functions that might be flowing from the eco-system. Our list is mainly based on the availability of information as well as the relative importance of specific services to the existing management system. We have tried to estimate values of most of these services that are marked with `*' in Chart II.1. We could not cover the rest because of inadequacy of data or skills or both. Ecological services were particularly difficult to value as noted earlier.

A similar exercise is also done for estimating the cost of conservation. This includes the actual cost, mitigation (or replacement cost) to minimize loss of potential benefits, opportunity cost, and cost of alternative management system as perceived by the people (see Chart II.2).

Chart II.2

Cost of Conservation of Gir-PA

Types of Costs	Methods Used
Direct cost (and expenditure) of PA-management	Based on budget estimates and actual expenditure
Opportunity cost of conservation	For alternative land-use under crops, plantation and fodder
Loss of use-value (fodder) due to inadequate conservation measures a. Soil erosion b. Ground water depletion c. Cost of regeneration of degraded vidis especially in buffer zone	Estimating the gap between potential and actual yield of fodder a. Loss of nutrients b. Due to water intensive crops c. Replacement cost as per the assessment of the PA-management
Cost of resettlement of Maldharis a. Actual cost b. Extraction of forest resources	As per the 1972 package (at 1994-95 prices)

	Estimates of direct use-value by Maldharis in Gir and their income to workout cost of compensation
Cost of regeneration of grassland under alternative practices	Cost of regeneration, eco-development, and fodder supply management

2.4 Valuation of Environmental and Economic Benefits from Gir: Recent Evidence

In a recent study, Gujarat Agricultural University has attempted a fairly detailed exercise of quantification of Environmental and Economic Benefits of Gir-Eco-system (GAU, 2001). This includes a wide range of economic and environmental services noted above. At the end the study has provided a somewhat approximate estimation of the Total Economic Value (TEV), which works out to be Rs. 2,23,742 lakh per annum. Against this, the cost of conservation worked out to be Rs. 12,684 lakh, which gives a net economic value of Rs. 2,11,059 lakh per annum. To a large extent, the estimates are based on secondary data available from the Forest Department.

While the valuation exercise is fairly comprehensive in terms of coverage (of attributes or benefits), the estimation procedure adopted for various economic and environmental services are somewhat simplistic than what the existing data set (from secondary sources) may permit. For instance, valuation of fodder, which is the most critical resource for the people and also for conflict management, has been based on the estimates of the requirement of the entire population of about 95,000 animals in the peripheral villages. This, apparently does not take into consideration the other sources of fodder e.g. crop residue. At the same time it does not adjust for the composition of the livestock population in peripheral villages. Similarly, estimation of timber value is also based on estimated density rather than going into the details of its composition in terms of girth etc. Finally, the estimation of increased agricultural productivity due to availability of irrigation also represents gross aggregation assuming that the region would have been completely devoid of any kind of irrigation facility, if Gir eco-system did not exist. Also, the analysis does not take into consideration the negative impact that the present irrigation practices exert on the eco-system.

These are some of the indicative issues which suggest the need as well as scope for a further fine tuning of the valuation exercise, using the existing secondary data. However, before attempting that, it would be useful to recapitulate some of the major findings of the study. These are:

(i) Of the total benefits, direct use value constitutes about 30 per cent whereas, 70 per cent of the estimated value of benefits come from environmental (or ecological) services such as soil erosion, prevention, effect of hydrological cycle, wildlife habitat, micro-climate, upsets of ecological balance etc. These estimates however are based on the aggregate norm prescribed as kind of a thumb rule in the Rules and Guidelines of Forest (Conservation) Act, 1980. While these are some indicative norms for the entire forest cover in the country, location specific estimates of some of these functions might provide a more realistic picture.

(ii) Of the total estimated use value of Rs. 70395 lakh, a substantially large part (i.e. 85.5 per cent) is contributed by the additional value of agricultural production, which is mainly attributed to better availability of irrigation, and may be better soil-moisture in the periphery farms in the distant villages. This kind of valuation, besides some methodological problems discussed earlier, raises an important concern pertaining to the sustainable use of ground water resources in the peripheral regions. If greater availability of ground water results into over exploitation, as may be the situation in several villages in the periphery of Gir, these valuation may have to be adjusted against the changes in the hydrological cycles included in the `environmental benefits' mentioned above.

(iii) Conceptually, timber production in a Protected Area does not form a part of the direct use-value as the timber trees are not supposed to be harvested for commercial purposes. There are of course, exceptions in terms of using the timber for domestic use (i.e. for housing) by the people living within the PA. Given this caveat, it may however, be noted that the estimates/value of the standing timber stock is fairly low, which in turn, suggests low density, or poor growth, or substantial damages to the eco-

system. All the three factors seem to have been responsible for a relatively lower timber value in the PA.

Compared to these, the value of fodder is fairly substantial i.e. Rs. 6802 lakh (vs. 436 lakh for timber). This in fact reinstates the fact that the eco-system has a significant bearing on the livelihood base of the people. And that, the management strategy should try to focus on this aspect while setting up the priority.

(iv) Another interesting observation pertains to the low, but rapidly increasing benefits from tourism, which is primarily based on the entry fees collected by the PA-management. The entry fees, till mid-nineties were almost nominal. In the past five years the entry fees have increased to Rs. 30 to Rs. 300 for Indian and foreign visitors respectively. Apart from these, a large proportion of the visitors come as students or for pilgrims to the 26 temples located in the PA. A more relevant observation made in the context of tourism benefits is that apart from the attraction of lions (and perhaps, other wildlife), the PA does not offer any scenic beauty or recreation facilities. This is a concerning issue not only from the view point of attracting more visitors and earning more revenue but, more in terms of its reflection of the overall health of vegetation and ecology *per se*.

(v) What is however important to note is that the estimated direct use value is still significantly higher than the estimated cost of management, which prima facie, suggests need for reformulating the scale and pattern of expenditure (i.e. investment) in the PA.

(vi) Finally, the analysis of benefits and costs do indicate scope for alternative management approaches, where increased investment and right kind of prioritization would help not only enhancing the direct use values (like fodder and recreation) but, also help recovering a part of this cost from the users, and eventually ensuring better survival of vegetation and eco-system within the PA.

It is towards this objective, we present our analysis of benefits and costs of conservation in Gir- PA.

2.5 Valuation of Economic and Environmental Services in Gir-PA

This section discusses approach as well as results of the valuation exercise undertaken for estimating various economic and ecological services rendered by the PA. It may be mentioned at the outset, that the exercise does not include valuation of pure `ecological' services, as they are difficult to comprehend and also measure in monetary terms. Instead what we have attempted is estimation of the potential loss of some of the environmental services that may have indirect use value for the region. These include loss of soil nutrients, depletion of ground water, and low vegetation, especially fodder. Preventing these losses ideally, would result into improvement in ecology and, at the same time contribute towards enhancement of land productivity, household income and drought proofing. Together the estimates of direct use values from economic services and the select environmental services, in terms of potential loss of income may provide a fairly comprehensive, though not complete, picture of benefits from the PA. As noted earlier, we have not tried to put any value to these ecological attributes. Rather we have tried to capture perceptions of the two major stakeholders in the region i.e. the people and the `protectors' (i.e. members of the PA-management team) about the relative importance of these ecological attributes. Whereas people's perceptions have obtained through a sample survey of households in the study villages, the later have been obtained through informal discussions with the various functionaries of the management team. This information has been supplemented by the available data from some of the earlier studies.

2.5.1 Value of Economic Services

Table 2.1 provides estimates of the select economic services in terms of direct and indirect use value. The total estimated value from these services is Rs. 47,705.1 lakh of which about 20 per cent is comprised of the various direct use-values like fodder, fuelwood, irrigation etc. However, if we consider the value of fuelwood that might be realized through logging or maturation as well as damage due to natural factors like cyclone etc. as having direct use value, the share of direct use value increases to about 85 per cent.

Two important observations require special attention in this context. First, the estimated fodder value is based on the national average of Rs. 3000 kgs/hectare for

the Indian forest (Tewari, 1994). This was essential because the existing studies on Gir do not provide any estimates of the total fodder production from the PA. The published estimates (used in Graph 1 in section 1) pertain to collection rather than actual production of fodder. A detailed study on vegetation by (Khan, 1995) provides estimates of fodder yield on sample plots but, these estimates need to be adjusted for the drought conditions during which the field observations were obtained. This gives an average fodder yield of 4,300 kgs. per hectare, much higher than the national average. Conceding that a substantially large proportion (about 33 per cent) of the forest area is degraded or highly degraded, and the region is subject to frequent drought conditions, it appears reasonable to work with the estimated national average. Subsequently, we have also used alternative estimates by taking different levels of fodder yield.

The second aspects relates to the estimates of Minor Timber Forest Resources (MTFPs). Since there are no systematic estimates of the production of a large number of MTFPs available from the PA, we have once again, resorted to using the national average to estimate the market values. According to the CSO-norms, the actual production is generally 10 times the value realized in the market. We have however, not incorporated these projected values of MTFPs in our estimates.

Together, these two methodological issues result into a downward bias in our valuation of benefits resulting from direct use. In fact, in most part of our valuation exercise, we tried to keep a downward bias for estimating the benefits, so that they do not become unrealistic vis-à-vis the estimated cost of investment, necessary for regeneration of the PA.

2.5.2 Alternative Estimates of Economic Services

Besides estimating these direct and indirect use-values, we have tried to work out values of some of the economic services by using alternative methods. These alternative estimates have been presented in Table 2(a+ b).

a. Opportunity Cost of Conservation

Assessment of the opportunity cost of conservation has been done by considering alternative land-use under (a) crops + plantation and (b) fodder. Table 2.2(a)

provides estimated values of putting the forest-land under crops + plantation in the two zones of Gir-PA. It may be noted that while considering the alternative land use we have taken relatively less water-intensive crops (vis-a-vis sugarcane or cotton) but at the same time more remuneration crops such as groundnut (vis-à-vis subsistence crops like bajri). Since mango plantation is not suitable in a part of the periphery on Gir-West (i.e. Visavadar) and a large part of Gir-East, alternative crops have been considered in accordance to their suitability to the region. Given the crop-scenario (in Table 2.2) the opportunity cost works out to be Rs. 39,525 lakhs, which is lower than the estimated direct + indirect use-value in Table 2.1. Of course, the opportunity cost (or the minimum value of conservation) is much higher than the flow of direct use value from the PA.

Alternatively we have considered a scenario where access to the PA-resources is strictly prohibited. In that case, the peripheral villages will have to generate resources that are presently made available by the PA. We have made these estimates by considering availability of fodder which is the main source of use-value in the region. Table 2.2(b) provides such estimates considering different levels of fodder production within the PA. The estimated cost of shifting from groundnut to fodder production works out to be Rs. 6,438 lakhs and Rs. 2,592 lakh under the two scenarios of fodder-productivity.

Finally, we have also worked out the loss of fodder value in absence of proper conservation measures. It is stipulated that if the PA-management cannot ensure the present level of production, then production of fodder may decline at least by half. In that event, there will be a loss of Rs. 1170 lakh in terms of income from milk-production (see Table 2.3). In fact, a similar exercise can also be extended to other direct benefits like FYM, fuelwood, and medicinal plants, MTFPs etc. Basically, the idea is to highlight the importance of conservation even in terms of loss of income to the people in the region.

2.5.3 Valuation of Environmental Services

Valuation of Non-Use Benefits

More than direct as well as indirect use-values, non-use benefits have special relevance in the context of a protected area. These include benefits like existence

value, rarity and aesthetic value, option value, cultural value and ecological value. Assessing the monetary value of these benefits however, is difficult. Alternatively, what we have attempted here is obtaining stakeholders' perceptions about relative importance of some of these non-use benefits in comparison with the benefits of direct as well as indirect use, the value of which we have already estimated. This will provide some kind of an indirect assessment of non-use value of the resources within the PA.

Ideally, assessment of non-use benefits should be done by estimating willingness to pay among non-users like researchers, nature lovers, and common citizens in different parts of the country/world who may value the ecology purely from the viewpoint of its non-use benefits. This is what generally gets reflected in the pattern of perceptions between users and non-users. While the non-users like researchers, citizens of a distant urban location or foreign tourists attach relatively higher importance to benefits like existence, option, rarity and aesthetic values; those in the proximity of the PA would have a preference for direct + indirect use values over the non-use values. This has been observed by some of the earlier studies e.g. for Keoladeo National Park (KNP). In a detailed study for KNP, using Multi Criteria Analysis (MCA) Chopra (2000) observes a clear difference in the value perceptions among different stakeholders as demonstrated in Chart II.3. Compared to these, those who directly depend on the PA for their livelihood often have a mixed perception of use and non-use values. This is precisely the set of people who have suffered monetary loss due to conservation measures and also have relatively limited financial resources. Also, level of awareness and education of the respondents make the contingent valuation or ranking non-comparable. Nevertheless, obtaining the perceptions of these communities is particularly relevant for; they have a direct bearing on the nature and effectiveness of the conservation measures.

Chart II.3 Difference in Value Perceptions for KNP

Category	Scientists	Tourists	Village residents	Non-users
High value	Rarity, ecological function, existence	Aesthetic, curiosity	Livelihood and related services, employment	Ecological function consumption
Medium value	Consumption, liveli-hood future	Existence	Ecological function	Existence, future livelihood
Low value	Services, ritual, cultural aesthetic	Services, others	Others including ritual cultural	Ritual cultural , aesthetic

Source: Chopra (2000)

In an earlier study, Debnath (et. al, 2001) tried to obtain the perceptions of the local communities in and around Gir about the relative importance of various economic as well as ecological services rendered by the PA. The perceptions were obtained from the residents of three different categories of villages/clusters in and around the PA (Debnath et.al, 2001). It has been observed that people in the periphery-villages attach greater value to ecological functions like rainfall, environment, wildlife, vegetation etc. as compared to those in the Neses as well as forest settlements (See Chart II.4). It may be noted here that given the legal framework for PA-management in India, residents of revenue villages in periphery, represent a class of `non-users', which in reality also have large stakes in the direct use value of the PA. It might therefore, be useful to examine relative importance of non-use benefits vis-à-vis consumptive benefits among people in these villages so as to be able to gauge the monetary value of the former.

Chart II.4

Mean Value* of Characteristics of Gir

Attributes	Neses	FSs	RVs
Wild animals	2.33	1.75	2.3
Trees	1.33	2.25	1.4
Grazing facility	2.66	2.50	3.05
Availability of fodder	3.16	4.00	3.60
Temples	5.00	4.50	3.65

* Based on frequency distribution of number of respondents without obtaining the ranks.
Source:Debnath, et.al, 2001

In what follows we have tried to assess the value of non-use benefits by obtaining relative ranking of various functions/services provided by the PA. The exercise is based on the perceptions obtained from a sample of 162 households in four villages in the periphery of Gir (see details of the sample households see Table 1.2 in section 1).

Table 2.4 provides information of the relative ranking based scores of people's preferences over various services rendered by the PA. It is clear that the relative score is highest for fodder as well as fuel, and closely followed by vegetation and bio-diversity. The next group contains the other environmental services like rainfall,

wildlife and soil conservation. Benefits like MTFPs, timber and income-employment were among those, which are perceived to be relatively less important from the viewpoint of the perceived benefits from conservation of the PA. The relative score for each of the services are based on relative ranks in the ascending order (i.e. higher value getting a higher rank given by the respondents). The aggregate score for each of these services is worked out by taking a the total of the relative ranks for a particular service and standardizing it with respect to the maximum value of ranks that each of the service could get (i.e. the highest rank multiplied by the total number of respondents). This method of course, suffers from the limitation of attaching differential weights along the serialized scores. Standardising the total score by the maximum value of the score however, takes care of a part of the problem. Considering that fodder has an estimated value of about Rs. 307.6 lakh for households in the periphery, monetary value of the non-use benefits. Could be estimated on the basis of their relative ranking with respect to fodder. This is what has been reported in column 3 of Table 2.4. Of course, this is a somewhat crude way of estimating monetary values of these environmental services.

Alternatively we have tried to capture the relative importance of the five major attributes of Gir-PA by obtaining people's perception about the desirability of conservation of the PA. This was obtained by asking the respondents to rank the five major attributes which can be broadly classified as Watershed Functions, Rarity of Lion, Bequest value, religious-aesthetic value and consumptive value (grazing + fodder). It is interesting to note that apart from consumptive use, people in the peripheral villages attach significant importance to religious- aesthetic aspects of the PA, which is closely followed by watershed services, rarity and bequest value. It may be noted that the religious aspect has a close link with the overall ambience of the forest ecology and its aesthetic value. It is clearly believed that the religious spots may also lose their importance if the forest/vegetation get deteriorated. To a large extent, these perceptions confirm the earlier observations by Debnath et. al (2001) in Chart II.4.

Mapping of Changes in Bio-Diversity due to Conservation Measures

Given the relative importance of watershed functions, vegetation, and bio-diversity of the PA, we have tried to ascertain changes in some of the major attributes of Gir.

The idea is to gauge the impact of the conservation measures that started since early seventies. Table 2.6 maps out the changes in flora and fauna in Gir-PA. It is observed that the conservations measures in Gir-PA have yielded significant positive impact on wildlife as reflected in terms of increased population of lion and other species. As a result the ungulate-lion ratio has also improved from 1:31.3 to 1:127.5. Also, Gir-ecology has managed to retain substantial diversity in terms of flora and fauna though, tracing the changes has been difficult because of the non-availability of base-line data.

What is however a matter of concern is relatively lower growth of vegetation in the PA. For instance the number of timber trees has declined by 18 per cent between 1971 and 1995. To a large extent, this is due to the two devastating cyclones in the eighties, which had hit the PA very badly (Singh and Kambhoj, 1996). Other associated reasons for the phenomenon are: (i) frequent droughts; and (ii) low preference for regenerating/replanting timber trees vis-à-vis browsing species (Government of Gujarat, undated). As a result, a large proportion i.e. 44% of the PA area with trees remains to be degraded with a density lower than 0.2 (Singh and Kambhoj, 1996).

This observation however, is at variance with the recent debate about the high tree cover especially, within the core area, which makes it less conducive for habitation for lions. Recognizing this, the management plan has already considered measures for habitat manipulation involving thinning of the dense woody growth, and lopping of browsing species etc. It is plausible that both the realities co-exist; whereas the core area suffers from high density of trees, the sanctuary continues to face the problem of low density and degradation. This has been reflected by the fact the conservation measures so far, have succeeded in halting the process of degradation within the PA; but, the regeneration measures are yet to realize significant results. For, as noted earlier in Section 1, illegal grazing and cutting of timber as well as fuel wood continues to be recognized as major problems (Singh and Khamboj, 1996). Moreover, it is also noted that with increased protection of the PA, biotic pressure from the surrounding villages has shifted to the peripheral forest, which is a part of the multiple zone (Singh, M. 2001). It is difficult to resolve this issue in absence a detailed mapping of vegetation in different parts of the PA and changes therein. The

existing evidence by Sharma (1995) and Khan (1990) do provide useful information on this aspect. But, these estimates do not provide comparable picture over a period of time. We will get back to this issue in Section 3.

Similarly, there are no systematic estimates of fodder production as noted earlier. Instead what is available is the estimates of fodder collection, which shows an increase between 1971 and 1995. But, this increase is subject to very high year-to-year fluctuations as observed in Graph 1. In absence of a comparable set of information about changing vegetation in the PA, it is difficult to derive meaningful implications about the impact of conservation efforts on the type and density of vegetation in different parts of the PA. While the management plan (Singh and Kamboj, 1996) does indicate significant achievements in terms of improved vegetation, systematic quantification seems to be lacking. This of course, is a serious lacuna in the information base, which is very critical for a valuation exercise. We will get back to this issue in Section 5.

Impact on Environment

To an extent degradation in PA is manifested in terms of some of the environmental attributes. For instance, Gir-region is presently classified under an area having `high' degree of soil erosion (GEC, 2001). Based on this categorization, we have tried to estimate soil loss from Gir-PA. Table 2.7 provides estimates of the quantity of soil loss and its value in terms of loss of soil nutrients. The estimated loss works out to be Rs. 9,793.25 lakh per year. Mitigating this loss thus bears special significance as it may trigger a chain of positive impacts such as: improved soil-productivity, better vegetative cover, increased availability of fodder and fuel, increased income from crops and livestock and above all better rainfall and thereby reduced risk of drought which is of prime importance to the people in the peripheral region. The task is to check soil erosion and regenerate degraded land within and outside the PA (see Table 2.8).

Moreover, in absence of adequate measures for soil water conservation, water table in the downstream is also adversely affected (Sinha, 2001). This phenomenon is further aggregated by the fact that the peripheral region has been experiencing increased use of ground water resources for irrigating some of the water intensive

crops like sugarcane, cotton, jiru, wheat, summer groundnut etc. As a result, ground water table has depleted even in talukas in the immediate periphery of the PA (see Table 2.9). This problem had also surfaced as an important concern among farmers during our primary survey in the study villages.

High evidence of soil loss and water depletion also gets reflected in terms of the status of soil nutrients and soil-quality. A recent study based on the results of a number of soil samples collected from region suggest that the status of soil nutrients as well as ph-values is substantially lower in the nearby vis-a-vis distant villages in the periphery (see Table 2.10).

Finally, the reported low vegetation density (Khan, 1990) within the PA may also affect the carbon-sink function of the ecology. We have tried to estimate this by using the estimated densities of teak and miscellaneous trees (see Table 2.11). Obviously, there is a significant scope for improving this ecological function by improving the status of vegetation within and outside the PA.

While soil-water conservation is considered to be the basic treatment for changing the scenarios of environmental as well as economic services, major constraints faced by the PA-management is in terms of financial resource (Government of Gujarat, undated). This issue has been discussed in the light of the budgetary allocation for PA-management.

2.6 Cost of PA-Management

2.6.1 Budgetary Allocation and Expenditure

The management of Gir-PA has a distinction of preparing a very detailed management plan, which is considered as an exemplary exercise. The two volumes Gir-Management Plan prepared by Singh and Kambhoj (1996) is a comprehensive exercise, conducted almost for the first time in the context of PAs in India. Table 2.11(a) depicts the budgetary plan for the period 1995-2000. The estimated budget for the period is Rs. 5,957 lakh of which Rs. 1,874 lakh (i.e..45%) is contributed by the GEF-supported Eco-development Project (EDP). To a large extent, EDP was to focus on developing sustainable alternatives in the periphery to the bio-mass resources and income that are presently being obtained from the PA (Singh and

Pathak, 2001). This implies that the EDP constituted a major part of the funds required for regeneration of degraded forest/pastures within and outside the PA.

The average budget for the year is estimated to be Rs. 1191.4 lakhs. If we examine the details of the budgetary allocation, it is observed that the proportion of the budgetary resources allocated for measures that have direct bearing on regeneration of the PA, is about 52.4 per cent of the total budget including the Eco-development Project. This has been marked by `*" and `**' in Table 2.11(a). Compared to this, a significantly large proportion of the budget is allocated for infrastructure and recurrent expenditure. Moreover, the budgetary allocation for regeneration measures noted above also has some components that may not have direct impact on regeneration. For instance, the amount spent on tourism, socio-economic and village eco-development could be spent in a manner that may not directly improve vegetation and other ecological aspects with the PA. A similar pattern is also observed in the actual expenditure for Gir-region, which also includes Barda sanctuary. In fact if one looks at the component of soil-water conservation (SWC), it is fairly low i.e. < 4 per cent.

It is possible that the PA-region is also receiving benefits from the other on-going schemes like Watershed Development from the Ministry of Agriculture or Rural Development. We do not have estimates of these schemes in Gir-region. Nevertheless, the estimated budget for a critical intervention like SWC still appears to be significantly small. Further, it can be argued that a large proportion of expenditure on Integrated Forestry Management could yield better results if the SWC-component was also properly integrated with the former. It is difficult to ascertain the extent to which this has been achieved. The important point at this stage however is that of `appropriate' allocation of resources especially when funds are limited.

Since Eco-Development Project constitutes a major proportion (i.e. 31.45 per cent) of the total expenditure, it is pertinent to examine the profile of activities, actually planned and/or carried out under this project. If the major part of expenditure under the Eco-development Project is on development/support to the household's immediate requirements like land leveling, deepening of bore well, purchase of agricultural employment/inputs, or obtaining alternative sources of fuel and building

material, as it appears to be true in a large number of cases, regeneration of vidis and degraded forest may once again take a back seat in the total expenditure on the PA. We will get back to this issue at a later stage. This kind of concern is also shared by the management team, which often finds it difficult to obtain permission for regeneration of village pastures. Encroachment of the pastures and illegal grazing in the degraded forest in the peripheral villages is another important issue that constrained utilization of fund for some of the major activities like fodder development/nutrient enrichment programmes in the region.

2.6.2 Damages to Crops, Livestock, Human Life

Given a close interaction between people and the PA, there is always some chances of wildlife creating direct damages to the human life, livestock and crops. The situation is particularly acute because of the imbalance between the level of vegetation inside and outside the sanctuary area. Whereas vegetation within PA has been relatively sparse (due to a number of factors including grazing of livestock), vegetation is likely to be higher outside the PA particularly due to better availability of irrigation. The situation might hold good particularly during summer times and drought years when vegetation level within the sanctuary area is low, and thereby pushing the wildlife outside the sanctuary area in search of shelter, water and at times food (i.e. prey animals).

The damage to crop is reported to have been caused by wild boar, nilgai, chital and porcupine (Hag, 1997). Chudasama, et.al (1998) have estimated that the crop damages cover about 5-6 per cent of the cropped area. However, the estimate provided by the GAU study notes that the percentage of the cropped area damaged is higher especially during monsoon and summer (i.e. 14.1 and 13.4 per cent respectively) as compared to winter. The higher incidence of crop damage in summer requires special attention as it may result into relatively higher loss of monetary value of crops. To an extent, it also supports the view, mentioned above, that the crop damage is mainly a function of the imbalance in vegetative cover within and outside the PA.

We have tried out estimate the value of crop damages using the estimates of damaged area worked out by the GAU-study. Table 2.12 provides estimates of the value of crop loss in peripheral villages. The estimated crop damage combined for

the three seasons works out to be Rs. 419.8 lakh per year. But protection of crops from the ungulates is a tricky issue. Apart from being pushed out of the PA because of the sparse vegetation therein, movement of ungulates is also directly linked with the types of crops grown. For instance, Nilgai tends to get attracted more towards cereal crops whereas wild boar attacks the oilseeds like groundnut and castor. Sugarcane and mango plantation is under greater risk from wild boar.

Hence an important implication emerging from this pattern of crops and crop-damages is to reformulate the vegetation plan within PA in conjunction with crop-choice in the periphery. Two aspects deserve special attention in this context. First, to plant and/or develop the suitable vegetation pattern including browsing species in the inner parts of the sanctuary and manage it in a manner that ungulates do not get pushed towards the PA-boundary. And second, change the cropping pattern in favour of those, which are less water using and the same time less attractive to the ungulates. This might also take care of the problem of ground water depletion discussed earlier. Other measures like fencing etc. should form a part of this larger planning and be taken up as a defense mechanism. In fact, there is a substantial scope for inducing private investment for fencing provided it is planned properly and supported through credit facilities. For, prima facie, it makes perfect economic sense to make this investment and save the crop loss, which is fairly substantial. But this would need financial support in terms of credit and at times partial subsidy to meet the expenses on fencing.

2.6.3 Loss of Livestock

Apart from crop damage, the issue of killing of livestock is quite concerning. Earlier, the wildlife-domestic animal was seen as a part of the eco-system where unproductive livestock was integral to the food chain, protecting the economic interest of Maldharis within the PA. Of course, there are problems, as noted earlier, with respect to treating domestic animals as part of the wildlife. The relevant point at this stage however, is that this kind of practice may create further risk of damage to the livestock once the wildlife get used to finding livestock as their prey.

The situation gets further aggravated during drought years, when large number of livestock enters the PA for survival. This phenomenon has been noted for several

decades. According to an estimate for 1971, the number of “outside” animals was almost equal to that within the PA i.e. about 25,000 (Berwick, 1996). More recently, an expert committee of the Government of Gujarat looked into the issue of the reported increase of attack on human life (and livestock) since 1990. It was noted, “the constant and large influence of livestock in Gir and their sudden withdrawal after good rains (has) changed the hunting behaviour of the carnivores. Lions persisted with the killing of livestock in peripheral villages even after the sudden withdrawal of livestock” (GAU, 2001; p. 96). This observation leads to two pertinent issues: First, `large’ influx of livestock from `outside’ despite the fodder collection and distribution system prevailing during drought years. And second, which is closely following from what we have noted in the case of movement of ungulates from the sanctuary to the crop-farms, due to sparse and/or sub-optimal mix of vegetative spices within the PA.

While the technical assessment suggests that the increased incidents of attack on human life/ livestock could be due to accidental encounter or mistaken identity or disturbance to wildlife, solution to the problem is to be sought in the light of the two issues noted above. It may be mentioned here that during the recent droughts in Gujarat, outside animals were of the tune of 15-20 per cent of the existing livestock within PA. These animals get an `official entry’ through purchase and sale transactions by the people residing inside the PA. This has a direct bearing on the management of drought proofing in the entire region. What is however, more contentions is the issue of what kind of habitats are ideally preferred by the lion and how to manage these habitats without creating much damages to the people and livestock outside the PA. The historical evidence suggests that good forest cover with significant grass production and assured availability of water are some of the basic requirements for habitat management in the PA. For, earlier an `optimum’ lion population (i.e. close to the carrying capacity of about 300) seem to have co-existed with a more dense forest. The issue therefore, is more in terms of the type of vegetation and its manipulation or management rather than that of the density *per se.* It is thus, pertinent that the issue of livestock within the PA and the infiltration therein is seen in the context of the carrying capacity and the regeneration strategies adopted for the PA-management.

While we will address these issues at a later stage, it would be useful to look at the scale of damages to human life as well as livestock, and the compensation paid. Table 2.13 provides estimates of average number of loss of human life and livestock during the last 10 years. At the present rate of compensation, this would amount to Rs. 19 lakh per year. But, the prevailing rates of compensation are fairly low to the market price of the livestock. This has also been recognised by the Forest Department (Singh, undated). Hence if we work out the cost of compensation by using market prices, it would increase to Rs. 134 lakhs for killing of 1563 animals per year.

The issue of paying `adequate' compensation for the loss of life is very complex. For valuing human life have a lot of ethical undercurrents, and the estimation of value of `statistical life' is difficult. For livestock the relevant issue is that of `pushing the non-productive livestock' as a prey in order to (a) protect the more productive livestock and/or (b) getting the payment in the form of compensation. Moreover, it is observed that pushing the less productive livestock within PA during drought years is also seen as a substitute for other arrangements like `panjara poles'. Under these kinds of conditions, compensating the loss of livestock is difficult. In fact, such incidences create a drift between people and the forest department, which at times, shows its reluctance to pay proper compensation and/or delays in the procedure of payment. These are some of the issues that need to be considered while evolving an alternative management system.

2.7 Comparison of Benefits and Management Costs of Gir-PA

The above analysis of benefits and costs of conservation of Gir-PA could be summarized by comparing these two aspects. Table 2.14 presents a comparative picture of various types of costs and benefits. It is observed that as against the estimated cost of PA-management along with the alternative estimates of cost of compensation for the loss of crop and livestock, the benefits from the direct use alone are fairly high. The estimated benefits are more than four times that of the estimated costs i.e. Rs. 9669 lakhs vs. Rs. 1754 lakhs per year. The actual gap would be even greater if we had accounted for the ecological services. Also, the present valuation of economic services is an underestimate as noted earlier. Prima facie, this suggests a strong economic justification for enhancing the financial

support especially, to meet the requirements of the basic investment in soil-water conservation such that it improves the watershed function to take care of the ecology as well as livelihood needs of the people. This kind of approach, of course, will necessitate simultaneous measures for correcting non-sustainable use of natural resources – land, water, and fodder. Evolving a proper structure of incentives as well as appropriate institutional set-up could ideally help achieving these objectives. While the Eco-Development Project is a step towards this direction, it requires a detailed probing into the difficulties in actual implementation of the project. The national as well as international agencies may extend this additional financial support by looking into the aspects of organizational as well as administrative constraints in effective implementation of the project. We will discuss these issues in Section 4.

Table 2.1Value of Economic Services from Gir PA*

(at 1994-95 prices)

Economic benefits	Value (Rs.lakh)	%
Direct Use		
Fodder	4,114.23	42.55
Fuelwood	1,406.25	14.54
NTFP	1,319.02	13.64
FYM (from Neses)	392.44	4.06
Tourism	19.64	0.20
Irrigation	2,411.40	24.94
Medicinal plants	6.16	00.06
Sub-total (a)	9,669.14 (20.27)	100
Indirect Use		
Timber Teak	7,250.00	19.14
Non-teak	4,499.00	
Fuelwood from timber logging	2,751.00	
	30,633.00 (64.2)	80.86
Sub-total (b)	37,883.00 (79.41)	100
Drought proofing Grass collection (Tonne) Supporting about 2040 livestock for 4 months)	153.00 (0.32)	
Total (a+ b)	47,705.14 (100)	

Note: Based on the estimates presented in Appendix Tables 1 thru 6

These values are significantly estimated due to non-valuation of the ecological diversity.

Table 2.2(a). Opportunity Cost of Conservation in Terms of Alternative Land Use

	Area (ha)	Net return (Rs./Ha)	Value (Rs. Lakh)
Gir East			
Groundnut Mango	27642 6910.5	7500.00 40182.83	2073.15 2776.83
Gir West			
Groundnut Mango	20611.5 82446.0	7500.00 40182.83	1545.86 33129.14
Total (excluding the rocky uncultivable land at 1994-95 Prices)	137610	-	39524.98

Source: Based on the talukawise estimates of area under different crops obtained from District Statistical Handbook (District Planning Boards of Junagadh and Amreli). The yield estimates are based on the primary survey conducted for the study and also from the study by GAU (Pandya et.al; 2001).

Table 2.2(b). Loss of Cropped Area to replace Fodder Extraction from PA

Details	**Scenario I**	**Scenario II**
Productivity or fodder (kg./ha)	3000	1,500
Total fodder production (Tonne/year)	4,11,423	2,05,711
Availability of fodder from groundnut in the peripheral region (tonnes)	1,53,878	1,53,878
Area required for obtaining the remaining fodder production (ha)	85,840	34,555
Loss of revenue due to shifting of cropped area to obtain fodder production (Rs. lakh/year	6,438	2,592

(at 1994-95 prices)

Note: Based on the norms of crop: fodder ratios of 3125 kg. and 4560 kg. for groundnut and bajri respectively.

Table 2.3. Potential Loss of Fodder due to Degraded Land in PA

(Rs. In lakh)

Details	Fodder (Kg./Ha)	Value of production @ Rs. 1/kg.	Difference from the potential	Loss of income from milk ***
Average Productivity (Kg./Ha)				
Potential	3000*	4114.23	-	-
Projection 1	1500	2057.11	2057.11	1982.55
Projection 2	1000	1357.69	2756.54	1272.83
Projection 3**		1248.36	2865.87	1170.33
(a) Sanctuary	1000	1115.39		
(b) National park	514	132.97		

(at 1994-95 prices).

* Based on the National Average (Tewari, 1994)

** The actual production appears to be somewhere in the range. For, the estimated requirement for 97 villages of the tune of 1,61,925 tonnes per year is considered to be higher than what is available (Government of Gujarat, Eco-Development Project, p.29)

*** Average annual income from milch animal is 7500 Rs./animal, fodder requirement is 8 tonnes/animal/annum

Table 2.4. People's Perceptions About Benefits of Conservation of Gir PA

Attributes of Gir Ecology	Ranking Score	Score Relative to Fodder	Rs. In lakh*
Wild life	0.513	0.92	282.9
Rainfall	0.425	0.76	233.8
Soil Conservation	0.482	0.87	267.6
Soil Quality	0.356	0.64	196.9
Tourism	0.189	0.34	104.6
Fuel	0.555	1.00	307.6
Fodder	0.145	0.26	80.0
MTFPs	0.528	0.95	292.2
Timber	0.399	0.72	221.5
Income-Employment	0.323	0.58	178.4

Source: Primary Survey of Sample Households.

* Based on the estimated fodder benefits in the periphery, see Table 3.8

Table 2.5. Relative Importance of Non-Use Value

Non-Use Values	Relative Scores
Watershed Functions	0.538
Rarity of Lion	0.402
Bequest Value	0.331
Religious Aesthetic	0.571
Consumptive Use	0.596

Source: Primary Survey of Sample Households.

Table 2.6. Impact of conservation on biodiversity and ecological services

Sr. No.	Details	Change during 1971-1995		
		Year 1	Year 2	Difference
1	**No. of timber trees (in lakh)***	**21.01**	**17.30**	**- 3.71**
2	**Fodder collection (in tones)***	**2419**	**2965**	**+ 546**
3	**Biodiversity**			
3.1	No. of major tree species	NA	63	-
3.2	No. of herbaceous plants	486	514	-
3.3	No. of endangered species			
4	**Fauna**			
4.1	No. of mammal species		32	
4.2	No. of birds species		300	
4.3	No. of reptile species		26	
4.4	No. of insect species		>2000	

Sr. No.	Details	Change during 1971-1995		
4.5	No. of globally threatened species		26	
4.6	No. of extinct species		1	
5	**Wildlife population**			
5.1	Lion	205	304	+ 99
5.2	Leopard	155	268	+ 113
5.3	Hyaena	74	137	+ 63
5.4	Spotted Deer	4517	32601	+ 28084
5.5	Samber	706	2262	+ 1556
5.6	Blue Bull	1528	1856	+ 328
5.7	Four-horned Antelope	269	441	+ 172
5.8	Chinkara	195	387	+ 192
5.9	Wild boar	1922	1214	+ 708
5.10	Total	1451	1214	+ 237
5.11	**Lion:Ungulate**	**1:31.3**	**1:127.5**	**+ 1:96.2**

Note: While it is recognized that the Gir-Eco system has several endangered flora, it is difficult to list them because of the absence of any scientific studies on this aspect Singh and Kamboj (1996).

* Based on Forest Statistics of Gujarat, Government of Gujarat, Gandhinagar. Other estimates are obtained from Singh and Khamboj (1995).

Table 2.7. Estimate of Soil Loss in Sanctuary Area

Sr. No.	Details	Particulars
A	**Soil Erosion**	
1	Gir PA vulnerable to soil erosion[1]	Moderate to sever
2	Estimated Soil loss (tonne ha^{-1} yr^{-1})[2]	30.00
3	Area of vulnerable to soil loss (ha)	1,15,339
4	Total soil loss (tonne yr^{-1})	34,60,170
B	**Loss of Nutrients[3]**	
1	Total loss of Nitrogen (tonne)	86,502.50
2	Total loss of Phosphorus (tonne)	3,875.30
3	Total loss of Potash (tonne)	69,513.40
4	Value of loss of Nitrogen (Rs. lakh)[4]	7,525.71
5	Value of loss of Phosphorus (Rs. lakh)[4]	300.33
6	Value of loss of Potash (Rs. Lakh)[4]	1,967.21
7	Total loss (Rs. Lakh)	9,793.25*

- Assuming that the soil erosion is brought down to the level of moderate-slight, the soil loss will be reduced by on fourth i. e. 8,65,025 tonne per year. Accordingly the loss of nutrients as well as value of the lost nutrients will also be reduced in the same proportion. The difference between the two therefore should be treated as potential loss due to inadequate soil-water conservation measures in the region. This works out to be 25,95,075 tonnes of soil and Rs. 7,345 lakhs per year.

Source:
1. Sharma et el, 1994.
2. Kurothe et. al.2001.

3. Nutrients availability in ton soil of study area were Nitrogen 25 kg, Phosphorus 1.12 kg and Potash 20.09 kg (Shah *et al.* 1985)
4. On the basis of cost of chemical fertilizer for amend the nutrient loss; for kg Nitrogen from Urea Rs. 8.70, one kg P_2O_5 from Single Super Phosphate Rs. 7.75, and one kg Potash from Murate of Potash Rs. 2.83.

* In addition to this, household level data have been collected from four clusters within the PA.

Table 2.8. Details about the Degraded Pasture Land within and in the Periphery of Gir-PA.

Details	Area (ha)
Reserved Vidis*	9038.00
Non-Reserved Vidis*	19069.00
Degraded grassland within PA	46770.00
Culturable waste land in 80 villages of the periphery (< 5 km)	9435.50
Land Allocated to 485 Maldhari families resettled outside the PA	1565.60
Area of pastures having lost by villages to Gir-PA (under section 4)**	7485.92

* Mainly in the periphery. ** In 19 villages covered for collection of primary data on CPLRs.

Table 2.9. Changes in Groundwater Table in the Periphery and Distant Areas of Gir PA

Sr. No.	Ground water table (in mt)							
	Name of the taluka	Adjacent* taluka			Name of the taluka	Distant taluka		
		1980-82	1995-97	Diff (%)		1980-82	1995-97	Diff (%)
A	**Amreli District**							
1	Dhari	8.61	10.76	- 25	Babra	6.96	13.23	- 90
2	Khambha	2.00	4.85	- 143	Chalala	25.13	30.30	- 20
3	Kodinar	13.13	18.10	- 38	Kunkavav	6.42	14.89	- 131
4	Amreli	3.31	6.80	- 105	Liliya	3.11	8.56	- 175
B	**Junagadh**							
5	Veraval	2.96	3.74	- 26	Maliya	16.57	24.44	- 48
6	Vanthali	5.59	11.02	- 97	Ranavav	3.11	9.58	- 208
7	Visavadar	8.87	30.50	-243	Junagadh	6.86	13.13	- 91
8	Una	3.52	5.03	- 43				
9	Talala	NA	20.43	-				
10	Mendarda	12.67	17.79	- 40				

Source: Hirway, I. (1999). * Sharing boundary with the PA.

Table 2.10. Nutrient Status of Soils in Villages with Different Distance from the PA

Distance from Border (k.m.)	PH	EC	OC%	P2O5	K2O5	Total Nutrients
0 to 10	7.63	0.49	0.80	41.55	402.88	364.15
>10 to <20	7.75	0.61	0.75	38.26	345.00	384.01
More than 20	7.83	0.56	0.74	42.71	430.36	473.81
Mean	7.75	0.56	0.76	41.00	396.18	416.60

Source : Unpublished data Obtained from Gujarat Agricultural University, Junagadh

Table 2.11. Estimation of Carbon in Above Ground Biomass of Gir Ecosystem

Particulars	Estimates for Forest Strata	
Forest Strata	Teak tree dominated	Misc. tree dominated
Area for C estimation (Km^2)	371.2	634.48
Tree density (No. Tree/ha)	143.2	142.78
Volume of stem wood (m^3 ha^{-1})	193.47	124.41
Total volume in area (m^3 ha^{-1})	307.62	198.50
Above ground biomass (Mg ha^{-1})	197.80	122.67
C in above ground biomass (Mg C ha^{-1})	98.9*	61.34
C stock (Tg)	2.69	3.89
Total C stock in Gir ecosystem (Tg)	**6.58**	

Sources:

1. Area under teak and misc (non-teak trees) from Singh and Kamboj 1996
2. Tree density from Sharma 1995
3. Volume of stem wood is based on Table 1a.
4. Total volume is calculated on the basis of Volume of stem wood considering 1.59 BEF for both strata.
5. Above ground biomass is calculated on the basis of Total volume considering of 0.643 and 0.618 wood Density (DWD) for teak and non-tove ground mass is taken as 50 % of Total above ground biomass.

* This estimate is significantly higher than the all India estimates based on the tree density worked out by the Forest Survey of India. It is plausible that these densities have been estimated by taking the entire land mass under forests rather than the actually forested area. The estimates presented above are based on the actual areas having teak and non-teak trees.

Table 2.11(a). Budget Estimates for PA – Management in Gir (at 1994-95 Prices)

Budget Head	Estimated Expenditure for 1995-2000 (Rs. Lakh)	Average Per Year (Rs. Lakh)	Percentage
A.			
Demarcation	20.80	4.16	0.51
Habitat Improvement	131.00	26.20**	3.20
Development of Peripheral Coastal Forest	716.90	143.38**	17.55
Protection	161.00	32.20*	3.94
Research, Education and Training	82.80	16.56	2.02
Vehicle and Equipments	151.40	30.28	3.71
Quarters and Buildings	135.10	27.02	3.31
Tourism	170.00	34.00*	4.16
Socio-Economic (including Resettlements)	309.00	61.80*	7.57
Recurrent Expenditure	2205.00	441.00	54.00

Budget Head	Estimated Expenditure for 1995-2000 (Rs. Lakh)	Average Per Year (Rs. Lakh)	Percentage
Total	4083.00 (68.54)	816.60	100.00
B. Eco-Development Project			
Village Eco-Development	1239.00	247.8*	66.11
Improvement of Protected Area	396.00	79.2**	21.13
Education and Awareness	49.00	9.8	2.61
Research	190.00	38.0	10.14
Total	1874.00 (31.45)	374.8	100.00
Grand Total	5957.00 (100.00)	1191.4	0.0

** Indicates allocation for measures directly relevant regeneration. * Indicates allocation for activities that might indirectly contribute to regeneration. Source: Singh and Kamboj (1995).

Table 2.11 (b). Expenditure on Activities for Regeneration of Vegetation in Gir – PA

	Rs. Lakh per year	Percentage	Excluding Bards	
			Rs. Lakh Per year	Percentage
A. Non-Plan Expenditure				
Improvement and Extension of Forest	6.15	2.24	6.15	2.34
Project for Development of Gir and Barda Sanctuary	12.11	4.43	10.66	4.05
Development of Gir and Barda Sanctuary	49.01	17.92	43.13	16.38
	4.56	1.67	4.01	1.52
Sub Total (A)	71.83	26.26	63.95	24.28
B. Plan Expenditure				
Development of Gir and Barda Sanctuary	18.98	6.94	16.70	6.34
CSS Plantation of Minor Forest Produce	1.35	0.50	1.35	0.51
Soil Moisture Conservation and Afforestation	10.15	3.71	10.15	3.85
Integrated Forestry Management Project	170.91	62.48	170.91	64.89
Compensatory Afforestation	0.31	0.11	0.31	0.11
Sub Total (B)	201.70	73.74	199.42	75.72
Total (A+B)	273.53	100.00	263.37	100.00
% to be total Expenditure on Gir + Baroda (Rs. 868.92 lakh per year)	31.48		30.31	

Source: Compiled from Tables 40 and 41 in Pandya, et.al, (2001).

Table 2.12. Cost of Crop-Damage

Taluka	Estimated Area Affected by Damage (Ha)	Net Returns from Crops (Rs. Lakh)	Estimated Loss @ 50% of Standing Crops
Dhari	1919.98	144.0	72.0
Khambha	1160.83	87.1	43.5
Kodinar	N.A.	N.A.	N.A.
Maliya	249.93	18.7	9.4
Mendarda	609.67	45.7	22.9
Talala	1728.88	129.7	64.8
Una	2499.57	18.7	93.7
Visavadar	3024.55	226.8	113.4
Total	11,193.42	670.7	419.8

Source: Shiyani, et al. (2000). The value of crop loss is based on the estimated net returns from different crops as reported in the primary survey.

Table 2.13. Value of Loss of Livestock

Details	
Average Kill of Livestock (no/Year)	1563
Actual Cost of Compensation @1218 Rs. Per animal (Rs./Year)	19.04
Estimated Loss at Market Prices Weightage Average Price of Cows and Buffalos in Mulching No. of Livestock in Milching (No.) Killed (@15% dry animals) Total Value of Loss of Livestock in Milching	 0.101 1329 134.23
Loss of Income Due to Killing of Livestock in Milching	99.68
Loss of FYM	62.52
Total Loss of Income	162.20
Net Loss (Subtracting the Compensation Paid)	143.16

Source: As in Table 2.12.

Table 2.14. Summary Benefits and Costs (Rs. Lakh at 1994-95 Prices)

Benefits		**Value of Cost**	
Details	Value	Details	Value
Direct Use	9669.14	Average Budget for Management per year	1191.40
Indirect Use	37883.00	Crop Damage	419.80
Opportunity Cost	39524.98	Loss of livestock	143.16
Loss of Crops to replace the fodder	2592.00		
Potential loss of fodder	1170.33		
Soil Loss	9793.25		
Watershed Function	NA		

Appendix Table 1

Benefits from Irrigation

Taluka & irrigation scheme	Cultivable command area (Ha)	Weighted net returns from farming (Rs./ Ha)	Year of completion	Net return per year (Rs. Lakh)
Talala				
Scheme 1	3956	-	41	612.55
Scheme 2	9553	-	12	1479.19
Sub-total	13509	-	-	2091.74
Kodinar	8508	17312	12	1472.90
Una				
Scheme 1	8095	-	15	845.68
Scheme 2	790	-	42	82.53
Scheme 3	4860	-	20	507.72
Scheme 4	740	-	43	77.31
Sub-total	14485	10,447		1513.24
Mendarda	2508	7767	12	194.80
Total	39010	-	-	5272.68
Subtracting the value of unirrigated crop in the area	-	-	-	286.6
Net gain due to irrigation	-	-	-	2414.4

Note: The data on the command area have been obtained from the Management Plan (Singh and Kamboj (1995). The estimates of net returns are based on the primary survey.

Appendix Table 2

Estimates of NTFPs Production

Details	NTFPs		
	Gum	Timru leaves	All MTFPs
Average estimated production (kg./ ha)	0.10	3.67	-
Total production from sanctuary area (1154 sq.km) (tonne/year)	11.54	424.30	-
Value realized in market per year (Rs. Lakh)	110.86	534.79	1319.02[1]
Actual value per year (Rs. Lakh)[2] (CS0 norm)	1108.60	5347.90	13190.22

Note: Considers only two of the major MFPs for which data are available. The other major MFPs from the PA is Amala, Karamada, Jamun, Honey, Baheda etc.

1. Based on the CSO estimates of an average value of Rs. 1143/ha obtained from Haripriya (2001).
2. 10 times of the realized value in the market: CSO norms)
3. Price of Gum and Timru leaves

Appendix Table 3 (a)

Values of Medicinal Plants

Details	Value
Average medicinal value (Rs./ha)[1]	5.35
Total sanctuary area (ha)	115400.00
Total medicinal value of plant from the sanctuary (Rs.In lakh)	6.16

1. Based on the estimates prepared for Maharashtra. For details see Haripirya (2001).

Appendix Table 4

The Estimated Timber Stock and its Value*

Details	Timber		
	Teak	Non-teak	Total
The density (Number/ha)[1]	143.20	142.78	-
Area (ha)[2]	27192.00	63448.00	90640.00
Total trees (in lakhs)	38.94	90.59	129.53
Percent tree with > 6m height [3]	25.44	16.41	-
No. of tree with timber value (in lakh)	9.91	14.86	24.77
Volume of timber for 6mt height (in cum in lakh)	52.61	78.94	131.55
Volume of `timber' per year per 40 year/ cycle	13515	197350	-
Price Rs./cum[4]	3421.00	1394.00	-
Total value of timber (Rs. In lakh)	178986.50	110040.20	289026.70
Value per year over 40 year cycle (Rs. In lakh)	4499.60	2751.00	7225.66
Value per year per hectare (Rs.)	16547.51	4335.83	7971.82

Notes: 1. Tree density from Sharma 1995.
2. Area under teak and non-teak trees from Singh and Kamboj 1995.
3. Percent tree with > 6m height from Khan 1990.
4. Price of timber from Haripriya 2000.

Appendix Table 5

Estimated Fuelwood Production

Details	Estimated fuelwood
On the Basis of Timber Wood (for a Cycle 40 Year	
Total volume of biomas wood (cum in lakh)	131.55
Total fuelwood bio-mass (assuming 9:1 as	
Fuelwood : Timber Ratio (cum in lakh)	1183.95
Fuelwood (MT in lakh) (lm^3 = 1.38 MT)	1633.78
Fuelwood per year over 40 years cycle (ton)	4084450.00
Price (Rs./Tone)	750.00
Total value of fuelwood (Rs. In lakh)	1225335.00
Value per year over 40 years (Rs. In lakh)	30633.38
On the Basis of Estimated Collection Fuelwood (per year)	
Estimated wood collection per year (tonne)*	15000.00
Actual fuelwood available (12.5 times CSO norm.tonne)	187500.00
Price (Rs./tonne)	750.00
Value of fuelwood (Rs. In lakh) per year	1406.25

* Based on study by Meena et.al (1998)

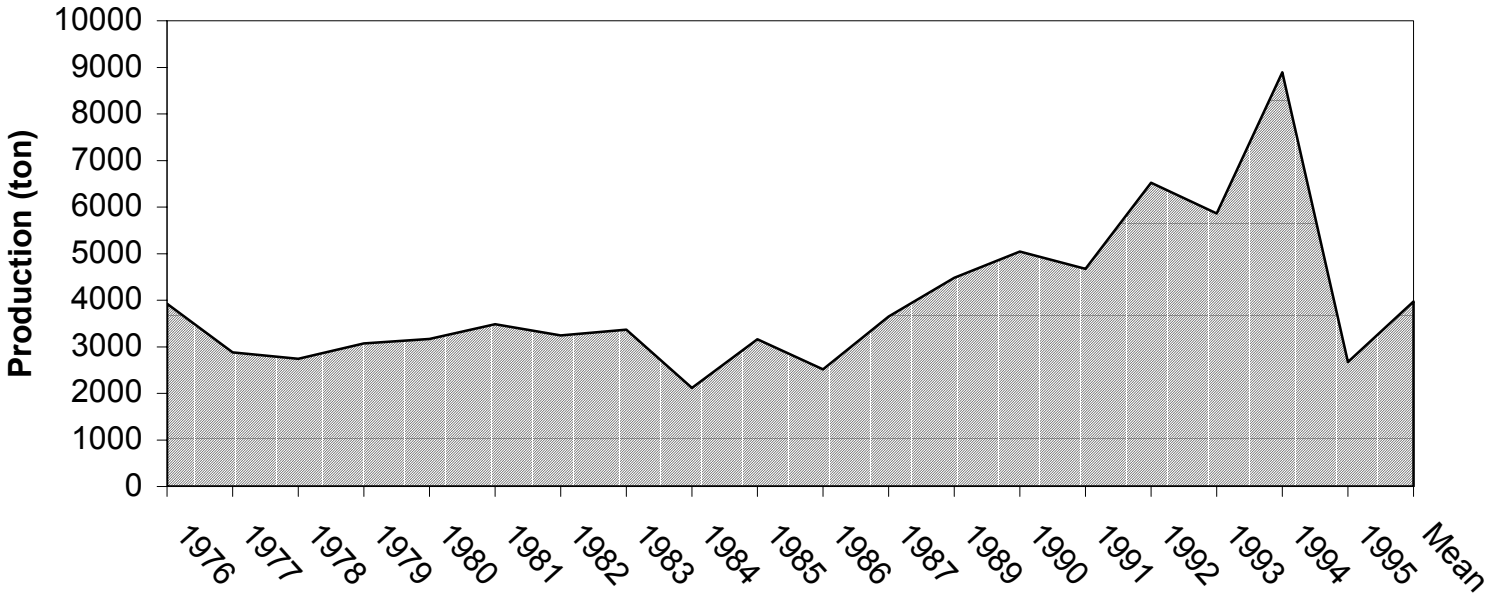
Appendix Table 6

Value of FYM Production

Detail	Ness
Livestock population (Number	9811
FYM production (tonne/year)	78488
Value (Rs. In lakh)	392.44

Note: Based on discussion with Maldharies within P. A.

Graph 1



Grass production from reserve vidies of Gir PA.

Chapter 3. People, Peripheral Economy and Interface with the PA

3.1 Context

As noted earlier, Gir, like most of the PAs in India, is surrounded by a large number of people and their economic activities. Understanding their interface with the PA is essential not only because they constitute a significant part of the stakeholders in the eco-system but, also because taking care of their interest may go a long way in regeneration and protection of the PA. This sections maps out different categories of local stakeholders and examines the nature and extent of their interface with the PA.

There are three sets of human settlements within and in the periphery of Gir. These include the neses, the forest settlements, and the revenue villages. Table 3.1 provides details about these settlements along with the status of their access to Gir PA. It is observed that people in neses have greater access to resources within the PA and therefore considered to be the most crucial category from the viewpoint of the PA management. The Forest Settlements are next in terms of people's access to the PA resources. The revenue villages, as such do not have any `legal' access or rights to obtain any direct use value from resources within the PA. Obviously therefore, the analysis of people's dependence will have to keep in mind the two separate categories viz; within and outside the PA. In what follows, we discuss the nature and the extent of dependence between these two categories of people and identify issues that emerge from the interface between the two. This has been done in two stages. First, at a macro level, using the secondary data as well as evidence from the existing studies. And second, at the level of households, covered by the sample survey of Neses, FSs, and Villages.

3.2 Interface with the PA and Issues of Conflicts

3.2.1 Neses and Forest Settlements

`Maldharis' the cattle herders of Gir, have been living in small hutments (called Neses in local parlance) for about 125 years. Being a nomadic community, visiting Gir as an important destination for fodder and pastures, these Maldharis have settled down in the region for several generations and have become an integral part of the Gir Ecology (Berwick, 1996; Gir Welfare Fund, 2000).

However, with deterioration of ecology and increasing human (+ livestock) population, these Maldharis are being viewed now, as threat to the wildlife and the eco-system. This was stated clearly by Joslin (1969), noting that `in consequences of the loss of grazing and browsing to domestic livestock, wild animals have either become rare or have disappeared from the sanctuary'. It was further noted that the `sanctuary has reduced from once a well balanced forest community rich in wildlife to an impoverished, artificial and heavily exploited area. If nothing is done to arrest these processes. This unique specie (i.e. Asiatic Lion) will be extinct within 20 years' (Choudhary, P. 2663).

One of the important policy responses to this kind of a `crisis' situation in Gir was to protect the habitat from overgrazing and loping by `improving the lot of Maldharis and phase their resettlement outside the sanctuary'. Apparently, the strategy of shifting out of the Maldharis was based on some kind of assessment of the carrying capacity of the ecology. For instance it was estimated that in the early seventies, carrying capacity of Gir Sanctuary was 21,816 cattle and buffalo. Against this there were 25,292 cattle and buffalos, not including the almost equal number of outside animals (Berwick, 1976). Similarly, carrying capacity in terms of human population was also found to be much higher i.e. 3.79 per sq.km as compared to 7.0 which prevailed at that time (Sinha, 1967). Resettlement of human and livestock population was therefore considered an essential part of the conservation measure at the time when the region was declared as National Park and Sanctuary in 1975.

Subsequently the government of Gujarat worked out a scheme for resettlement of 592 out of the total 845 households, of which 768 were considered as permanent settlers. By 1987-88, all these 592 households were allotted land though, only 323 households continued to occupy the resettlement sites. As a result of this process, the number of neses within the PA dropped from 129 to 54 and the human as well as livestock population reduced from 4,802 to 2,540 and 16,852 to 9,811 respectively (see Table 3.2).

3.2.2 Defining Carrying Capacity in terms of Livestock:

It is difficult to gauge the actual population within neses since a large number of households seem to have re-entered and, at the same time, there must have been

natural growth of population among the households within PA. Imputing population growth at the rate of 2 per cent per year, the human population within PA might have increased from 2540 to about 3290. Similarly, livestock population might also have increased since 1987. Assuming that average number of livestock among 361 households is 30, the livestock population may work out to be around 10,830. Alternatively, the estimates provided by some of the informed persons in the region suggested that at present, the number of human as well as livestock population with the PA would about 3- 5,000 and 20,000 respectively.

Prima facie, it is difficult to judge whether this kind of population and livestock density is compatible with the eco-system, which has undergone substantial improvement due to the conservation measures since the early seventies (Chavan, 1993). However if we take the estimated carrying capacity of 21,816 livestock, the existing livestock population is just marginally within the limit estimated for the early seventies. Apparently, the estimated population of 20,000 might be inclusive of the livestock owned by those households, which have been officially relocated but, continue to live within the PA. Or else, they might be sending their livestock to the relatives who live within the PA. According to Kameshwar (2000) as many as 270 households might be in this category as they are not occupying the sites of resettlement. If so, the existing livestock population is only marginally lower than the estimated carrying capacity. Any additional infiltration by the `outside' animals, especially during droughts might lead to `over utilisation' of resources provided, the carrying capacity has not improved since the early seventies. Examining this is therefore, very critical for designing the management plan for the future.

Unfortunately scientific estimates of carrying capacity are not available for a more recent period. However, the official estimates suggest that the `eco-system provides grass and leaf fodder for the survival of more than 1.25 lakh cattle with an estimated production of 50,000 metric tonne per year' (Singh, Mahesh, undated). Given this magnitude of fodder production, the issue of `carrying capacity' with respect to livestock within the PA, may not be considered a very acute one. The problem of interface or conflict however, might arise on several other counts as discussed below:

I. While the estimated livestock population (of say, 20,000) is considered within the limits of the carrying capacity, there is often a temptation of grazing `outside' animals in exchange of certain monetary benefits.

II. Maldharis are not willing to accept any kind of restraint in terms of area of grazing and maintaining a seasonal cycle, which used to be a part of their traditional practice. Also there is not much willingness on the part of Maldharis for adopting the `cut and carry' method for collection of fodder.

III. Those living in Neses and Forest Settlements at times, get into `illegal' selling of fuelwood by violating the rules. Of course, these kinds of activities often involve `outside' people as well as some of the local level staff of the Forest Department. In fact, it is this kind of activities which lead to a conflict between the people and the forest staff. And sometimes these conflicts lead to severe feuds, which take the form of physical assault, forest fire, and even killing of wildlife. It would however be erroneous to state that such crimes take place only at the instance of the people living within the PA. A more realistic statement would be that, the people within PA are more vulnerable to the illegal activities, which even otherwise take place in most of the protected areas. Since these people within the PA have to operate within a complex situation of `rights and restrictions' it is more likely to bring distrust between the people and the protectors.

IV. Some of the restrictions affect quality of life among these Maldharis. These are: absence of electricity, roads, and above all, school for their children. Lack of access to markets and other sources of entertainment as well as socialization also become impediments to their links with the `mainstream' social and/or economic activities. Since many of these households have already started living outside the PA, their preference for a `life style' may have also started changing. But the economic incentives are strong enough for Maldharis to continue to stay within the PA.

Apparently, this phenomenon has been reflected in terms of their stated `willingness' to shift from the interior parts to the boarder of the PA. The underlying rationale for such a shift is that they can avail of the infrastructure as

well as other benefits of the `mainstream' economy without losing their rights to access the resources within the PA. In that sense, it works out to be a `win win' situation for the people in the Neses. The benefit from the viewpoint of conservation is that of the physical distance, for, this would imply that the eco-system in the `interior' parts of PA would be less damaged. More than that, once these households get used to a different lifestyle, it might be easier to convince them to accept relocation outside the PA. While this might be a possible solution for reducing the pressure on the PA, its actual feasibility would depend on the design of the resettlement package and its effective implementation.

V. Finally, there has been a strong dissent among people about the rate and the time lag for payment of compensation in the event of loss of livestock or attack on human beings by wildlife. The actual price, as we noted earlier, is fairly lower than the actual market price of the livestock. Also, the time taken in payment of compensation is often quite long. Given the fact that paying compensation at the rate of market price may create a substantially large burden on budgetary allocation for the PA, efforts should be made to reduce the incidence of killing of livestock. A part of this strategy would be to reduce livestock population especially, by checking infiltration of the `outside' animals on the one hand, and regulating the grazing practices on the other. These aspects, even otherwise, are quite crucial for PA-management. Unless this is ensured, resettlement of Maldharis would turned out to be an essential condition for conservation and regeneration of the eco-system in Gir. Moreover, it may be noted that resettlement of Maldharis is important, also because of the on-going conflicts with the forest staff. While the issue of resettlement of Maldharis is becoming increasingly debatable and politicized, it is important to assess the cost arising due the dependence of Maldharis' on the PA.

3.2.3 Benefits and Costs to Maldharis:

Table 3.3 presents estimates of benefits and costs accruing to Maldharis living in Neses within the PA. Whereas the benefits are mainly in terms of greater access to forest resources as compared to those living outside the PA. Against these, the costs are mainly in terms of lack of physical infrastructure, social and economic

alienation, and conflicts with the forest department. It may be noted that the loss of livestock forms a marginal proportion say, about 4-5 per cent of their total stock every year. Since a substantial part of the livestock-loss is likely to be consisting of less productive cattle (as the more productive cattle are better protected and taken care of), the actual loss could be treated as a `rent' for occupying the area within PA.

It is observed that the estimated value of the benefits in terms of direct use of forest resources is Rs. 1147.81 lakh per annum. Against this, the cost bone by the Maldharis works out to be Rs. 112.5 lakh. The net benefit is Rs. 1,035.31 lakh. Alternatively, we worked out the net returns from selling of milk and farmyard manure. This was estimated worked out to be Rs. 906. 98 lakh per annum. It is thus, quite clear that the Maldharis are at least economically better off within PA. Shifting them out would thus require a fairly attractive compensation package that could take care of the present level of the rightful benefits from the PA. Or else, these Maldharis should be convinced to cooperate with the conservation objectives through participatory processes of awareness generation and compliance of the given norms of `rights and restrictions.'

The compensation package prepared in the early seventies, consisted of 3 hectares of cultivated land with proper treatment, access to CPLRs @ 16 hectares per 100 livestock, a plot of 600 sq. meters for housing and cash subsidy for construction cost, seed and agricultural equipments, and other amenities. The cost of the package works out to be about 2. to 3 lakh (at 1994-95 prices) per household. This is fairly small compared to the annual flow of benefits derived from the PA.

3.3 Peripheral Economy and Interface with PA

The periphery in Gir consists of 99 villages. Tables 3.4 (a and b) provide information about these villages with varying distances from the PA-boundary. In 1991 these villages had 26,397 households with a population of over 1.52 lakhs. Between 1971 and 1991, the population increased at the rate of 2.19 per cent per annum. This is slightly lower than the district average of 2.23 percent and the state average of 2.74 per cent per annum. If we compare the growth rates of population in the nearby vs. distant villages, we find them more or less same i.e. 2.25 vs. 2.10 respectively. However, if we look at the estimates of two sets of villages viz; nearby and distant, we observe that the growth in population is higher among nearby

villages, as compared to the distant villages, in the case of four out of six talukas for which we have comparable estimates. These are Dhari, Mendarada, Talala, and Visavadar. Prima facie, this observation supports the generally held view that the PA-ecology attracts more human as well as livestock population in the immediate periphery i.e. in the radius of < 3 kms.

Notwithstanding the difference across the two sets of villages, one finds that growth of population in three taluks is low i.e. < 1.5 % per annum in Dhari and Mendanda, and about 2 percent in Talala as shown in Table 3.4 (b). Together these talukas constitute about 50 per cent of the total population in the peripheral villages. Prima facie low level of population growth in these talukas could be attributed to two important changes that have taken place since the mid-seventies. First, due to protection measures the people's access to forest resources has declined (though, not stopped) over time. And second decline in the quality and quantity of Common Property Land Resources (CPLRs) have led to out-migration besides the `pull' effect from the urban centers. While these are propositions are difficult to ascertain through the existing data, we have tried to find plausible explanations by examining some of the important changes during 1971-1991 in the periphery of Gir. The important observations emerging in this context have been presented in Table 3.5. These are:

i. Proportion of forest to the total area has increased by 18 and 15 percent in the nearby and distant villages respectively.

ii. Against this, there has been a decline in the area not available for cultivation. However, a major part of the increase in forest area seems to have come from conversion of village pastures into forest vidis at the time of demarcation of the PA and subsequently while redefining the boundary.

iii. Irrigation has also increased substantially but, more so in the distant villages. In 1991, the total area under irrigation was 8,088 ha among 77 nearby villages vis-à-vis 6,237 ha. in 20 distant villages.

iv. As a result, area under crop also increased in 52 out of the 99 villages. In the remaining 47 villages, net-cropped area (NCA) had declined by 20,

646 hectares. To a large extent, this decline is mainly due to demarcation of the PA boundary. It is observed that as many as 32 villages in the periphery had lost more than 100 hectares of private cultivated land in each village, besides several villages having lost their CPLRs under section 4 of the Land Acquisition Act.

Prima facie, increased irrigation in the region along with regeneration of the PA should imply higher rate of population growth vis-a –vis the district or the state average. But this, as we noted earlier, is not the case. In that case the lower growth in of population in the peripheral region suggest two possibilities in terms of population movements. That is people in the distant villages are either pushed into the nearby villages and/or have been pushed out of the region probably due to declining size and quality of CPLRs in these villages. Given the fact a large number of villages have also lost a part of the cropped land, out-migration from the periphery appears to be a more predominant phenomenon than the movement nearer to the PA.

The issue of CPLRs has been probed further by obtaining information from 29 villages in the periphery. The information has been collected through repeated visits and informal discussions with individuals as well as groups of people in these villages. This was essential because the issue of CPLRs is very sensitive and highly politicized. In turn it makes it difficult to get accurate information on the size and status of CPLRs. The situation becomes more complex as many of these villages have continued conflicts with the Forest Department over the inclusion of CPLRs within the boundary.

Notwithstanding these limitations we have tried to capture some of the basic information pertaining to CPLRs in these 29 villages (see Table 3.6). It is observed that the size of CPLRs has declined substantially in 18 out of the 29 villages. To a large extent this has happened due to notification of the village pastures as forest area within PA. Moreover, there is a significant problem of encroachment of CPLRs by the individual households. As a result, 7 out of the 29 villages have no or very small (i.e. <10 hectares) area left as Gaucher (or pasture) land. Another 14 villages have about 10-50 hectares of pastureland. It is therefore, crucial that these pastures

are properly regenerated and managed so that people in these villages do not have to depend much on the resources within the PA.

How far people in the periphery actually depend on the forest resources? What is the extent of their dependence on these resources? What is the nature of conflict over these resources? And what is their perception about future plan for regeneration of pastures and vidis within and outside the PA? These issues have been examined through a sample survey of four villages, 4 Neses and 2 Forest Settlements in Gir-PA. The following section discusses the main findings of the survey.

3.4 People's Dependence on the PA: Results from a Primary Survey of Sample Households

3.4.1 Broad Pattern of Dependence

Ascertaining people's dependence on PA is somewhat tricky since extraction of resources by people outside the PA is illegal. Hence, soliciting responses on these issues through primary surveys is generally found to be difficult. Notwithstanding these limitations, attempts have been made to quantify the use of PA-resources by people in the periphery. The study by IIFM has tried to estimate the extent of use by the households rather than quantify the actual use of various resources within the PA (see Table 3.7).

It is observed that while people in neses as well as forest settlements depend almost entirely on Gir-PA for their fodder and fuel requirements the reported dependence among the revenue villages is fairly low. Only 8 per cent of the households in revenue villages reported dependence for fodder and 19% of the households for fuel wood. Of course, the study does report that this is an underestimation of the actual reality. What is important therefore is to know who depends and for how much of their total requirement of fodder and fuel? And how do they obtain this from the PA? We have tried to examine these aspects in the light of the estimated population of livestock as well as production of fodder within the PA.

Changes in Livestock Population and Fodder Budget:

While we do recognize the problems of under reporting of fodder collection in a primary survey, it might be useful to scan through some of the secondary data pertaining to the livestock population in the region. It may be noted, at the out set that, between 1982 and 1992 the number of livestock had declined in the two districts viz; Junagadh and Amreli, within which Gir is located (Shah, 2001). Similarly, there is evidence that the number of livestock within neses has also declined due to resettlement of Maldharis. What is important is that, livestock population had declined among both- the resettled Maldharis as well as those within the PA. And that the decline had occurred within a shorter span of time after the resettlement had taken place. This phenomenon has been brought out clearly by a detailed study on the Impact of Resettlement of Maldharis (Directorate Evaluation, 1992). It was observed that the number of livestock has declined among both – those who were shifted out and those remained inside the PA. But the decline is sharper in the case of those who shifted vis-à-vis those who did not. This has been reflected in the data given in the following chart.

Details	Shifted HHs		Non-shifted HHs	
	1971	1986-87	1971	1986-87
No. of milch animals	857	172	516	254
Average milk production (litre/day/ Animal)	11.3	5.8	11.0	7.5
Milk consumption per day (litre/HHs)	3.04	0.86	3.91	1.50

Note: Based on a sample survey of shifted and non-shifted Maldhari families.

These observations may further support the earlier assertion about overall decline in the livestock population and thereby, declining dependence on the PA among households within and in the periphery of Gir. While resettlement of Maldharis explains a part of the decline in pressure on the PA, there might be some other forces at work, which might also have reduced people's dependence on the forest resources. These include increased crop productivity on the one hand, and declining availability of water and fodder to sustain livestock in the periphery of the PA. A close association between landlessness and lack of ownership of livestock seems to be a manifestation of this phenomenon.

This however does not mean that people do not have access to fodder from the PA. Table 3.9 provides some crude estimates of access to fodder from the PA among people in the peripheral villages. It is observed that given the total production of 4,11,423 and the requirement of Maldharis, FSs, and herbivores within the PA, there would be a surplus of 1,71,068 tonnes of fodder per year (with an alternative estimate of fodder yield of 1500 kg. Per hectare, the surplus would be negative). This could support about 21,000 adult milch animals in the periphery, which is just about the same as the estimated carrying capacity in terms of livestock as discussed above. Since Maldharis inside the PA already have 20,000 cattle, the PA can support hardly 1000 milch animals in the periphery, given the carrying capacity of 21,000 livestock.

Assuming that 50 per cent of the total 94,582 livestock are adult milch animals, fodder production within the PA can meet the requirement of about 42 per cent of the stipulated estimate of about 50,000 adult milch cattle in the periphery. The remaining 58 per cent may have to survive on fodder obtained from vidis/pastures outside the PA + crop residue. It is estimated that the crop residue can support about 19,000 adult milch cattle. This still leaves 10, 000 adult milch cattle and the remaining 50 per cent of the other livestock out of the total population of 95,000 in the periphery (See Table 3.8). It is likely that the estimated population of 20,000 livestock inside the PA might include the 10,000 adult milch animals who remain left out of the fodder support from both- the PA as well as the crops.

Given these estimates the PA seems to be fully supporting a population of about 35,000 adult milch cattle, which is much higher than the estimated carrying capacity of 22,000 in 1971. The available information thus tends to indicate three important aspects: first, the overall livestock population seems to have declined, which in turn, might have resulted in reduced pressure on the PA. Second, despite the decline in population, the number of livestock fully dependent on the PA is much higher than the carrying capacity. And third, a large proportion of the estimated livestock of 95,000, if correct, may have to remain under fed unless, pastures in the peripheral villages are regenerated.

This brings back the issue of the estimated fodder productivity within the PA. It may be noted that the above estimates are based on the national average of 3000 kgs. Of

fodder per hectare, which is likely to be on a higher side. Similarly, the estimate of carrying capacity is based on a situation when the ecology was highly degenerated. Both these estimates therefore, need to be revised in order to prepare a proper fodder budget for the region.

3.4.2 Results from the Primary Survey

We have tried to examine these aspects by conducting a house listing in eight revenue villages, four neses and three forest settlements. The exercise was conducted by combining a survey method with informal discussions by forming groups of the homogeneous categories of households. The information is also supplemented by functionaries of outside agencies having close familiarity with the village communities over a long period of time. The main observations emerging from this exercise have been discussed in the subsequent analysis (Sse Table 3.9).

(a) Livestock and Fodder

It is observed that as large as 45 percent of the households in the peripheral villages do not own land. Similarly, 32 percent households in these villages do not own any livestock. This is quite significant. The households in neses and FSs are not permitted to own land though, land is made available to households in the FSs for cultivation on lease. The large proportion of landlessness in revenue villages however, reflects dynamic changes in the land market where many of the traditionally cultivating communities like Kolis are coming from other (less irrigated) regions to till the land of other households in the Gir region. Thus it is possible that a part of these landed households in the study villages are owners of land in their own villages.

Notwithstanding this specific feature of a part of the landless households, what we have generally observed in the study region is a fairly close relationship between those without land and those without livestock. This, of course, leaves out the traditional herder community, which owns substantial number of livestock, at times without much of a land base. These communities traditionally depend on the village pasture and/or the PA for sustaining their livestock. Among the remaining households, average number of milch animals is found to be fairly small i.e. 2.4, 11.8 and 23.3 in revenue villages, FSs, and neses respectively. These estimates are

worked out by considering only those households, which had some livestock. The gross average would be even further lower than this.

Prima facie, the limited ownership of livestock in the peripheral villages would suggest lower dependence on the PA for fodder. While it is difficult to get a realistic estimate of e people's dependence on the PA, findings from our primary survey suggest that nearly 35 per cent of the households in the peripheral villages obtain up to 50 per cent of their fodder requirement from the forest vidis (Table 3.10). Only 13 percent obtain more than 50 percent of the fodder requirement from these resources. The remaining 48 percent did not report accessing fodder from the forest. As noted earlier, a part of these 48 per cent households may not have any livestock; the proportion of households without any livestock was found to be 32 per cent (see Table 3.9). This implies that only 16 per cent of the households owning livestock did not depend on forest for their fodder requirements. These estimates seem to be fairly reasonable.

Overall the findings, notwithstanding the lower livestock population per household, suggest substantial dependence on the PA for meeting at least a part of the fodder requirement even in the peripheral villages. Obtaining a realistic estimate of the total livestock population thus, becomes crucial for assessing the total dependence for fodder among the peripheral villages. In absence of this, the micro level estimates, based on the households' reported access to the PA, may not help working out the aggregate estimates of the actual availability of fodder from the PA and people's dependence on that.

(b)

Fuel wood

Compared to fodder, people's dependence on PA for fuel wood is much higher as already shown by the IIFM study and also our house listing (see Tables 3.7). However, at a closer investigation and the information obtained through informal discussions with the people it is learnt that nearly 80 per cent of the households in peripheral villages depend on PA for the fuelwood requirements. This excludes households belonging to socially as well as economically better-off communities viz; Patel, Brahmin, Luhana, Ismailis, and Mahajans (Rohinivij, 1992). The above

phenomenon has been further confirmed by the estimates presented in Table 3.11(a). It is observed that as large as 74 percent of the fuelwood requirement of households in the peripheral villages is being met by fodder collection from the forest or, through market purchase, a large part of which is likely to have come from the forest.

Of course, fuel wood collection varies significantly across households as observed during our survey in the sample villages (see Table 3.11 (b). Basically, the dependence on forest would depend on the households' capacity to shift to alternative sources like kerosene, cooking gas (LPG), and bio-gas While most of the households in the peripheral villages use kerosene, it constitutes only a part of their requirements for fuel. To a large extent these households obtain a fixed quota of kerosene i.e. 10 liters per month at a subsidized rate. This might be sufficient at the most for one third of their requirement. For the rest, these households depend on fuel wood either through direct collection from the forest or through purchase from market/other households.

According to recent estimates, fuelwood requirement per household is 6 kgs. per day. For the 26,397 households in 1991 the total requirement would work out to be 57,809 tonnes per year. Assuming that fuelwood constitutes half of the total requirement of these households, the demand for fuelwood in the periphery would be 28,904 tonnes per year. This is based on the assumption the remaining fuel requirement is met by kerosene, dung cake and LPG etc.

Thus the total requirement and the estimates demand by the peripheral villages (subtracting the kerosene, dung, LPG) are 57,809 tonnes and 28,904 tonnes per year. These estimates are fairly lower than the estimated availability of fuelwood (of the tune 1.87 lakh tonnes per year) from the PA (i.e. sanctuary area). This kind of vast difference between the total requirement and the estimated availability, notwithstanding the limitations in estimation of the later, would suggest substantial amount of fuelwood extraction for commercial purposes. This corroborates the estimated requirement by the people from a larger periphery covering 150 villages. According to this the required fuelwood is 1.17 lakh tonnes per year. It appears reasonable to argue that a large part of the fuelwood requirement of these 150

villages is met by the Gir-PA through collection and/or market purchase (Karim 1990).

(c) Timber

Extraction of timber is strictly prohibited. However there are occasional evidences where people from the periphery indulge into illegal filling either directly or indirectly. Such instances often surface during informal discussions with people where it is reported that about 5-7 per cent of the village community in the immediate periphery of Gir (i.e. <3 kms. radius) are involved in such activities. These households/individuals often belong to economically and socially very vulnerable groups of the society. However what is concerning is that their involvement in such activities, at times, is triggered by some of the resourceful households in the villages often having political patronage. The economically vulnerable individuals fall prey to the `greed' of the resourceful persons in the time of extreme distress when they need cash income. On other instances they do undertake this risky activity because of their sheer need and ability to maneuver the protection system. It is thus essential to distinguish the circumstances that lead and make it possible to extract timber from the PA.

3.4.3 Differential Pattern of Dependence Among Households

The above observations along with our informal interactions with the village communities suggest a broad pattern of interface between people and PA across different categories of households in the periphery of the PA (see Chart IV below). Prima facie, we have categorized these households into three: First consists of the resource poor households with no or small piece of land and limited livestock. The next category consists of middle level agriculturalists with medium size of land and livestock ownership. The third category represents households with large land holdings and/or livestock and also socio-political power. It is postulated that households in the first and the third categories `depend' significantly on the PA- the former does that out of the `need' to meet their subsistence requirements, and the latter out of the `greed' to maximize their earnings. Apart from the economic base, the actual dependence is also determined by household's capacity to manipulate `rules and rulers' of the PA.

Chart III.1

Type of Households	Asset Base	Potential/ Actual Benefits from the PA	Losses due to the PA	Likely Response to the EDP
Poor	Landless or marginal farmers with no or limited livestock	Fuel wood, NTFP, Illegal grazing for small ruminants	Limited	Good response if (a) alternative grazing space is provided; and (b) alternative fuel is affordable
Middle range of Farmers	Moderate land and livestock	Moderate use for fuel wood	Moderate to high (depending on the location of the farmers)	Good response if, effective protection to farms is provided
Better off	Large land holdings and livestock	Fodder	High	Limited response because the loss of fodder benefit might exceed the limited protection which could be provided under the project

Understanding this dynamics is very crucial for evolving right kind of incentives as well as compensation packages for different categories of households so as to reduce their dependence on the PA. It is crucial to note that whereas all the households have similar access to the forest resources in practice the access varies significantly depending upon the socio-economic and political base.

3.5 Negative Externalities: Cost of Protecting Crops

Despite the direct benefits from the PA, people in the periphery face severe problems of the wild life damaging the crops. This aspect has already been discussed while estimating the economic cost emanating due to conservation of the PA (See Table 2.12). However, apart from the actual damage to the crops, people have to face lot of hassles for protecting their crops especially, during night hours. A large majority of people reported that they have to keep guarding their crops from various herbivores such as blue bull, chital and wild boar. The problem starts right from the time when the crop is sown. Farmers have to keep awake through out the

night for protecting the fields as the herbivores cover as much as 20-25 kms. of area both times while going as well as while returning in early morning.

To a large extent, the phenomenon of herbivores going out to the field is an outcome of the degraded as well as improper vegetation within the PA. Availability of irrigation and might have aggravated the situation. The result therefore, is migration of lions in search of the herbivores. While it has been argued that lions have always been moving out in the radius of 20 –25 kms. its frequency has increased has increased due to the frequent droughts. It may be noted at this stage that the increased frequency of droughts is more a manifestation of the high rate of soil and water erosion rather than a result of the declined rainfall in the region. Hence, in absence of proper measures for watershed management inside the PA, the vegetation is likely to remain low, which in turn, pushes the herbivores outside the PA. Lions happen to follow this food chain and in the process gets into conflicts with the people or the livestock. Interestingly, people in the sample villages reported that they would rather have lions on their fields so that the herbivores keep away! Breaking this cycle therefore, would require appropriate management of vegetation inside the PA, which in turn, necessitates proper measures for soil and water conservation.

The recent debate among the management team however, views increased vegetation as non-conducive for lion-habitat. But, this view Pont argument needs further qualification. It appears that increased vegetation density has taken place mainly due plantation activities in the National Park Area. This kind of vegetation is preferred only by Sambar. Other herbivores prefer more of open grassland with shrubs found in the sanctuary area in the western part of the PA. Given the degradation (rather than increased density) of vegetation the western region may not be able to sustain more herbivores so as to be able to increase the lion population beyond 150 or 160. This is perhaps, why one observes that the increase in lion population in the past few decades has taken place mainly in the eastern region. This however, still does not imply that the improving the density of vegetation especially, grass and shrubs in the sanctuary area is non-suitable for habitation of lion. Resolving this issue is very crucial for, increased vegetation and its proper management (including `cut and carry' operations for collection of grass, weed-

management etc.) has a significant bearing on economic benefits derived by people in the periphery. These issues have been discussed in the subsequent sections.

Table 3.1. Local Stakeholders and Access to PA

		Access*
Neses		1. Free grazing and cutting for their cattle 2. Kacha housing without land ownership 3. Free access of NTFPs 4. Timber for construction of their houses 5. Free access of water 6. Rights to sell FYM & animal products 7. Compensation for loss of livestock and human life 8. Free access for fuelwood for their own use 9. During drought year right to shift their cattle by getting prior permission 10. Rationing: Kerosene, food grains etc. 11. Free movement in forest area within his territory 12. Rights to vote (same as FSUs)
No.	54	
House-hold	361	
Population (1991)	3000	
Live-stock	10000	
FSs		1. Rights were granted to cultivate piece of forest land on lease 2. *Pucca* house without land owner-ship 3. Total 8 villages having rights for free grazing for their cattle. All villages having rights for collecting grass for their animal 4. Timber for construction of their houses 5. Rights to sell FYM & animal products 6. Compensation for loss of live-stock, human life 7. Avail transport facility by prior permission 8. Prior permission require before getting and general enmity 9. Rights to vote in state and national level elections. No rights to vote or contest in election of local body
No.	14	
House-hold	556	
Population (1991)	4494	
Live-stock	424	
RVs		1. Compensation for loss of livestock and human life 2. Several villages having a rights for grazing in non-reserve vidi
No.	99	
House-hold	26377	
Population (1991)	152032	
Live-stock	94582	

Note: This list consists of the major entitlements; it is not exhaustive.

Table 3.2. Population in Neses within PA

Detail	1972	1987	1995
Neses	129	54	54
Households	845	361	NA
Livestock	16852	9811	20000
Human population	4802	2540	3000 – 5000*

* Rough estimate provided by a network of Maldharis in Gir [Mahida and Shrimali, 1996].

Table 3.3. Benefits and Costs to Maldharis in Gir

Economic Benefits and Costs	Rs. Lakh	Other Gains and Losses
A. Benefits		**Gains**
1. Fodder	784.48	1. Clean air and water
2. Fuel wood	5.93	2. Less risk of droughts
3. Timber	4.30	3. Free housing
4. FYM	156.98	4. Grazing outside livestock
5. MTFP	NA	5. Natural ambiance
6. Grazing of outside animals	196.12	**Losses**
7. Water, Housing, Other Amenities	NA	1. Absence of schools 2. Absence of electricity 3. Lack of health facilities 4. Limited scope for occupational diversification 5. Limited links to market 6. Problems of mobility 7. Conflicts with FD-staff
Total economic benefits	1147.81	
B. Loss of livestock (750/Year)	112.50	
C. Total net benefits (A-B)	1035.31	
D. Cash Income		
1. Milk	750.00	
2. FYM	156.98	
Total	906.98	

Notes: Based on the information obtained from Maldharis about average consumption of fodder per livestock and fuel wood per households. The norms used for fodder consumption by cow and buffalo are 20 and 25 kgs. per day per animal respectively. Fuel consumption per household was estimated @ 6kg. per day. For timber the norm used is 10 cubic meters per household for 20 years. The FYM production per livestock is 8 tonnes per year and the net price received is Rs.0.2 though, the market price is Rs. 0.5. The prices used for fodder, fuel wood and FYM are Rs. 1, 1.25 and 0.75 per kg. respectively.

Table 3.4 (a). Changes in Population and Employment

All (99) villages on periphery	Total HHs	Total population	Total main workers	Cult. as % to main worker	Agril. Laborers as % to main workers	Livestock etc as % to main workers	Non-workers as % to main workers
1971	18386	106620	28200	68.38	35.27	2.80	248.41
1991	26397	152032	41513	51.27	32.17	2.68	166.53
Difference	8011	45412	13313	-17.11	-3.1	-0.12	-81.88
% change	43.57	42.59	47.20	-	-	-	-

Source: Census of India, 1971 and 1991.

Table 3.4(b). Talukawise Growth in Households (1971-1997) and Population in Periphery of Gir-PA

Taluka	Households (%)			Population (%)		
	<3 kms.	>3 kms.	Total	<3 kms.	>3 kms.	Total
Dhari	21.52	-5.14	18.49	24.58	-6.41	21.01
Khambha	44.46	50.77	47.36	50.56	57.10	53.52
Mendarda	45.79	25.61	36.60	32.97	22.46	28.22
Maliya	65.33	-	65.33	70.39	-	70.39
Talala	51.86	29.84	45.93	48.35	23.48	41.71
Una	43.49	69.54	52.37	40.66	62.13	47.76
Visavadar	74.48	51.56	59.37	61.63	39.53	47.18
All	48.22	49.37	46.68	45.15	42.03	43.93

Source: Census of India, 1971 and 1991

Table 3.5. Changes in Land Use among Peripheral Villages

Distance from PA	Year	Total area (ha)	Forest area as % of total area	Irrigated area (ha)	Cultivable wasteland (ha)	Not available for cultivation 95% to total	NCA
<3	1971	79494	15.59	4339	14340	10.44	43380
<3	1991	78685	33.67	8088	7994	7.33	47002
Difference	-	-809	18.08	3749	-6346	-3.11	3622
>3	1971	32715	3.93	2171	7012	9.53	23001
>3	1991	34386	19.32	6237	2823	3.34	15183
Difference	-	1671	15.39	4066	-4189	-6.19	-7818
Both	1971	112209	19.52	6510	21352	19.97	66381
Both	1991	113071	52.99	14325	10817	10.57	62185
Difference	-	862	33.47	7815	-10535	-9.40	-4196

Source: As in Table 4(a)

Table 3.6. Status of CPLRs in Selected Villages

Village	Status of *Gauchar*				Current (in Ha)		Other Grazing	
	Earlier (in ha)	Encro-ached (in ha)	Donated (in ha)	Notified forest (in ha)	Avail-able	Condit ion	*Vidis* (in ha)	Privat e (in ha)
Kamdadi	34.89	5.87	0.00	23.16	5.87	A	0.00	0.00
Hirava	111.15	0.00	0.00	111.15	0.00		111.15	185.24
Paniya	0.00	0.00	0.00	0.00	0.00		0.00	15.44
Gigasan	30.87	0.00	0.00	0.00	30.87	A	0.00	0.00
Shivad	15.44	0.00	0.00	0.00	15.44	A	0.00	0.00
Jhankia	10.03	0.00	0.00	0.00	10.03	C	0.00	0.00
Fareda	77.18	30.87	0.00	0.00	46.31	C	78.11	15.44
Dron	385.92	46.31	169.81	0.00	169.81	A	0.00	0.00
Nitli	293.30	15.44	0.00	0.00	277.86	A	0.00	0.00
Juna Ugla	30.87	6.17	15.44	0.00	9.26	A	0.00	0.00
Itvaya	92.62	46.31	0.00	0.00	46.31	A	0.00	0.00
Khilvad	77.18	46.31	0.00	0.00	30.87	A	0.00	15.44
Bhalchel	231.55	0.00	0.00	231.55	0.00		0.00	0.00
Kenedipur	571.16	308.74	77.18	108.06	23.16	A	38.59	0.00
Ambala	61.75	30.87	0.00	0.00	30.87	B	0.00	52.02
Amrapur	120.41	0.00	0.00	108.06	12.35	A	0.00	0.00
Jalandhar	648.35	324.1	0.00	0.00	15.44	A	287.13	0.00
Khodiyar	154.37	0.00	7.72	0.00	146.65	A	0.00	77.18
Ratang	385.92	30.87	108.06	0.00	246.99	A	0.00	0.00
Limadra	231.55	0.00	0.00	0.00	231.55	A	0.00	0.00
Monpari	77.18	0.00	0.00	30.87	46.31	A	0.00	0.00
Laduli	185.24	0.00	100.34	0.00	84.90	A	154.37	0.00
Jepur	277.86	30.87	38.59	154.37	54.03	A	23.16	12.35
Jambur	308.74	46.31	77.18	154.37	30.87	A	0.00	0.00
Rasulpara	15.44	0.00	0.00	0.00	15.44	A	0.00	0.00
Bhojde	540.29	0.00	0.00	540.29	540.29	C	0.00	0.00
Borvav	277.86	46.31	77.18	0.00	77.18	A	77.18	0.00
Surajgadh	12.35	0.00	0.00	0.00	12.35	A	0.00	0.00
Chitrod	123.49	0.00	0.00	123.49	0.00		0.00	0.00

Source: Primary data

A; Indicates land supports livestock of the village for 2 or 3 season for grazing and frequent harvesting of grass is possible

B; Indicates land supports livestock of the village for monsoon season and harvesting of grass is not possible every year.

C; Indicates land partially supports village livestock during monsoon.

Table 3.7. Accessing Resources from PA

Location	Households Obtaining Resources from PA (No.)					
	Fodder	Fuel	MTFP	Medicinal Plants	Timber	Mud
Neses	42 (100)	42 (100)	42 (100)	12 (28)	42 (100)	26 (62)
FSs	24 (77)	28 (90)	31 (100)	8 (26)	29 (93)	9 (29)
RVs	35 (8)	5 (19)	112 (24)	68 (15)	56 (12)	17 (4)

Note: Figures in parentheses indicate percentage

Source: Debnath, etal. (2001)

Table 3.8. Supply of Fodder to Peripheral Villages-Alternative Estimates

(Tonne/Year)

	Scenario I	Scenario II
1. Total fodder production	411423	205711
2. Fodder use within PA:		
2.1. By Maldhari	78488	78428
2.2. FSs	33928	33928
Total	112416	112356
3. Difference (1-2)	299007	93355
4. Fodder available for supporting herbivores*	127939	127939
5. Surplus fodder	171068 **	- 34584
6. Fodder from crop residual	153878	153878
7. Livestock supported by crop residue	19235	19235
8. Support to livestock in periphery by PA	30765	-

Note: Total no. of livestock in the periphery is assumed to be 50,000 out of the estimated population of 94,582

* Estimated @ 7kgs. per day (Source: Pandya et al; 2001; Table 15).

** This can support 21,383 livestock in the periphery

Table 3.9. Important Features of Households in Selected Villages/FSs/Nes

Category	Households											
	Total	Landless		Having land <5 Acre		Having Irrigation		Having Livestock		Av. No. of Milch Animal	Herder Community	
	No.	No.	%*	No.	%**	No.	%**	No.	%*		No.	%*
RVs	2763	1238	44.81	901	59.08	1047	68.66	1888	68.33	2.43	294	10.64
FSs	186	108	58.06	37	47.43	59	75.64	112	60.22	11.77	54	29.03
Ness	62	61	98.39	1	100.00	1	100.00	58	93.55	23.53	60	96.77

Source: primary Survey.

* Per cent to total households. ** Per cent to landed households.

Table 3.10. Seasonwise Sources of Fodder among Peripheral Villages

Seasons	Sources of Fodder (% of HHs)					
	Village Pastures			Forest Vidis		
	<25 %	26-50 %	50+ %	<25 %	26-50 %	50 %
Monsoon	31	29	48	16	16	21
Winter	39	34	17	18	19	12
Summer	36	6	13	28	8	6
Average	35	23	26	21	14	13

Source: Primary survey in 8 Revenue Villages in the periphery

Table 3.11a. Zone-wise Sources of Fuelwood (Percentage of Fodder)

Zones	PA	Bought from forest community within PA	Forest vidi	Private land	Gaucher
A	100	-	-	-	-
B	35	25	-	40	-
C	-	25	25	50	-
D	-	-	20	50	30
All	30	23	9	32	7

Note: i. A = Within PA; B = <5 kms.; C = 15 kms; D = 15-20 kms.

ii Overall Fuelwood obtained from forest, private land + gaucher and market purchase has been estimated to be 40%, 26% and 34% respectively

Source: Source: Based on the study by Karim (1990).

Table 3.11 (b). Main Sources of fuel wood

Villages	Wood	Dung	Kerosene	Bio-gas	Ele. Heater	All
Kenedipur	33	4	3	3	-	43
Madhupur	32	3	-	3	1	39
Govindpur	27	3	1	9	-	40
Dedali	32	8	-	-	-	40
All	124	18	4	15	1	162

Source: Primary Survey.

Chapter 4: Livelihood Base, Environmental Implications and Alternative Approaches for PA-Management

4.1 The Status

The foregoing analysis of the various economic and ecological services from PA and people's interface with the resources therein has highlighted some important issues that need special attention while exploring right kind of approaches for its future management. *Prima facie* the issues pertain to: (a) habitat management which is conducive for the `core' wildlife specie; (b) regeneration of vegetation that could sustain wildlife and also people's needs subject to the carrying capacity of the ecosystem; (c) sustainability of resource-use; (d) institutional mechanism for sharing of resources; and (e) effectiveness of the protection measures. In fact, all these issues are closely inter-related, hence should be seen in a comprehensive manner rather than as isolated issues while designing management plan for the PA.

The central theme of the PA-management is to evolve an alternative land-use (and vegetation) plan, which in turn, calls for a suitable mechanism of accessing (or sharing) these resources with the people whose livelihood needs are closely linked with the health of the PA. At present, the existing legal structure does not recognise the stakes of the people especially, in the periphery. But this is not in tandem with the historical developments and the ground realities. Non-recognition of the people's rights therefore leads to a situation of a legal status quo where people continue to access the forest resources but, without the formal system taking note of this. The formal perception therefore, treats this as `stray incidences' of illegal activities rather than a regular practice as a part of the people's livelihood base. This kind of a scenario is most untenable not only for sustainable development of wildlife habitat, but also for conflict resolutions and effective management of the PA. The experience in many parts of the world suggest that imposing unrealistic restrictions, may help checking people's pressure on PA but only in the short run. In the long run it may prove to be more damaging. For, a sudden and an artificial ban on accessing the PA-resources may induce certain informal arrangements that do not formally come to the surface though, extraction of resources may continue. What makes this worse is the fact that such extractions take place not only at the instance of those

who `need' them for their survival but, also by those who have economic-social-political power to get into faulty alliances without being questioned. To an extent Gir-PA also resembles such a scenario as seen in Chart III-1 in the previous section. What is however, encouraging is that the management plan clearly recognizes illegal extraction including grazing as the major issue facing the PA. Exploring alternatives for more effective management in future should therefore, try to look into the changing pattern of the resource base within and outside the PA, people's livelihood requirements, and the prevalence of these informal alliances for extraction of the PA-resources. This section tries to look into these issues with a view to identify alternative approaches for PA-management in the next stage. This has been done in the light of a sample survey of households.

4.2 People's Livelihood Base: The Present Scenario

4.2.1 Land, Irrigation and Livestock

The analysis in the previous section had indicated certain patterns in terms of population movements, changing land-use pattern, and people's dependence on forest. We propose to take this analysis further by looking at the livelihood base among five major categories of households in the peripheral villages. These are: Medium-Large farmers with irrigation (LI); Small farmers with irrigation (SI); Farmers without irrigation (UI); Landless (LL); and Livestock herders (LH). The idea is to understand the present status of their livelihood base, emerging issues, and perceptions about future policies with respect to the PA-management.

Tables 4.1 thru 4.3 provide information about the sources of income across different categories of households. The important observations are:

i. A large proportion of the farmers (i.e. about 81 per cent) with irrigation pursue livestock as supplementary source of income, whereas many of those without irrigation and the landless cannot afford to have livestock. The proportion of households having income from livestock is 63 among farmers without irrigation and 27 among landless (Table 4.2). Thus, livestock as a source of income is associated more closely with access to irrigation rather than land.

ii. Landless households depend more on the prospects of agriculture by seeking employment on farm. This, in turn, is influenced more by access to irrigation rather than on fodder and livestock. What is however, surprising is that 9 per cent of the landless households reported collection of forest produce as the source of income (among others) and another 13 per cent reported trading, which is also likely to be related to the various forest produce. Thus, landlessness appears to be closely associated with dependence on forest.

iii. Similarly a large proportion of the traditional herders also have to depend on agriculture. This might imply that livestock alone is no more an adequate source of employment and /or income even among the herder communities. To an extent this confirms smaller size of livestock owned by these households as noted earlier in Section 3. Declining access to CPLRs as well as fodders from the PA might also be responsible for this phenomenon.

Together these observations substantiates the earlier findings that the households on the two ends of the spectrum in terms of access to land and irrigation tend to depend more on the forest resources. Whereas, those with land and irrigation tend to access fodder for their livestock, the landless (excluding herders) may depend on forest mainly for MTFP, illegal extraction of timber, fodder, etc.

The herder communities on the other hand seem to have faced a crisis because of their receding resource-base under the relatively more stringent measures for protection of the PA. This in turn seems to have reduced the size of their livestock, which worked out to be 6.3 per household (Table 4.3) as against 23.5 in the case of the Maldharis living inside the PA (Table 3.9). In fact, this observation, once again, raises doubts about the estimate of about 95,000 livestock in the periphery of the PA. Projecting an apparently overestimated population of livestock leads to a misplaced emphasis on the actual pressure on the PA and at the same time gives a misleading impression about the higher (than the actual) productivity of forest from the PA. In fact, there is an inherent contradiction in these two phenomena i.e. large population of livestock creating a high pressure on the PA, and a higher productivity of fodder. As per the management plan (1996) the improved protection of the PA has

shifted the pressure to the pastures in the peripheral villages. As a result, these pastures got further degraded. While this is fairly valid explanation for the degraded status of the village pastures, it however does not go consistently with the assessment of the `pressure from the people'. In fact, the reality appears to be a mix of all these phenomena: (a) improved protection vis-à-vis the seventies; (b) continued pressure on the PA but at a lower rate than before because of the combined effect of the improved protection measures as well as reduced livestock population in the periphery; and (c) increased degradation of the village pastures, which might be partly due to the protection measures but also due to the loss of relatively better pastures to the PA. We will return to this issue at a later stage.

In terms of income, agriculture and livestock, besides services, are found to be more rewarding. The average income per household works out to be highest in the case of service i.e. Rs. 64,090 per annum. This is followed by agriculture (Rs. 44,273) and trading (Rs. 15,250). The average income from livestock is Rs. 12,728, which is almost same as that from other casual labour. This kind of income, in absence of multiple sources of income may hardly suffice for ensuring subsistence livelihood (Table 4.1).

Of course, these are somewhat crude estimates. What is however important is that they reinstate the importance of agriculture and agriculture related labour for livelihood base of the people in periphery. This, as we noted earlier, has a direct bearing on availability of irrigation. In fact, declining access to fodder seems to have created increasing burden on agriculture and in turn, on water resources in the region. What is the status of the use of ground water? How sustainable it is? And, what measures could be taken to mitigate the depleting ground water resources? These are some of the critical questions for the PA-management as depletion of ground water resources may exert negative impact on the level and pattern of vegetation and also water table within the PA. These issues have been discussed subsequently.

4.2.2 Status of Ground water and Shift in Cropping Pattern

The decline in ground water table has been fairly widespread as reported in Table 4.4. In fact, those in the nearby villages recognised the problem more clearly than in the distant villages that are likely to be in the proximity of the command area of the

irrigation dams in the region. Obviously therefore, the extent of irrigation is higher in the distant villages (41%) vis-à-vis the nearby villages (17%) as shown in Table 3.5 in the previous section. While we do not have details of the cropping pattern in all the 99 villages in periphery, the observation about the relatively better access to irrigation in the region suggests predominance of some of the more water intensive crops like sugarcane, cotton, castor, groundnut, wheat etc. Since the nearby villages constitute a large proportion i.e. about 68 per cent of the net-cropped area within the region, the pressure for using ground water is likely to be much more stronger than in the distant villages. If so, it may exert a negative impact on the ground water resources within the PA. An important way out is to change the cropping pattern from more water intensive to less water intensive crops especially, in the nearby villages.

We have tried to explore this option by obtaining the perceptions of the sample farmers. This has been done by suggesting an alternative crop to the more water intensive crop presently grown by the farmers. Some of the crop-combinations discussed with the farmers were as follows:

Present Crops NR/Ha	**Alternative Crops NR/Ha**
Sugarcane	Groundnut or mango plantation
Groundnut	Castor or bajri
Cotton	Groundnut + fodder
Wheat	Jiru or castor

While a large number of farmers agreed that the present cropping pattern is not conducive for ground water situation in the region, they were not willing to accept the proposed changes in cropping pattern. For most of them felt that shifting to mango-plantation in place of sugarcane or, groundnut instead of cotton will adversely affect their net returns (see Table 4.5).

Nevertheless, a large number of farmers did recognize the fact that there has been a significant overuse of water and that; there is a scope for improving the water-use efficiency. Table 4.6 depicts people's perceptions about the measures that could help checking ground water depletion in the region. It is interesting that farmers though, unwilling to change their cropping pattern, recognise alternative crop-mix as

an important mechanism for mitigating the problem of depletion of ground water. Incidentally, water-harvesting measures turned out as the most important aspect in this context.

It is pertinent that the gap between `what should be done' and `what they are willing to do' with respect to cropping pattern changes emerges because of the perceived loss of income. Creating an appropriate incentive structure thus, becomes very critical for influencing the shift in cropping pattern in the region. Prima facie, this would involve (a) management of water resources on a watershed basis; (b) regulated use of water with incentives for adopting measures for water-use efficiency; and (c) creating a mechanism for sharing of resources from the PA + CPLRs such that they may compensate the loss incurred by the farmers while shifting to a farming system involving an alternative combination of crops, plantation, and livestock. This kind of an alternative approach to water resources management and planning may also provide some incentives to the Maldharis for adopting a more sustainable use of fodder and other resources within the PA. Improving the quality of livestock could be one of the crucial strategies to be adopted by the Maldharis.

A central point, which has emerged out of the above discussion, is that: the PA-management needs land plus water use planning where management of water (rather than land) should take a lead. However, before we discuss this issue in further details, we take a brief account of people's perceptions about the preferences for regenerating CPLRs and pastures outside as well as within the PA.

4.3 Use of CPLRs and Perceptions about their Regeneration

Table 4.7 presents information about the use of Common Property Resources (CPRs) in the study-villages. It is observed that a large proportion, i.e. 62 per cent of households access fodder/fuel from the village pastures, whereas 46 per cent also access the forest-vidis. This is substantially high considering the fact that about 22 per cent of the households do not have milch animals and 14 per cent of the households do not have any livestock. Moreover, it is likely that the actual use of forest vidis is under-reported. This kind of extensive use of CPLRs and forest vidis, when seen in conjunction with limited number of livestock per household, reinforces the need for better management of these resources especially, when an alternative strategy for cropping pattern and land + water-use is being explored.

We have tried to obtain people's perceptions about their preferences for regenerating the CPLRs and also for reducing pressure on the PA. This has been discussed in the subsequent analysis.

4.3.1 Regeneration of Village Pastures

We had detailed discussions with the sample households as well as with the village communities regarding the appropriate approaches for regenerating the village pastures. It was noted that whereas a majority of people in the villages in Gir-West preferred development of fodder alone, those in Gir-East felt that fodder + plantation might be a good strategy. This apparently suggests importance of livestock in the former vis-à-vis the latter. This reinstates the earlier observation regarding a mutually reinforcing impact of irrigation and on preference for availability of fodder in Gir-West. Those having relatively low access to irrigation as in the case of Gir-East may like to access NTFPs from the CPLRs since their livelihood base is fairly low. Prima facie, this kind of preferences, viewed in the light of a proposed water-use planning, would imply increased allocation of water for fodder in Gir-West and for plantation in Gir-East. Table 4.8 presents main reasons for the stated preference for fodder while regeneration of the CPLRs. It is heartening to note that reducing the pressure on PA has turned out to be the most important reason for increased development of the CPLRs/forest vidis. This is followed by increased income from livestock, and then by drought relief. However, people's involvement in the protection of PA was not considered as an effective mechanism especially, in absence of a effective set of incentives.

4.3.2 Regeneration of Forest Vidis

We tried to understand people's perceptions about improving the status especially by reducing the pressure on the PA. Among the various measures suggested, management of fodder collection and distribution, development of village-pastures, providing alternative source of livelihood and protection were reported as important steps (see Table 4.9).

While these are the usual responses with respect to PA-management, what is important is to note that a large proportion of the people (i.e. 60 per cent) perceived economic + ecological services from the PA as non-sustainable given the present

scenario of management practices and people's pressure on the PA. Evidently, large farmers with irrigation and households from herders' community do not share this perception. This kind of divergence in perceptions tends to confirm the pattern of differential stakes across households presented earlier in Chart III.1. Despite this, it is encouraging to note that there is almost a consensus on desirability of conservation measures for sustenance of the ecology. It may however, be noted that, people by and large, do not think the present management system to be functioning satisfactorily.

We have tried to ascertain what kind of support people would expect in case the present restrictions are tightened further in order to achieve better protection of the PA. The responses, in a way, reflect people's willingness to accept complete ban on accessing the PA-resources. The responses have been grouped into five broad categories in terms of their relative importance (See Table 4.10). These are: availability of alternative employment and income, setting up of a system ensuring smooth supply of fodder and fuel, access to land (private as well as common), provision of alternative sources of fuel, and development of agriculture.

The above responses indicate two important aspects. First, people attach significant value to conservation of the PA, and seek alternative arrangements for its effective management. And second, in absence of an adequate livelihood base as well as development of CPLRs, they continue to depend on the PA, despite the realization that the use is non-sustainable.

It is in this backdrop, we have tried to explore alternative management scenarios for the three important sets of communities: (i) households with land + irrigation and livestock; (ii) households with small land holdings without irrigation or landless having no/very small size of livestock; and (iii) Maldharis within the PA. Before we attempt this, it would be useful to recapitulate some of the major observations regarding the present status of the various resources and the problems faced in their management.

4.4 Status and Issues Pertaining to PA-Resources: A Recapitulation

PA-Resources (present stock)	Status	Ises
Wild life (No.) Lion 300 to 320 Ungulates 36,555	• Increased number	• Possibility of exceeding the carrying capacity • Increased damages to crops/ livestock • Need to develop coastal corridors • Problem of water for drinking
Timber (Teak + Non-teak): (No. in lakh) Teak 27,192 Non-teak 63,448	• Low density and slow regeneration after the cyclones in the mid-eighties	• Teak not suitable for the ecology • Appropriate mix of trees and browsing species so as to maintain medium density
NTFPs + Medicinal plants: Ambala, Harde, Jamun, Gum, Timru etc.	• Substantial diversity	• Need for regeneration and regulated management • Support livelihood among landless
Fodder: Estimated productivity: 3000 kgs./Ha or 1500 kgs./Ha Total production (T/Year) 4,11,423	• Large tracts of degraded and highly degraded areas • Balancing of vegetation for habitation of wildlife and livestock.	• Degradation due to: Natural conditions (drought) Increased pressure Ineffective protection • **Declining size of CPLRs in peripheral villages due to:** **Loss of CPLRs to PA** Encroachment Continued degradation • **Limited intervention in terms of collection and distribution thereby leaving a large proportion of the fodder resources to be exploited by the people**
Fuelwood: Total availability (T/Year) 1,87,500	• Substantial supply and heavy dependence by the people even through market channels	• Need to regulate supply through appropriate channels so that people can find some employment-income without over exploiting the resources • Promoting alternative sources of fuel through proper incentives
FYM: Production (T/Year) 78,488	• Large quantity of supply	• Selling out by Maldharis for very low revenue-realization • Selling of fertile soil by Maldharis • Scope for restricting the sales and retaining a part of it within PA • Scope for composting

		and value addition
River streams and seven dams: Total cultivable command area 39,010 (Ha)	• Major source of irrigation and income from agriculture as well as livestock outside the PA	• Limited measures for SWC • High level of soil-moisture erosion in the catchments, aggravating the problems of low regeneration of vegetation • Depletion of groundwater to due over use by farmers • Imbalance between availability of water within and in periphery of the PA i.e. between the upstream and the downstream • Private control of groundwater and lopsided incentive structures against the measures for efficient use of water
Livestock: 13-14,000 within PA 95,000 in the periphery	• Declining livestock population though systematic estimates are not available	• Livestock population inside the PA is well within the carrying capacity • Infiltration of livestock from outside PA perhaps consisting of less productive livestock • Grazing vs. stall feeding • Landless and small farmer without irrigation not being able to afford livestock
People: Population Periphery 1.8 lakh Maldharis in PA 35,000 FSs	• Shifting of population to the nearby villages partly due to declining NCA and CPLRs in distant villages	• Recognise the value of conservation but continue to exploit resources due to: **Prevalence of the `Tragedy of the Commons'** Conflicts with the FD-staff Need + Greed of the people
The PA-Management: The next plan is under preparation	• Fairly good understanding of the problems and significant achievement in the first phase of conservation	• Problems of second generation, policy formulation • Absence of proper data base on resources, stakeholders and dependents • Faulty alliance between people and protectors • Water scarcity as critical constraint for regeneration efforts

		• Budgetary constraints
Funders: National + global	• Support through eco-development project	• Inadequate consultation with stakeholders and managers
Researchers & global comm.-unities interested in bio-diversity: Various disciplines	• High level of awareness and large number of quality research	• Need for synthesis • Projection for fund raising and tourism • Absence of a policy dialogue

4.5 Exploring Alternative Management Scenarios

The above description of the resources, status and issues for the PA-management highlighted critical importance of improving vegetation in a manner that can serve the needs of the eco-system as well as a part of the peripheral economy on a sustainable basis. Management of water resources is central to this objective. While the PA-management realises this critical need, there is perhaps, inadequate recognition of people's stakes in the resources especially, fodder and fuel. As a result, it tends to maintain an artificial boundary between the pastures within and outside the PA while preparing a regeneration plan. The alternative approaches may therefore focus on conservation, allocation and utilization of water resources within and outside the PA i.e. in the upstream and downstream of the watersheds in an integrated manner.

Prima facie, the objective function of a watershed-based planning in the region should be to maximize surplus resources to support livelihood of the people in a sustainable manner. Here, `surplus resources' is to be defined with respect to the requirement of an optimum size of the core specie i.e. lion and the ecological chain thereof. This kind of a co-existence of wildlife and people (+ their livestock) is increasingly being accepted in the on-going debate on protected areas especially in the context of developing countries with sizeable population (Parker, 1983). This has given way to a wide range of alternative arrangements for management of the PA through collaborations between the statutory conservation bodies and private land owners (Biglake, 2000). The emerging perspective on PA-management thus, is based on a wide-ranging experiences suggesting that: (a) the interaction between domestic species and wildlife is complex-symmetric, asymmetric, positive and/or negative. And (b) designing of parks have to take cognizance of the functional

relationships between parks and the area (Gichochi, 2000). This kind of emerging perspective is particularly relevant in the case of Gir-PA where a large number of human and livestock population have co-existed with wildlife; both these have increased over time.

The recent literature on PA-management highlights a wide range of management approaches to deal with the issues of the functional relationship between parks and agriculture on the one hand, and competition between wildlife and livestock on the other. Also there has been an increasing emphasis on privatization and/or people's participation in PA-management. What however, has remained relatively less explored is identification of an appropriate combination of public-private partnership where the former retains the overall responsibility and regulatory role of protection within which specific functions could be carved out for private initiatives through development of markets as well as institutions. This is important because depending on regulation and restrictions alone may leads to conflicts, corruption and over-exploitation. And, too much of emphasis on people's participation may also result into neglect of some of the basic functions of conservation, habitat management and long-term sustainability. In what follows we present some of the alternative approaches for PA-management with specific focus on: (a) water-centered resource management on a watershed basis; and (b) public-private partnerships for resource development and sharing. The management approaches have been explored for three sets of communities.

4.5.1 Farmers with Irrigation (and Livestock)

As noted earlier, there has been a significant increase in irrigated area since 1971 (Table 3.5). In 1991, the irrigated area constituted about 24 per cent of the NCA, which is likely to have increased over time. The present use of irrigation has two major problems. First, in absence of proper SWC-measures in the upstream region, increasing irrigation in the downstream is often at the cost of its availability within the PA. And second, water-use is quite inefficient in terms of the crop-choice as well as methods. Thus, the issue of water availability centers rounds its allocation between PA and the periphery; and across households within the periphery. Two alternatives can be explored with respect to the allocation of water following from a watershed based planning where soil-water conservation within PA is considered to be the first

step and the top priority. As an immediate impact of increased soil-water conservation measures, availability of water (surface + ground) resources might decline in the periphery. This could be compensated through two alternative approaches as described below:

Components	Alternative Water-Use Approaches	
	I	II
Crop-mix	Same crops with predominance of cotton, sugarcane, mango plantation, groundnut and wheat	Change to less water intensive crops like: Groundnut → Castor Sugarcane → plantation/groundnut Cotton → Castor Groundnut → Bajri + Fodder Wheat → Bajri + Jiru
Water-use	Improve the field channels to reduce waste, Adoption of modern methods of irrigation (like drip, sprinkler), Agronomic practice	Reduce number of watering Improved efficiency of irrigation Reduced demand for farm labour Reduced availability of crop residue Fencing to reduce crop-damage
Live-stock	Reduced number and/or improved quality of livestock	Reduced quality/number of livestock
Increased fodder-supply from PA	Improved quality of livestock	Improved quality of livestock and reduced no. of livestock
Income and compen-sation/subsidy	More or less same from crops Subsidies on modern methods of irrigation Reduced income from live-stock Employment on SWC	Same/reduced income from crops Subsidies modern on irrigation methods comp. More or less same income with reduced number of livestock Compensation for the loss of income through supply of plantation material, compost from PA, fencing on farms, bio-gas/LPG etc. at a `reasonable price'.
Cost to PA-manage-ment in the short-run	Increased cost of SWC-measures Increased subsidy on irri. methods Support for bio-gas/LPG etc.	SWC-measures Increased subsidies on irrigation methods Supply of fodder and other material at `reasonable price'. Cost of compensation against net loss in income crop
Benefits to PA in the long term	Moderate increase in vegetation Pressure for grazing may continue at moderate level Crop-damage may continue	Significant increase in vegetation, Pressure for growing may reduce Crop damage reduces due to fencing etc.

4.5.2 Farmers with Unirrigated Small Holdings and Landless – with Limited/No Livestock

Components	Alternative Water and Land-Use Approaches	
	Fodder + Fuel	Plantation+ Fodder + Fuel + NTFP
Crop-mix on private land	Same crops	Shift to plantation and/or fodder
Regeneration of village pastures	Fodder + fuelwood	Plantation+ fodder + fuelwood
Livestock	Increased from the present size	Increased from the present size
Increased availability of water	SWC-measures on private and public land	SWC measures + increased allocation of water from irrigation dams as well as other structures within the villages
Protection of CPLRs	Incentives through supply of fodder	Supply of fodder + fencing/ watchman etc.
Employment & income	On SWC, forest vidis + CPLRs (for collection of grass and MTFP)	On SWC, forest vidis, CPLRs, NTFP collection and SWC-work
Sources of fuel	Fuelwood from CPLRs and forest through regulated markets	Fuelwood from regulated markets

4.5.3 Maldharis within PA

Components	Alternative Locations for Settlement	
	Outside PA	Within PA
Livestock	Reduced	Same
Grazing practices	Grazing in specially developed plots	Seasonally regulated pattern + cut & carry method
Supply of fodder from PA	On regular basis through cut and carry method + droughts	During droughts
Outside livestock	Stopped completely	Only in limited number during normal years
FYM	Compost for the development of the fodder plot	FYM selling restricted to half
Availability of water	Irrigation for fodder plot + water for livestock	Water for livestock
Compensation	To ensure development of fodder plot + rights to access (not graze) fodder & fuel + cash compensation through term deposits and institutional backing+package of amenities	Incentives for improving quality of livestock without increasing their number

4.6 Implications for PA-Management

Exploring the alternative management plans described above would however require a comprehensive exercise involving

- Compilation of adequate information especially on vegetation, livestock, people's dependence etc.
- re-assess the carrying capacity of the periphery as well as PA in terms of livestock population
- processes of consultation and involvement of various stakeholders

- creating institutions/public-private partnerships in managing the supply of fodder, fuel, NTFPs
- raising funds for undertaking SWC measures and allocating water for regenerating CPLRs, fodder plots and degraded vidis on a priority basis
- evoke a policy debate on regulating the use of irrigation water by farmers and evolve an incentive structure which helps adopt water-efficient crops and methods
- review the experiences of eco-development projects in different PAs and introduce suitable modifications
- improve transparency to reduce corruption.

The PA-management is presently engaged in working out a fresh plan for the next five years. It appears that they have tried to address many of the issues raised earlier in this report. We would however, like to highlight the most important components to be considered by the proposed management plan and discuss their implications in terms of benefits and costs.

Components	Costs	Benefits
SWC to be given a top priority	Average cost Rs.15-20000/ ha including the cost of water harvesting structures	Triggers a chain of improvement in terms of : Availability of soil-moisture Improved vegetation in PA Providing fodder +fuel through regulated operations Reduced illegal extraction and grazing Saving of the value of soil-loss Employment generation

Regenerating vidis with-in PA through additional inputs to be used as incentives to reduce irrigation and grazing	Average cost of Rs.10, 000/ ha (including seedling, water, manure, labour)	Replenishing groundwater Reallocating water to CPLRs and vidis Reduced damage due to illegal grazing within PA
Regeneration of CPLRs in periphery	Fodder +plantation Rs. 35,000/Ha	Better employment +income to small farmers +landless Reduced dependence for fodder, fuel-wood, illegal felling Reduced risk of fire
Institutional arrange-ment for collection of fodder, fuel and NTFP	Involving a professional developmental agency to arrange supply and distri-bution at a reasonable price	Saving of cost of drought relief programmes Reduced impact of droughts Reduced pressure on PA Reduce conflicts with FD-staff and better cooperation Improved quality of livestock Reduced pressure of grazing Stopping of outside animals
Mobilisation funds	Loan from national govts. Grant from environmental groups and donor agencies Credit support to people	Evolving a mix of incentives through: Increased availability of resources, cost-sharing, and subsidies rather than subsidies and compensation alone

It is of course, difficult to generate a complete account of the benefits and costs to the PA-management. The idea here is to provide a broad outline of alternative management approaches that are based on the assumption that: (a) regeneration of the PA needs appropriate mechanism for sharing of resources with the people. For, it is widely recognised that: the problem with existing national and international policies is that, although they may be trying to encourage conservation, they tend to do so in a way that excludes local people and leads to greater degradation (Conway and Pretty, 1991; Utting, 1993; Pretty, 1995) And (b) enhancing availability of water and soil-moisture is central to the regeneration efforts. This essentially, would involve a more balanced allocation of water resources between (i) PA and the periphery ; (ii) forest and crops; and (iii) households with and without irrigation + livestock.

The perceptions obtained through a primary survey of different categories of households have indicated that people are not averse to conservation. Rather they

need proper incentives, compensation and transparency from the PA-management. This could perhaps be attained in the light of the recent experiences from eco-development project. Some of the important lessons that have from the project implementation might be useful at this stage. These could be highlighted as follows:

4.7 Lessons from Eco-Development Project

Gir is one of the seven sights selected for the eco-development project funded by the GEF-World Bank. The central theme of the project is to regenerate and develop the peripheral villages so as to be able to protect the core (i.e. the PA). This has to be done by involving people in implementation of project in the peripheral villages. While these are laudable objectives, there are certain inherent problems in the design of the project. These are:

i. The project does not envisage any direct and/or systematic links with the vegetation and habitat management within the PA. The only strong link between the periphery and the PA is the assumption that reduced pressure on PA will itself ensure better protection and regeneration. But, this is without any need for a mechanism for sharing PA resources with the people. This implies tinkering only at the margin of the problem of conservation and resources use planning.

ii. Although, there is special emphasis on development of community based activities, it does not get in terms with the ground realities like encroachment of CPLRs. As a corollary it does not visualize any kind of negotiations in terms of sharing of PA-resources, with better institutional support and regulation, as incentives for releasing encroachment and/or ensuring protection of CPLRs. Also, SWC is a lower priority in EDP. This is despite the fact that the budgetary allocation for SWC is already too small.

iii. People's participation is viewed in a somewhat limited manner i.e. by sharing a part of the project cost. But participatory processes also need to be based on equity-principle. This should imply differential rates of contribution and mechanism of cross subsidization across households with different economic base.

iv. It fails to recognise that shifting from almost a cost-free source of fuel i.e. from fuelwood to bio-gas or LPG is non-feasible for a large number of households without land/ livestock and having very low levels of income. These households need to be supported on a sustained basis.

v. Insistence of payment of cash-contribution in advance, prior to setting-up of a robust village institution, may give way to some kind of wrong practices that might hamper participatory processes in the subsequent stages of project implementation.

The actual implementation of EDP on Gir however, has made certain positive achievements such as:

i. Orientation and sensitization of the FD-staff towards participatory approaches

ii. Building-up of confidence between the people and the FD-staff.

iii. Increasing recognition of the need for transparency and accountability in PA-management.

iv. Evolution of innovative ideas for sharing of cost, responsibilities and weakening of the traditional power structure within the village communities.

v. Positive demonstration effect of the successful interventions into CPLR-development on a few cases.

It is hoped that some of these lessons could be incorporated into the management plan under preparation. It is encouraging that the management team is increasingly recognizing the need for a Regional Planning Approach for the PA-management (Singh and Pathak, 2000). This might pave way for exploring the new approaches that are inclusive rather than exclusive people, and thereby ensure better conservation by regenerating the PA-resources and sharing a part of that with the people.

The need however, is to take forward the idea of a `regional planning' through a series of dialogue with various stakeholders viz; FD-staff, funders, researchers and environmental groups, policy makers and above all, the people. This will not only help evolving a shared understanding on the issues and alternatives for PA-management among the various stakeholders, it will also (hopefully) break open new paths in the on-going discourse on the perspectives of PA-management. It is towards this larger goal, the foregoing analysis might be found useful.

Table 4.1. Income from Major Sources Among Sample Households

Sources of income	Average income Rs,/Year	Households by category (No.)					
		I.L (21)	I.S (41)	UI (40)	L.L (45)	Livestock owners (15)	All (162)
Agri. Labour	7426	1	6	14	27	11	59
Other labour	12563	6	2	13	13	1	35
Service	64090	-	2	3	6	1	12
Trading	15250	-	1	3	6	-	10
NTFCs	2514	-	-	3	4	-	7
Others	13617	-	-	2	9	1	12
Agriculture+ population	44273	21	41	40	-	1	103
Livestock	12728	17	33	25	12	15	102
All sources	47596	45	85	103	77	30	340

* Figures in parentheses indicate number of households in each category
Source: Primary survey

Table 4.2. Distribution of Households not Owning any Livestock (No.)

Category of Household	Kendipur	Madhupur	Govindpur	Dadali	All
Irrigated large	-	-	-	-	-
Irrigated small	-	-	-	-	-
Unirrigated	-	3	1	1	5 (12.5)
Landless	4	4	6	4	18 (40.0)
Livestock herders	-	-	-	-	-
All	4	7	7	5	23 (14.2)*

* If we consider households not having milch animals + bullock it works out to be 22 per cent of the total households
Source: Primary Survey.

Table 4.3. Land and Livestock in Sample Villages

Features	All	Kendipur	Madhupur	Govindpur	Dadly
Average landholding (for land owning HHs)	5.79	7.96	4.73	5.33	4.80
% area irrigated	47.25	47.90	63.70	39.60	38.70
Average number of livestock (All HHs)	1.98	1.6	2.5	1.8	2.1
Irrigated large	3.0	3.0	2.8	3.5	2.8
Irrigated small	1.89	1.45	1.5	1.7	2.9
Unirrigated	1.05	1.9	0.5	1.5	1.3
Landless	0.75	-	1.4	0.2	0.5
Herder community	6.33	3.0	10.7	4.2	4.2

Source: primary Survey.

Table 4.4(a). Distribution of Households Reporting Decline in Groundwater Table

Response	Kendipur	Madhupur	Govindpur	Dadly	All
Yes	39	30	38	35	142
No	2	1	1	1	5
Don't know	2	8	1	4	15
All	43	39	40	40	162

Source: Primary survey

Table 4.4(b). Distribution of Households Reporting Changes in Water Table (% of Households)

Water Table in Feet	Before Ten Years				At Present			
	<50	51-100	100-151	>151	51-100	101-300	301-500	>501
Kendipur	97	3	-	-	73*	-	-	-
Madhupur	86	11	3	-	69	31	-	-
Govindpur	63	30	5	2	48	30	12	-
Dadli	85	10	3	2	65	32	-	3
All	82	14	3	1	70	23	5	2

* 24% households reported <50 feet

Table 4.5. Farmers' Perceptions about Changes in the Cropping Pattern

Reasons for not changing the crop-mix	Kendipur	Madhupur	Govindpur	Dadly	All
Uncertainty of income	25	13	8	7	53
Increase in cost	11	-	2	-	13
Susceptible hence increase in cost	12	19	18	11	60
Get less fodder	2	-	4	11	17
Not suitable for soil or soil degradation	1	10	17	9	37
Other	3	6	4	10	23
All*	54	48	53	48	203

* Total no. of respondents are 102

Source: Primary Survey.

Table 4.6. Farmers' Responses for Adoption of Measures to Improve Efficient Use of Water

Measures	Kendipur	Madhupur	Govindpur	Dadly	All
Changing Crop mix	35	22	24	27	108
Less Use of water	37	35	34	22	128
Use of Drip Irrigation	21	19	27	17	84
Control of High Power Electric Motor	17	19	28	20	84
Water Storage and Management	40	39	38	38	155
Well recharging	16	15	12	29	72

Source: Primary survey

Table 4.7. Use of CPRs Among Sample Households

Use of CPRs	Kendipur	Madhupur	Govindpur	Dadly	All
Gaucher	37	9	21	34	101
Forest vidi	19	16	7	32	74
Check dams/pond	6	12	10	13	41
All	43	39	40	40	162

Source: primary Survey.

Based on multiple responses

Table 4.8. Preferences for Regeneration of Village Pastures/Forest Vidis

Reasons for preference	Preference for Treatment		
	Only fodder	Fodder + plantation	Only plantation
Increase in income from livestock	77	53	-
Increase in no. of livestock	74	53	-
Reduce pressure on PA	97	83	1
Reduce time and labour	13	34	1
Help in drought relief	63	53	1
Plantation not possible due to water scarcity	05	15	-
Suitable to soil	6	09	-
Income can help development of village	26	69	1
All responses*	361	369	4

* Based on multiple responses
Source: Primary Survey.

Table 4.9. Measures Required for Better Protection of and Reduced Pressure on PA

Measures	Relative ranking score
Collection and distribution of fodder from PA (Supply-management	71
Development of CPLRs and vidis	64
Fencing	45
Alternative sources of employment-income	63
Improvement in quality of livestock	35
Reduction in livestock population	50
Protection by village committees	29

Source: Primary Survey.

Table 4.10. People's Expectations from Management of Gir-PA

Expectations	Revenue villages %	FSs %	Neses %
Adequate employment + self-employment schemes	40	6	14
Access to fodder and fuel	22	38	22
Pasture development on degraded vidis	3	26	36
Measures of agricultural development	4	-	-
Allocation of land to landless	8	-	-
Settling down the issue of land lost of the PA	7	-	-
Distribution of gobar gas	12	-	-
Other amenities	4	30	28
All responses	100	100	100

Source: Primary Survey.

Chapter 5: Summary and Conclusions

The policy discourse on PA-management has come a long way from purely conservationist strategies to participatory approaches. In between these two there is a wide range of options that combine different elements of resource sharing, market regulation and privatization. Ideally, the choice of PA-management approach has to be in tune with the location specific situation-ecological, socio-economic-political and financial. Also, the choice is time specific; it may undergo changes along with the different stages of PA-management. Exploring options and evolving new approaches therefore are important aspects of policy formulation on PAs.

Gir-PA represents one of the successful cases of design and implementation of a management plan. This has been achieved through effective protection and habitat development practices. As a result, it has succeeded in reviving wildlife population, especially lion, up to a level, which is fairly close to its 'optimum size'. The next stage therefore, is to evolve sustainable strategies for regeneration and conservation of vegetation and bio-diversity. Given a large number of local stakeholders, sharing of the regenerated resources might help both conservation as well as people's participation in PA-management.

It is in this context the present study tried to examine the status of Gir-ecology, people's dependence, and alternative approaches that might be more relevant for the next phase of management in the PA. Valuation of economic and environmental services has special relevance in this process. The study focused on the three main objectives:

iv. Identification as well as Valuation of Economic and Environmental Services from the PA.

v. Assessment of the Dependence of Different Categories of Households within and out side the PA. And Estimation of Cost Under Alternative Management Practices especially, for Regeneration of Community Pastures, Wasteland, and Reserved/ Protected Forest.

vi. Drawing Implications for a Management Strategy, which Incorporates People's Stakes while Ensuring Ecological Sustainability of the PA.

The study is based on secondary as well as primary data collected from a sample of villages, neses and forest settlements in the region. Since Gir is one of the well-researched PAs, assessment of benefits and costs has been done mainly by using secondary data. This has been supplemented through primary data, which also captured people's perceptions on three important aspects viz; non-use benefits, expectations from the PA, and alternative management practices. Primary data have been collected through various methods such as houselisting, detailed survey of sample households, focus group discussions, informal interactions, and participant observations.

5.1 Major Findings

In what follows we present a summary of the major findings:

I. Status of the PA

- Spread over an area of 1412 sq. kms, Gir-PA is a source of various economic as well as ecological services.

- About 34 percent of the area is degraded or highly degraded due to climatic factors, human interference and slow or inadequate efforts for regeneration.

- Management interventions are constrained by financial resources especially, in absence of a well-developed tourism sector or other mechanisms for resource generation. The average expenditure of PA-management during 1995-96 to 2000-2001 was Rs. 868 lakh per year. Of the total budgetary provision, about 52 per cent is allocated for activities that are related to regeneration measures.

- Enhancing investment at this stage is crucial not only for its regeneration but, also for its effective protection in the long run.

- Being the last home of Asiatic Lion, the PA offers a significant value in terms of rarity. Projecting this, along with a sustainable management plan, may go a long way in mobilizing resources-locally, nationally, and globally.

II. Benefits and Costs of PA-Conservation

Monetary benefits in terms of selected economic services from PA is estimated to be Rs. 47, 705 lakhs per year. This is significantly higher as compared to the average allocation of Rs. 1,191 lakh per year under the management plan. Even if we compare the value of direct–use benefits, the estimates are fairly higher i.e. Rs. 9,669 lakh against the budgeted expenditure. A comparison of Benefits and Costs has been summarized as follows:

Summary Benefits and Costs (Rs. Lakh at 1995-96 Prices)

Value of Benefit		Value of Cost	
Details	Value	Details	Value
Direct Use	9669.14	Average Budget for Management per year	1191.40
Indirect Use	37883.00	Crop Damage	419.80
Opportunity Cost	39524.98	Loss of livestock	143.16
Loss of Crops to replace the fodder	2592.00		
Potential loss of fodder	1170.33		
Soil Loss	9793.25		

III. People's Dependence on PA

- Local stakeholders consist of a human population of 3-5,000 and livestock population of about 14,000 within the PA. The periphery consisting of 99 revenue villages has an estimated population of about 1,80,000 persons and 95,000 livestock.

- People within the PA have rights for grazing their livestock and depend entirely on PA for their livelihood. The total economic benefits accruing to Maldharis within PA amounts Rs 1,035 lakh per year and Rs. 2.87 lakh per household per year. Against this, the major cost incurred by the Maldharis is in terms of loss of livestock, which is estimated to be Rs. 112 lakh per year besides the difficulties arising due to lack of basic amenities like education, roads and electricity etc. While the present size of livestock inside the PA is well within the carrying capacity of about 22, 000, there are other costs due to human settlements within PA. These are infiltration of outside animals, faulty grazing practices, damaging the regeneration process, selling of FYMs

outside the PA, extraction of fuel wood for commercial purpose; and offering less productive livestock as easy prey, and thereby distorting the genetic characteristics of lions.

- More than 50 per cent of the households in peripheral villages access fodder from the PA. Similarly, a large proportion (i.e. about 80 percent) of the households obtain fuel wood from the PA-directly or indirectly from the markets. These constitute about 74 per cent of the total requirements for fuelwood in the peripheral region.

- There are no systematic estimates of fodder production nor about its requirement in the peripheral villages. Ascertaining the actual extraction of fodder by the people is difficult because it is illegal. However, assuming an average fodder yield at the national level, i.e. 3000 kgs/hectare, the surplus fodder (after meeting requirements of the livestock and herbivores within PA) can support about 21,000 adult milch cattle in the periphery. Another 19, 000 can be supported by the crop-residue. This still leaves a large number of adult milch cattle plus other small livestock, which need to be supported through regeneration of pastures within and in periphery of the PA.

- Since landless as well as small farmers without irrigation can hardly afford to keep milch animals, they tend to depend mainly on agriculture of the large-farmers with irrigation, and also on collection of MTFP+ fuel wood from the PA. Nevertheless, increased irrigation leads to depletion of ground water resources at the expense of soil-moisture and availability of water inside the PA. Reducing the use of irrigation for growing water intensive crops may result into stagnating/declining demand for labour on farms. But, this could be compensated by increased availability of fodder and MTFP from pastures possibly by applying irrigation within and outside the PA.

- Enhancing the livestock base among landless/small farmers without irrigation thus, needs to be preceded by a realistic assessment of livestock population in the periphery and carrying capacity of the PA. The reported livestock population of about 95,000 in 1991, appears to be an over estimation. With an average of 2- 2.5 livestock per household, the total population among

approximately 30,000 households in the periphery may work out to be around 60-75,000. The recent droughts in the late nineties might have further reduced the number closer to the lower end of the range i.e. around 55-60,000. A realistic estimate of livestock in the peripheral villages is therefore quite crucial for assessing the requirement as well as pressure on the PA.

- Against the various economic services, people in the periphery have to face several difficulties especially, for protecting the crops and livestock from wild life. While the actual incidence of crop damage is not very significant, the efforts and the risk involved in protection is fairly high.

- A large proportion of people recognize the present level of dependence on PA as non-sustainable. While they consider conservation as necessary, they don't endorse the present system of protection and restrictions, which in their opinion leads to corruption and over exploitation of the PA-resources.

- People's expectations from PA-management are availability of fodder through a regular supply system, limited grazing rights, fuel collection, and employment in PA-management activities. Settlement of the issues pertaining land-acquisition is also an important concern; absence of which leads to non-cooperation among a large number of villages having lost a part of the community pastures or private land to the PA.

IV. Alternative approaches for PA-Management

Given the need for regeneration of vegetation within and outside the PA, and the critical role of soil-moisture and water thereof, we have tried to explore alternative land + water use planning for the region. This is based on three basic principles: First, soil-water conservation assuming a top priority. Second, a more balanced allocation of water-resource within and outside the PA. And, third, using a part of regenerated resources from the PA as incentives to reduce the pressure by checking the haphazard and 'illegal' use of the forest-resources on the one hand, and over exploitation of ground water on the other.

We have identified alternative approaches for land-water use and the requisite resource sharing mechanism as well as other subsidies/support to compensate the

loss of income in the short/medium term. Subsequently implications of each of these alternatives have been mapped out for the three sets of stakeholders viz; farmers with irrigation, landless households and farmers without irrigation, and Maldharis. This, of course, is an indicative planning for regeneration, conservation and sharing of resources.

Since SWC is a resource intensive activity with a long gestation period of says 7-10 years, the initial investment has to be funded by external resources. Convincing funders (national or international) would require a realistic assessment of the impact of resource regeneration, and sharing a part of the regenerated resources with the local stakeholders, so as to mitigate the future loss in terms of continued pressure and degradation within the PA. Lessons from Eco-Development Project in Gir and other PA-sites should get integrated into the fresh planning. Some of the important suggestions for the next phase of the PA-management have been highlighted as follows:

Components	Costs	Benefits
SWC to be given a top priority	Average cost Rs.15-20000/ ha including the cost of water harvesting structures	Triggers a chain of improvement in terms of : Availability of soil-moisture Improved vegetation in PA Providing fodder +fuel through regulated operations Reduced illegal extraction and grazing Saving of the value of soil-loss Employment generation
Regenerating vidis with-in PA through additional inputs to be used as incentives to reduce irrigation and grazing	Average cost of Rs.10,000/ ha (including seedling, water, manure, labour)	Replenishing groundwater Reallocating water to CPLRs and vidis Reduced damage due to illegal grazing within PA
Regeneration of CPLRs in periphery	Fodder +plantation Rs. 35,000/Ha	Better employment +income to small farmers +landless Reduced dependence for fodder, fuel-wood, illegal felling Reduced risk of fire
Institutional arrange-ment for collection of fodder, fuel and NTFP	Involving a professional developmental agency to arrange supply and distri-bution at a reasonable price	Saving of cost of drought relief programmes Reduced impact of droughts Reduced pressure on PA Reduce conflicts with FD-staff and better cooperation

		Improved quality of livestock Reduced pressure of grazing Stopping of outside animals
Mobilisation funds	Loan from national govts. Grant from environmental groups and donor agencies Credit support to people	Evolving a mix of incentives through: Increased availability of resources, cost-sharing, and subsidies rather than subsidies and compensation alone

5.2 Policy Implications:

For PA-Managers and Policy Makers:

I. The PA-management in Gir has made significant achievements in terms of protection and habitat development. The next phase has to focus on vegetative regeneration over a vast tract of area within and out side the PA.

The regeneration plan however, needs to be prepared in accordance with the carrying capacity in terms of lion population. Given the fact the Gir had never sustained more than 300 lions, this should be treated as the carrying capacity, given the area of about 1400 sq. kms. In the event of expanding the lion population to 400 as envisaged by the proposed regional plan, the area and the vegetation will have to be further enhanced. This would require a detailed planning of the land use, land quality, livestock as well as human population, water use practices, and crop technology.

At present, vegetation within the PA is not able to sustain the existing population of herbivores, especially during droughts. As a result, herbivores continue to migrate out of the PA and try to damage the crops. On the other hand, people in the periphery also keep entering the PA for obtaining fodder and fuel, which leads to further degradation of pastures within the PA. Focusing on regeneration of vidis out side the PA alone may not work resolving the situation. For, this is administratively difficult owing to the problems of legal permission and encroachment.

The beginning therefore, should be made by regenerating the pastures as well as degraded forests within the PA and sharing a part of the additional fodder/fuel resources with the people in the periphery. If, a system of fodder supply is properly established and the protection measures are tightened, people will find it more beneficial to obtain fodder by paying a nominal price rather than continue with the

uncertainty of fodder availability from the degraded pastures. In turn, this could also induce the households to improve the quality of their livestock by simultaneously reducing the number. Regeneration of the forest vidis and setting up of a supply management system should thus, become a starting point for triggering a process of change in the PA-management. Once this happens it might also open up avenues for regeneration of pastures in the periphery because of the improved management of livestock and institutional arrangements for fodder supply.

Soil water conservation measures have to take a lead in this context, followed by a detailed water and land use planning. While the recent thinking on PA-management does emphasise the importance of watershed treatments, the efforts are somewhat limited. For instance the four dams on the major rivers within the PA have a capacity of catching only 10 per cent of the total run-off (Walker, 1994). This leaves a significant scope for managing water resources and thereby, checking soil erosion, which at present is considered as severe.

To a large extent, the limited efforts for watershed management could be attributed to paucity of funds for the PA-management. This has been reflected by the fact that the proportion of the budgetary funds spent on soil water conservation is only 3.85 per cent of the total expenditure as shown in (Table 2.11(b)). This ideally, could be supplemented by the other schemes for watershed development in the region. The proposed regional plan thus, aims at integrating various developmental programmes in the region. What is however, missing is placing all these efforts by considering the complete watersheds. If this is attempted, it will give a major impetus for regeneration of vegetation especially, pastures within and outside the PA. It appears that protection alone cannot help regeneration of pastures given the degraded status of soil-moisture and the frequent droughts in the region. In fact, the need is to break the vicious circle of low soil-moisture conservation, `low vegetation, continued pressure from the people, further degradation, and increased impact of droughts'.

This apart, improvement in watershed treatments will also facilitate availability of water for the wild life and thereby, reduce the incidence of conflicts with the people in the periphery. Increased availability of water and recharge of the ground water aquifers in turn, may also help the process of regeneration of pastures outside the PA as well. At present, regeneration efforts seem to be focusing mainly on protection

and re-plantation without ensuring water and other moisture retention practices such as mulching and manuring. All these would involve additional funds and management capacity. But, the direct benefits to the people could be employment and income, which might help reducing their pressure on the PA.

Recently, there has been some kind of a dilemma about the efforts for watershed management in the PA. It was felt that whereas these efforts led to increased vegetation they were responsible for reduced growth in lion population especially in the western part of the PA. This phenomenon needs a closer scrutiny before drawing conclusions about the cause and effect on habitat management. While it is true that certain kind of vegetation in certain proportions might not be suitable for the herbivores as well as lions, what is essential is to identify right kind of vegetation and its effective management rather than halting the process of vegetative regeneration. Incorporating people's stakes into this increased vegetation and working out appropriate systems for its sharing (with the people) might help meeting this objective. In that case, people's needs could be taken care of without significantly damaging the interest of the wild life, given its carrying capacity.

II. Eco-Development Project could help in promoting the watershed based development for community resources both- within and outside the PA. While the initial experiences have been somewhat less encouraging, important lessons could be learnt for its future implementation and sustenance in the long run. The need therefore, is to integrate the project with the rest of the activities for management of the PA. In turn, this would imply that regeneration of pastures within and out side the PA should be seen as contiguous resources forming parts of the same ecology. It is plausible that, efforts for regeneration of the pastures outside the PA might be much more effective if, these efforts are preceded by a system of fodder and fuel supply on a regular basis rather than only during the droughts.

III. To an extent, the issues of adequate funds especially, watershed management and regeneration of pastures thus, is contingent upon effective utilization of the EDP-fund for carrying out these activities on community resources. Since EDP has a built-in mechanism for mobilizing additional resources for maintenance

and future development of land and water resources by way of collecting contribution from the local communities, this alone, may not be sufficient for carrying out a complete watershed treatment for the major watersheds inside the PA. The above phenomenon has been reflected in the management plan prepared by Singh and Kamboj in 1995. According to the plan, it would take about 15 to 20 years before a large part of the degraded pastures could be regenerated. The actual time taken however could be even longer. Considering that the economic value of regeneration of pastures from the present low level of productivity to a potential level of say, 1500 to 3000 kg. per hectare in different parts of the PA, delaying the process of regeneration due to paucity of funds may have substantial economic loss. Besides this, ecological cost in terms of loss of bio-diversity, top soil, and other watershed functions is also significantly high.

IV. Given the substantial benefits received by Maldharis within the PA, the cost of compensation, based on the concept of opportunity cost to these households while shifting out of the PA, should also be very high. In this context, the present approach of shifting these Maldharis from the interior to the border of the PA appears fairly valid. Nevertheless, the Maldhari households inside the PA should not be deprived of some of the basic amenities like housing, electricity, schools, dispensary, transport etc. Against these facilities, the households should be made to share at least a part of the FYM for regeneration of the forest.

Special schemes should be prepared to actually rehabilitate the Maldharis already shifted out, by improving the quality of land (+ irrigation) and livestock. In fact, resettlement process undertaken during the early nineties were quite inadequate. As a result, most of these households could not be actually rehabilitated out side the PA. The result is twofold: (a) continued pressure on the PA; and (b) immerisation of these households, which still form a part of the Gir-ecology. Hence, the cost of effective rehabilitation of these Maldharis should be in tune with the value of the economic services that the households within the PA are using. This works out to be about 2.87 lakh per household per year. Against this, the cost of the resettlement

package (at 1994-95 prices) would have been in the range of 2-3 lakh, which is only a one-time expenditure. Essentially, this would imply putting-in additional resources on the pastures as well as the crop land given to the Maldhari households as a part of the compensation package.

For Local Institutions:

V. Awareness generation is an important aspect of the strategy for PA-management. At present the efforts are focused mainly on educational institutions and, to a limited extent on the tourists. Development of eco-tourism is difficult because of the high infiltration i.e. about 1,50,000 persons visiting the temples every year within the PA. Since people perceive that a large part of the importance attached to the temples is derived out of the greenery and natural beauty of the PA, there is a potential scope for linking up pilgrimage with conservation efforts. This could possibly, be done by involving some environmentally conscious leaders/organizations with substantial influence on people's perceptions and cultural values. It seems some efforts were already made in this direction. Also there is a scope to revive certain existing value systems for conservation. These need to be linked up with the various initiatives for regeneration of pastures within and out side the PA. It may however, be recognized that the official management team alone cannot do this. The leadership has to come from a large number of organizations- educational, developmental, cultural etc. Evolving a broad based institutional network for management and conservation of Gir might pay significant dividends especially, if the proposed development of the home range of lion is to be effectively materialized. This of course, would require sharing of information, and informed debates among various stakeholders in the region. Eco-development committees, might potentially, perform this role.

For Researchers:

VI. The above suggestions, in turn, lead to certain implications for research and information system. The most important gap, as noted in the analysis pertains to important indicators like vegetation as well as productivity and changes

therein over time; habitat management and reasons as well as frequency of movement of different wild life out side the PA; status, present use, and scope for regeneration of CPLRs; and finally, the carrying capacity, the actual population of people and livestock within as well as outside the PA, and their dependence on the forest-resources. In absence of these basic information, it is difficult to work out a management plan which could improve the ecology and also help supporting a part of the livelihood needs of the people on a sustainable basis. This kind of fine-tuning of the existing thinking on the PA-management might need reconsidering some of the provisions of the existing legal framework. A more interactive process of identification of the objectives, problems and possible solutions thereof might go a long way in modifying the management approach without losing the focus on the core wild life specie i.e. Lions of Gir.

Together the above discussion on policy implications suggest that the need is to shift away from a purely conservationist approach to a more pragmatic approach whereby people's 'needs' are taken care of in an appropriate manner. This would call for a proper incentive structure and a mechanism for sharing of resources at a `reasonable price' rather than being fully subsidized. This may also help improving the effectiveness of Eco-Development Project, which needs to be closely integrated with the overall management for the PA plan

References

Barth, F. 1976, “Socio-economic changes and social problems in pastoral lands: Ssome concrete factors.” Background paper No. 6. In: Proceedings of IUCN Ecological Guidelines for the Use of Natural Resources in Middle East and South West Asia. Persepolis, Iran, 24-30 May, 1975.

Barzetti, V. (Ed.). 1993, “ Parks and Progress: Protected Areas and Economic Development in Latin America and Caribbean.” IUCN- The World Conservation Union, Washington, D. C., USA.

Berwick, M. 1996, “The ecology of maldhari grazier in Gir forest, India.” In: Proceeding of the Centenary Seminar of Bombay Natural History Society, Daniel J. C. and Serrao, J. S. Eds. Oxford University Press, Bombay.

Berwick, S. H. 1976. “The Gir Forest: An endangered ecosystem.” American Scientist 64: 31-40.

Bigalke, R. C. 2000, “ Functional relationships between parks and agriculture areas in south Africa and Nambia.” In: Prins, H. H. T., Grootenhuis, J. G. and Dolan, T. T. (Eds.) “Conservation of Wildlife by Sustainable Use.” Kluwer Academic Publishers, London. Pp. 169-202.

Bingham, G., Bishop, R., Brody, M, Bromley, D., Clark, E., Cooper, W. Costanza, R., Hale, T., Hayden, G., Kellert, S., Norgaard, R., Norton, R., Payne, J., Russell, C. and Suter, G. 1995, “Issues in ecosystem valuation: Improving information for decision making.” Ecological Economics. 14:73-90.

Chavan, S. A. 1993, “Vegetational and wildlife studies in Gir forest.” Ph. D. thesis. The M. S. University of Baroda, Baroda, India.

Chopra, K. 1998, “Shared management of protected areas: possibilities and constraints in Keoladeo National Park, Bharatpur.”

Chopra, K. and Gulati, S. C. 1998, “Environmental degradation, property rights and population movements, hypothesis and evidences from Rajasthan.” Environment and Development Economic 3: 35-57.

Chopra, K. and Gulati, S. C. 2001, “Migration, Common Property Resources and Environmental Degradation: Interlinkages in India’s Arid and Semi-arid Regions.” Sage Publications, New Delhi.

Chopra, K. Population Movements, Environmental degradation and institutional changes: A study in western India. In:

Choudhary, K. 2000, “Development Dilemma: Resettlement of Gir Maldharis.” Economic and Political Weekly, July 22, 2000: 2662-2668.

Chudasama, A., Singh, A. and Singh, M. 1998, “Crop damage by wild ungulates in and around Gir.” Research Review Seminar, Sasan Gir, Gujarat.

Conway, G. R. and Pretty, J. N. 1991, “Unwelcome Harvest: Agriculture and Pollution, Earthscan, London.

Costanza, R., Perrings, C. and Cleveland, C. (eds.) 1997, “The Development of Ecological Economics. Cheltenham, Edward Elgar.

Dave, A and Awasthi, B. (1982), “Pashupalan, Shri Bhartiya Krushi Vikash Parishad”, Baroda.

Debnath, D., Hasan, S. M. and Rishi, P. 2001, “Assessment of people’s attitudes towards park resources and park management: a study of Gir National Park.” Indian Institute of Forest Management, Bhopal, India.

Directorate of Census 1971. “District Census Handbook 1971.” Govt. of India. New Delhi.

Directorate of Census 1991. “District Census Handbook 1991. Govt. of India.” New Delhi.

Directorate of Evaluation , “Evaluation study on the rehabilitation programme of Gir Maldhries.” Directorate of Evoluation, Government of Gujarat, Gandhinagar.

Dixon, J. A. and Sherman, P. B. 1991, “Economics of Protected areas.” Ambio. 20(2): 68-74.

GEC 2001. Land degradation database. https//:www.gec.gov.in.

Gichochi, H. 2000, " Functional relationships between parks and agriculture areas in East Africa." In: Prins, H. H. T., Grootenhuis, J. G. and Dolan, T. T. (Eds.) "Conservation of Wildlife by Sustainable Use." Kluwer Academic Publishers, London. Pp. 141-168.

Haight, R. G. 1995. "Comparing extinction risk and economic cost in wildlife conservation planning." Ecological Applications 5 (3): 767-775.

Haq, S. 1997, "Identify and assess the wildlife damage problems in Gir Conservation Unit (GCU) and suggest mitigation." Management term paper presentation, Gir Conservation Unit (GCU). 21, March, 1997.

Haripriya, G. S. 2000. "Estimates of Biomass in Indian Forests." Biomass and Bioenergy 19: 245-258.

Hirway, I, Patel, M. and Pathak, N. 1999. "Integrated Environmental and Economic accounting: the case of Gujarat- phase-1, Center for Development Alternatives (CFDA), Ahmedabad.

Joslin, P. 1973, "The Asiatic lion: A study of ecology and behaviour. Ph. D. thesis, University of Edinburgh, Edinburgh, U. K.

Karim, A. 1990. "Study on biogas and Gir periphery program of AKRSP (I)." Aga Khan Rural Support Program, Ahmedabad.

Khan, J. A., Rodgeres, A. J. T., Johnsingh and Mathur, P. K. 1990. "Gir Lion Project: Ungulate habitat ecology in Gir. Project Report. Wildlife Institute of India, Dehradun.

Kothari, A., Pathak, N. and Vania, F. 2000, "Where Communities Care: Community-based Wildlife and Ecosystem Management in South Asia." Kalpavriksh and International Institute of Environment and Development, Pune, India.

Kothari, R. 1995, "Perspectives on decentralization." Vikalp, 4 (2):

Kumar, P. 2001, "Estimation and economic evaluation of soil erosion: A case study of Doon valley in India." Discussion paper No. 23/2001. Institute of Economic Growth, Delhi, India.

Kurothe, R. S., Batta, R. K. and Sharma, J. P. 1997. “Soil erosion map of Gujarat.” Indian J. Soil Cons. 25 (1): 9-13.

Mahida, C and Shrimali, A. 1996. “*Gir na Maldhari Vipadao na Vanmaq*.” Setu, Ahmedabad.

Marothia, D. K. 1998, “Shared management in non-timber forest resources.” Paper presented in the International Workshop on Shared Resources Management in South Asia- The Next Step. Institute of Rural Management, Anand, India. February 17-19, 1998.

Meena, R. L., Kamboj, R. D. and Singh, M. 1997, “The Gir.” Gir Welfare Fund, Wildlife Division, Sasan-Gir, India.

Meena, R. L., Kamboj, R. D. and Singh, M. 1998. “The Gir” Gir Welfare Fund, Wildlife Division, Sasan Gir.

Munasinghe, M. and McNeely, J. 1997, “Protected area economics and policy: Linking conservation and sustainable development.” Word Conservation Union (IUCN) and The World Bank Washington DC. pp. 20-39.

O'Niell, J. 1997, “ Managing without prices: The monetary value of biodiversity.” Ambio; 26(8): 546-550.

Pandya, H. R., Shiyani, R. L. and Dhruj, I. U. 2001, “Quantification of environmental and economic benefits of conserving Gir ecosystem.” Gujarat Agricultural University, Junagadh Campus, S. K. Nagar.

Panwar, H. S. 1984, In: Berwick and Saharia (Eds). Wildlife Conservation in Southeast Asia, New Delhi.

Panwar, H. S. 1985, “Protected areas and people: The Indian approach. Conserving Asian Natural Heritage.” In: Proceedings of 25 th Working Session of Corbett National Park. Feb. 4-8, 1985. Commission for National Parks and Protected Areas, IUCN_ The World Consevation Union, Gland, Switzerland.

Parker, I. S. C. 1983, “Conservation, realism and the future.” In: Owen_Smith, R. N. (Ed.), Management of Large Mammmals in African Conservation Areas. Pretoria Haum. Pp. 281-290.

Pearce, D. and Moran, D. 1994, “The Economic Value of Biodiversity.” Earthscan Publications. London.

Pearce, D. W. and Markandya, A. 1989, “Environmental Policy Benefits: Monetary Valuation. OECD, Paris.

Pearce, D. W. and Turner, K. 1990, “Economics of Natural Resources and the Environment.” New York: Harvester Wheatsheaf.

Perrings, C. 2000, “Modelling sustainable ecological economic development, “Chopra, K., Perrings, C. Rao, U. R., Parikh, K. and Hanumantha Rao, C. H. Eds., Indian Society for Ecological Economics, Delhi.

Petry, F. 1990, “Who is afraid of choices A proposal for Multi-Criteria Analysis as a tool for decision-making support in development planning.” Journal of International Development 2: 209-231.

Pimbert, M. P. and Pretty, J. N. 1995, “Parks, people and professionals: putting participation into protected area management.” International Institute for Environment and Development, Discussion paper No. 57. pp. 1-60.

Pretty, J. N. 1995, “Regenerating Agriculture: Policies and Practices for Sustainability and Self-Reliance, Earthscan, London.

Prins, H. H. T., Grootenhuis, J. G. and Dolan, T. T. (Eds.) 2000, “Conservation of Wildlife by Sustainable Use.” Kluwer Academic Publishers, London.

Ramachandran, A. V., Mankodi, P. C. and Vachhrajani, K. D. 2001, “Assessment of water quality in major streams and rivers in Gir protected area and siltation rate in four reservoirs. The M. S. University of Baroda, Baroda, India.

Randall, A. 1991, “Total and non-use values.” In: Braden, J. B and Kolstad, C. D. (eds.), Measuring Demand for Environmental Quality. New York: Elsevier.

Reddy, B. S., Parikh, J. K. and Reddy, B. S. 1996, “Frame work for economic, social and natural resource accounting for land regeneration.” In: “Background Papers of the National Seminar on Utilisation of Common Property Land Resources Through Cooperatives: A Step Towards Sustainable Deveopment.” Capacity 21 Project_UNDP, Indira Gandhi Institute of Development Research, Mubai, India.

Rohinivijh 1992. “Study of socio economic impact on head loaders of biogas and forest protection programmes and alternative income generation for them in Junagadh Gir Forest. Final Report, Organisational Training, Institute of Forest Management, Bhopal.

Shah et al. 1985. “Nutrient Status in Gujarat.” Gujarat State Fertilizer Corporation Ltd., Vadodara, Gujarat.

Shah, Amita 2001. “Water scarcity induced migration: can watershed project help?” Economic and Politically Weekly 36 (35): 3405-3410.

Sharma, D. 1995. “Ecology and management of lion and ungulate habitats in Gir.” Ph. D. Thesis, Suarastra University, Rajkot, Gujarat, India.

Sharma, J. P., Shyampura, R. L. and Sehgal, J. 1994. “Soils of Gujarat for optimizing land use”. NBSS publ. 29b (Soils of India series). National Bureau of Soil Survey and Land use planning, Nagpur, India.

Shiyani, R. L., Singh, M., Pandya, H. R. and Dhruj, I. V. 2000. “Conflicting issues and management options for conservation of Gir Protected Areas. Indian J. Agric. Econ. 55 (3): 447.

Singh, H. S. 1997, “Gir lion- present scenario and future conservation strategy. In: India Ecodevelopment Project Workshop: Regional Planning for Conservation and Development of Gir Conservation Area held at IIM, Ahmedabad, 7-9 Nov., 2000. pp. 52-61.

Singh, H. S. and Kamboj, R. D. 1995, “Biodiversity Conservation Plan: A Management Plan for Gir National Park and Sanctuary, Forest Department, Government of Gujarat, India.

Singh, M. 1995, “Issues for integrated Management Plan for Gir.

Singh, M. and Pathak, J. 2000. “Ecodevelopment in Gir- initiative and future.” In: India Ecodevelopment Project Workshop: Regional Planning for Conservation and Development of Gir Conservation Area held at IIM, Ahmedabad, 7-9 Nov., 2000. pp. 62-78.

Sinha, S. K. 1967, “A draft scheme for settlement of Maldharis in the Gir Forest Division. Unpublished report.

Sinha, S. P. 2001. “Recommendations on the man-animal conflict around Gir Protected Area” Submitted to Gujarat Forest Department, Junagadh.

Tewari, D. N. 1994. “Tropical Forest Produce. International Book Distributors,” Dehradun, India.

The World Bank 1996, “Inda Ecodevelopment Project.” Global Environment Facility, Project Document.

Tidsell, C. 1994, “Conservation, protected areas, and the global economic system: how debt, trade, exchange rates, inflation, and macroeconomic policy affect biological diversity. In: Munasinghe, M. and McNeely, J., Protected area economics and policy: Linking conservation and sustainable development. Word Conservation Union (IUCN) and The World Bank Washington DC.

UNEP. 1995, “Global Biodiversity Assessment.” Cambridge University Press. Cambridge.

Utting, P. 1993, “Trees, People and Power: Social Dimensions of Deforestation and Forest Protection in Central America. Earthscan, London.

Walker, S. 1994. “Executive summary of Asiatic lion PHVA. First draft report.” Zoo’s Print Jan/Feb: 2-22 (Coimbatore, India).