EERC

ENVIRONMENTAL ECONOMICS RESEARCH COMMITTEE

Theme: Wetlands and Biodiversity
EERC Working Paper Series: WB-4

Economics of Protected Area: A Case Study of Pench National Park

Anjali Kulkarni and V M Vaidya

Nagpur University, Nagpur

Mrunalini Phadanavis

Mahila Mahavidyalaya, Nagpur

MOEF IGIDR WORLD BANK

ECONOMICS OF PROTECTED AREA – A CASE STUDY OF PENCH NATIONAL PARK

FINAL REPORT

SPONSORED BY

INDIRA GANDHI INSTITUTE FOR DEVELOPMENT AND RESEARCH (MUMBAI)

UNDER WORLD BANK CAPACITY BUILDING PROGRAMME

Principal Investigator
Dr. A. P. Kulkarni
Head,
Department of Economics
Nagpur University, Nagpur

Co- Investigators

Dr. V. M. Vaidya
Retired Professor and Head
Department of Economics
Nagpur University, Nagpur

Dr. Mrunalini Phadanavis
Head,
Department of Economics
Mahila Mahavidyalya
Nandanvan, Nagpur

Research Team

Mr. Sarang Bhakre
Mr. Babarao

Mr. Prashant Tambe
Mr. Milind Narnaware

P. G. T. D. Of Economics, Nagpur University Campus, Nagpur, 2002

PREFACE

Sustainable economic development and environmental protection are the key aspects of modern economic development. Importance of biodiversity conservation through environmental protection and policy of creating protected areas has received worldwide attention as manifested in various conventions on bio-diversity. Bio-diversity conservation has not only ethical and aesthetic implications but also have various economic and social dimensions. These concerns are being increasingly reflected at National and International levels through research and policy programmes as well as related activities undertaken by NGO's.

The present study endeavours to estimate the benefits and cost of P.A. of Pench National Park (PNP) located in central India. This study focuses on rational for creation of protected areas and its direct as well as indirect benefits and costs. It is also an exercise in research methodology where internationally accepted methods like IFRI, TCM etc. have been used for estimation of costs and benefits of PNP.

This project has been awarded by IGIDR (Mumbai) under The World Bank Capacity Building Programme. Hon. Chairperson Prof. Jyoti Parikh deserves sincere thank for her valuable feedback at various stages of the project. Our sincere thank also due to Dr. Sudarshan Iyangar who was a guiding sprit behind this work. Dr. Raghu Ram Tata from IGIDR also helped from time to time in the completing this project.

The authors acknowledges the facilities extended by the Nagpur University and are grateful to the Hon. Vice-chancellor Dr. A. S. Satputaley, Registrar Mr. S. T. Belsare, Finance Officer Mr. W. S. Kalode and Deputy Registrar (Development) Mr. Puran Meshram and his staff.

Our special thanks are due to Shri Ram Indurkar Retd. CCF wildlife, Shri Muzumdar CCF wildlife, Shri Bhagawan, CF wildlife, Shri Chowdhari Deputy CF Wild Life. We are highly indebted to them for their valuable guidance and providing vital information regarding Pench Tiger Project. Deputy C. F. Wildlife, Dr. Jafri, Director Forest Survey of India Nagpur, also deserves special thanks for his willing cooperation and providing valuable information about Pench National Park- Shri. A. R. Khan Dy. Conservator of Forest Research Wing, and Shri B. S. Giri R.F.O. extensively helped during entire project work. We fall short of suitable words to express our deep sense of gratitude for their valuable help. Dr. S. Dwivedi from

Maharashtra Fisheries Development Corporation also willingly extended his help for providing statistical data.

'SHODH' the research institute, deserves special thanks for offering consultancy services. The secretary of the institute Dr. Rucha Ghate offered her constructive comments which helped to enrich the quality of work.

Our colleagues in the department have been very co-operative in extending all possible help in completion of this project. Dr. Mahore, Dr. Deshpande, Dr. Ghate, deserve sincere thanks for their valuable comments on the research methodology of the project.

The research team of the project, Mr. Sarang Bhakre, Mr Milind Narnaware, Mr. Bhushan Lanjewar and Mr. Prashant Tambe spared no pains in bringing this project to the final stage. They need special thanks from us.

The non-teaching staff of the department had been very co-operative in extending their helps at various stages on the project.

One debt we have to acknowledge, which runs all through this efforts, is that to our family members, who were compelled to bear inconvenience because of our non availability at home and providing us a moral support in completion of the work. They were also a constant source of inspiration to us.

Anjali Kulkarni

Vijay Vaidya

Mrinalini Fadnavis

CHAPTER I

1.1 Prologue

Protected Areas have received a special attention from the cross section of the population for their unique role in biodiversity conservation. Increasingly more geographical areas are being reserved for conservation of natural resources and biodiversity. Bio-diversity represents the very foundation of human existence and a rich source of resources. The loss of biological diversity is causing a major concern all over the world. However, population explosion and changing character of human wants are eroding this very essential capital at an alarming rate. Today, the biological wealth is threatened by an overexploitation of natural resources, resulting in devastation of habitat and ecosystem. In this situational matrix, conservation of biodiversity has rightfully received an impetus in the form of coming into force the Convention on Biodiversity in December 1992.

The current debate is centered around demonstrating the economic values of biological resources in the contexts where the values are often not reflected in market process. There is also a need to explain why despite those economic values, biodiversity continues to be threatened. The debate is also concerned about the ways to capture or realize economic value.

1.2 Private & Social Costs of Biodiversity Use:

Private costs and benefits refer to those losses or gains as perceived by the immediate user of the environment: the farmer, the industrialist, the consumer. Social costs and benefits refer to the losses and gains that accrue to the society as a whole. Social and private interest often do not coincide. What is good for one as an individual, may impose costs on the rest of the society (externalities). Sometimes what is good for the world as a whole is also good for a person as an individual. But no institution exists to capture the “global value”.

1.3 Biodiversity & Market:

The need to declare certain areas as protected areas arises out of the need to conserve valuable natural resources or to prevent loss of biodiversity. Since markets may fail to reflect the benefits and costs of protected area, the need arises to highlight the issues associated with creation of Protected Areas- National Parks or Tiger Projects.

1.4 THE PRESENT STUDY:

The present study has been undertaken to focus the benefits as well as costs and other issues related to Pench National Park (PNP) arising from the conservation of its rich natural resources. PNP is considered as a custodian of the valuable flora and fauna, which is representative of this region.

'It is argued that creation of network of national parks or Tiger Project is a transition from Anthropocentric (human centered) to bio-centric (human as only one element in the ecosystem) philosophy'. Emerging from this philosophy are some radical conclusions drawn by the deep ecologists that intervention in nature should be guided primarily by the need to preserve biotic integrity rather than need of humans.[i]

It is also argued that the Project Tiger, hailed by the International Conservation Community as an example of outstanding success, sharply protects the interests of the tiger against those of the poor peasants living in and around the reserves. This exclusive concept of management of PAs does not take into account the livelihood implications of wild-lands/life preservation. Until recently wild-land/life preservation has been identified with environmentalism by the state and conservation elite. As a result of which the problems which impinge far more directly on the lives of poor-fuel, fodder, soil erosion, air and water pollution have not been adequately addressed.

1.5 Forest of Pench:

Pench in Maharashtra was declared as 25th Tiger Project in 1999. It is a magnificent forest and it boasts a healthy population of predators and prey. Previously in 1975, it was declared as a protected area entitled 'Pench National Park'. Years of protection have paid off and ultimately it was included in the Network of Project Tiger. Project Tiger is committed to the philosophy of total habitat protection, with management practices restricted to reamelioration of the land and selective repair of damage caused by past biotic interference.

The Pench Tiger Reserve (blessed with National Park Status of 257.26 sq. km.) derived its name from the river Pench that flows through the reserve in a north-south direction. It is about 67 Km from Nagpur by road on Nagpur Jabalpur National Highway No. 7.

The rich diversity of flora and fauna has already found it a deserving place in literature dating as far back as 17th century. The track has been mentioned by several famous naturalists like Captain J Forsythas the high lands of Central India, A.A. D. Brander Wild Animals in Central India and even the famous Rudyard Kipling, author of 'The Jungle book'. An exceedingly vital ecological zone, Pench is fortunate to be blessed with contiguous forests extending east, north and southwards.

The general physiognomy and floristic of the tiger reserve are indicative of two main types of forests- southern tropical dry deciduous teak, and southern tropical mixed deciduous forests. There are, of course, numerous other co-dominants and associates of teak, along with many other species of trees, shrubs and climbers. There is also a great variety of herbs and palatable grasses for the wild ungulates to subsist on. The park supports a high density of mammalian prey-species such as chital, Nilgai, Wild pig and Languor. Tiger scats and tracks are found plenty but sightings are always a matter of luck.

As with most natural forests, Pench is bird watcher's paradise. There are over 175 species listed from within the reserve and surely more await. Bulbul, tailor birds etc.

1.6 GEOLOGY ROCK & SOIL

1.6.1 GEOLOGY: The area falls in North West fringe of Sausar-meta Sedimentary belt of Central India with intensely folded and faulted structurally disturbed rocks.

1.6.2 ROCK: Metamorphic rocks of archaen age. They are comprised of schist's, gneisses, marble and quartzite. Rocks are with deep and sleep cut across the river and are folded into major syncline and Anticline with mansar formation at core of syncline and Kadbikheda member at the core of anticline. Granulites and marble bands repeated due to folding.

1.6.2 SOIL: The metamorphic rocks from sandy loose soil with patches of lateritic soil at places. Soil is well suited for teak and miscellaneous trees growth.

1 Sandy Loam: The soil derived from the weathering of granitic gneisses and biotic gneisses is dark brown loamy soil. Most of the area inside the park is covered with this type of soil. These soil are fairly fertile on gentle slopes & very fertile in deep valleys.

2 Red Soil: Some parts have red soil derived from rapid disintegration of the present rocks due to excessive folding and faulting with steep dips.

3 Kankar and saline soil: In some areas kankar and saline soils are found. These can be seen in compartment 568, 567 etc. Obviously these areas generally with sparse growth.

4 Alluvial soil: The Alluvium is confined to the banks of major streams and Pench river. Alluvial soil consists mostly of the siliceous debris, washed down from the nearest hills, mixed with humus. Alluvium derived from the trap rocks in the upper reaches of Pench river is deposited by the river in a narrow belt along its bank. Due to steep gradient of the river, no sand deposits and also mollusks are seen.

Soil and vegetation are mutually dependent on each other. The soil influences growth of vegetation which in turn enriches the soil.

1.6.3 TERRAIN: The Park is located in the southern lower reaches of the Satpura hill ranges, which form the catchment for river Pench National Park. The Pench river flows almost through the centre of the Park in North-South direction. The folding and upheavals in the past resulted in formation of a series of hills and valleys.

In West Pench range areas the land from river Pench gradually rises towards west forming a plateau between Lamandoh to Gawalioghat. After gradually sloping down towards Narhar, the land again rises forming a series of undulating hills. Again the land rises and continues as highly undulating plateau upto Totladoh. Most of the low lying lands on eastern side of river Pench have come under submergence area of the Pench Hydro Electric Project.

Terrain of whole of the West Pench National Park range area has a slope on eastern side to form a major watershed for the Pench river. Whereas, nearly half of the East Pench range along North – south line slopes towards Pench river to West while the eastern fringes of the Park has slopes towards east.

The highest peak in East Pench is located in compartment no. 525 with a height of 583 m. while that on the West Pench side is located in compartment no.685 with a height of 574 m.

A marked species preference towards certain topography is observed in that, herbivores like Sambar prefer hilly, undulating terrain with valleys while Chital and Gaurs prefer moderate undulating terrain with gentle slope, through Chital has preference for flatter areas. Nilgai and four horned antelope also seem to prefer flatter areas.

The hilly and undulating terrain of the Park poses various problems in its management. Due to steep slopes and resulting flash floods, cross drainage works and roads are washed away. Roads are in need of frequent repairs. This in turn adversely affects the communication and thus the protection aspect.

Effective fire control is hampered as remote to be made accessible by climbing up & down the hills. The fire is deliberately lighted on scattered hilltops, which then soon advances downwards to join and cover a large area.

In drains and steams, water does not remain for long and building a series of closely spaced check dams becomes essential. Soil erosion in the form of rill and gully erosion on slopes and sheet erosion in plains is also enhanced.

1.6.4 HABITAT[ii]: Sufficient data regarding the various habitats one comes across in the P.A. and its classification is not available at present for proper prescriptions. However, the area can be broadly classified as under.

1.6.4.1 CLASSIFICATION OF HABITAT:

Actual delineation of the various habitat types and covers has not so far been done to prepare distinctive cover maps. Similarly, help from aerial photographs or satellite imagery has not been taken. Nevertheless based on the field observations in relation to various plant assemblages, crop density and other features, habitats of the conservation unit have been roughly classified as follows:

1 Very dense forest with good ground cover

2 Moderately open forest with good ground

3 Cover

4 Sparse forest with ground cover

5 Open forest with weed cover

6 Meadows

7 Riparian habitat

8 Aquatic habitat

1.7 Importance Of Pench National Park

The Pench National Park contributes significantly to such tangible and intangible benefits to the mankind which have local to global values. It has such potential values so as to perceive the real worth of this beautiful treasure house of nature which must be protected as a part of our national heritage.

1 **Ecological Values:** The National Park, in its Biogeographic Location is a true representative of the Central Highland which comes under the Deccan Peninsula. The bio geographic subdivision or region which it represents is Satpuda Maikal division.

2 **Faunal Value:** Pench National Park is so rich in its faunal representation that most of the wild animals which identity with this area, have taken shelter here. It is home of many endangered species including tiger. The Pench National Park is the abode of innumerable invertebrates including insects. A significant diversity of butterflies, moths, beetles, spiders etc. also exist here. A lot of nature's treasure is hidden in the PA which still needs to be explored to its hilt to become aware of the faunal richness of this area.

3 **Floral Value:** The Pench National Park is very rich in floral diversity pertaining to this area. The forest type is "Southern Tropical Dry Deciduous Forest" and is grouped as $5Ac_3$ under revised classification of the forest by Champion and Seth. The diverse vegetation type ranges from such climax forests as Dry Teak forest and Southern dry deciduous mixed forests to edaphic type as Boswellia forest, Mowai forest, Garari forest and primary stages like dry tropical Riparian forests. The PA serves a living repository of various economical, medical, aromatic, ornamental plant species diversity.

4 **Value as a Conservation Unit:** The expanse of the forest of Pench National Pak is contiguous to the forest of Pench National Park, M.P. all along is northern boundary adjoining to Chhindwra and Seoni district of M.P. It provides an unfragmented habitat to the fauna thriving in this part of central part so as it form a "Maharashtra-Madhya Pradesh joint Conservation Unit".

5 **Value of Catchments Area:** The Pench River, which emerges from Mahdeo hills of Satpura range and the various nallas and streams which bear the forests of the PA act as excellent watershed area for the Totladoh as well as lower Pench reservoirs.

6 **Role in Irrigation Projects:** The network of root systems of the vegetation and geological formation functions as a sponge for conservation of moisture and also restrict the silt from being deposited in the Totladoh as well as Navegaon Khairy reservoirs. The PA thus plays a vital role in helping to maintain the life expectancy of these reservoirs.

The Totladoh reservoir located on northern boundary of the PA helps in generation of electricity for supply to both MP and Maharashtra and also in maintaining water level for the lower Pench reservoir located at Navegaon Khairy on the Southern boundary of the P.A. This reservoir helps in irrigation as well as supply of drinking water to Nagpur city. It also supplies water for electricity generation to Koradi and Khaparkheda thermal power stations. Therefore, the P.A. plays a significant role in being the "Life Line" of Nagpur city and other benefited areas by ensuring life expectancy of the reservoir and improvement of catchment capability.

1 **Value in employment generation:** All these contributions made by the PA in ensuring water supply to the related activities, industries etc. for a longer period has helped indirectly in generation of employment to a lot of people. Fishing activity in lower Pench also generates a major employment for the local people.

2 **Environmental Value:** Role of P.A. in maintaining vital environmental attributes is important. It acts as sponge for the population and other hazardous fumes, works as a storehouse of moisture. This way it acts as a "Green Lung" for the surrounding human settlement and helps in maintaining the environmental balance.

3 **Educational And Research Value:** Proximity of the P.A. to a metropolitan city Nagpur has resulted into a number of people visiting the park to seek solace from the hustle-bustle of city life into the serene tranquillity of the deep woods. The mainly day visitors through their preferred sites mostly on weekends and holidays. This is because the P.A. has tremendous recreational values in its hilly undulating terrain with gentle slopes and forest rich with activities of nature.

Recreation along with education and awareness about nature conservation is brought about by observing and interpreting the forest and wildlife.

1.8 Wildlife

In the following paragraphs a birds eyeview about the wildlife of the PNP is presented.

Range Of Wildlife[iii]

Pench national Park is quite diverse in its faunal and also floral wealth. This includes a number of endangered species. The faunal range is as given below in brief.

1 **Invertibrates:** The P.A. harbours a wide range of insects including beetles and species. Butterflies and moths belonging to a wide range also occur here. A host of Arachnids have taken shelter here. Appendix No. XV gives a list of Butterflies found in the Park. It includes Danaid egg fly which is a Schedule I (Part IV) species listed in Wildlife (Protection) Act, 1972.

2 **Mammals:** About 33 species of mammals are observed in the Park, a sizeable number of which are of endangered status, namely, Tiger, Panther, Jungle Cat, small Indian Cievet, Palm Civet, Jackal, Sloth bear, Ratel, Common Giant, Flying Squirrel, Gaur, Four horned antelope etc. List of mammals found in the National Park is given in Appendix XVI.

3 **Birds:** Diversity in the wealth of avifauna in the park is quite remarkable. Well over 164 species of birds belonging to 46 families of 16 different orders have been recorded here. These include some migratory and endangered birds including peafowl. See Appendix No. XVII.

4 **Reptiles:** The P.A. is abode of a number of reptiles out of which 6 species are of endangered status, namely, Indian Cobra, Indian Rock Python, Rat snake, Russel's viper, Checkered keelback and common Monitor Lizard.

5 **Amphibia:** A number of representatives of class amphibia are found in these forests.

6 **Fishes:** The Pench river, reservoir at Totladoh and lower Pench at Gavalighat and other water bodies shelter a variety of aquatic fauna in the shape of fresh water fishes a number of which are also hill stream fishes.

1.9 Research Methodology

Research methodology adopted to study the various aspects of the PNP is detailed out in the following paragraphs.

1.9.1 Short Run Objectives:

1 Identification of major stakeholders of Pench National Park.

2 Estimating the dependence of local communities in the proximity of PNP on forests of PNP.

3 Assessing the impact of existing resource use pattern as well as human activities on the status and vegetation composition of PNP.

4 Assessing the benefits of PNP to tourists, fishing and other related facilities.

5 Identifying the cost-direct as well as indirect- of PNP.

6 Preparing inventory of flora and fauna to represent biodiversity status of PNP.

1.9.2 Long Run Objective:

In the interest of 'sustainable development' and optimum use of natural resources, preparing a management plan of PA with focus on eco-tourism and eco-development.

1.9.3 Methods of Data Collection:

Data are collected at two levels (1) Village level and (2) Forest level.

The methods adopted to study the resource dependency of local communities involved following major steps:

1. Questionnaire Survey.
2. Personal Observations
3. Monitoring of entry points at village boundary.
4. Monitoring of selected households.
5. IFRI Method

Econometric Methods

6. Multiple Regression

7. TCM Method

8. Log Linear Method

1.9.4 HYPOTHESES:

Following hypotheses are tested in the course of study to examine the dependence on PNP.

1 There is a heavy dependence of local communities in and around PA on the forests of PNP

2 Dependence of local communities on the forest for biomass extraction has inverse relationship with the distance from PA boundary i.e. longer the distance from the PNP lesser is the dependence of the PNP and vice-versa..

3 Dependence of local communities is determined by their economic status or their ability to purchase alternative forest resources.

4 Extraction of biomass resources by local communities does not cause any adverse impact on the regenerative potential of the forest.

1.9.5 SAMPLING: For testing the above hypotheses census of Fulzari village was undertaken and stratified sample of surrounding villages has been drawn. Villages within 10 Kms., of PNP boundary have been first identified and stratified into three distance categories[iv]:

Criteria for stratification –

a) Villages within 0 to 3 Kms from the boundary of PNP

b) Villages within 3 to 5 Kms from the boundary of PNP

c) Villages within 5 to 10 Kms from the boundary of PNP

Criteria for dependence.

1) Income criteria or ability to purchase substitutes.

2) Accessibility criteria or access to forest resources

3) Fuel use criteria.

1.9.6 Methods Used For Quantification Of Dependence: The estimation of dependency on the PNP has been worked out for:

(a) Fodder Consumption

(b) Firewood Consumption

(a) Fodder Consumption: Quantification of fodder consumption by livestock owned by the sample households was done by monitoring the time period for which they grazed in the forest of PNP.

(b) Fuel Wood Consumption: Information is being collected through two methods:

1) Household surveys

2) Monitoring of consumption by giving pre-weighed quantity of wood.

3) Reports of the various committees for standardized consumption

Multiple Regression is carried out at three levels to study the dependency

a) For households of Fulzari village

b) For households of the sample village

c) For the all households of Fulzari and the sample villages.

It follows-

P_1 = f (ntfp, hunting, forest labour, fishing, livestock, P_2, qty number, firewool, firewood.)

P_2 = percentage of non-forest income.

IFRI- Internationally accepted IFRI method has been used to examine the impact of human intervention on status of bio-diversity in PNP.

TCM method with following functional form has been used to estimate the total cost of visiting the site-

Zjm /nj = F (Yi, TCjm + Pm, Xj, TCjk + Pk, Qm, Qk, NL, TS)

Log linear method has been used for the estimation of stocking and harvesting of fishes in and around PNP.

Section II

Review of Literature

Contribution to commons literature has travelled a long way since Olson's (1965) 'zero contribution thesis' through Hardin's (1968) 'tragedy of commons', to many scholars taking cognizance of voluntary associations that are creating and enforcing rules that protect natural resources. Literature published in last two decades provided ample evidence of this. Field research has established today that though temptation to free ride on the provision of collective benefit is a universal problem, self-organized resource governance too has survived in multiple generations (Ostrom, 1990). It is also found that when the users of a common-pool resource organize themselves to devise and enforce some of their own basic rules, they tend to manage local resources more suitably than when rules are externally imposed on them (Tang, 1992; Baland and Platteau, 1996; Wade, 1994).

Looking at the writings of many scholars, it is found that, three independent works that have come up with some 'requirements' that are critical to the sustainability of commons institutions, are those of Robert Wade, Elinor Ostrom, and Jean-Marie Baland & Jean-Philippe Plateau. After wide ranging discussions and considerations of many factors, each arrive at a summary set of conditions and conclusions that they believe to be critical to sustainability of commons institutions. Wade's ([1988], 1994) important work examines when it is that corporate institutions arise in villages and what accounts for their success in resolving common dilemmas, and it provides a set of reasons about successful management of commons. Small group size, clear boundaries, and ease in monitoring and enforcement are some of the conditions, according to him, which determine the effectiveness of rules. He has given, in all, 14 conditions, that are important for successful management of the commons.

After studying many cases of collective action all over the world, with the help of 14 case studies, Ostrom (1990) has designed 8 principles i.e. "essential elements or conditions that help to account for the success of these institutions in sustaining the CPRs and gaining the compliance of generation after generation of appropriators to the rules in use" (1990:90). These are: clearly defined boundaries, congruence,

collective-choice arrangements, monitoring, conflict-resolving mechanisms, minimal recognition of rights to organize, and nested enterprises. Later on, she further suggested attributes of the resource and attributes of the appropriators that are conducive to an increased likelihood that self-governing associations will form (Ostrom, 1999a). Attributes of the resource are: possibility of feasible improvement of the resource, availability of reliable and valid indicators of the condition of resource system, predictability, and sufficiently small spatial extent for the appropriators to have appropriate knowledge of external boundaries. Attributes of the appropriators are: salience of the resource, common understanding, low discount rate, trust and reciprocity, autonomy, and prior organizational experience and leadership.

Baland and Platteau, too, have reviewed large number of studies on commons. They suggest that the failure of CPRs in comparison to privatization "rests on the comparison between an idealized fully efficient private property system and the anarchical situation created by open access" (1996:175). They suggest incorporation of cultural and political factors into analysis to know when people cooperate, and when inverted opportunists dominate, and make collective action impossible. Small size of user group, location close to the resource, homogeneity among group members, effective enforcement mechanism, and past experience of cooperation are some factors necessary to achieve cooperation. Characteristics of the resource as substantive factor affecting effectiveness of institutions governing the commons too are varied. Volatility and unpredictability in the flow (Wade, 1988), mobility of resource (Naughton-Treves and Sanderson, 1995), stationarity and storage (Blomquist et al 1994) are some of the aspects in addition to the 'attribute of the resource' (Ostrom, 1999b) mentioned earlier. Role of technology, population pressures, property rights regimes, heterogeneity, are some of the many other variables studied by different scholars.

However, in the absence of a well-integrated and accepted theory of collective action in commons, substantial gap still exists in theoretical predictions, and the scholars of the commons themselves are now accepting this fact (Agrawal, Forthcoming). The literature on commons has only partially succeeded in answering questions like how aspects of the resource system, of user group, and

the external social, physical and institutional environment affect institutional durability and long term management at the local level.

On JFM

Joint forest management strategy can prove to be advantageous from all these aspects if practiced in the right spirit. The experience with JFM, however, has been different. Ostrom has also discussed the limits of self-organized resource governance systems: some appropriators will not organize; some self-organized efforts will fail; local tyrannies may prevail; stagnation may occur; access to scientific information may be limited; conflicts may arise; and appropriators may be unable to cope with larger-scale resources. Studies of various scholars and experiences of grassroots organizations have brought up several additional limitations specific to JFM. Some are discussed here.

The reasons for the government's shift from a centralized management system to decentralization in the form of participatory JFM have intrigued scholars ever since the inception of JFM. Thompson (1995) best summarizes the probable reasons: fiscal crisis, exacerbated by structural adjustment/economic liberalization policies; pressure from donor agencies for greater accountability and transparency; the recognition of the failure of past approaches by state agencies; and the demonstration effect of successful pilot efforts by non-government organizations or other government agencies in other sectors.

Environmental activists and the rural communities have been skeptical about the intentions of the government in sharing powers with the people, especially in the forest sector as it is one of the revenue-generating sectors. Their apprehensions are based on past experience as well as the inherent limitations of the provisions of the JFM scheme.

It is a well-established fact that measures designed to conserve biodiversity must provide economic incentives to increase the net local benefits from conservation and sustainable resource use. Such measures should be targeted to link biodiversity conservation with improvement in human welfare (McNeely et al, 1988). Earlier, in all the government forestation programs, participation of the rural poor was largely limited to wage employment. As users of forest products, the poor were seen as destroying forests through overuse and overgrazing. The forest-poverty

relationship was defined negatively—if people continue to be poor they will destroy forests. JFM talks about the positive role that forests can play in poverty alleviation and the role that people can play in forest protection.

The JFM strategy implies an increase in the collective ability of the communities adjacent to forests to manage, grow, and equitably share common resources. Yet there have been few efforts to involve people in the planning process or in establishing plan priorities. Rarely can the communities decide which species are to be taken up for plantation. There is no correlation between the amount of land that is brought under JFM and the amount of land required to meet the biotic requirements of people and livestock. The fact that village-level institutions might be better able to manage these commons is accepted. However, the fact that the management objectives of the locals may be very different and may not coincide with those of the state (Ligon and Narain, 1999) is totally neglected. While the JFM agreement talks about sharing long-term benefits from timber, the harvesting of non-timber forest produce and sharing its returns is not discussed. It thus remains hazy as to what the fate of the forests will be after they have been successfully regenerated (Arora & Khare, 1994). Another major limitation is that the important question of “tenure” that includes clear, secure, and exclusive rights of access to the resource is kept ambiguous in the JFM scheme (Lele and Rao, 1996).

The much-advertised idea behind JFM is to transform the age-old authoritative and policing role of the state forest department into that of a facilitator for the local communities. The JFM resolution assumes a symmetrical relationship between the government and the local institutions. Yet state governments and their forest departments still refrain from conceding legal status to FPCs, retain the right to dissolve FPCs, and appropriate a large share of forest produce (Pattnaik and Dutta, 1997). Although JFM is a shift from centralized management to decentralization, from revenue orientation to resource orientation, and from unilateral decision making to participatory decision making, the final decision regarding site selection and regulation of harvest is vested in state authority. JFM remains an institutionally challenging strategy as ownership of forest lands remains with the state while the communities are involved in its protection and regeneration. It is strongly felt that only because the governments found it difficult to monitor and manage the village forest commons directly, and enforcement was becoming expensive, the state

found it prudent to involve local communities in management (mainly protection). The participation envisaged in JFM is more in execution than in planning, “the structures more puppetish than autonomous” (Lele, 1998a.). It is often mentioned that as long as the ultimate control of all these aspects, including right of land, is retained by the state, one cannot expect the communities to attain the level of local responsibility needed for self-reliant, cost-effective, and sustainable conservation management (Wily, 1999).

As mentioned earlier, impoverishment due to deforestation has encouraged many rural communities to start managing state-owned forests on their own. These self-initiated efforts have proved quite effective at regenerating forests. Due to serious limitations regarding technical skills and finance, often these local initiatives can be sustained only if supported by external institutions (Krishnaswamy, 1995), yet there is no conscious effort to give them the necessary backing through JFM. Although there is a new and joint “construction of needs” within the limited degree of choice the JFM allows, the basic agenda of the program is pre-determined and cannot be considered very participatory in nature (Sundar, 2000).

It is also observed that the need to design formal institutions that are complementary to existing informal institutions (Kant and Cooke, 1998) is neglected. The common experience is that sociopolitical overlap between new induced institutions and the existing forms of local government, such as the village panchayat, are proving to be counterproductive (Andersen, 1995). The most successful FPCs charge fees for collection of forest produce, although this practice is strictly contrary to the forest act. Although the state governments recommend the formation of FPCs, the committees have no legal or statutory basis. FPCs are recognized only by the forest department; all other government departments recognize panchayats, making them more powerful than FPCs. The relationship between FPCs and the village panchayats is not well defined. The lack of legal authority may affect the power of the FPCs to check free riding and may make it difficult for them to manage resources in long term. Often, in the case of group-panchayats, the sarpanch (one who heads panchayat) is not interested in the FPC of a particular village. This is very much resented by the villagers who would prefer one amongst them to head their FPC (Ghate, 2000a). The legal standing of FPCs needs to be defined to make them strong grassroots organizations.

The different demarcation of boundaries by two different governmental departments (in this case the Revenue Department and the Forest Department) is also creating some internal conflicts. Communities joining the JFM program are unsure of their areas of operation from which access can be denied to outsiders. This territorial conflict is reflected at the management level as well. The confusion can be appreciated by the fact that, at present, as many as 52 rural development schemes are operational through several state units. Often, more than one state department will bring in the same schemes in a single village, incurring huge duplication costs in the process.

Another important aspect that is criticized as being neglected is the lack of acknowledgement of women's special values, knowledge, and uses of forest produce (Locke, 1999). Gender relations are neither understood nor are there any special provisions to accommodate women's specific knowledge, needs, and capacities in the JFM program. Similarly, the strong historical sense of place and (particularly tribal) identity that can prove to be effective in mobilizing interest in and concern for local resource management and protection have not been adequately considered in the JFM program. Nor has the influence of charismatic leaders in overcoming intra-village tensions been recognized (Jewitt, 1995).

Linking Livelihoods and Conservation: A Conceptual framework and Scale for addressing the integration of human needs and biodiversity by NICK SALAFSKY, Biodiversity support programme; Washington D.C. U.S.A. and Eva Woolenberg Center for International Forestry Research, Jakarta, Indonesia:

The above research paper published in World Development vol. 28 No. 8 has developed a conceptual framework for defining the linkage between livelihood activities and conservation. Three approaches that can be characterized as no linkage, indirect linkage and direct linkage have been described by the authors. Each approach has strength and weakness and therefore best shifted to certain conditions.

The first approach assumes no linkage between livelihood and conservation of protected areas.

A common approach to protecting biodiversity has been the creation of parks and P.A.s that exclude livelihood activities. The key feature of the protected areas

strategy is that local livelihood is assumed to conflict with conservation. P.A.s have strictly defined borders that are unauthorized. People are not supposed to cross them. People are meant to use resources outside the park, and plants and animals are meant to stay in the park.

Second approach is based on indirectly linking livelihoods and conservations, economic substitutions; one of the earliest indirectly linked approaches was the biosphere reserve (UNESCO,1972, Sayer, 1999). In a biosphere reserve, people are entitled to use biological resources according to defined spatial zones. A core zone is designated as a strict protection area where people's consumptive use of resources is prohibited. The core is surrounded by one or more buffer zoners that allow use within limits that ensure protection of core zone. The original buffer zones were designed as rings of more or less arbitrary width.

The key feature of buffer zone strategy is that Zonation is used to create a spatial compromise that enables local people to continue to meet their livelihood needs while still protecting key species and habitats. In particular, the theory is to decrease reliance on natural biodiversity by substituting other livelihood activities. The idea here is that providing substitute economic activities will keep local people on livelihood. Activities that damage the local biodiversity are indirectly linked activities have been found difficult to implement. Perhaps the biggest problem is that their approaches have not been directly tied to conservation behaviour as in the case of PAs, Local people often have continued to use resource in the core reserves even if prohibitors were posted or otherwise made public. Second, economically attractive activities in the buffer zone have often created incentives or expanding the buffer zones into the core area. Finally these approaches have not provided local people with the incentives to stop external threats to the biodiversity such as logging, company clear cutting the forest from the other side of the reserve or for a fishing boat coming in and unsustainable harvesting marine resources.

The third approach is directly linking livelihood and conservation. Link incentive for conservation. The key feature of the link incentive strategy involves developing independent relationship between the biodiversity and surrounding peoples. The local stakeholders are given opportunities to benefit directly from the biodiversity and thus presumably have an incentive to stop external threats to biodiversity. It is livelihood drive conservation rather than simply being compatible with it.

Furthermore this strategy recognize local peoples' role in maintaining biodiversity. Under this strategy, conservation might, for example, help local communities N.T.F.P. harvesting enterprise as a live tourism enterprise.

To analyse linkages, five dimensions of linkage have been mentioned.

1. Species dependence.
2. Habitat dependence.
3. Spatial Dependence.
4. Temporal dependence.
5. Conservation association

The linkages between them have been studied in the above dimensions

The Principal and Practice of Buffer Zones and Local Participation in Bio-diversity Conservation: Michel P. Wells and Katrina E. Brandon- AMBIO Vol. 22, 2-3 May 1993.

Recognition is growing that successful management of protected areas ultimately depends on the cooperation and support of local people. The study is based on the analysis of 23 Integrated Conservation Development Projects (ICDPs) in 14 developing countries. This paper explores the challenges, which have arisen in operationalizing two key concepts which lie at the heart of community based conservation.

a) Buffer Zones around park boundaries.
b) Greater participation of local people in conservation and development.
c) Important practical constraints, which have so far limited the effective implementation of these two concepts, have been described in the above paper. The paper concludes that, innovative well-designed projects at carefully selected protected area sites that constructively address local people- park relationships will be essential to the conservation of biodiversity, and thus to sustainable development.

The Economics of Third World National Parks-Issues of Tourism and Environmental Management- Arun Shah Published by Edward Elgan Publishing Ltd.

This book analyses the impact of economic activity on the management of Buffer area as well as protected area. Various models of management with flow effects of buffer area activity on the national park have been discussed at length. The effect of stock externality a thinner buffer area biomass makes management success harder to achieve. The paper identifies spactical externalities arising from grazing of cattle in the buffer area and work out the solutions to internalize the externality.

Issues in Social Policy: -

Collaborative Management of Protected Areas: Tailoring the Approach to the Context—Garza Borrini – Feyerbend-IUCN- The World Conservation Union Sept. 1996.

This article discusses essential feasibility conditions for collaborative management. It discusses the conditions for collaborative management to be effective and sustainable. It also discusses the obstacles most likely to stand in the way of collaborative management. It also discusses the legal and ethical bans for exploitation of natural resources by local stakeholders.

State of the World's Protected Areas at the end of the 20th Century: by Michael J.B. Green and James Paine, World Conservation Monitoring Center, Cambridge, U.K.

This article discusses various categories of protected area. It describes Matrix of protected area management objectives and IUCN categories. The network of global protected area is also described in the present article.

Valuing Tropical Forest: - Randall Krame, Priya Shyamsundar, Evan Mercer and Mohan Manasinghe.

This article is a case study of Madagascar and the Mantadia National Park. The study has examined the economic impacts of a new national Park on a variety of stakeholders. The work suggests that while proper tailoring to local conditions, environmental valuation methodologies can be useful in assessing resource value changes in developing countries.

Planning for People and Park : Design dilemmas by Katrina Eadie Brandon and Michel Wells – The World Bank, Washington (D.C.) published in World Development Vol. 20.

The authors highlight the evolution and performance of integrated conservation-development projects. These projects try to link biodiversity conservation in PAs with social and economic development. The performance of ICDPS thus far has been hampered by numerous difficulties, many of which are strikingly similar to those encountered in rural development efforts, while many of these difficulties can be stressed to speatic design implementation flows, more fundamental conceptual issues pose a challenge to the approach.

Management Plan of Pench National Park & Pench Tiger Reserve Maharashtra Vol. II & I:

This plan depicts the entire profile of PNP with its floristic and faunistic composition. The management aspects of PNP have been dealt at length the tourism sub-plan is a remarkable contribution of PNP.

Wood Consumption Survey of Nagpur District published by Forest Survey of India, Nagpur GOI 2000-01:

This study is an attempt to estimate consumption of wood for different income groups within the periphery of 5 Kms. of forest area in Nagpur district (Rural). The study gives separate estimates for different income groups and different categories of wood consumption

---

END NOTES

REFERENCES

Agrawal, Arun and Ostrom, Elinor. 1999. “Collective Action, Property Rights, And Devolution in Forest and Protected Areas Management.” W99-11, Working Paper, Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington.

Alagh, Y.K (1999) ‘Macro Economic and Sectoral Policies and Forestry Sector in India–Role of the World Bank’. Draft. World Bank document.

Andersen, K.E. (1995) ‘Institutional Flaws of Collective Forest Management’. *Ambio* 24(6):349-53.

Arora, H., and Khare, A. (1994) ‘Experience with the Recent Joint Forest Management Approach’. Paper prepared for the IN workshop on India’s Forest Management and Ecological Revival, New Delhi, February 1994.

Balakrishnan, Mundanthra, and Ndhlovu Dora E. 1992. “Wildlife Utilization and Local People: A Case-Study in Upeer Lupande Game Management Area, Zambia.” Environmental Conservation 19(2):135-143.

Bishop, K, Andrian P., and Warren L. 1995. “Protected for Ever?: Factors Shaping the Future of Protected Areas Policy.” Land Use Policy 12(4):291-305.

Borrini-Feyerabend, G. 1996. *Collaborative Management of Protected Areas: Tailoring the Approaches to the Context,* Issues in Social Policy, IUCN, Gland (Switzerland).

Bromley, Daniel W., David Feeny, Margaret McKean, Pauline Peters, Jere Gilles, Ronald Oakerson, C. Ford Runge, and James Thomson, eds. 1992. *Making the Commons Work: Theory, Practice, and Policy.* ICS Press, San Francisco, CA.

Chaudhary, Ashok. 1996. “Conservation, Conflitct and Struggle: Rajaji National Park.” In sustainable Development: Ecological and Sociocultural Dimension. K.G.Iyer, ed. New Delhi: Vikas Publishing House.

Chopra, K. 1995. “Forest and other sector: Critical role of Governemnt policy.” *Economic and Political Weekly*, Vol.30 (25): 1480-1482.

Datta, S and Varalakshmi, V. 1999. “Decentralization: An effective method of finanacial Management at the grassroots (evidence from India).” Sustainable Development 1999, Vol 7 (3): 113-120.

Dore, E. 1996. “Capitalism and Ecological Crisis:Legacy of the 1980s”, in *Green Gurrillas* (ed.) Helen Collinson, Latin American Bureau (Research and Action) Ltd., London.

Fortin, MJ and Gagnon, C. 1999. “An Assessment of Social Impacts of National Parks on Communities in Quebec, Canada.” Environmental Conservation 1999, Vol 26, Iss 3, pp 200-211.

Gadgil, M. (1998) ‘Conservation: Where are the People?’ in N. Ravi (ed.) *The Hindu Survey of the Environment, 1998.* Chennai, India: National Press.

Gadgil, M. 1998. “Conservation: Where are the People?” In *The Hindu Survey of Environment 1998*, ed. Ravi, *The Hindu*, Chennai Edition, India, p.107-137.

Gadgil, Madhav. 1998. “Conservation: Where are the People.” In *The Hindu Survey of the Environment 1998.* (Ed) Ravi, The Hindu, Chennai, India, p 107-137 .

Gaikwad, V.1995. “Tribal and the Tiger: A Case Study of the Kanha National Park.” Centre for Managament in Agriculture, Ahmedabad, India.

Ghate R. and Kulkarni, M. 1998. “A major setback to Participatory Efforts: A story of Tragic Success”, Tiger Link, Vol 4, No.2, September 1998.

Ghate, R. (2000b) 'Global Gains at Local Costs: Imposing Protected Areas: A Case Study From India', working paper. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Ghate, R. 1998. "Andhari Tiger Sanctuary (Maharashtra): A Case study for people's Participation in the Management of Protected area", The Indian Forester, Vol. 124, No.10, October 1998: 853-860.

Gibson, Clark. Forthcoming. "Dependence, Scarcity, and the Governance of Forest Resources at the Local Level in Guatemala." In Joanna Burger, Richard Norgaard, Elinor Ostrom, David Policansky, and Bernard Goldstein, eds. *The Commons Revisited: An Americas Perspective*. Island Press, Washington, DC.

Gichuki, F.N. 1999. "Threats and Opportunities for Mountain Area Development in Kenya." Ambio 1999, Vol 28, Iss 5, 430-435.

Gillingham, S. and Lee, P.C. 1999. "The Impact of Wildlife-related Benefits on the Conservation Attitudes of Local People around the Selous Game Reserve, Tanzania." Environmental Conservation 1999, Vol 26, Iss 3, pp 218-228.

Green Michael J.B. and Paine James. 1997. "State of the World's Protected Areas at the end of the Twentieth Century." Paper presented at the IUCN World Commission on Protected Areas Symposium on 'Protected Areas in the 21st Century: From Island to Networks', Albany, Australia, 24-29 November, 1997.

Guha, R. 1989. "Radical American Environmentalism and Wilderness Preservation: A third World Critique." *Environmental Ethics*, 11:71-83.

Hurni, H. 1999. "Sustainable Management of Natural Resources in African and Asian Mountains." *Ambio*, Vol 28, Iss 5, pp 382-389.

Ite, U.E. 1997. "Community perception of the Cross River National Park, Nigeria", *Environmental Conservation,* 23(4): 351-357.

IUCN, 1994. *1993 United Nations List of National Parks and Protected Areas.* Prepared by WCMC and CNPPA. IUCN, Gland, Switzerland and Cambridge, UK.

Jena, Nalin R. 1996. “National Parks and Sanctuaries vs people’s Rights: Some Issues of Concern.” In Sustainable Development: Ecological and Sociocultural Dimensions. K.G. iyer, ed. New Delhi: Vikas Publishing House.

Kulkarni, S.D. 1979. “Encroachments on Forest Lands-The Experience in Maharashtra.” *Economic and Political Weekly* 19(45): 1846-49.

Lee, P.N. 1993. “Market-State relations and Environmental policy: Limit of State Capacity in Senegal.” In The State and Social power in Global Environmental Economics, ed. R.D.Lipschutz and K. Conca. New York: Columbia University.

Ligon, E., Narain, U. (1999) ‘Government Management of Village Commons: Comparing Two Forest Policies’, *Journal of Environmental Economics and Management* 37(3):272-89.

Locke, C. (1999) ‘Constructing a Gender Policy for Joint Forest Management in India’, *Development and Change* 30(2):265-85.

McGinnis, Michael, ed. 1999. *Polycentric Governance and Development: Readings from the Workshop in Political Theory and Policy Analysis.* Ann Arbor: University of Michigan Press.

McKean, Margaret A. 2000. “Common Property: What Is It, What Is It Good For, and What Makes It Work?” In Clark Gibson, Margaret McKean, and Elinor Ostrom, eds. *People and Forests: Communities, Institutions, and Governance*. MIT Press, Cambridge, MA.

McNeely, J.A., Miller, K.R., Reid, R.W., Mittermeier, R.A., and Werner, T.B. (1988) ‘Economics and Biological Diversity: Developing and Using Economic Incentives to Conserve Biological Resources’, Gland, Switzerland: IUCN.

Ostrom, E. (1990) *Governing the Commons*. Cambridge: Cambridge University Press.

Ostrom, Elinor, Roy Gardner, and James Walker. 1994. *Rules, Games, and Common Pool Resources.* University of Michigan Press, Ann Arbor.

Ostrom, Elinor. 1990. *Governing the Commons*. Cambridge University Press, Cambridge.

Ostrom, Elinor. 1999. "Coping with Tragedies of the Commons." *Annual Review Political Science*. 2:493-535.

Ostrom, Elinor. 1999. "Institutional Rational Choice: an Assessment of the Institutional Analysis and Development Framework." In Paul A. Sabatier, ed. (1999) *Theories of the Policy Process.* Bolder, CO: Westview Press, 35-71.

Ostrom, Elinor. Forthcoming. "Reformulating the Commons." In Joanna Burger, Richard Norgaard, Elinor Ostrom, David Policansky, and Bernard Goldstein, eds. *The Commons Revisited: An Americas Perspective*. Island Press, Washington, DC.

Pathak, N. and Kothari, A. 1998. "Sharing benefits of wildlife conservation with local communities: Legal implications." *Economic and Political Weekly*, Vol. 33 (40): 2603-2610.

Resources. University of Michigan Press, Ann Arbor.

Ribot J.C. 1993. "Market-State relations and Environmental policy: Limit of State Capacity in Senegal." In The State and Social power in Global Environmental Economics, ed. R.D.Lipschutz and K. Conca. New York: Columbia University.

Sekhar, N.U., Ulrik A.M., and Shanmugratnam N. 1996. “Park Management, Land Use Patterns and People’s Perceptions: the Case of Desert National Park, Rajasthan, India.” Presented at “Voices form the Commons,” the Sixth annual Conference of the International association for the Study of Common Property, Berkeley, CA, June 5-8, 1996.

Sharpe, B. 1998. “’First the Forest’: Conservation, ‘community’ and ‘participation’ in southwest Cameroon.” *Africa*, Vol. 68 (1): 25-45.

Townsend, Amy K. 1992. “Protected Areas as Common Property and India’s Sundarbans National Park.” Presented at “Inequality and the Commons,” the third annual conference of the International Association for the Study of Common Property, Washington, D.C., Sept. 17-20, 1992.

Venter, A K. and Breen Charles M. 1998. “Partnership Forum Framework: Participative Framework for Protected area outreach.” Environmental Management vol. 22, No.6: 803-815.

Wells, M. 1992. “Biodiversity conservation, affluence and poverty: mismatched costs and benefits and efforts to remedy them.” Ambio 21(3): 237-243.

Wells, M. 1995. “Biodiversity conservation and local peoples’ development aspirations: New proprities for the 1990s.” Rural Development Forestry Network, Network Paper 18a, Winter 1994-Spring 1995.

Laws and Bills referred to:

Wild Life (Protection) Act (as amended in 1991).

Amendment Proposals for the Wild Life (Protection) Act, 1972, Government of India, April, 1997.

Forest Conservation Act, 1980.

Indian Forest Act, 1927.

National Forest Policy, 1988.

[i] Ramchandra Guha; Radical American Environmentalism and wilderness Preservation: A Third World Critique; Environmental Ethics ; Spring 1989. Vol. 11

[ii]Pp. 39-41 -Management Plan of Pench National Park & Pench Tiger Reserve Maharahtra; Plan Period 20001-2002 to 2009-2010; Dhamge Kamlakar and Sunil Banubakode; Volume I

[iii] Pp. 45 -Management Plan of Pench National Park & Pench Tiger Reserve Maharahtra; Plan Period 20001-2002 to 2009-2010; Dhamge Kamlakar and Sunil Banubakode; Volume I

[iv] Please refer to Annexure No. 1

CHAPTER II : ECONOMICS OF PROTECTED AREA

Establishment of Protected Areas is one of the important ways of ensuring conservation of World's natural resources with the goal of meeting the material and cultural needs of present as well as future generations.

Conservation has some times been thought of as a protective, 'Locking away' of resources by powerful elite who have time to enjoy the beauty of nature, an essentially selfish and anti development activity. On the contrary, protected areas, when designed and managed appropriately are now recognized as offering major sustainable benefits to society.

2.1 World Conservation Strategy

The World Conservation Strategy (WCS) prepared by four of the world's leading conservation agencies- the International Union For Conservation of Nature and Natural Resources (IUCN), World Wild Life Fund (WWF), Food and Agricultural Organisation (FAO) of United Nations and the United Nations Environment Programme (UNEP)- launched in 1981, demonstrates how the conservation of living resources is essential for sustaining development by:

- Maintaining the essential ecological process and life support system on which human survival depends;
- Ensuring that man's utilization of species and eco-system, which supports millions of rural people as well as major industries is sustainable.

2.2 Genesis Of Protected Areas:

Most nations accept the desirability of protecting outstanding examples of their natural heritage and acknowledge that this is a contribution to the worldwide effort to protect living resources and conserve biological diversity. The national park has been the most common and popularly known form of protection, but national parks can be complemented by many other categories of protected area. The Commission on National Parks and Protected Areas (CNPPA) is the Commission of IUCN specifically responsible for promoting the establishment of a worldwide network of

effectively managed terrestrial and marine protected areas and has distribution guidelines on this topic (IUCN, 1978a, 1984 b).

A protected area by definition should be saved from unrestricted use of its resources. Designating large tracts of lands as national parks may be desirable from conservation point of view, but it is simply not feasible for most countries. Any country limiting itself to protected areas suitable for national park status might find that it is doomed to have very small reserves or only areas of no alternative production value. Moreover, the protection agency would have no authority over extensive forestry and other wildlands, although such tracts would certainly contain most of the country's wild natural resources.

2.3 What Is A PA?

The first section of the National Wildlife Plan (NWAP) says- The establishment of a network of PAs such as national parks (NPs), sanctuaries (WLs) and biosphere reserves (BRs) to cover representative samples of all major wildlife ecosystems and with adequate geographic distribution.' It is clear, therefore, that a PA may be legally established NP or WLS under the provisions of Wildlife (Protection) Act, 1972 or Biosphere Reserve (BRs) under the provisions of the World Conservation Strategy formulated by IUCN or any other PA with the objectives. A Protected Area is essentially an area to play the roles in [i] the conservation of biodiversity; [ii] contribution to the mitigation of global warming and, [iii] adaptation to new global initiatives (IUCN 1990). Other definitions of a PA are:

- A protected Area is defined by the convention on biodiversity as '*a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.'*

- At the fourth World Congress on National Parks and Protected Areas, held in Caracas. Venezuela, in 1992 (IUCN) 1994b). PAs were defined as an '*area of land' and or sea especially dedicated to the protection and maintenance of biodiversity, and of national and associated cultural resources, and managed through legal or other effective means.'*

- The Global Biodiversity Strategy (WRI/ IUCN/ UNEP 1992) defines a PA as *'legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation goals.'*

The PAs can play a variety of roles in nation's economy and provide a range of benefits. They can be managed to meet different objectives ranging from strict preservation of natural ecological process to provision of sustainable level of timber, wildlife, water, or recreational use. Many nations accept the desirability of protecting outstanding examples of their natural heritage and acknowledge that this is a contribution to the worldwide effort to protect living resources and conserve biodiversity. In practice, most of the countries find it advantageous to have several categories of PAs, each with different management objectives and each permitting different level of manipulation.

2.4 Categorization Of PAS

In the year 1959, IUCN was given the task of maintaining a list of the world's National Parks (NPs) and equivalent reserves. It had defined ten *categories* of conservation areas representing different levels of protection (from strict nature reserves to multiple use areas) and varying degrees of local, regional and global importance; each category is designated to meet different objectives (IUCN 1990). In the year 1994, IUCN revised the PA categories. At present, PAs are classified by IUCN (1994) under six broad management categories (Box-2.1) These range from strict nature reserves, managed primarily for research and/or environmental monitoring to managed resource PAs, established for the long-term protection and maintenance of biodiversity. As well as providing for the sustainable use of natural products and services to meet community needs. Within these six generic categories are hundreds of country specific designations of PAs, many of which have the potential to provide locations for research and monitoring. In addition, there are three international conventions, namely world heritage convention (WHC), UNESCO man and biosphere program (MBP) (see Box-2.2), and Ramsar convention and regional agreements such as ASCEAN (Association of South East Asian Nations) and for Africa Convention on the Conservation of Nature and Natural resources by which natural sites can be assigned as being of global and regional importance (Box-2.4). The countries may not need to develop all the categories listed, but through a

mix of several different categories a country can design a system that reflects its own objectives and constraints (IUCN 1984). The Biosphere Reserves (BRs) are sites of exceptional richness concerning the diversity and integrity of biotic communities of flora and fauna within natural ecosystems, e.g., *Sinharaja Forest Reserve of Sri Lanka, Kanha NP in Madhya Pradesh [India], Mount Kulai in Kenya.* The primary use of BR is for research, education and training. WHC are unique natural and cultural sites considered to be outstanding universal significance. e.g., *Serengeti NP in Tanzania, Sagarmatha NP in Nepal, Everglades NP in USA.* Kanha NP in India. There are at present 10 BRs and 15 WHS in India. While all PAs control human occupancy or use of resources to some extent, considerable latitude is available. The IUCN categories of PAs, illustrated in the following paragraph, are arranged in ascending order of degree of human use permitted in the area.

IUCN Revised categories of PAs[i]

Group-A (Area of particular interest to CNPPA)
Category-I : Strict Natural Reserve/ Wilderness Area

Objectives: To protect nature and maintain natural process in an undistributed area in order to have ecologically representative examples of natural environment for scientific study, environmental monitoring education and maintence of genetic resources in a dynamic and evolutionary state.

There are two sub-categories:

(a) PAs managed mainly for scientific research and monitoring.

(b) PAs managed mainly for wilderness protection, subsistence and recreation.

Examples: Yala Strict Nature Research in Sri Lanka, the island of Barro Colorado in Panama, Gombe Stream NP in Tanzania.

Category II: National Park

Objectives: To protect outstanding natural and scenic areas of national or international significance for scientific educational and recreational use. These are relatively large areas not materially altered by human activity and where extractive resource uses are not allowed.

Examples: Royal Chitwan NP in Nepal, Bandhavgarh NP in Madhya Pradesh (India), Etosha NP in Nambia, Iguazu NPs in Argentina and Brazil.

Category III: Natural Monuments/ Natural Landmarks

Objectives: To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focused on the protection of specific features.

Examples: Angkor Wat NP in Kampuchea, Petrified Forests Nature Monuments in Argentina, Gedi National Monument in Kenya.

Category IV: Habitat/ Species Management Area

Objectives: To assure the natural conditions necessary to protect nationally significant species, groups of species biotic communities or physical features of the environment where these may require specific human manipulation for their perpetuation Controlled harvesting of some resources may be permitted.

It is new category, so these PAs is to be established.

Category V: Protected Landscapes and Seascapes

Objectives: To maintain nationally significant natural landscapes that are characteristics of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism. These are mixed cultural/ natural landscapes of high scenic value where traditional land uses are maintained.

Examples: Pulluhua Geobotanical Reserve in Ecuador, Machu Piechu Historic Sanctuary in Peru, the national parks of England.

Group-B (Area of particular interest to IUCN in general)

Category VI: Managed Resource Protected Area

Objectives: This is a new category designed to include areas that ensures long-term protection and maintenance of biodiversity while providing a sustainable flow of natural products and services to meet community needs. They are intended to be relatively large and predominantly unmodified natural systems where a traditional and sustainable resource uses are encouraged.

Examples: The state parks of the United States, the provincial parks of Canada, the community forests and grazing lands of Africa, and the sacred forests of India, Indonesia and the Amerindians of the west Hemisphere.

Group-C Internationally recognized/ afflicted designations

(These categories are international levels which overly PAs in the above categories)

Category-VII: Biosphere Reserves

Objectives: To conserve for present and future use the diversity and integrity of representative biotic communities of plants and animals within natural ecosystem and to safeguard the genetic diversity of species on which their continuing evolution depends.

Examples: Sinharaja Forest Reserve of Sri Lanka, Mt. Katal in Kenya and Rio Platano Reserve of Honduras.

Category-VIII: World Heritage sites

Objectives: To protect the natural features for which the area was considered to be of world heritage quality and to provide information for the public Worldwide.

2.5 Functions And Values Of Protected Areas

The natural ecosystems in PAs due to their ecological diversity fulfil many different functions. Which functions are most relevant for a given protected area depends on the ecological characteristics, the cultural and socio-economic setting and the management objective of the area in question. Many of the functions are provided by all natural ecosystems regardless of their management status; that is, these functions can be attributed to both protected area and unprotected areas:

These functions come under the following categories (1) Regulation functions; (2) Carrier Functions; (3) Production Functions; (4) Information Functions.

2.6 Benefits Associated With Protected Areas[ii]

These benefits to individuals or society at large are frequently referred to as social benefits and are said to be a primary justification for PAs.

1. *Ecological Processes:* In their natural state, PAs provides a number of environmental services, viz., fixing and cycling of nutrients, soil formation, circulation and clearing of air and water, and global life support.

2. *Biodiversity:* By protecting habitats, one protects the variety of species they contain and these biological resources from the basis of numerous industries and are major sources of food, medicines, chemicals and other products used in both traditional and industrial societies. A lot of benefits are related to biodiversity conservation, viz., gene resources, species protection, ecosystem diversity, and evolutionary processes.

3. *Education and Research:* PAs instill people with an understanding and appreciation of the environment, making them more aware of the harmful consequences. Certain types of behaviour research is often integrated with education, the PAs provide fertile ground for field study by students at all level.

4. *Consumption Benefits:* PAs can lead to various (timber and NTFP) products including timber, forage, food, wildlife, fish, herbs and medicines that may only be harvested on sustainable basis.

5. *Non-consumption Benefits*: These benefits include the values people derives from PAs that are not related use, viz., aesthetic, spiritual, cultural/historical. Existence value.

Future Values: The protection of certain areas ensures a variety of benefits from their potential use in future, viz., optional value, quasi-optional value.

6. *Recreation/Tourism:* These are services which not only yield direct financial benefits from PAs but stimulate employment and rural development in surrounding areas, as well.

7. *Watershed Protection:* Maintaining the natural vegetative cover helps control erosion, reduces sedimentation and flooding down stream and regulates stream flows. The extent of the benefit depends on the type of the soils, topography, and natural cover in PA, the alternative usage available and the

type of investment and land-use down stream. These benefits include erosion control, local flood reduction, and regulation of stream flows.

2.7 Proteced Areas And Agriculture

Protected areas often perform a useful service for neighbouring agriculture areas in safeguarding against floods, by providing water through dry periods and fertile soil in the rainy season (as in the Mekong and Red River areas of Vietnam).

Water sources may have serious ecological impacts. Chemical pollution of waterways from urban or industrial waste poses a similar threat.

Spread of fire into protected areas from deliberately burned fields, wind erosion of protected areas resulting from clearing of neighbouring agricultural lands, and the invasion of protected areas by agriculture weeds, exotic species, domestic animals and man himself, are other threats to reserves. These further underlines the need for the protected area management authority to develop close links with neighbouring agriculture communities to avoid such negative interactions and to settle any problems that may arise.

As a general principal, intensive agriculture and protected areas do not make good neighbouring and the development of buffer zones or some areas of intermediate land use is needed between the two.

2.8 Tiger Reserves

“Project Tiger” was launched in 1973 based on the philosophy that: “The ‘tigers’ cannot be preserved in isolation. It is the apex of large and complex biotope. Its habitat, threatened by human intrusion, commercial forestry and cattle grazing, must first be made inviolate” [Dept. of Environment, undated-a]. Under this Project, certain areas (constituted from existing national parks or sanctuaries, with additions of surrounding areas in some cases), were declared as Tiger Reserves (TRs). These reserves in themselves are not legal entity, but they all contain national parks or sanctuaries as their core and in some cases their buffer zones, and the entire Reserve comes under the control of wildlife authorities. As of 2000, India has 27 TRs spread over 17 states.

ANNEXURE- 2.1

Protected Areas (PAs) in India:

- India has 92 NPs and 480 WLS (572 PAs) occupying 4.58% of the geographical area.
- The oldest protected area is Corbett National Park in Uttaranchal, notified on 8th March 1936, and the youngest are Mahadei and Netravali Wildlife Sanctuaries in Goa notified on 4th June 1999.
- The **largest national park** is Hemis in Jammu & Kashmir with an area of 3,350 sq. kms while the **smallest national park** is South Button Island in Andaman & Nicobar Islands with an area of 0.03 sq. kms.
- The **largest wildlife sanctuary** is Great Indian Bustard in Maharashtra with an area of 8496.64 sq. kms and the **smallest wildlife sanctuaries** are Goose Island and Rowe Island in A&N Islands with an area of 0.01 sq. kms each.
- The **largest biosphere reserve** is Gulf of Mannar in Tamilnadu with an area of 10,500 sq. kms.
- The **largest tiger reserve** is Nagarjunasagar Srisailam in Andhra Pradesh with an area of 3,568 sq. kms.
- A & N Islands has the **highest number of PAs** (105) while three Union Territories- Dadra Nagar Haveli, Lakshwadweep Islands and Pondicherry **do not have any PAs**.
- Chandigarh has the **highest proportion of land under PAs** (22.81%) while Gujrat has the **largest area of land under PAs** (17,224 sq. kms.).

  Haryana has the **lowest proportion of land under PAs** (0.51%) while Daman & Diu has the **smallest area of land under PAs** (2.18 sq. Kms).

Annexure – 2.2 State-wise Break-up of Protected Areas of India

Sr. No.	State/Union Territory	National Parks No.	National Parks Area (sq.km.)	Wildlife Sanctuaries No.	Wildlife Sanctuaries Area (sq.km.)	Total Protected Areas No.	Total Protected Areas Area (sq.km.)	Total Geogra-phical Area (sq.km.)	% Area under Protection
1.	Andaman & Nicobar Islands	9	(excl. Marine NP areas) 616.50	96	389.33	105	1005.83	8249	12.19
2.	Andhra Pradesh	4	373.26	20	11500.57	24	11873.83	275045	4.31
3.	Arunachal Pradesh	2	2468.23	11	7606.36	13	10074.59	83743	12.03
4.	Assam	5	1548.81	12	532.77	17	2081.58	78438	2.65
5.	Bihar	1	335.60	11	2949.17	12	3284.77	94163	3.48
6.	Chandigarh	0	0.00	2	26.01	2	26.01	114	22.81
7.	Chhattisgarh	3	2929.50	10	3417.46	13	6346.96	135100	4.69
8.	Dadra & Nagar Haveli	0	0.00	0	0.00	0	0.00	491	0.00
9.	Daman & Diu	0	0.00	1	2.18	1	2.18	112	1.94
10.	Delhi	0	0.00	1	13.20	1	13.20	1483	0.89
11.	Goa	1	107.00	6	647.91	7	754.91	3702	20.39
12.	Gujarat	4	479.67	21	16744.28	25	17233.95	196024	8.78
13.	Haryana	1	1.40	9	223.25	10	224.65	44212	0.51
14.	Himachal Pradesh	2	1429.40	32	5086.88	34	6516.28	55673	11.70
15.	Jammu & Kashmir	4	3925.07	13	10279.80	17	14204.87	222236	6.39
16.	Jharkhand	1	231.67	10	1868.31	11	2099.98	79714	2.63
17.	Karnataka	5	2472.18	20	4732.10	25	7204.28	191791	3.75

Sr. No.	State/Union Territory	National Parks		Wildlife Sanctuaries		Total Protected Areas		Total Geogra-phical Area (sq.km.)	% Area under Protection
		No.	Area (sq.km.)	No.	Area (sq.km.)	No.	Area (sq.km.)		
18.	Kerala	3	536.52	12	1788.36	15	2324.88	38863	5.98
19.	Lakshwadeep	0	0.000	0	0.00	0	0.00	32	0.00
20.	Madhya Pradesh	12	2857.20	25	6806.47	37	9663.67	308346	3.13
21.	Maharashtra	5	956.48	34	14363.46	39	15319.94	307690	4.97
22.	Manipur	1	40.00	1	184.80	2	224.80	22327	1.00
23.	Meghalay	2	267.48	3	34.20	5	301.68	22429	1.34
24.	Mizoram	2	250.00	5	874.00	7	1124.00	21081	5.33
25.	Nagaland	1	202.02	3	20.35	4	222.37	16579	1.34
26.	Orissa	2	1212.70	17	6576.40	19	7789.1	155707	5.00
27.	Pondicherry	0	0.00	0	0.00	0	0.00	492	0.00
28.	Punjab	0	0.00	10	316.63	10	316.63	50362	0.63
29.	Rajasthan	4	3857.03	22	5691.64	26	9548.67	342239	2.79
30.	Sikkim	1	850.00	5	265.10	6	1115.1	7096	15.71
31.	Tamil Nadu	5	307.83	19	2616.53	24	2924.36	130058	2.25
32.	Tripura	0	0.00	4	603.64	4	603.64	10486	5.75
33.	Uttaranchal	6	4920.73	6	2867.71	12	7788.44	55845	13.94
34.	Uttar Pradesh	1	488.29	23	5221.05	24	5709.34	238566	2.39
35.	West Bengal	5	1693.25	16	1201.90	21	2895.15	88752	3.26
	Total	**92**	**353557.82**	**480**	**115451.8**	**572**	**150809.6**	**3287231**	**4.58**

Source: Pp.2-4, Table 1: State-wise break-up of Protected Areas of India; Protected Areas In India-A Profile; Roshni Kutty & Ashish Kothari ; Kalpavriksh (2001) Pune

ANNEXURE –2.3

Wildlife Sanctuaries In Maharashtra

Sr. No.	Name	District	Area (in ha.)	Date of Notification
1.	Ambabarw	Buldhana	12,711	09.07.97
2.	Andhari	Chandrapur	50,927	25.02.86
3.	Aner Dam	Dhule	8,294	10.10.86
4.	Bhamragarh	Gadchiroli	10,438	06.05.97
5.	Bhimashankar	Pune, Thane	13,078	16.09.85
6.	Bor Game	Wardha, Nagpur	6,110	27.11.70
7.	Chandoli	Sangli, Satara, Ratnagiri, Kolhapur	30,897	16.09.85
8.	Chaprala	Gadchiroli	13,478	25.02.86
9.	Deulgaon-Rehekuri Black Buck	Ahmednagar	217	29.02.80
10.	Dnyanaganga	Buldhana	20,523	07.05.97 / 09.05.97
11.	Gautala Autramghat	Aurangabad, Jalgaon	26,061	25.09.79
12.	Great Indian Bustard (Nanaj)	Solapur, Ahmednagar	8,49,664	27.09.79
13.	Jaikwadi Bird	Auragabad, Ahmednagar	34,105	10.10.86
14.	Kalsubai Harishchandragadh	Ahmednagar	36,181	25.02.86
15.	Karanja Sohal (Kalvit)	Akola	1781	1997
16.	Karnala Fort Bird	Raigad	448	06.05.68
17.	Katepurna	Akola	7,369	08.02.88
18.	Koyna	Satara	42,355	16.09.85
19.	Malvan (Marine)	Sindhudurga	2,912	13.04.87
20.	Mayureshwar	Pune	515	19.08.97
21.	Melghat	Amravati	76684	20.06.67
22.	Nagzira	Bhandara	15,281	06.08.69
23.	Naigaon Peacock	Beed	2,989	08.12.94
24.	Nandur Madhmeshwar	Nasik	10,013	25.02.86
25.	Narnala	Akola	1,235	02.05.97
26.	Painganga (Kinwat)	Yavatmal	32,463	27.05.71
27.	Phansad	Raigad	6,979	25.02.86
28.	Radhanagari	Kolhapur	35,116	02.12.58
29.	Sagreshwar	Sangali	1,088	16.09.85
30.	Tansa	Thane	30,481	12.02.70
31.	Tipeshwar	Yawatmal	14,863	30.04.97
32.	Wan	Amravati	21,100	28.07.97/ 29.07.97
33.	Yaval	Jalgaon	17,752	21.02.69
34.	Yedsi- Ramling Ghat	Osmanbad	2,238	16.05.97
		Total	**14,36,346**	

Source: Table 2: Wildlife Sanctuaries of India Protected Areas In India- A Profile; Roshni Kutty and Ashish Kothari; Kalpavriksh (2001), PP. 22-23.

TABLE – 2.4
National Parks In Maharashtra

Sr. No.	Name	District	Area (In ha.)	Date of Notification
1.	Gugamal	Amravati	36,184	27.11.87
2.	Nawegaon	Bhandara	13,388	22.12.75
3.	Pench	Nagpur	25,726	22.11.75
4.	Sanjay Gandhi	Mumbai-Suburban, Thane	8,696	1950 16.01.96[ر]
5.	Tadoba	Chandrapur	11,654	31.03.55
		Total	**95,648**	

Source: Table 3: National Parks of India; PP 40; Protected Areas In India- A Profile; Roshni Kutty and Ashish Kothari; Kalpavriksh (2001).

Notes and References

[i] Source: IUCN 1994): Guidelines for PA management Categories. CNPPA with the assistance of WCMC, IUCN, Gland: Switzerland.

[ii](Source: adapted from Dixon & Sherman, 1991)

Economics of Protected areas and its effect on biodiversity Pp 104-105; 108-109)

CHAPTER III

Dependence of Village Fulzari on the Forests of Pench National Park

This chapter is divided in three sections; Section-I outlines a brief profile of village Fulzari and its dependence on PNP.

Section – II gives dependence of 11 villages around PNP.

Section – III Estimation of dependence by using multiple regression analysis.

SECTION- I

3.I Struggling And Suffocating Village –Fulzari

3.I.1 Human Settlements In Pnp And Fulzari Village:

There were three human settlements in Protected area of Pench National Park i.e. Fulzari, Totladoh and Bodalzira. Out of these three, only Fulzari still continues within the geographic limits of PNP. Village Bodalzira, which was located in compartment 521, has gone under submergence. Totladoh was a human habitation and was not a revenue village (only recently the entire encroachment in Totladoh has been demolished). It was in the form of colonies of irrigation department, MPEB, police outpost, School, Bank and other village settlers. Totladoh settlement was initially formed in order to facilitate the construction of Pench Hydal Dam; but subsequently the 'labourers, traders, contractors, etc. gradually encroached upon the land to form a sprawling human settlement. It was a population of about 1200 persons with approximately 2000 cattle heads. The people did not practice agriculture but resorted to illegal fishing, grazing, firewood collection, daily labour works etc. Fulzari will soon be shifted to village Sawara located outside PNP. From last 10 years the local people of Fulzari have been asked to vacate the area. Number of notices has been given to them in this respect. However, it is yet to be shifted to village Sawara, keeping the status of village communities indeterminate.

3.I.2 Village Profile

Fulzari village is a human settlement located within the geographical limits in compartment number 565 of protected area of Pench National Park. It lies to the east side of Pench with human population of 213 in 44 households and cattle population of 432 as per the management plan of the forest department (1991). Gond communities (Tribal population) constitute a major proportion in total population with some Korkus.

3.I.3 Area

The total area of Fulzari Village is 262.75 hectares. The land use pattern of the village is shown in the following table:

Table – III-I-1 Land Use Pattern of Village Fulzari

Land use	Area (Hectares)
1. Forest	88.84
2. Irrigated by source	--
3. Unirrigated	40.09
4. Cultivable waste (including Gouchar and grains)	4.88
5. Area not available for Cultivation	128.94
Total Area	262.75

Source: Land Records, Ramtek

3.I.4 Socio-Economic Attributes

The information about socio-economic attributes of the village has been collected through a census of households in Fulzari. This is supplemented by the secondary source of data obtained from Tehsil Offices and Forest Departments wherever required. As has been mentioned in the chapter on research methodology a census of village Fulzari has been undertaken to assess the dependence of this village on the forests of PNP. The results of the household surveys have been used to describe socio-economic-demographic

characteristics of the village, while conducting surveys only 42 households could be traced.

3.I.4.1 Basic Amenities In The Village: The village has one community temple, one primary school for imparting education to the villagers. Medical, Post & Telegraph and Market facilities are accessible to them within 5 to 10 kms. Transport facilities (Bus Stop) are within the reach of 5 kms. The village has only one well providing drinking water facilities to the residents of the village. No electric connections, tap water facilities are provided to them. All roads are kuccha roads.

3.I.4.2 Population: Total population of village Fulzari is 188. As per management plan of the forest Department, in 1991, the total population of the village was 213 displaying a fall by 25. People seem to have migrated to other areas in proximity of Fulzari. Distribution of population according to sex shows that there are 101 males and 72 females. The distribution of population according to caste is given in the Table-III.I.2.

Human population in the Fulzari village is dominated by Gond, a schedule tribe, with Hindu as their religion (100%). The distribution of 42 households (2 households have left the village) shows 83.3% of the households belonged to ST, 14% belong to NT and only 2.4% percent belonged to SC.

Table- III.I.2 :Caste wise Distribution of Population

Caste Name	Percentage
S.C.	02.4
S.T.	83.3
N.T.	14.3

3.I.4.3 Educational Status:

Table- III.I.3 : Educational Status of the Household Heads

	Frequency	Percent
1.00 Primary	16	38.1
2.00 Middle school	1	2.4
3.00 High School Education	1	2.4
4.00 Higher Secondary	-	-
5.00 Graduation	-	-
7.00 Illiterate	24	57.1
Total	42	100

A cursory glance at the table- III.I.3 shows that 57 percent of the heads of the village households are illiterate. Mass illiteracy is a common feature of native population in and around PNP. However, 38.1 % of the population has level of education up to primary. Only 2.4 percent of the households have level of education up to middle school and high school.

3.I.4.4 FAMILY SIZE: The average size of the family is estimated at 5 members per household. As per secondary source of data obtained from the tehsil office in 1991, the highest number of families (36.36%) shows 5 members in each households. Only two households (4.5%) have seven family members each. The average size of the family for the village is 5.

3.I.4.5 AGE COMPOSITION OF POPULATION: The distribution of population in Fulzari village shows 60 family members in the age group of 0-18, 95 family members in the working age group (18-50) and 33 family members in the age group of above 50 years .The dependency ratio (child +old age dependency) is almost 1:1, i.e. 1 person in the working age group has to support the population of one person in the child and old age group. The following table shows the distribution of population of Fulzari village according to different age groups.

Table- III.I.4 : Age composition

Age group	No of persons	% of total
0-18	60	31.91
18-50	95	50.54
50 and above	33	17.55
Total	**188**	**100.00**

Child dependency ratio = 1: 0.63

Old age dependency ratio = 1: 0.34

Total Dependency ratio = 1: 0.97

3.I.5 NUMBER OF YEARS OF SETTLEMENT: Majority of households reported their settlement period in Fulzari exceeding 30 years. Households having settlement period with duration of 20 to 30 years constitute 21.4 per cent of the total. Only two households have had less than 10 years of duration of stay. Most of the households have almost two generations of stay in Fulzari village. They were initially settled in Fulzari village to work for forest related activities. The development of Fulzari village is suffocated due to hanging sword of rehabilitation to village Sawara since last 25 years, which does not provide any incentive to them for their development either at micro or at macro level. Any initiative of investment in land to improve productivity of soil or make their occupational structure diversified has been found to be missing in the village community. Most of the development work in Fulzari has come to a standstill due to suspension of Working plan by the forest department.

Table –III.I.5: Years of Settlement in the village

	Frequency	Percent
1 0 to 10 yrs	2	4.8
2 10 to 20 yrs	3	7.1
3 20 to 30 yrs	9	21.4
4 More than 30 yrs	28	66.7
Total	42	100

3.I.6 HOUSE CONSTRUCTIONAL MATERIAL: Use of timber in construction of house in Fulzari village is seen as a natural choice. The wooden material used in the form of wooden ballya, wooden plates and mayali; gives estimates of the value of timber in construction of houses in the village. In household surveys attempt has been made to count their use and then quantify the value on the basis of market price. The timber used in construction gives once for all investment or it may be taken as fixed capital used in construction. The value of wooden ballya, wooden plates and mayali gone in the construction of house is as follows:

Table- III.I.6 : Dependence on forest for construction of Houses- Use of Timber

	Ballya*	Wooden plates	Mayali
Units	3955	8747	27
Value (Rs)	9,88,750	87,470	14,850

* Ballya= 250 Rs Wooden plates= Rs. 20 Mayali= Rs. 550

The recurring (repair) expenditure may be taken at 15% of the value of timber used in construction of a house. Household surveys revealed that they replace some part of wooden material (specially wooden plates) after every 5 to 7 years. As per the report of Forest Survey of India per capita requirement of bamboo is 29 for the villages in the distance of 5 kms from boundary of forest. In Fulzari it may be more than 29. However minimum per capita consumption may be assumed at 29. The total consumption (29 * 153) may be estimated at 4437 units[i]. For the construction of additional shed in summer, additional wooden and grass material is required.

3.I.7 THE AGRICULTURAL ECONOMY OF FULZARI VILLAGE: Agriculture forms the major occupation of the people in Fulzari village. Of the total workforce of 95 persons in the village, 18 are engaged as cultivators (principal occupation) and 22 are engaged as agricultural labourer. The remaining working population is, in a major way, is also engaged in agriculture, which constitute their secondary source of livelihood.

3.I.8 OCCUPATIONAL STATUS: The distribution of households in Fulzari village, as per principal occupation, shows 18 heads of the households (42.9%) are cultivators. Whereas13 households (31%) are working as labourers either in forest or in agriculture. Fishing is a principal occupation of only 5 (11.9%) households. In spite of huge livestock population of the village (400 cattles), only two households reported their principal occupation as milkmen. Government service is a rare phenomenon in Fulzari as only one household is engaged in government service (In Forest Department as guard).

Almost equal proportion of households is found working as agricultural labourer or forest labourers (27[1] households have reported as working in agriculture as labourers and 26 have reported as forest labourers). Since agriculture is mainly rain fed, it fails to provide a source of livelihood for the entire year to the agricultural labourers. Due to suspension of working plans for the Fulzari village, even work in forest does not provide employment for more than 3 months in a year. Rural Development Works and Micro plans implemented by the forest department do not benefit village communities in Fulzari as it is being shifted to village Sawara.

The area of land that can be cultivated in any year depends to a large extent on the availability of water either through the expansion of irrigation or through the capturing the large part of run off with the help of soil and water conservation and management measures. Agriculture in Fulzari is mainly rain fed and the village community is observed to be practicing no method of soil conservation. The

[1] The total will not add up to 42, as many households have reported their occupation as both agriculture as well s forest labourer

forest cover of Pench helps in ensuring soil conservation without resorting to special measures of soil and water management.

Table III.I.7: Principle Occupation

	Frequency	Percent	Cumulative Percent
1 Cultivator	18	42.9	42.9
2 Fishing	5	11.9	54.8
3 Self Employment	2	4.8	59.5
4 Labourer	13	31.0	90.5
5 Govt. Service	2	4.8	95.2
6 Milk Man	2	4.8	100.0
Total	42	100.0	

Source: Survey

3.I.9 PATTERN OF LAND OWNERSHIP IN THE VILLAGE: The total area under land ownership in Fulzari is 70.4 hect. The average size of land holding in the village is 10.6 hect.

The distribution of landholdings among the households is highly skewed with maximum size of landholding at 10.1 hect and minimum zero acre showing the range of 10.1 hect. The estimate of standard deviation shows the inequality in the distribution of landholdings. The following table explains this:

Table- III.I.9: Pattern of Land Ownership

Land holding/ Land ownership (Hectors)	No. of households	% To total
0	20	47.6
1 to 2	09	21.4
2 to 5	09	21.5
05 to 7.5	03	7.1
7.5 to 10.5	01	2.4
Total	42	100

Source: Primary Source – based on household survey

The above table shows that 47.6% of the households do not own any land, whereas 2.4 percent of the households own 18.18% of the land. Almost 43% of the households own land between 1 to 5 hect. Thus, most of the cultivators in village Fulzari are small and marginal farmers with uneconomic size of land holding. Average size of cultivated land is 1.3 hect.

Human & Livestock Population

3.I.10 RIGHTS & PRIVILEGES OF LOCAL COMMUNITIES:

The rights and privileges of the local communities in village Fulzari came to be legally restricted and they were prohibited to use the resources from Pench forest consequent to the status of Protected Area (1975) and Project Tiger (1999) accorded to the Reserve Forests of Pench. It is said that Project Tiger, a network of Park is held by the international communities as an outstanding example of success, sharply posits the interest of tigers against those of poor peasants living in and around the reserve. The designation of tiger reserves was made possible only by the physical displacement of existing villages and their inhabitants. Their management requires continuing exclusion of peasants and livestock (Ramchandra Guha 1989). Same is the case with Fulzari village which will be shifted to Sawara- out side the geographical limits of PNP. Declaration of Pench as Protected Areas has created an adverse impact on the village community by depriving them of the opportunity to augment their income from forest produce. In the absence of alternate source of livelihood, Fulzari village still continues to depend heavily (though illegally) on the natural resources of Pench, which substantially supports their income. However, since Fulzari village does not have any commercial orientation towards collection of forest produce, most of it is being used for self consumption, the rate of extraction may not create any adverse impact on regenerative potential of the forests of PNP. Dependence on the forest of PNP by villagers can be studied by using various parameters. In the present analysis the dependence of local communities has been assessed by studying the resource use pattern of the village community of Fulzari. The dependence of local population for biomass collection from the forest of PNP has

been estimated through household surveys and monitoring of entry points in the village.

3.I.11 RESOURCE USE PATTERN: The resource use pattern of the villagers is studied by collection information about:

a) Firewood consumption pattern of Village community.

b) Fodder/grass consumption pattern of Village community for livestock population.

c) Use of medicinal plants extracted from the forest by Village community.

d) Use of forest produce either for self-consumption or for social purpose by Village community.

The resource use pattern with the above objectives has been studied to find out the dependence of village community for biomass collection. The degree of dependence can be studied by three criteria:

1)Income Criteria 2) Accessibility Criteria 3) Fuel use Criteria

3.I.11.1 The dependence of village will be first studied by observing annual activity pattern.

Annual Activity Pattern: Observations based on the household surveys at different points of time as well as monitoring of their activities, show that the inhabitants of Fulzari village are dependent on natural resources of PNP for six to nine months in the year either for collection of fuel wood or for NTFPs or fodder/grass for livestock grazing. In monsoon, they are mainly engaged in activities connected with agriculture. In winter and summer they mainly concentrate on NTFP collection. In summer they build up inventory of grass augmented from the fresh forest of PNP for feeding the livestock population in rainy season. In winter they take their livestock population to forest for grazing purpose. Normally they spend one to two hours in the morning for fuel wood collection by walking a distance of about one to two kms daily. For grazing purpose, they spend about one to two hours in the morning and one hour in the evening. Collection of tendu leaves, a very important economic activity of the

local population is confined to a period of two months (April-May) or collection of Moha flower (two months). All this shows their dependence on forest.

Thus, monitoring of their activities at various points of time during a day, and at various seasons shows that forest of PNP constitutes their major source of livelihood.

Estimation of Dependence on PNP:

3.I.11.2 Income criteria: Dependence of Fulzari village is reflected in income earned through forest labour, NTFPs collection, hunting, fishing, and other activities having direct or indirect links with forests of PNP. Through questionnaire surveys, information regarding source of income of villagers has been collected. Even though agriculture has been reported as the main occupation of the village, the income from agriculture crops does not occupy a place of prominence to local population. The following table – III.I.9 shows distribution of income according to different sources.

Income from agriculture, forest etc. is self explanatory. However, in case of Fulzari village, all households reported income from other sources as nil. The discussions with the forest department about the village Eco-developement schemes and their implementation in the villages in and around PNP shows suspension of theses schemes due to non availability of funds from 1991. The survey of households pertains to the year 2002. Other agencies also reported almost same scenario as Fulzari village has to be shifted to Sawara leading to lack of development activities in the village

Table- III.I.9: Annual Average Income of Fulzari from Different Sources

Total Avg. inc per household Rs.	Income from different sources (Annual Average) (Rs)								
	Agriculture (Rs.)	NTFP (Rs.)	Fishing (Rs.)	Hunting (Rs.)	Self-emp (Rs.)	Agri - Labor (Rs.)	Forest Labor (Rs.)	Income from Milch animals	Othrsrs
17509	3012.98	7902.32	2757.9	628.05	646.15	2234.4	653.37	39.42	--
In (%)	16.87	44.22	15.42	3.51	3.61	12.50	3.65	0.22	--

As is discernible from the table, agriculture contributes only 16.87 percent to the average annual income of the households. The small-uneconomic size of land holdings and lack of incentives on the part of village community to improve land productivity seems to be the main factor behind a low level of income originating from this sector. Small size of land holdings fails to provide employment to all the members of family, thereby compelling them to work as agriculture labourer in other farms and supplement the income. The average annual income from agricultural labour is estimated as Rs. 2234.4 (12.50%). This gives 29% contribution of agriculture to the total income of the village community. The major crops grown by the villagers and income from these crops is given in the following table:

Table- III.I.10 :Annual Production of Agricultural Crops

Name of the crop	Annual production (Quintal)	Rates (Per Quintal) (Local arket)	Income from Agriculture (Rs.)
Dhan	98.65	550.00	54270.5
Jwari	84.00	500.00	42000.00
Tur	25.40	1700.00	43180.00
Chana	10.00	1000	10000.00
Javas	1.8	500	900
Wheat	4	600	2400
		Total (Rs.)	174337.00

Since most of the production is for self-consumption, the market price obtaining in the nearby local market has been taken to quantify the value of production of various crops in estimating their income from agriculture.

3.I.13 DEPENDENCE OF FULZARI VILLAGE ON NTFPs: Non-timber forest products (NTFPs) have provided an important source of livelihood to a large number of forest communities. The income and consumption from NTFPs have complemented that from agricultural activity in most of the better-forested regions of the country. Forests are traditionally considered as suppliers of timber. Perhaps due to overwhelming significance of the market as an economic institution, this function of forest has been given somewhat exaggerated importance. Of late, however, a large number of goods and services have come in prominence. Preservation of biodiversity being recognized as an important

objective of natural resource management, NTFPs have come to occupy a significant position. All kind of tropical forests occupy a critical niche in this context because tropical forests are distinguished by the availability of large variety of NTFPs. India, for instance, possesses about 320 of the world's 425 families of flowering plants, or about 21000 species of which 3000 are known to yield NTFPs[ii]. Forest communities have derived sustenance from NTFPs in periods of stress and have used NTFPs as inputs of raw materials into production of items of daily use in normal time. In effect, NTFPs, if harvested and used judiciously, is a kind of renewable resource available for exploitation from year to year.

NTFPs play a crucial role in supporting sustenance of village communities in Fulzari village. However, consequent to declaration of Pench as protected area in 1975 and Tiger Project in 1999. It has prohibited village communities in PA to extract NTFPs from forests of Pench.

Pench National Park is gifted with abundant variety of NTFPs. Though legally prohibited villagers collect these NTFPs for self-sustenance. The major NTFPs found in the forests of Pench and collected by the villagers are Charoli, Amla, gum and Bamboo, Tendu leaves, Moha leaves, grasses etc. Through household surveys the information regarding NTFP collection by the residents of Fulzari village was obtained. The information collected from household surveys was supplemented by monitoring the entry points of PNP to estimate their daily extraction of NTFPs.

3.I.13.1 Valuation of NTFP in Fulzari Village: Treating NTFPs as renewable, user valuation is estimated by attempting to find out how the collector views an NTFP. Such a user's perception of the value of the product may be in terms of either use or exchange value. As communities become more and more monetized, and as linkages with market are forged, the distinction between community's perception of use value and market value is reduced. Sale becomes an available option through which purchasing power is obtained, which, in turn, can be used to acquire access to other necessary articles of

consumption. It is, in the final analysis, the perception of the value of a commodity, whether for self-use or exchange, that should be paramount in determining the utility that accrues from it.

The value of NTFPs whether it is a use value or exchange value, accrues first and foremost to forest communities, although they are also consumed by large units both within the district and outside. As long as factor and product market imperfection continue to exist, this value will continue to be place and product specific. In the context of Fulzari village, since NTFPs are collected by the local communities for self-consumption only, the market price in the local market in proximity of Fulzari has been taken as a proxy for valuation of NTFP or income derived from NTFPs.

3.I.13.2 Collection of Tendu Leaves: Collection of Tendu leaves constitute a separate category by itself since almost the entire population is involved in harvesting them during the collection period of about one month. As there is nationalization of Tendu leaves, the villagers earn a fixed income per bundle of collected Tendu leaves. The annual income from collection of Tendu leaves for the village is estimated at Rs. 6754.5. Total mean income per household is Rs.5510.40. Annual income from bamboo is estimated at Rs. 1900, fuel wood & firewood at Rs. 112704, grass Rs. 73,000; Charoli Rs. 3305, Amla Rs. 375; Gum Rs. 780.

3.I.13.3 Income/Consumption of NTFPs: The table- III.I.15 gives estimated income/ consumption of major NTFPs in Fulzari. All available evidence therefore indicates that NTFP collection is not only a part of survival strategy followed in period of stress but constitutes a legitimate part of economic activity of the local community in Fulzari village. The total annual value of NTFP has been estimated at Rs. 2,31,441/-.

Table – III.I.15: Total Household Income from collection of NTFPS in Fulzari

1	2	3	4
NTFP (Type of Commodity)	Annual Income (Rs)	Mean Income per household[1] (Rs)	Percentage to total
1. Charoli	3305	78.69	0.96
2. Amla	375	8.92	0.23
3. Gum	780	18.57	0.11
4. Bamboo	1900	45.23	0.55
5. Fuel-wood / Fire-wood	112704	2683.42	32.74
6. Grass	73000	1738.09	53.97
7. Moha	32123	764.83	9.33
8. Tendu Leaves	6754	160.80	1.96
9. Honey	500	11.90	0.15
10. Total	2,31,441	5510.45	100

3.I.13.4 Collection Calendar: Collection calendar for NTFPs On the basis of Survey, and presented in the following table- III.I.16

Table – III.I.16: Collection Calendar

Product	Collection Months
Nationalized	
Tendu leaves	April 15 to May 30
Sal Seed	Mid May to second week of June
Gum	June
Harda	Feb. 15 to March 15
Non Nationalized	
Aonala	Sept to Oct
Bamboo	June to July
Chironji	March

[1] Mean Income per household is calculated by dividing total income by total number of households i.e. 42

Product	Collection Months
Grass for	Sept. to Oct
Grass for fodder	Throughout the year except Monsoon
Honey	March
Kusum Seeds	June to July
	July
Lac	Feb to March
Mahua Flower	March 15 to April 15
Mahua	Mid Apr to Mid June

3.I.14 DEPENDENCE OF LIVESTOCK POPULATION ON THE FOREST OF PNP FOR FODDER AND GRASS: Livestock can be treated both as a resource and as an economic entity and consequently as a source of demand for other resources. A dynamic link exists between this resource, agricultural and forestlands and water. Livestock as a resource supplies inputs such as draught power and organic manure for agriculture, and milk, meat and skin for human consumption. Its existence also impacts the nature of forest existing in a particular region, in particular if their number exceed the carrying capacity of the area.

On the other hand, the food and water requirement of the livestock population constitutes a demand on the land and water resources of the region. Crop-residue from agriculture land, leaf biomass and forest grass and forage from pastureland are sources of food. Climate impacts livestock existence indirectly through its influence on food and fodder availability and directly by affecting rates of natality, mortality and migration.

3.I.14.1Livestock population of Village Fulzari: The total livestock population of village Fulzari (based on household survey) is estimated at 216[iii]. The composition of livestock population is given in the Table- III.I.17

Table – III.I.17: Livestock Population

Type	Number	Percentage
Bullock	65	30.01
Cows	105	48.61
Goat	46	21.29
Total	216	100

3.I.14.2 Distribution of Livestock Population: The distribution of livestock population is depicted in the following table:

Table – III.I.18 : Distribution of Livestock Population

Size distribution of Livestock	Livestock Population (No.)	% To total population	No. of Households	% To total households
0	0	-	04	10.26
1-5	87	40.27	27	69.23
6-10	32	14.81	04	10.26
11-20	17	07.88	01	02.56
21-35	80	37.04	03	07.69
Total	216	100.00	39*	100

* 3 missing

The average ownership of livestock population in Fulzari village is 5.00. However, the distribution of livestock ownership is highly skewed. Three households in the village own more than 20 cattles, whereas 27 households own up to five (1 to 5) cattles. Four households do not own any livestock (0). 69.2% of the households own only 40.27% of the cattle population, whereas 7 per cent of the households own 37.04% of the livestock population.

3.I.14.3 Livestock Grazing Pattern: Results of door-to-door survey revealed that the entire cattle population of village Fulzari is being illegally grazed on the fringe of the village or within 2 to 3 kms inside the PNP. Villagers send their cattle to the forest twice a day, 2 to 4 hours in the morning and two hours in the evening (Based on interview of herdsmen and monitoring). One herdsman from the entire village (with some lum-sum payment per cattle population) is entrusted

the responsibility of grazing the cattle population of village Fulzari. Normally in the morning, the livestock population is taken for grazing inside the forest of PNP up to 2 to 3 kms. The evening trip is rather short and restricted to only 1 to 1.5 kms on the boundary of the village.

The livestock population of the village has shown a fall in the current year as compared to 1991 livestock population. The falling livestock population of the village is indicative of the declining dependence of the village on the forest of PNP. In 1991 it was reported at 432 (Management plan of Forest Department for Pench). However, household surveys show only 216 as cattle population of the village.

3.I.15 Fodder Availability: Fodder supply for purposes such as animal feed comes from three different sources namely, grass, leaf bio-mass and crop residue (Kadba/Kutar) Depending upon the edibility of these biomasses and corresponding areas and crop yield rates, the total availability of fodder can be estimated for the Fulzari village. From the demand side, precise data or surveys giving magnitudes of demands from livestock do not exist for either Fulzari village or villages around the periphery of Pench National Park. At best, norms of feed requirements based on scientific methods of estimation can be used to estimate demand for fodder for feeding the livestock population of the village.

The type of areas which produce grass as fodder are generally forests, barren and uncultivable land, other uncultivated land, land under miscellaneous tree crops and groves, cultivable wastelands, and fallow land other than current fallow. The output and yield varies for each category of land. Tree leaf fodder is available from forest and miscellaneous tree crops in farmers' own lands. Crop-residue is obtainable out of cultivated lands.

The quantity and quality of grass produced depend on the type of areas, soil fertility, and type of grass, climate condition and biotic factors. Broadly eight major types of grassland are recognized in the country. Out of these Diachanthium, Sehma Hatroposan types of grasslands are found in Fulzari

village. In Fulzari, 132.97 hectors of land (Cultivable waste + area not available for cultivation) is available for grass.

No local level information about productivity of grass is available for the village or for the surrounding areas of PNP. The productivity of grass in the forest areas is generally higher than in other grass producing areas. The production of dry grass is reported to vary generally from 0.5 to 6.0 tones per ha, per year. The average grass yield from the forests in the proximity of Fulzari may be taken to be 5.0 tonnes per hectors based on accessibility and other considerations. It can also be assumed that about 25% of the grass growing in the forest area near Fulzari is presently utilized (though illegally).

Leaf fodder from trees constitutes the second major source of fodder. It is difficult to estimate the quantity of leaf fodder available from forest areas, as this will depend on several factors including the type of forest, proportion of fodder trees to total growing stock, density of the forest, the practice and intensity of harvesting leaf fodder, distance of forest areas from village etc.

SECTION- II

A STUDY OF SAMPLE VILLAGES

SOCIO ECONOMIC PROFILE OF SAMPLE VILLAGES:

3.II.1 In the present world, no entity whether it be an individual or family or village or city or state or a nation is self-sufficient. The interdependence is the rule of the day. A village has to depend on a number of other entities. The dependence of a village can be defined in terms of the proportion of total household income derived from the surrounding environment. In case of the village, in the proximity of a national park, the dependence is reflected in the proportion of total household income derived form the forests, or forest related activities, the accessibility to the national park resources or availability of alternative fuel and purchasing power of the households to have the alternatives. The criteria normally used for assessing the degree of dependence are: (a) the

income, (b) Accessibility; and (c) Fuel use. A sample of villages in the vicinity of PNP is drawn to have an idea of dependence on the PNP.

3.II.2 SELECTION OF SAMPLE: As mentioned in the Chapter I the selection of villages in the proximity of the PNP has been made on the basis of the distance of these villages from the PNP. Three distance categories are used for selecting the sample villages. Selection of villages in each distance category is done by giving weightage to human as well as livestock population. The selected eleven villages are shown in the following table:

Table – III.II.1: Sample Villages

Distance Category (in Kms)	Selected Villages
1 to 3	Ghatpendhari, Kolitmara, Narhar, Kirangisarra, Khapa, Wagholi
3 to 5	Tuyapar, Ghoti-Dahoda
5 to 10	Ambazari, Kadbikheda, Chargaon

The second step is to select sample households from the selected villages. A sample of minimum 5 per cent of the households has been selected for the further study. Since the villages lying on the boundary of the PNP are expected to have more dependence, a larger weightage is assigned to the first category of villages (within the vicinity of 3 Kms.)

3.II.3 Socio-economic Characteristics- Out of the selected villages, Tuyapar, Ghoti- Dahoda, Wagholi, Khapa, Kadbikheda are on the East side of Pench and Kirangisarra, Ghatpendhari, Kolitmara, Chargaon, Ambazari, Narhar are on the West side. The socio-economic characteristics like the total geographical area, caste, religion and occupational status of the sample villages are discussed in the following paragraphs.

3.II.4 AREA: The total area under sample villages is 2077.17 hectors Village wise area of land for the sample villages is given in the following table.

Table- III.II.2 : Sample Village wise Area

S.N.	Village	Total population	No of households	Cattle population	Distance from PNP (km)	Area Ha.
East Pench						
01.	Ghoti (Dahoda)	797	130	705	3.5	426.08
02.	Kadbikheda	467	83	382	10	261.00
03.	Khapa	323	58	433	1	313.16
04.	Tuyapar	85	17	284	4	261.00
05.	Wagholi	420	77	282	1	657.24
West Pench						
06.	Ambazari	606	117	900	6.5	485.95
07.	Chargaon	448	87	1752	7	528.29
08.	Ghatpendhari	916	166	2146	1.5	260.25
09.	Kirangisarra	142	27	305	1	48.24
10.	Kolitmara	268	54	026	2	313.81
11.	Narhar	398	79	569	1	220.0
	Total	4870	895	7784	0 to 10	2077.17

3.II.5 POPULATION: Total population of these eleven sample villages according to 1991 census is 4870 with 895 households. The sample population is 378 consisting of 143 males and 129 females.

The population settled in the surrounding villages is mostly tribal and the area falling within Ramtek and Parseoni Taluka has been classified by the revenue dept. They are mostly Gonds and a small percentage of it on the M.P. side is known as korku. A very small proportion of non-tribal population has got intermixed with the local populance, which are mostly in the form of traders and contractors.

3.II.6 SEX Ratio: Village wise sex ratio of the population is given in the following table. It is 143: 129 for all the villages i.e. 1: 0.902

3.II.7 CASTE: There is a predominance of Tribal population in these villages. In Tuyapar, Kolitmara, Kadbikheda, Kirangisarra, Khapa and Wagholi the proportion of tribal population is 100 percent only 60 percent schedule tribes are found in

Ghatpendhari village. Table IV.4 gives village wise distribution of population according to caste.

RELIGION: 100% of the respondents in these villages are Hindus

Table- III.II.3 : VILLAGEWISE SEX RATIO

S. N.	Village	No of Males	No of Females	Children	Total population	Male :Female Ratio
East Pench						
01	Ghoti (Dahoda)	19	18	26	63	1:0.947
02	Kadbikheda	14	17	11	42	1:1.214
03	Khapa	23	19	09	51	1:0.826
04	Tuyapar	18	15	10	43	1:0.83
05	Wagholi	14	10	06	30	1:0.71
West Pench						
06	Ambazari	07	08	08	23	1:1.14
07	Chargaon	14	10	05	29	1:714
08	Ghatpendhari	13	15	16	44	1:1.153
09	Kirangisarra	09	04	04	17	1:0.444
10	Kolitmara	06	05	04	15	1:0.833
11	Narhar	06	08	07	21	1:1.333
	Total	**143**	**129**	**106**	**378**	**1:0.90**

3.II.8 STATUS OF LITERACY: Out of the total sample, 82 per cent of the household heads in the sample villages are literate. The distribution of households according to different levels of education is shown in the table III.II.5

3.II.9 STATUS OF EDUCATION: It may be seen from the table III.II.5 that out of the total sample population, 46.25 per cent of the households in sample villages has level of education up to primary, 11.25 per cent have educational level up to middle school, whereas 17.5 per cent have this level up to high school and 11.25 per cent of the households have some extra qualifications like ITI. The highest proportion of households with extra qualifications is reported by Wagholi (40%) followed by Tuyapar 2.5 per cent of the population which is

graduate. Level of illiteracy is the highest for village Ambazari (57.14%) and the lowest for Ghatpendhari (10.00%).

3.II.10 LAND UTILIZATION PATTERN: Pattern of land utilization (area under different types of land use) for sample villages is given in Table- IV.6

For the eleven villages under investigation, 33.14 per cent of the land is under forest. Only 1.20 per cent land is irrigated or as high as 39.26 per cent of the land is unirrigated. Area not available for cultivation is 21.17 per cent.

Ghoti (Dahoda) and Ambazari village reported more than 75 per cent unirrigated land. The lowest proportion of unirrigated land is found in Tuyapar. Kadbikheda showed highest proportion of irrigated land (3.95%) followed by Chargaon (2.21 %).(Table III.II.6)

The importance of irrigation in the area surrounding P.N.P. has special significance from the point of view of dependence on forest. Since irrigation is an essential input for agricultural production and higher productivity, it may help in raising the productivity of land thereby raising income from agriculture. Higher production and productivity in agriculture may help in reducing their dependence on forest for livelihood purpose.

Table- III.II.4 :Distribution of Sample households according to Caste

Village Name	Caste	Total with Percentage	Village Name	Caste	Total with Percentage
East Pench			West Pench		
Ghoti	S.C.	0	Kolitmara	S.C.	00
	S.T.	9 (66.28%)		S.T.	03 (100%)
	N.T.	2 (14.28%)		N.T.	00
	O.B.C.	3 (21.42%)		O.B.C.	00
	Total	**14**		**Total**	**03**
Tuyapar	S.C.	00	Kirngisarra	S.C.	00
	S.T.	08 (100%)		S.T.	03 (100%)
	N.T.	00		N.T.	00
	O.B.C.	00		O.B.C.	00
	Total	**08**		**Total**	**03**
Wagholi	S.C.	00	Chargaon	S.C.	00
	S.T.	05 (100%)		S.T.	04 (66.7%)
	N.T.	00		N.T.	01 (16.7%)
	O.B.C.	00		O.B.C.	01 (16.6%)
	Total	**05**		**Total**	**06**
Khapa	S.C.	00	Ambazari	S.C.	00
	S.T.	10 (100%)		S.T.	03 (42.9%)
	N.T.	00		N.T.	00
	O.B.C.	00		O.B.C.	04 (57.1%)
	Total	**10**		**Total**	**07**
Kadbikheda	S.C.	00	Ghatpendhari	S.C.	03 (30%)
	S.T.	09 (100%)		S.T.	06 (60%)
	N.T.	00		N.T.	00
	O.B.C.	00		O.B.C.	01 (10%)
	Total	**09**		**Total**	**10**
- -	**- -**	**- -**	Narhar	S.C.	00
- -	**- -**	**- -**		S.T.	05
- -	**- -**	**- -**		N.T.	00
- -	**- -**	**- -**		O.B.C.	00
- -	**- -**	**- -**		**Total**	05

Table- III.II.5: Number of households and their level of Education

Sr no	Village Name	Sample size	Primary	Middle school	High School	Higher Secondary	Graduation	ITI*	Illiterate
1	Chargaon	6	-	2 (33%)	1 (16.66%)	-	1 (16.66%)	1 (16.60%)	2 (33.33%
2	Narhar	5	3 (60%)	1 (20%)	1 (20%)	-	-	-	-
3	Ambazari	7	1 (14.28%)	-	1 (14.28%)	1 (14.28%)	-	2 (28.57%)	4 (57.14%
4	Ghatpendhari	10	5 (50%)	1 (16%)	3 (30%)	-	-	-	1 (10%)
5	Kirangisarra	3	1 (33.33%)	-	1 (33.33%)	-	-	-	1 (33.33%
6	Kadbikheda	9	5 (55.55%)	1 (11.1%)	-	-	-	-	3 (33.33%
7	Ghoti	14	7 (50%)	1 (7.14%)	2 (14.28%)	2 (14.28%)	1 (7.14%)	1 (7.14%)	1 (7.14%)
8	Tuyapar	8	4 (50%)	1 (12.5%)	2 (25%)	-	-	3 (37.5%)	1 (12.5%)
9	Wagholi	5	1 (20%)	-	2 (40%)	1 (20%)	-	2 (40%)	1 (20%)
10	Kolitmara	3	2 (66.66%)	1 (33.33%)	-	-	-	-	-
11	Khapa	10	8 (80%)	1 (10%)	1 (10%)	-	-	-	-
	Total	**80**	**37 (46.25%)**	**9 (11.25%)**	**14 (17.5%)**	**4 (5%)**	**2 (2.5%)**	**9 (11.25%)**	**14 (17.5%)**

* Extra Qualification

3.II.11 PATTERN OF LAND OWNERSHIP: Distribution of households according to different size group of land holdings shows that most of the farmers are either marginal farmers or small farmers. Table III.II.6 gives villagewise distribution of households into marginal farmers and small farmers

As can be seen from the table III.II.6 out of 80 households, 4 households (5%) are landless and livestock less and 11 households (13.75%) are landless but with some livestock. 15 households are landless households. The distribution of landholdings is also skewed in most of the villages under study. In Kolitmara 66.66 per cent of households do not own any land, whereas 33.33% of the households own more than 6 acres of land.

The landless status combined with zero ownership of livestock population increases their probability of dependence on forest of PNP. Lack of subsidiary sources of income as reflected in non diversified occupational structure in these villages has further added to their dependence on the forest.

3.II.12 OCCUPATION: The chief occupation of the people in sample villages is agriculture that is mostly rainfed and primitive in character. Agricultural crops which are mainly cultivated in this area are wheat, jawar, gram, cotton, tur etc. The villages located along the West Pench Range mainly rely on cultivating good quality wheat owing to flatter terrain. They also cultivate cash crops such as turmeric, garlic, ginger etc. Paddy is also cultivated to a small extent where irrigation, facilities are available.

The cattle population in these villages is quite significant. It mainly consists of bullocks and cows to a larger proportion along with goats, whereas buffalos are relatively small in number. It is note-worthy that cows and bullocks are not mainly used in the agricultural operations or as milk cattle but are kept as assets for easy liquidity in hard times. Buffalos are mainly kept for dairy purposes.

Table- III.II.6 :Village wise Land Utilization

S.N.	Village	Total area of the village (in hectares rounded upto two decimal places)	Land use (i.e. area under different types of land use in hectares rounded up to two decimal places)				
			Forest	Irrigated by source	Un-irrigated	Culturable waste (including gouchar and groves)	Area not available for cultivation
1.	Ambazari	326.19 (100%)	--	WE (1.61) (0.49%)	253.70 (77.78%)	7.31 (2.24 %)	63.57 (19.48%)
2.	Chargaon	528.29 (100%)	242.55 (45.91%)	GC (5.00) (0.94%) WE (11.70) (2.21%)	181.84 (34.42 %)	8.25 (1.56%)	78.95 (14.94%)
3.	Ghatpendhari	378.53 (100%)	117.66 (31.08%)	---	243.90 (64.43%)	10.42 (2.75%)	6.55 (1.73 %)
4.	Ghoti (Dahoda)	463.95 (100%)	--	WE (9.75) (2.10%)	365.45 (78.77%)	53.14 (11.45%)	35.61 (7.67%)
5.	Kadbikheda	261.75 (100%)	91.51 (34.96%)	TK (10.36) (3.96%)	62.46 (23.86%)	65.20 (24.91%)	32.22 (12.31%)
6.	Khapa	279.16 (100%)	190.91 (68.38%)	WE (0.20) (0.07%)	77.05 (27.60%)	5.00 (1.79%)	6.00 (2.15%)
7.	Kirangisarra	48.24 (100%)	--	--	36.75 (76.18%)	11.49 (23.81%)	--
8.	Kolitmara	313.81 (100%)	117.05 (37.30%)	--	80.55 (25.67%)	9.51 (3.03%)	106.70 (34.00%)
9.	Narhar	220 (100%)	111.84 (50.84%)	--	78.11 (35.50%)	18.78 (8.54%)	11.27 (5.12%)
10.	Tuyapar	548.36 (100%)	--	W (2.00) (0.36%)	52.70 (9.61%)	5.47 (1.00%)	488.19 (89.03%)
11.	Wagholi	657.24 (100%)	467.74 (70.40%)	W (10.50) (1.69%)	148.00 (22.52%)	13.00 (1.98 %)	23.00 (3.50 %)
	Total	4025.52 (100%)	1334.26 (33.14%)	51.12 (1.27%)	1580.51 (39.26%)	207.57 (5.16%)	852.06 (21.17%)

Table- III.II.7 : Distribution of Households according to Landholding Size

Village Name	Sample size (No.)	Landless with no livestock (No.)	Landless with livestock (No.)	Small land holding without Livestock	Small land holding with Livestock	Marginal Land with Livestock
Ambazari	7	1 (14.29%)	--	5 (71.42%)	1(14.29%)	- -
Chargaon	6	- -	--	5 (83.33%)	- -	1(16.67%)
Ghatpendhari	10	- -	3 (30%)	6 (60%)	1 (10%)	--
Ghoti	14	2 (14.29%)	2 (14.29%)	8 (57.14%)	- -	2 (14.29%)
Kadbikheda	9	- -	2 (22.22%)	5 (55.55%)	- -	2 (22.22%)
Khapa	10	- -	1 (10%)	6 (60%)	1 (10%)	2 (20%)
Kirangisarra	3	- -	- -	3 (100%)	- -	- -
Kolitmara	3	1 (33.33%)	1 (33.33%)	1 (33.33%)	- -	- -
Narhar	5	- -	- -	3 (60%)	2 (40%)	- -
Tuyapar	8	- -	2 (2.5%)	5 (62.50%)	- -	1 (12.5%)
Wagholi	5	- -	- -	2 (40%)	1 (10%)	2 (40%)
Aggregate	80	4 (5%)	11 (13.75%)	49 (61.25%)	6 (7.50%)	10 (12.50%)

Much of the employment opportunities are not available in these areas except for agricultural work, fishing in reservoir area outside the park, collection of minor forest produce like tendu, gum, moha, lac, and fuel wood etc. in surrounding area out side the park. Skilled workers such as masons, carpenters are engaged on construction works undertaken by the irrigation department, forest dept, Zillah Parishad etc. People are engaged in soil and moisture conservation works which are regularly undertaken by Soil Conservation Department on agricultural land. Wells are also being dug under various developmental schemes under block levels. Thus, a significant proportion of population shows dependence on the forest either directly or indirectly.

3.II.13 OTHER ACTIVITIES: Though mining of manganese, Ferro alloy, and coal goes on in full swing at a distance away from the park no mining operators or industrial development likely to be detrimental to the conservation efforts, is in

existence in the vicinity of P.A. at present but it is a future threat as these activities may extend in the areas.

3.II.14 VILLAGEWISE OCCUPATIONAL DISTRIBUTION: Even though most of the households in the sample villages have reported cultivation or agriculture as their main occupation, wide variations are observed in this proportion. This is presented in the Table- III.II.9.

As is clearly discernible from the table, the village wise variations range from 20% to 100%. Distribution of households according the different occupations for the sample villages shows that in 80% of the villages, the proportion of households working as cultivators is more than 70 percent. Only in Wagholi village it is 20 per cent, which is the lowest.

Table- III.II.8 :LAND OWNERSHIP

Village Name	hects of land	No of households	Percentage	Village Name	hects of land	No of households	Percentage
01 to 03 Km				3 to 5 Km			
Ghatpendhari	0-0	3	30%	Tuyapar	0-0	2	25%
	1 to 2.5	3	30%		0-0	3	37.5%
	2.5 to 7.5	-	-		1 to 2.5	2	25%
	7.5 above	4	40%		2.5 to 7.5	1	12.5%
	Total	10			**Total**	8	
Kolitmara	0-0	2	66.66%	Ghoti	0-0	3	27.77%
	1 to 2.5	0			0-0	3	27.77%
	2.5 to 7.5	1	33.33%		1 to 2.5	3	27.77%
	7.5 above	-			2.5 to 7.5	2	18.18%
	Total	3			**Total**	11	
Kirrangisarra	0-0	00	-	5 to 10 Km			
	1 to 2.5	2	66.66%	Ambazari	0-0	1	14.28%
	2.5 to 7.5	1	33.33%		1 to 2.5	3	42.85%
	7.5 above	-	-		2.5 to 7.5	2	28.57%
	Total	3			7.5 above	1	14.28%
Khapa	0-0	1	10%		**Total**	7	
	1 to 2.5	5	50%	Kadbikheda	0-0	2	22.22%
	2.5 to 7.5	2	20%		1 to 2.5	5	55.55%
	7.5 above	2	20%		2.5 to 7.5	1	11.11%
	Total	10			7.5 above	1	11.11%
Wagholi	0-0	-	-		**Total**	9	
	1 to 2.5	3	60%	Chargaon	0-0	0	-
	2.5 to 7.5	1	20%		1 to 2.5	3	60%
	7.5 above	1	20%		2.5 to 7.5	2	33.33%
	Total	5			7.5 above	1	16.16%
Narhar	0-0	-	-				
	1 to 2.5	3	60%				
	2.5 to 7.5	2	40%				
	7.5 above	-	-				
	Total	5					

The villages under study have been classified into three groups as per distance from the PNP. In category A, villages lying within 0-3 KM from the boundary of PNP has been shown. They are Ghatpendhari, Kolitmara, Narhar, Kirangisarra, Khapa and Wagholi. The two villages Tuyapar and Ghoti-Dahoda are lying within 3 to 5 KM from boundary (B –category) and Ambazari, Kadbikheda, Chargaon are three villages within 5 to 10 KM of boundary (Category- C). The following table gives occupational distribution of households as per three categories mentioned above.

The proportion of households working as labourer (Agricultural + forest) amount to 80 per cent in Wagholi,50 percent in Ghatpendhari and 33.33 per cent in Kolitmara. It is the lowest (12.5%) in Tuypar. Distance variable does not seem to be influencing the variations either in cultivation as main occupation or labourer as subsidiary occupation. Absence of diversified occupational structure appears as a distinguishing feature of occupational distribution. The village Kolitmara presents a unique picture as 1/3rd households are engaged in fishing and another 1/3rd households are pursuing self-employment. Next to this village, is village Ghatpendhari where 14.2 per cent of the households are engaged in self-employment. As agriculture fails to provide them a regular source of income throughout the year, they are forced to work either as agricultural labourer or any other type of work. Most of the population in these villages have a subsidiary occupation as labour, or fishing and hunting.

Table- III.II.9 :Villagewise and Categorywise Occupational Distribution

Village Name	(1) Cultivator	(2) Labourer (Agri +Forest))	(3) Hunting	(4) Fishing	(5) Self-employment	(6) Govt. Service
Category- A						
Ghatpendhari	50%	50%	- -	- -	- -	- -
Kolitmara	- -	33.33 %	- -	33.33 %	33.33 %	- -

Narhar	80 %	- -	- -	- -	- -	20 %
Kirnagisarra	100%	- -	- -	- -	- -	- -
Khapa	70 %	30 %	- -	- -	- -	- -
Wagholi	20 %	80%	- -	- -	- -	- -
Category- B						
Tuyapar	75 %	12.5 %	- -	- -	- -	- -
Ghatpendhari	64.3 %	21.1 %	- -	- -	14.2 %	- -
Category- C						
Ambazari	85.71	14.29				
Kadbikheda	77.8 %	22.2 %	- -	- -	- -	- -
Chargaon	100 %	- -	- -	- -	- -	- -

DEPENDENCE OF SAMPLE VILLAGES ON FOREST OF PNP:

3.II.15 The dependence of local communities, belonging to the village Fulzari, on forests of Pench National Park has been studied with the help of its census. Fulzari lies within the geographical boundaries of PNP. The dependence of it has been studied by estimating the income derived by the local communities from NTFPs as well as by studying their resource use pattern and daily activity status.

This chapter also attempts to study the dependence of the local communities in proximity of PNP. The same criteria as used in the earlier chapter, have also been used to assess their degree of dependence on PNP i.e. income and employment derived from forest, fuel wood and fodder consumption, accessibility to PNP etc. Their dependence on bio-mass consumption from the forest of PNP as reflected in their resource use pattern has also been studied for the sample villages. Use of pre-structured questionnaire, interviews with the members of the households and monitoring of their activities has been followed to collect the relevant information.

Prima facie it is expected that villages in close proximity of PNP boundary will exhibit a higher degree of dependence on PNP than those lying away from PNP boundary. To study their dependence as reflected in income from the forest and its relative share in total income, all villages have been classified into three categories depending upon their distance from PNP boundary. The relationship between proximity to PNP and proportion of income earned from sources having direct or indirect links with forest resources vis-à-vis other non-forest sources of income has been observed. The Table- III.II.10 focuses on this relationship[iv].

It may be observed from the table [III.II.10] that out of six villages within the distance of 1 to 3 km of PNP boundary, four villages have shown a high degree of dependence based on the criterion of the percentage of income derived from forest or forest related activities. Wagholi, Ghatpendhari and Kirangisarra have shown a lower degree of dependence in so far as income derived from forest is concerned.

The villages lying within 3 to 5 kms. of PNP boundary have shown relatively low degree of dependence as compared to villages within the distance of 1 to 3 KM from PNP boundary.

Out of three villages in the third category (5 to 10 KM) except one (Kadbikheda) two remaining villages have shown low degree of dependence. However, almost all the villages (except Wagholi) within 10 KM have shown that their share of income from the forest exceed 20 per cent. This factual evidence goes to substantiate the hypothesis that, closer the village from the PNP boundary, higher the degree of dependence on PNP or villages lying away from the PNP boundary show lower degree of dependence.

Income from non-forest sources i.e. agriculture (cultivation), self-employment, and agricultural labour for the above three distance categories shows wide variations.

In case of Ghatpendhari Wagholi and Kirangisarra the villages within the distance of 1 to 3 Km, the dependence on agriculture as reflected in income earned thorough cultivation, the agriculture labour, and self-employment is high.

In Narhar and Khapa, agriculture supports the income of the village communities only marginally inspite of the fact that in both Khapa and Narhar more than 70% of the sample households have reported their major occupation as cultivators. Kirangisarra and Kolitmara villages have alternate sources of income by way of self-employment. The common feature of all the sample villages is, where dependence on agriculture is high, it has contributed to reduce the pressure on forest of PNP to some extent. Except Chargaon and Kolitmara, self-employment opportunities contributing to reducing their dependence on PNP have played a marginal role.

Table –III.II.10 : Dependence of villages as per the distance from the PNP boundary

Name of the village/Distance form PNP boundary	Percentage of income from forest related activities (%)				
	NTFP	Forest labour	Fishing	Hunting	Total income from forest (%)
a) **1 to 3 KM**					
1) Ghatpendhari	25.1	03.71	-	-	28.72
2) Kolitmara	37.62	01.40	31.52	-	70.54
3) Narhar	37.55	12.51	0	0	50.06
4) Kirangisarra	15.13	1.48	1.97	0	21.58
5) Khapa	38.61	10.80	00.26	05.30	54.97
6) Wagholi	17.54	01.76	-	-	19.20
b) **3 to 5 KM**					
1) Tuyapar	40.20	03.35	-	-	43.55
2) Ghoti Dahoda	33.94	07.21	-	-	41.15
c) **5 to 10 KM**					
1) Ambazari	23.25	02.42	01.24	-	26.91
2) Kadbikheda	42.58	07.38	02.91	-	52.87
3) Chargaon	19.43	01.99	-	-	21.42

3.II.16 DEPENDENCE FOR LIVESTOCK CONSUMPTION: In the following paragraphs it has been attempted to examine the status of dependence of livestock population for grazing purpose

Two estimates of dependence of livestock population on the forests of PNP have been worked out:

1. On the basis of household surveys;
2. On the basis of estimates of per capita consumption of fodder as given in various Reports i.e. on the secondary source of data.

3.II.16.1 ESTIMATES OF DEPENDENCE OF LIVESTOCK POPULATION ON PNP: The livestock population of sample villages has been estimated at 447. The village wise break up of this is given in Table- III.II.12.

The highest cattle population is for the village Ghoti- Dahoda (81), followed by Chargaon (65) and Tuyapar (64). The lowest cattle population is in Kirangisarra village (11), followed by Kolitmara (12).

The total annual consumption of grass for the 79 households is reported at 3,35,720 bundles of grass weighing 3,35,720 kg. Per capita annual consumption of grass by livestock population is estimated at 757.05, which gives daily consumption of 2.05 Kgs. The estimates based on local market rates (Re 1 per Kg) show the monetory value of the total dependence at Rs. 3,35,720 or Rs.757.05 per capita dependence of livestock for grazing purpose. This provides an estimate of daily dependence of Rs.2/- for grazing.

Table- III.II.11: Income from Non-Forest Sources

Name of the village/Distance form PNP boundary	Income from Non-Forest Sources					
	Cultivation	Agri. Labour	Self-emp	Milch income	Other income*	Total
a) **1 to 3 KM**						
1) Ghatpendhari	51.43	17.35	06.45	0.15	--	75.38
2) Kolitmara	0	05.90	14.21	0.14	--	20.25
3) Narhar	40.84	9.1	0	0.16	--	50.1
4) Kirangisarra	69.11	4.84	4.47	0.29	--	78.71
5) Khapa	24.43	16.52	02.37	0.17	--	43.49
6) Wagholi	75.81	04.25	01.06	0.15	--	81.27
b) **3 to 5 KM**						
1) Tuyapar	42.98	13.42	00	0.17	--	56.57
2) Ghoti Dahoda	39.71	11.35	07.49	0.26	--	58.81
c) **5 to 10 KM**						
1) Ambazari	64.22	02.42	06.45	0.01	--	73.1
2) Kadbikheda	34.49	12.64	-	0.14	--	47.27
3)Chargaon	36.43	05.08	37.07	0.12	--	78.7

*Other income includes income from various rural development schemes as well as schemes implemented by forest department as well as NGO's (for details refer Annexure-III)

The above estimates are gross underestimation as the estimate of consumption as reported by them pertain to a period of only eight months. For remaining four months they are dependent on crop residue from agriculture. The daily per capita consumption (for eight months in the year) of grass by livestock population is estimated at (757.05/240 days) 3.13Kg. The fodder consumption in the form of agricultural waste or crop residue supplements the consumption of livestock population in the sample villages.

Table-III.II.12 : Livestock Population (Sample)

Village Name	Total Livestock Population	Village Name	Total Livestock Population
Ambazari	30	Kirangisarra	11
Chargaon	65	Kolitmara	12
Ghatpendhari	36	Narhar	23
Ghoti- Dahoda	81	Tuyapar	64
Kadbikheda	46	Wagholi	30
Khapa	49	**Total**	**447**

3.II.16.2 DEPENDENCE OF POPULATION ON FOREST OF PNP FOR FUELWOOD: For estimating dependence on forest of PNP, the relative share in total income of the villagers originating from the forest sources has been estimated. The income from forest mainly consists of income from firewood or fuel-wood and income from grasses and other NTFPs. For valuation of this, income from these sources has been reduced to a common denominator. Each village has its own measure of the quantity of each product harvested. This local unit of measure can be converted into standard metric unit of kilograms where a bundle is equal to 15 kg for fuel-wood and 20 kg for fodder (residue of jawar crop). For timber, the conversion is equal to 12 kg. In some villages, the local unit used to measure quantity of the products harvested is different for all the three products. In case of timber, the measure used is number of poles which when converted in the standard metric units comes to one pole measuring 10 kg.

The measure for fuelwood is cartload and when converted into standard metric units comes to one cartload equalling to 300 kg. For fodder, in almost all villages, no real measure existed as the animals were left in the forest for open grazing. In 90% of the villages, the measure of quantity defined for the three products is head load. One head load of fuel would be 15 to 20 kg and cartload of bamboo equal to 200 kg to 300 kg. In estimating the dependence of these villages on PNP above method was used to reduce them into common denominator of monetory value. The price in the settlement area or in the local market in proximity of PNP has been used to quantify the dependence.

The estimates of fuel-wood consumption for the local communities in 11 villages show their dependence to the tune of 17305 bundles of fuel wood or cart load converted into head-loads of bundle of wood reduced further to uniform category of (17305 * 15 KG) 2,59,575 kgs. The quantification in monetory units is estimated at Rs. 2,66,135 annually. This in turn works out to annual per capita consumption of Rs. 704 or in terms of physical units (17305 bundle /88 households) 196.65 bundles of fuel-wood per household (annually).

The requirement of fuel-wood for the village communities in 11 villages has also been estimated on the basis of secondary source of data[v]. The estimates of fuel-wood consumption are based on the Report on Wood Consumption Study in Nagpur district by Forest Survey of India, Nagpur. Assuming per capita consumption of fuel wood at 0.99 m^3 or 297 Kgs (as per the estimates for the rural area of Nagpur district), the total consumption of fuel wood comes to 374.22 m^3 for the sample population of the 11 villages. An average of 300 KG per cubic meter for quantification is taken which gives estimates of (374.22 m^3 * 300 Kg) 1,12,266 Kgs.

These alternative estimates based on primary and secondary sources of data have been presented to show the range within which consumption of fuel wood of the local communities in 11 villages would lie. This would give the lower limit (1,12,266 Kgs) as well as upper limit (2,59,575 Kgs) of dependence for fuel wood on the forest of PNP, and help in minimising the error in reporting.

Proportionate share of population of 11 villages (as per 1991 census) to the total rural population of Nagpur district (as per 1991 census) has been worked out to estimate the demand for timber, fuel wood, agricultural waste, etc. On the basis of total rural consumption of above products, proportionate share of 11 villages in total consumption has been estimated.

The per capita estimates based on the Report on Wood Consumption Study are given below. For sample population of 11 villages, total consumption for the following uses has been worked out.

Table- III.II.13 : Estimates of consumption

Sr. No.	Item	Annual per capita consumption*	Total consumption	In Kg (1 M^3 = 300 Kg)
1.	Bamboo	29 (No.)	11542	- -
2.	Building construction	0.507 M^3	201.79 M^3	60537 Kg
3.	Agri., Implements	0.037 M^3	147.26	44178 Kg
4.	Total Timber	0.574 M^3	228.45	68535.6 Kg
5.	Fire wood	0.99 M^3/ annum	394.02	118206

* Estimates based on the Report on Wood Consumption Study 2000-01

In the same manner, for low and medium income groups the estimates of consumption for cow dung/ agri. waste, kerosene, fire wood have been worked out by assuming uniform distribution of total population in two income groups, i.e. 50 per cent in low and 50 per cent in medium income group. Population in high income group is assumed to be zero.

Table-III.II.14: Consumption of Cow-dung, Agri. waste, Kerosene oil, Firewood

Sr. No.	Item	Low income** (Kg)	Medium income** (Kg)
1.	Cow dung	5390.28	7592.13
2.	Agri. Waste	13,900.95	13,774.32
3.	Kerosene il*	2052.54	1744.47
4.	Fire wood	60,480	60,480

* Kerosene oil is measured in terms of litres

** 50% of the population is assumed to be from low income group and 50% from medium income group. Population in high income group is assumed to be zero.

SECTION- III

REGRESSION ANALYSIS

3.III.1 The purpose of this section is to investigate the dependence of the households on the forest of PNP with the help of regression analysis and particularly to identify the determinants of the dependence. The methodology consists of multiple regression and employs cross sectional data set. The ordinary least squares method is used to estimate the parameters. The estimates of the parameters provide the direct and indirect effects. The estimated coefficients of the equation indicate the relative strength (magnitude), direction (sign) and significance of the contribution of exogenous variables to the endogenous variable. The results of the regression analysis will be useful for deriving policy implications. The regression analysis is carried out at three levels:

- For the households of Fulzari village
- For the sample households of the sample villages
- For all the households of Fulzari and the sample villages

The Model: The dependence of the households on forests and its various components are already explained in the earlier sections. For regression analysis, the dependence is defined as the percentage of forest income (sum total of income from NTFP, income from hunting and wages of forest labour), denoted by p1, in the total income of the family. The regression model considered for investigating the dependence of the households in and around the PNP, the multiple regression, is as follows:

p1= f(ntfp, hunting, forlab, fishing, livestock, p2, qtynumer, firewoo1, firewoo2)

where

p1= dependence on forest of PNP

ntfp= imputed value of NTFP

hunting= imputed income from hunting

forlab= income (wages) of forest labour

livestock= total number of livestock

p2= percentage of non-forest income (sum total of income from agriculture, wages income from agricultural labour and income from self-employment, other income like eco-development, rural development schemes)

qtynumer= estimated value of headload of feed for livestock

fishing = income from fishing

firewoo1 and firewoo2 are the dummy variables used to capture the effects of collection of firewood from reserve forest and core forest respectively and are defined as

firewoo1=1 if the firewood is collected from the reserve forest

=0 otherwise

firewoo2=1 if the firewood is collected from the core forest

=0 otherwise

3.III.2 Dependence: For the data set obtained by interviewing the households in the Fulzari village and the sample households in the selected villages the estimated dependence on the PNP is presented in the following tables.

The comparison between the cumulative percentages of table1 and table2 brings out that the dependence of the households on the PNP varies inversely with the distance of the village. Fulzari being in the core forest area its dependence on the PNP is naturally the maximum.

Table III.III.1:Dependence on the PNP (% of forest income in the total income of the family): Fulzari Village

Dependence (%)	Number of Households	Cumulative total greater than lower boundary of class	Cumulative percentage
0-10	2	41	100.00
10-20	0	41	100.00
20-30	7	39	95.12
30-40	3	32	78.05
40-50	5	29	70.73
50-60	9	24	58.54
60-70	5	15	36.59
70-80	2	10	24.63
80-90	3	8	19.51
90-100	5	5	12.20
Total	41		

Table III.III.2 :Dependence on the PNP (% of forest income in the total income of the family) : Other Villages

Dependence (%)	Number of Households	Cumulative total greater than lower boundary of class	Cumulative percentage
0-10	8	80	100.00
10-20	9	72	90.00
20-30	5	63	78.75
30-40	10	58	72.50
40-50	12	48	60.00
50-60	14	36	45.00
60-70	11	22	27.50
70-80	1	11	13.75
80-90	5	10	12.50
90-100	5	5	6.25
Total	80		

Table III.III.3 :Dependence on the PNP (% of forest income in the total income of the family): Combined Sample

Dependence (%)	Number of Households	Cumulative total greater than lower boundary of class	Cumulative percentage
0-10	10	121	100.00
10-20	9	111	91.74
20-30	12	102	84.30
30-40	13	90	74.38
40-50	17	77	63.64
50-60	23	60	49.59
60-70	16	37	30.58
70-80	3	21	17.36
80-90	8	18	14.89
90-100	10	10	8.26
Total	121		

The households in the PNP with 40 per cent or more dependence accounts for more than 63 per cent of the total sample.

3.III.3 Interlinkages: The estimates of correlation coefficients indicate the degree of relationship or, interlinkages between the variables. The bivariate correlations between the dependence and other variables are presented in the following table.

Table III.III.4: Correlations

Dependence &	Fulzari		Other Villages		Combined Sample	
	Correlation	t-value	Correlation	p-value	Correlation	p-value
NTFP	0.267	0.092	0.488**	0.000	0.378**	0.000
Hunting	0.212	0.183	0.161	0.154	0.189*	0.038
Forest Labour	0.317*	0.043	0.191	0.090	0.183*	0.05
Fishing	--0.503**	0.001	--0.069	0.542	--0.221*	0.015
Livestock	0.221	0.166	0.180	0.111	0.184*	0.043
p2	--0.605**	0.000	--0.065	0.565	--0.65	0.482
qtynumer	0.291	0.065	0.202	0.072	0.150	0.099

The NTFP, hunting and forest labour, are the direct contributors to the dependence on the PNP. The correlations of these variables with the dependence are positive. For households of other villages and the combined sample, the correlations are not only positive but they are also statistically significant. Similarly livestock and qtnumer also positively contribute to the dependence. The correlations of these variables with the dependence are also positive. Agricultural income plus the agricultural labour (p2) and fishing constitute the components of the total income of a family besides the forest income. *A priori* the relationships of dependence with the p2 and fishing are assumed to be negative because the increase in any of these variables will decrease the p1. The estimates of correlation coefficients are observed to be negative for all the three situations. For the households of Fulzari and the combined sample, the correlation coefficients between the dependence and fishing are found to be statistically significant. The correlation between

dependence and p2 is observed to be statistically significant for the households of Fulzari village.

3.III.4 Regression Results: The linear multiple regression results are presented in the following paragraphs. The multiple regression under estimation is

p1= f(ntfp, hunting, forlab, fishing, livestock, p2, qtynumer, firewoo1, firewoo2)

The regression results are presented first for the households of Fulzari village.

Table III.III.5 : Regression Results :Dependent Variable: p1

	Fulzari		
Independent Variable	Estimate	t-value	p-value
Constant	94.5980**	15.879	0.000
NTFP	0.000180	0.508	0.615
Hunting	0.000672	1.351	0.186
Forlab	0.000644	0.673	0.506
Firewood2	6.839*	2.038	0.050
Fishing	--0.00331**	--10.400	0.000
Livestock	0.219	0.991	0.559
Qtynumer	--0.00971	--0.620	0.539
P2	--0.865**	--11.289	0.000

$R^2 = 0.889$

Fishing, income from agriculture plus agriculture labour (p2) and Firewood2 are the variables that have significant impact on the dependence. Out of these variables, p2 and fishing have negative impact whereas firewoo2 has positive impact. The estimate of the coefficient of determination brings out that the exogenous variables explain almost 89 per cent variation in the dependence of the households in Fulzari village on the PNP. When the insignificant variables are dropped from the model, the model reduces to

p1= f(fishing, p2, firewoo2,)

The results are presented in the following table.

Table III.III.6 :Regression Results for Fulzari: Dependent Variable: p1

Independent Variable	Estimate	t-value	p-value
Constant	97.940**	26.274	0.000
Firewood2	7.061*	2.22	0.033
Fishing	--0.00341**	--11.442	0.000
P2	--0.899**	--13.366	0.000

$R^2 = 0.873$

The three variables, fishing, income from agriculture plus agriculture labour (p2) and collection of firewood together explain more than 87 per cent of the dependence of Fulzari households on the PNP. As compared to the previous model wherein all the determinants were considered the decline in the coefficient of determination is only marginal.

3.III.5 Other Villages:

The regression results for the sample households from the selected villages are presented in the following table.

Table III.III.7: Regression Results : Dependent Variable: p1

	Other Villages		
Independent Variable	Estimate	t-value	p-value
Constant	26.943**	3.109	0.003
NTFP	0.002221***	4.361	0.000
Hunting	0.00204	1.326	0.189
Forlab	0.00105	0.950	0.346
Firewood2	2.187	0.257	0.798
Fishing	--0.000801	--0.475	0.636
Livestock	--0.404	--0.693	0.491
Qtynumer	0.000120	1.929	0.058
P2	--0.000203	--0.637	0.526

$R^2 = 0.323$

In case of these households, the exogenous variable, NTFP seems to be playing a very important role in determining the dependence on the PNP. Although the

signs of the other variables are in the proper direction, their impact is statistically insignificant. The model after dropping the insignificant variables is as follows:

p1= f(ntfp)

The results of the estimation of the model are furnished in the following table

Table III.III.8 :Regression Results for Households of other villages

Dependent Variable: p1

Independent Variable	Estimate	t-value	p-value
Constant	25.93**	5.556	0.000
NTFP	0.002093**	4.934	0.000

$R^2 = 0.238$

Combined Sample

The regression results for the sample households of the combined sample are presented in the following table.

Table III.III.9 :Regression Results

Dependent Variable: p1

	Combined Sample		
Independent Variable	Estimate	t-value	p-value
Constant	40.449**	6.730	0.000
NTFP	0.001614**	3.688	0.000
Hunting	0.002071**	2.297	0.023
Forlab	0.001397	1.444	0.151
Firewood2	7.015	1.266	0.208
Fishing	--0.00141**	--2.270	0.025
Livestock	--0.271	--0.558	0.578
Qtynumer	0.0001113	1.739	0.085
P2	--0.000256	--0.782	0.436

$R^2 = 0.269$

In case of the combined sample households, NTFP, hunting and fishing seem to have statistically significant impact. All the exogenous variables together explain about 27 per cent variation in the dependence of the households of villages in the PNP. The model after dropping the insignificant variables is as follows:

p1= f(ntfp, hunting, fishing)

The regression results for the sample households of the combined sample are presented in the following table.

Table III.III.10 :Regression Results

Dependent Variable: p1

	Combined Sample		
Independent Variable	Estimate	t-value	p-value
Constant	36.198**	9.579	0.000
NTFP	0.001489**	4.478	0.000
Hunting	0.002137**	2.369	0.019
Fishing	--0.00134**	--2.182	0.031

R^2= 0.216

All the four exogenous variables together explain 21.6 per cent variation in the dependence of the households of villages in the PNP.

The significant positive effect that the constant term in all the equations suggests clearly the synergy that The PNP dependence performance can derive from the general socio-economic, political and resource-related within the PNP framework.

Annexure-III

Income under the category of 'Other' includes income from various rural development programmes and the schemes implemented by the Forest Department under Eco-Development or micro plan. Through field surveys, information regarding rural development programmes was collected both at village level (sample villages) and at the level of households. Benefits under Indira Awas Schemes, water supply and Sanitation Schemes, S. G. S. R. Schemes etc. are available to the local communities at the village level. (for some of the sample villages like Tuyapar, Khapa, Kolitmara). However, the sample households, selected randomly, did not get benefits or those who were benefited, experienced only marginal growth in their income. The respondents of the sample households did not report any information regarding income received through these rural development programmes.

The benefits of Eco-development and micro plan executed by the forest department were not received by the respondents in sample villages as it was suspended in 1999 (as reported by Forest Dept.).

The column showing income from 'other' sources therefore shows nil income for villages under consideration.

Notes and Reference

---

[i] The estimates of consumption of wood for construction purpose are given in the Report of Wood Consumption Study 2000-01, Nagpur, Forest Survey of India.

[ii] Gupta (1991) and Prasad and Bhatnagar (1991 a)

[iii] The livestock population of Fulzari has witnessed a fall from 422 in 1991 to 216 in 2002 (survey period) which may be indicative of falling dependence of it on PNP.

[iv] The sample design is discussed in detail in methodology

[v] As per Report on Wood Consumption Study of Nagpur District, Forest Survey of India Ministry of Environment and Forests, GOI 200-2001

CHAPTER- IV: BIODIVESITY–An OVERVIEW

4.I.1 Having analysed the dependence of the village communities on the natural resources of the PNP for biomass consumption in the preceding chapters, it is now attempted to discuss the impact of human intervention may be for recreational purpose. Such an intervention is likely to have an adverse impact on the bio-diversity of the PNP. In the present chapter, it is attempted to present biodiversity status of PNP by giving inventory of flora and fauna. In order to examine the impact of human intervention on biodiversity status or vegetation structure, an attempt has been made to present botanical information collected by using the 'International Forestry and Resources Institution (IFRI) technique. The medicinal value of sample plots or marketable medicinal value of sample plots or major three species (timber, firewood, movai, saja etc.) in the biodiversity plots has been attempted in the same chapter.

With above purpose in view, the present chapter is divided into following sections, Section I gives general profile of biodiversity at global as well as at the level of PNP. Section- II depicts vegetational status by taking a sample of plots in PNP by using IFRI method. It also tries to analyse impact of human intervention on the vegetational structure of PNP. Section-III attempts to measure marketable value of major tree species in the sample plots. Section IV gives inventory of medicinal plants in PNP.

SECTION- I

BIO-DIVERSITY –A GENERAL PROFILE

4.I.2 Maintaining biodiversity through creation of National Park and Tigers Reserve is gaining increasing importance. Worldwide, numerous species are going extinct, and even more that have not yet been identified are likely to be threatened. Perhaps the most comprehensive data about extinction and threats of extinction are found in Red Lists and Red[1] Data Books published by the World Conservation Monitoring Centre. (WCMC1992; IUCN 1995; UNEP 1995) Those data indicate that in 1994, just for the species about which enough is known to assess their status, nearly 5,400 animal species and more than 26,000 plant species were threatened; that is, they were listed as endangered, vulnerable, rare or indeterminate. The loss of even a specie diminishes the earth's store of biological diversity, for once eliminated the specie

cannot be recovered or regenerated. It is important to be concerned about the loss of species or any other loss of biodiversity because biodiversity is the very stuff of life. It includes the variety or list the millions of different species and unique genes that each individual of each species carries- and the process through which all species interact.

INDIAN SCENARIO: Indian flora comprises of 46,620 species of plants of which, about 15000 species are of flowering plants, 2500 species of algae, 1,600 lichens, 23,000 fungi , 2584 bryophytes, 1,022 pteridophytes, 64 gymnosperm and 850 bacteria. There are about 75000 species of animals including 50,000 insects, 4,000 molluscs' 2,000 fishes, 140 amphibians, 420 reptiles, 1,200 birds and 340 mammals and other invertebrates. It is estimated that 79 species of mammals, 44 of birds, 15 of reptiles, 3 of amphibians and about 3000 plant species are going to be extinct in the near future. To conserve these species, we have to protect their viable habitats and specific measure have to be taken to prevent poaching and prevent trade of wild life products such as ivory, rhino horns, furs, skins, musk, peacock feathers, etc.

A glimpse of biodiversity scenario and conservation measures needed to be adopted are enumerated below:

BIODIVERSITY

A Total plant species in the World Medical and aromatic plants known globally	4,00,000 8,000
B Plant species in India Flowering plants Algae Lichens Fungi Bryophytes Pteridophytes Gymnosperm Bacteria (Source: BSI 1980)	15,000 2,500 1,600 23,000 2,584 1,022 64 850
C Biodiversity in Himachal Pradesh Number of flowering plants in HP Medical plants Aromatic plants Plants of Ethonobotanical Importance	 3,500 900 150 050
D Commercial medicinal and aromatic plants available Commercial medicinal and aromatic plants	150- 200

available in PNP	80-100
E Plants species harnessed for trade and industry Plants species which can be harnessed in PNP	85- 100 20-25
F Threatened /endangered species of medicinal and aromatic plants Threatened /endangered species of medicinal and aromatic plants inPNP	36 00
G Medicinal and aromatic plants species that can be cultivated in different agroclimatic zone of Himachal Pradesh Medicinal and aromatic plants species that can be cultivated in different agroclimatic zone of PNP	375 40
H Plant species under threat World India (endangered species) Himachal Pradesh (endangered species)	 20,000-30,000 >3000 >100

4.I.3 BIODIVERSITY OF PNP:

The PNP is endowed with such biodiversity of flora and fauna which has local as well as global value. It is a treasure house of wide ranging species with life saving medical value and has potential of improved foodstuff to feed a burgeoning human population. The attempt, in the present study, has been made to provide an inventory of floristic composition of PNP. The objective is to provide forest biodiversity spread over PNP.

4.I.4 Structure and Composition of Tree Vegetation in PNP:

Vegetation constitutes one of the major components of natural resources of any ecosystem, because it acts as an ecological indicator of all aspects of environment. It acts as an important source of food to the wild as well as domestic animals and human beings and provides habitat to the wild animals. Any change in the vegetation structure due to human activities directly creates impact upon the population structure of faunal species, which signifies important role of vegetation in the ecological studies. To study the impact of human activity induced change in the ecosystem, it is necessary to understand floral aspects of the ecosystem from conservation and management viewpoint. The process involves, assessment of certain parameters such as floristic inventory, quantification of vegetation cover and various uses like commercial, medicinal use of plants.[2]

4.I.5 GENERAL CAUSES OF THREAT TO PLANT SPECIES

Both natural as well as man-made causes are posing a great threat to the survival of may medicinal and aromatic plant species. Certain natural disaster leading to destruction of habitats cannot be blamed for, but certain factors can be controlled or their effects can be diluted to a great extinct. The major causes leading to loss of biodiversity are listed below :

Abiotic Factors

- Floods, droughts, earthquakes, landslides, etc
- High rate of endemism
- Critically low population (less than 100
- Individuals) plants)
- Pathogens/ Disease
- Absence of pollinators
- Invasion by exotics or other aggressive species
- Land, water and air pollution

Biotic Factors

1. Destruction or modification of habitats
2. Over exploitation for commercial, scientific and educational purposes
3. Over grazing by domestic animals
4. Regeneration of obnoxious weed
5. Change/ expansion in farming activities
6. Distribution

SECTION- II

BIO-DIVERSITY OF THE SAMPLE PLOTS AND IMPACT OF HUMAN INTERVENTION ON BIODIVERSITY

4.II.1 Methodology

For the present study IFRI method has been used for collecting botanical information.

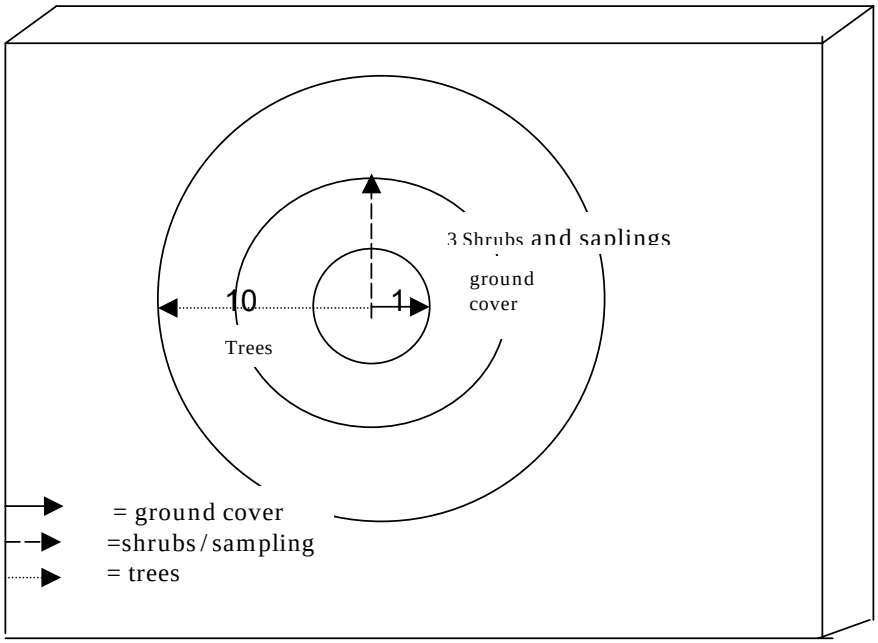
'International Forestry and Resources Institutions' (IFRI) has developed 10 instruments to collect socio-economic data. Of these, one is the Forest Plot form, which are used to collect forest data. 'Plots' are demarcated areas for studying the ecology of a forest. IFRI researchers use them to identify trees, saplings, and herbaceous matter found in the forest they are examining. By carefully determining the number and distribution of plots according to the major objective of the study, IFRI researchers can hypothesize how the local population uses (or abuses) forest resources. Plots, in other words, are the key link between the social and institutional data collected on most forms and the biological data collected on the Forest Plot form.

The purpose of the *Forest Plot Form* is to record names, extent of cover, and the size of plant species within each forest. The information collected on each plot is aggregated to describe the forest as a whole. Important values of tree species based on density, frequency, and dominance, as well as diversity indices, can be readily calculated from this data. Biodiversity, size class structure, and abundance of plants ranked as priority species by local user groups can also be calculated.

This method requires placing a grid over a map of the forest and, using a random number table, selecting coordinates of a "random point" in the forest. Using the table of random numbers, plots are determined. The team locates the random points in the forest by using established landmarks such as streams, trails, or large trees that have been marked on the map. If the forest is small, it may be possible to pace off and mark two reference lines crossing the forest perpendicular to each other. Once one plot is found, teams can use compass bearings and paces to reach the other plots. For this study, however, GPS is used for identifying the marked plots. Once the pre-determined plot is reached, center is marked with a stick or surveying flag, and a boundary of the 1-meter radius circle is also marked. The other two circles are

also easily marked off by walking around the center stake at radial distances of 3 and 10 meters. Once the plot is demarcated, measuring and counting plants starts in the small circle, working outward.

Diagram of Radial Dimensions (meters) for Concentric Circles of a Forest Plot



Ground cover includes species of grass and other ground cover. In the 3 meter circle all the sapling, their DBH and height is taken, and in 10 meter radius circle DBH and height is enumerated for all trees with the help of Clinometer.

4.II.2 OBSERVATIONS

Pench National Park is very rich in floral diversity pertaining to this area. The forest type is "Southern Tropical Dry Deciduous Forest" and is grouped as 5AC under revised classification of the forests by Champion and Seth. The diverse vegetation type ranges from such climax forests as Dry Teak forest and Southern dry deciduous mixed forests, edaphic types as Boswellia forest, Mowai forest, Garari forest and primary several stages like dry tropical Riparian forests. The PA serves as a living repository of various economic, medicinal, aromatic, ornamental plant species diversity.

The entire protected area of the park shows that, around 622.94 Ha. Forest area is cleared for construction of approach roads, saddle dam, colonies, stores, power house, and quarries. Around 1993.78 Ha area is under submergence. Although

several compartments have been demarcated as 'tourism zone', only areas that are most frequented by tourists are being considered. In this study, area around the dam as well as the river is taken as tourism area. Forest area surrounding villages, used by them for grazing and fuelwood collection is taken as human affected area. Area where no human intervention is present is taken as core area

Vegetation around the villages shows presence of dominance of tree species, *Tectona grandis, Terminalia alata, Buchanania lanzan, Lannea coromandelica, Sterculea urens, Anogeissus latifolia, Bauhinia racemosa, Buteamonosperma.* Other woody elements comprises *Chloroxylon sweitinia, Dalbergia paniculata, Diospyros melanoxylon, Grewia tilifolia, Ixora arborea, Acacia catechu, Aegle marmelos, Madhuca longifolia, Schleichera oleosa, Mitragyna parvifolia, Bombax ceiba, Butea monosperma, Ficus sp., Mallotus philipenses, Mimosa hamata, Soymida febrifuga. Bridelia retusa, Cassia fistula, Cichlospermum religiosum, Echnocarpus sp., Eugenia jambolaena, Flacourtia indica.* Most obvious perennial monocots include *Bambusa arundinacea and Dendrocalamus strictus.* Most common woody climbers are *Tinospora cordifolia, Ventilago denticulate, Zizyphus glaberrima, & Butea superba* (Table 4-7).

This area also shows presence of saplings of number of woody plants. It is dominated by L*agerstroemia parviflora, Tectona grandis, Diospyros melanoxylon, Terminalia alata, Chloroxylon swietenia, Buchanania lanzan, Ixora arborea, Bauhinia racemosa, Acacia catechu, Annona squamosa, Butea superba, Echnocarpous sp., Flacourtia indica, Grevia hirsuta, Semecarpus anacardium, Tamarindus indicus & Zizyphus glaberrima, dominating saplings of woody climbers are of Argyeria nervosa, Cryptostegia grandiflora, Gymnosporia montana, & Tinospora cordifolia* (Tables 1-3).

Ground flora of the area around the villages shows great bio-diversity of herbs and seedlings. It is dominated by annuals, *Desmodium dichotomum, Lagascea mollis, Rostellularia diffusa, Chrysopogon fulvus, Andrographis paniculata, Andropogon pumilus*. Weeds also make their presence around villages like, *Parthenium sp.,Tephrosia purpurea,Aerva lanata, Sida* species and many more grasses. Most frequent seedlings belong to *Butea monosperma, Ixora arborea, Diospyros melanoxylon, Tectona grandis, and Terminalia alata.* Seedlings of xerophytic

perennials, such as *Zizyphus sp., Mimosa hamata,Grewia tilifolia, Flacourtia indica* are also very common (Figure 2).

Tourism zone shows comparatively lesser number of species. This area is dominated by trees of *Pterocarpus marsupium, Lannea coromandelica, Anogeissus latifolia, Bauhinia recemosa, Butea monosperma, Lagerstroemia parviflora, Sterculea urens, Tectona grandis, Zizyphus glaberrima, Buchanania lanzan, Ficus racemosa, Butea superba, Bauhinea vahlii, Diospyros melanoxylon, Phyllanthus emblica, Soymida febrifuga & Terminalia alata* species (Tables 4-6).

Tourism area also shows lesser regenerative capacity, as only few saplings are observed in this area belonging to *Tectona grandis, Lagerstroemia parviflora, Helectris isora, Flocourtia indica & Chloroxylon swietenia* (Tables 1-3). Annual flora of tourism zone shows very few species of grasses , like, *Chrysopogon fulvus, Andropogon pumilus, Iseilema laxum* and few herbs. Seedlings are totally missing (Figure 3). In this area pressure of tourists, developmental plans of the government in the interest of the tourist industry [development of Dam site as picnic spot, fair weather roads etc.] resulted in, if not complete obliteration but depletion of herb on this land (Figure 4).

Core area, which forms around 230.35 sq.km., shows dominance of tree species *Tectona grandis, Terminalia alata, Lannea coromandelica, Pterocarpus marsupium, Sterculia urens, Anogiessus latifolia, Bauhinia racemosa, Bombax ceiba, Boswellia serrata, Cassia fistula, Dalbergia paniculata, Diospyros melanoxylon, Madhuca longifolia, Ougeinia ougeinensis, Terminalia tomentosa* and some small woody elements like *Grewia tilifolia, Ixora arborea, Zizyphus glaberrima & Bauhinia vahlii* (Tables 4-6).

Saplings & Tree species of the core area belong to *Lagerstroemia parviflora, Tectona grandis, Terminalia sp., Bauhinia recemosa, Butea superba, Grewia tilifolia, Mimosa hamata and Asparagus racemosus. Borassus flabellifer* also shows its appearance in the form of saplings (Tables 1-3).

Ground cover of core area is dominated by grass species, like, *Andropogon pumilus, Apluda mutica, Heteropogon contrtus* and few members of family *Acanthaceae, Malvaceae and Asteraceae*. Common seedlings of core area are of *Diospyros*

melanoxylon, Bambusa sp., Grewia hirsuta and Zizyphus species [Appendix I] (Figure 2).

4.II.3 Discussion

It is a general belief that increasing population of Fauna particularly cattle, promotion of tourism as an industry, and other anthropogenic pressures influence the quality and quantity of vegetation. On the foundation of this dicta exclusive model of National parks, Sanctuaries and Biosphere reserves came into existence to preserve natural habitat for survival of wild life as well as flora in their natural state. Demarcation of core area within these protected areas as *sanctum sanctorium,* is to preserve the genetic diversity and to allow it to grow naturally without any outside impact, mainly human intervention.

Observations and analysis of the study area, i.e., Pench national park depicts an interesting picture. Comparison of vegetation of village boundaries, tourism area and core area suggests that in the area around villages, influence of biota has resulted in increase in the biodiversity. It could be due to the fact that initial introduction, followed by naturalization and spread of plants of human interest. For example, presence of *Acacia catechu, Buchanania lanzan, & Chloroxylon swietenia* are found around villages, but they are absent in the core area. Similarly trees which are growing around villages are equally good in height and D.B.H [Tables 7-10], which also substantiate the fact that all the villagers living around the PA do not cut down trees for trade or commercial purposes. Top strata (15-20 meters) of the forest is occupied by *Terminalia alata, Tectona grandis, Anogeissus latifolia, Dalbergia paniculata. Sterculia urens, Lannea coromandelica & Madhuca longifolia.* Middle strata (10-15 meters) of the forest shows presence of *Diospyros melanoxylon, Lagerstroemia parviflora, Chloroxylon sweitenia, Buchanania lanzan, bauhinia racemosa [*Figure 8]. Sapling flora of these trees [Tables 9,10] shows that the saplings are taller in height but lesser in diameter. Probably this is because of either coppicing or high density of saplings.

This forest is characterized by a preponderance of random distribution and the rarity of regular distribution, as it is evident from abundance and frequency of trees and saplings [Tables 1-6]. The occurrence of contagious distribution of natural vegetation has been reported by several workers, [Greig- Smith, 1957; Kershaw, 1973; Singh

and Yadav,1974]. According to Odum [1971], clumped [contagious] distribution is the commonest pattern in nature, where as random distribution occurs in uniform environments, and the regular distributions occur in areas where severe competitions between the individuals exist.

Core area shows regular distribution of *Lagerstroemia parviflora Sterculia urens* and *Tectona grandis.* Contiguous distribution is shown by *Anogeisus latifolia, Buchanania lanzan, Dalbergia paniculata, Lannea coromandelica and Terminalia alata.* While rest of the trees species are characterised by random distribution. However, same species show variation in abundance and density. *Anogeisus latifolia* and Tectona grandis show highest degree of abundance, followed by *Lagerstroemia parviflora and Sterculia urens* and then *Lannea coromandelica, Diospyros and Terminalia alata.*

Village boundary flora exhibits contigious distribution of *Tectona grandis* and *Terminalia alata*, while the rest of the species are random in distribution. At the same time *Bauhinia racemosa* shows highest abundance, followed by *Tectona grandis Lagerstroemia parviflora, Dalbergia paniculata, and Chloroxylon sweitenia.*

In Tourism area *Grewia telifolia* and *Lagerstroemia parviflora* are more regular in their occurrence, but most abundant specie in this region is *Lannea coromandelica,* followed by *Bauhinia racemosa, Anogeisus latifolia, Sterculia urens , Tectona grandis and Lagerstroemia parviflora.*

Comparison of relative frequency, relative density and abundance of the three different land use area shows higher values for *Tectona grandis, Terminalia alata* around villages. *Grewia telifolia and Lagerstroemia parviflora* in Tourism zone and *Tectona grandis , Sterculia urens* and *Lagerstroemia parviflora in* Core area (Tables IV.11, 12).

Regeneration of trees is of special interest because of high economic and ecological importance. The regeneration rate of these trees in natural forests is quite low. It is also affected by degradation of habitats, livestock, population pressure, shrinking water resources, unregulated extraction of natural forest produces, and threats from trade.

Growing population and its dependence upon bounties of nature, particularly for fuel wood, fodder and other NTFP, has resulted in degradation of the habitat. Livestock

population, which is reported to be half of that of human population, places an unacceptable pressure on shrinking biomass.

Sapling flora shows relatively higher frequency and dominance of *Tectona grandis,* and *Lagerstroemia parviflora* in village boundary; *Chloroxylon sweitenia, Lagerstroemia parviflora and Tectona grandis* in tourism zone and *Anogeisus latifolia Lagerstroemia parviflora, Tectona grandis* and *Terminalia alata* in core area.

Analysis of saplings shows complete elimination of *Anogeisus latifolia, Dalbergia paniculata, Lannea coromandelica and Madhuca longifolia*. While saplings of*, Lagerstroemia parviflora and Tectona grandis* find their place in each categories with higher number, density and frequency. Presence of *Chloroxylon sweitenia, Acacia catechu and Dendrocalamus strictus* around villages suggest their introduced nature [Tables IV.1-3].

Tourism area shows poor representation of number of species in terms of frequency, abundance and density. Most affected species are *Dalbergia paniculata, Lannea coromandellica, Madhuca longifolia , Tectona grandis,* and *Terminalia alata*.[Tables IV.1-3].

Saplings are also very few in number and diversity in the core area because of dense crown cover. Regeneration of plants is less in case of *Grewia tilifolia, Lagerstremia parviflora & Tectona grandis.* Clearing, thinning and other management practices could be taken up if regeneration and growth of vegetation in this area is targeted.

Among the shrubs dominant species are *Ixora arborea, Helectris isora, Grewia species, Lantana camara, Mimosa species,Woodfordia fruticosa, Nyctanthus, Zizyphus and Kirginalia reticulata.* Common climbers of the area are *Cissus quadrangularis, Tinospora cordifolia, Mucuna prurians, Butea superba, Cryptolepis buchanani, Cryptostegia grandiflora, Hemidesmus indicus, Discorea bulbifera, Cocculus hirsutus, Combratum ovalifolium and Bauhinia vahilii.* These climbers are more frequent in core area than other parts of the protected area. Only few epiphytic species observed in this area are *Dendrophthoe falcata* and *Vanda tesellata* (Appendix – IV.1)*.*

Analysis of Truncated trees around Village boundries suggests more pressure on *Tectona grandis, Bamboosa arundinacea, Diospyros melanoxylon, Dendrocalamus*

strictus, Lagerstroemia parviflora, Buchanania lanzan, Acacia catechu, and Aegle marmelos, Circumference range [Figure 1] of these cut trees shows their primary use as timber.

Other plants which find their place as utility plants (fuel plants) belong to species of *Grewia, Helectres, Maytenus, Mimosa, Zizyphus , acacia, Calycopteris, Flacourtia,.* It seems that the pressure of grazing and browsing, being sustainable, results in higher reproductive capacity. In some cases vegetative propagation and small life span is the basic cause of increased biodiversity and density of ground flora around settlements. In the tourism area and the core area, it is the total loss of the flora because of unfavorable conditions [Figure 2].

Analysis of Biodiversity of Pench National Park [Figure 5] present dominance of *Leguminosae* followed by *Poaceae, Acanthaceae, Combrataceae and Rubiaceae*. In sum total 175 species are distributed in 134 genera and 56 families. 93 percent of families, 87 percent of genera and 90percent of species belong to Dicots [Figure 6-8]. Biological spectrum of the Pench National Park potrays sixty herbs, twenty five shrubs, seventy five trees and seventeen climbers. Herbs are more in number in the village area while Trees are more in the Core area.

Conclusions

Pench biodiversity is negatively affected by Tourism, but not necessarily due to grazing and construction and other extractions by the people living close to the park boundary. Because of the proximity to Reserved forest and Protected forest, the locals fulfill their major needs from there. They are utilizing natural resources only for small timber fuel and some other non-timber forest products like fruits, leaves, gum, medicinal plants, grass for thatching and some other minor uses. Development of roads and pressure of tourists are the main causes for disturbance of biota of the area.

Dominant Families

Pench National Park [Present Study, 2002]	Nagpur District [Ugemuge, 1986]	Central India [Hooker, 1872-1897]
Leguminosae	Leguminosae	Poaceae
Poaceae	Poaceae	Leguminosae
Acanthaceae	Cyperaceae	Acanthaceae
Rubiaceae	Asteraceae	Orchidaceae
Euphorbiaceae	Euphorbiaceae	Cyperaceae
Combretaceae	Acanthaceae	Euphorbiaceae
	Malvaceae	Rubiaceae
	Convolvulaceae	Asteraceae
	Scrophulariaceae	Lamiaceae
	Lamiaceae	Asclepiadaceae

Section-III

4.III.1 MEASURMENT OF MARKET VALUE*

The quantification of timber and firewood is based on secondary source of data collected from the forest department. Forest Department has adopted conservation plots from which the information about species is collected. The quantification of nine species has been done. Namely- Tendu, Dhawda, Salai, Miovai, Bija, Haldu, Kalam, Shivan and Saja. The information about girth size class, volume of tree, number of trees, and rate of timber and firewood has been calculated on the basis of following method.

The information for different girth classes, volume per tree in cubic meters for these species has been obtained from local volume tables of Government of Maharashtra working plan for reserved and protected forests of Nagpur division and price lists for the timber and firewood for the year 1990-91 to 1999- 2000.

The volume of trees in cubic meters depends upon the no. of trees species and volume per tree for girth class.

Each girth size class (per c.m.) has been taken into consideration to get total value of each specie. This gives the idea about the marketable value of each specie for

* This quantification is related to the size of plot 250m*400m

that area i.e. PNP. However, the various adjustments like transportation cost, middleman's commission etc. have also been taken into consideration.

The existence value of the trees in the forest has been calculated which provides separate valuation of timber as well as firewood. This way the intrinsic valuation of the species has been shown in the following table-

Table- IV.1: Quantification According to species Rate for timber and firewood

Species	Rate for timber (Rs.)	Rate of Firewood (Rs.)	Total (Rs.)
1. Tendu and Dhawada	1,00,908.37	175.39	1,01,083.96
2. Salai and Movai	25,770.16	176.06	25,946.22
3. Bija	46,245.96	2050	48,295.96
4. Haldu, Klam and Shivan	33,913.45	2200	36,113.45
5. Saja	2,45,756.00	27,491.00	2,73,247.00
Grand Total	4,52,593.94	32,092.65	4,84,686.59

Source: Lal J. B. – Economic Value of India's Forest Stock; P. 46; The Price of Forest Edited by Anil Agrawal

The estimates have been made on the basis of per cubic meter rates in rupees for every species for timber and firewood.

The table shows that out of nine species the most important is Saja in terms of valuation/ environmental accounting. The availability of this species at PNP shows the richness of forest cover. Tendu and Dhawada are contributing a lot because of its timber, firewood quality in the forest. Followed by these species, Bija is also one of the important species in the context of environmental benefit from this area. Other species are also remarkably important from the point of view of timber and firewood valuation. Haldu, Kalam, Shivan, Salai and Movai species are worth mentioning for calculating environmental gain from the forest.

The grand total of the species for rate of timber (per C. M.) is Rs. 4,52,593.94 and for firewood (per C. M.) is Rs. 32,092.65 for the preservation plot of 250 m * 400 m. It means the well maintained thick forest cover is rich in terms of timber availability for these nine species. The environmental benefit from these species are worth mentioning.

SECTION- IV

MEDICINAL PLANTS IN PNP

4.IV.1 MEDICINAL PLANTS: India's diverse agro-climate zones, variations in regional topography, wide variations in flora and fauna has contributed to the richness of its biological diversity. This diversity is a rich source of various medicinal inputs. Depending on the availability of medicinal plants, the country has been divided into eight phyto-geographic regions. The principal medicinal and agromatic plants found in different regions and the respective tribal population[3] who are the custodian of the treasure, are given in Table-IV.1

The majority of the medicinal plant species (70 percent) occur in the forest areas and the remaining 30 percent are found in non forest lands including land under cultivation. The tribal people and the forest dwellers collect a variety of leaves, fruits, seeds, nuts, roots, bark, tubers and rhizomes which have rich medicinal value.

4.IV.2 The tribal people collect such items during the lean season, i.e., when they are left with no other option of livelihood and they sell or exchange their collections for their daily needs. However, sporadic spatial distribution of plants makes bulk collection impossible. Inadequate knowledge about the medicinal values of many of the plants occurring locally is also responsible for local collection. There has also been shrinkage of Common Property Resources (CPRs) and areas under forests. Population pressure and diversion of forestland are mainly responsible for such reduction in forest area.

4.IV.3 Collection of medicinal plants and other non-timber forest produce (NTFPs) from forest provides for income for the tribal population for their subsistence. A study conducted by Administrative Staff College of India, Hydrabad, indicated that agricultural production from tribal land is inadequate to maintain a household at subsistence level. The tribal people, hence, depend on collection of medicinal plants and other NTFPs for their livelihood (N.C. Saxena 1996)

Realizing the importance of collection of wild medicinal plants and other NTFPs in the tribal economy the Indian Forest Policy 1988 provided for safeguarding the customary rights and interest of the tribal people.

Protected areas are custodians of the wild medicinal plants. One of the reasons for granting status of PA to the forest is to preserve valuable biodiversity of these medicinal plants. Pench National Park is also endowed with rich biodiversity of flora possessing high medicinal values. This PA serves as a living repository of various economical, medicinal, aromatic, ornamental plant species. Nearly 2000 species of medicinal and economical importance are seen in this National Park. So far, there is no record of any endemic or rare species from this PA. No detaile study has so far been carried which could give the extent of floristic diversity in the National Park.

An inventory of medicinal plants found in PNP and their medicinal use for various diseases is given in the Annexure-I

Table- IV.3 ECONOMIC BOTANY OF PENCH NATIONAL PARK

Family Name	Botanical Name	Marathi Name
Timber Yielding Plants		
Anacardiaceae	*Buchanania lanzan*	
Anacardiaceae	*Lannea coromandelica*	Mohwai
Anacardiaceae	*Semecarpus anacardium*	Bibba
Burseraceae	*Boswelia serrata*	Salai
Burseraceae	*Garuga pinnata*	Kakad
Ceasalpinoideae	*Cassia fistula*	Bahawa
Ceasalpinoideae	*Tamarindus indica*	Chinch
Cochlospermaceae	**Cochlospermum religiosum**	Gogal
Combretaceae	*Anogiessus latifolia*	Dhawda
Combretaceae	*Terminalia alata*	Ain
Combretaceae	*Terminalia arjuna*	Aajan
Combretaceae	*Terminalia bellirica*	Behada
Combretaceae	*Terminalia chebula*	Hirda
Combretaceae	*Terminalia tomentosa*	N/a
Euphorbiaceae	*Mallotus philippensis*	Shendi
Euphorbiaceae	*Bridelia retusa*	Kutgi
Flocourtiaceae	*Flacourtia indica*	Kakai
Lecythidaceae	*Careya arborea*	Kunbhi
Leeaceae	*Lea crispa*	Kuram
Lytheraceae	*Lagerstroemia parviflora*	Sinha/lendi
Malvaceae	*Kydia calycina*	
Meliaceae	*Azadirachta indica*	Kadu Neem
Meliaceae	*Melia azadirachta*	Bhaka neem
Meliaceae	*Soymida febrifuga*	Rohan
Mimosoideae	*Albizzia lebbeck*	Sirish
Mimosoideae	*Albizzia odoratisima*	Chichuva
Mimosoideae	*Albizzia procera*	Sirish(pandra)
Mimosoideae	*Cassia siamea*	Kashid
Mimosoideae	*Leucaena leucocephala*	Subabul
Papilionoideae	*Dalbergia paniculata*	Dhobin
Papilionoideae	*Dalbergia sisso*	Sisam
Papilionoideae	*Pongamia pinnata*	Karanj

Family Name	Botanical Name	Marathi Name
Papilionoideae	*Psoralea corylifolia*	Bawchi
Papilionoideae	*Pterocarpus marsupium*	Bija
Papilionoideae	*Erythrina variegata*	Kasai
Rubiaceae	*Mitragyna parvifolia*	Karam
Rutaceae	*Aegle marmelous*	Bel
Rutaceae	*Chloroxylon swietenia*	Behru
Sapindaceae	*Schleichera oleosa*	Kusumb/kojab
Verbenaceae	*Tectona grandis*	Sagwan

Plants which are having Medicinal value

Acanthaceae	*Andrographis paniculata*	Bhui neem
Acanthaceae	*Peristrophe bicalyculata*	N/a
Amaranthaceae	*Achyranthus aspera*	
Anacardiaceae	*Semecarpus anacardium*	Bibba
Apocynaceae	*Ichnocarpus frutescens*	N/a
Apocynaceae	*Holarrhena antidysenterica*	Pandra kuda
Apocynaceae	*Wrightia tinctoria*	Kala kuda
Burseraceae	*Boswelia serrata*	Salai
Combretaceae	*Terminalia arjuna*	Aajan
Combretaceae	*Terminalia bellirica*	Behada
Combretaceae	*Terminalia chebula*	Hirda
Euphorbiaceae	*Phyllanthus emblica*	Awla
Euphorbiaceae	*Phyllanthus virgatus*	
Laminaceae	*Hyptis suaveolens*	N/a
Laminaceae	*Leucas biflora*	
Liliaceae	*Asparagus racemosus*	Shatawari
Meliaceae	*Azadirachta indica*	Neem
Meliaceae	*Melia azadirachta*	Kadu neem
Meliaceae	*Soymida febrifuga*	Rohan
Papaveraceae	*Argemone mexicana*	Pivla dhotra
Sterculiaceae	*Helicteres isora*	Murad sheng/ Attai
Verbenaceae	*Lantana camara*	N/a
Verbenaceae	*Vitex nigunda*	Nirgundi

Family Name	Botanical Name	Marathi Name
Plants which are having Industrial value		
Bombacaceae	*Bombax ceiba*	Kate sawari
Euphorbiaceae	*Mallotus philippensis*	Shendi
Graminae	*Bambusa arundinacea*	Katang bamboo
Graminae	*Dendrocalmus strictus*	Bamboo
Mimosoideae	*Acacia catechu*	Khair
Mimosoideae	*Acacia nilotica*	Babul
Papilionoideae	*Butea monosperma*	Palas
Mimosoideae	*Leucaena leucocephala*	Subabul
Papilionoideae	*Butea superba*	Palas vel
Euphorbiaceae	*Cleistanthus collinus*	Garadi
Graminae	*Bambusa arundinacea*	Katang bamboo
Graminae	*Dendrocalmus strictus*	Bamboo
Mimosoideae	*Acacia catechu*	Khair
Mimosoideae	*Acacia nilotica*	Babul
Palmae	*Borassus flabellifer*	Sindhi
Plants which are useful for Fuel wood		
Combretaceae	*Calycopteris floribunda*	Gilibuli
Combretaceae	*Combretum ovilifolium*	Piwarvel
Euphorbiaceae	*Cleistanthus collinus*	Garadi
Mimosoideae	*Acacia catechu*	Khair
Mimosoideae	*Acacia nilotica*	Babul
Rhamnaceae	*Zizphus glaberrima*	Ghoti
Tiliaceae	*Grewia hirsute*	Gaturli
Tiliaceae	*Grewia tilifolia*	Dhaman
Plants which are useful for Edible purpose		
Amaranthaceae	*Amaranthus blitum*	
Annonaceae	*Annona squamosa*	Sitaphal
Ceasalpinoideae	*Tamarindus indica*	Chinch
Ebenaceae	*Diospyros melanoxylon*	Tendu
Euphorbiaceae	*Phyllanthus emblica*	Awla

Family Name	Botanical Name	Marathi Name
Moringaceae	*Moringa critifolia*	Aal
Myrtaceae	*Eugenia jambolana*	Jambhul
Rhamnaceae	*Ziziphus oenoplia*	Aroni
Rhamnaceae	*Ziziphus jujuba*	Bhor

Alcoholic beverage / Beedi manufacturing plants

Ebenaceae	*Diospyros melanoxylon*	Tendu
Sapotaceae	*Madhuca longifolia*	Mohwa

Plants which are having Religious Importance

Amaranthaceae	*Achyranthus aspera*	
Ceasalpinoideae	*Bauhinia racemosa*	Apta
Cyperaceae	*Cynodon dactylon*	Durva/haialli/doob
Moraceae	*Ficus benghalensis*	Wad
Moraceae	*Ficus racemosa*	Umber
Moraceae	*Ficus religiosa*	Pimpal

Plants which are useful for Grazing

Acanthaceae	*Andropogon pumilus*	Diwartan
Acanthaceae	*Barleria cristata*	
Acanthaceae	*Dyscoriste depressa*	N/a
Acanthaceae	*Dyscoriste vagans*	N/a
Acanthaceae	*Justicia procumbens*	N/a
Acanthaceae	*Lepidagathis cristata*	N/a
Acanthaceae	*Peristrophe bicalyculata*	N/a
Acanthaceae	*Rostellularia diffusa*	N/a
Acanthaceae	*Rungia repens*	N/a
Amaranthaceae	*Aerva lanata*	
Amaranthaceae	*Alternanthera sessilis*	N/a
Amaranthaceae	*Amaranthus blitum*	
Ceasalpinoideae	*Cassia tora*	Tarota
Compositeae	*Ageratum conyzoides*	N/a
Compositeae	*Glossogyne pinnatifida*	N/a
Compositeae	*Lagascea mollis*	N/a

Family Name	Botanical Name	Marathi Name
Convolvulaceae	*Evolvulus alsinoides*	N/a
Convolvulaceae	*Evolvulus nummularius*	N/a
Cyperaceae	*Cynodon dactylon*	Durva/haialli/doob
Graminae	*Apluda mutica*	Phulkia
Graminae	*Aristida funiculata*	Datanbahari/dusara
Graminae	*Arundinella setosa*	Fuler
Graminae	*Dichanthium annulatum*	MARVEL(small)
Graminae	*Dichanthium aristatum*	MARVEL(big)
Graminae	*Eragrostis tenella*	Bhurbusi
Graminae	*Heteropogon contortus*	Kusal
Graminae	*Chrysopogon fulvus*	Gadasheda
Graminae	*Cymbopogon martinii*	Tikhadi
Graminae	*Iseilema laxum*	Mushan
Graminae	*Mazus sp*	N/a
Graminae	*Themeda quadrivalvis*	Ghonyad
Malvaceae	*Malvastrum tricuspidata*	
Malvaceae	*Sida acuta*	N/a
Malvaceae	*Sida cordata*	N/a
Malvaceae	*Sida cordifolia*	N/a
Mimosoideae	*Leucaena leucocephala*	Subabul
Papilionoideae	*Alysicarpus monilifer*	
Papilionoideae	*Alysicarpus rugosus*	
Papilionoideae	*Crotalaria ramosissima*	
Papilionoideae	*Desmodium dichotomum*	N/a
Papilionoideae	*Desmodium gangaticum*	N/a
Papilionoideae	*Desmodium triflorum*	N/a
Papilionoideae	*Indigofera linifolia*	
Papilionoideae	*Tephrosia purpurea*	Divali

Climbers

Asclepidaceae	*Pergularia doumia*	Utaranvel
Celastraceae	*Celastrus paniculata*	Dhimarbel
Combretaceae	*Calycopteris floribunda*	Gilibuli
Combretaceae	*Combretum ovilifolium*	Piwarvel

Family Name	Botanical Name	Marathi Name
Convolvulaceae	*Cuscuta reflex*	Amar vel
Convolvulaceae	*Argyria nervosa*	Rakath vel
Dioscoreaceae	*Dioscorea bulbifera*	Akas vel
Liliaceae	*Asparagus racemosus*	Shatawari
Menispermaceae	*Cocculus hirsutus*	Vasan vel
Mimosoideae	*Mimosa hamata*	Chillati
Minispermaceae	*Tinospora cofdifolia*	Gulvel
Papilionoideae	*Butea superba*	Palas vel
Periplocaceae	*Cryptostegia grandiflora*	Rabarachavel
Periplocaceae	*Hemidesmus indicus*	Khobar vel
Rananculaceae	*Cleome viscosa*	Pivili tilwan
Rhamnaceae	*Ventilago denticulata*	Lokhandi
Vitaceae	*Cissus quadrangularis*	Kand vel

Table: IV.4: Medicinal use of plant

Local Name	Medicinal uses
Char	Seed---Brain Tonic ,Stomach Muscle Oil---For Black Hair
Amaltas/ Bahawa	Root—TONIC ,Fever Leaves—Skin Disease Seed---Diabetes Dissenter
Aonla	Fruit----Purification of blood ,Vitamin C and for Lungs disease .
Arjun/ Kahu	Skin—Bone and joint
Babul	skin—Dental Disease ,Mouth Disease ,Throat
Bad / Wad	Gum—Foot crèches
Bel	Fruit juice—Cough ,Acidity Sperm Leaves juice---Jodi's , sperm fall
Bibs/ bhilwa	Skin juice— Flower--- Oil---Bacteria dying (child)
Bija	Leaves—Skin disease Gum—Dental pain disease Flower—Acidity to improve hunger ,Urinary
Bor/ Ber	Leaves--- Diabetes
Chandan	Small wood—Pimples ,Cough Oil—Heat
Dhaman	Skin—Bloodful Dissenter
Dhaora / Dhawada	Gum—Tonic in the period of delivary

Local Name	Medicinal uses
Dikamali	Stomach ,Germs ,Digestive Skin disease
Ghpoti / Ghot	Fruit—Stomach pain
Gogal / Ghongal	Leaves paste—To cool the head Gum—Urine disease (Ladies)
Haldu	Leaves juice--- Jerome's
Hiwar	Skin juice—on stomach pain
Hirda / Hira	Use for pickle to improve the digestion Use for tooth paste
Imli / Chincha	Vitamin ABC to decrease heat
Jambhul / Jamun	Skin juice—Teeth, Throat Bodypain Seed powder+powder+milk on dibeates Leaves—On burning
Kakad	pickle use for undigest
Karanj	Fresh skin and leaves use for Mulvyadha Oil—Skin disease Flower—on dibeates Seed--- Cough Root--- Sandhiwat
Karaswad/ Semal	Night fall ,for improve strong sperm
Khair	Juice of fresh skin—when spit is out From mouth with blood
Kullu	Gum—Throat disease
Kumbhi	Skin juice—Snake bite, on burn ,Dental
	Disease,To make the strong teeth.
Kusum	Seed—skin disease Skin—Headuche
Medsing	Leaves juice—Abortion
Moha / Mahuwa	Flower—Tonic Skin juice—On Tonsils Seed—Snake poison
Padar	Flower—Tonic to make strong sperm Skin—on acidity
Palas	Skin juice – cold cough Leaves juice—on diabetes Sees—to decrease the swell
Pangara	To kill the germs, to clean the eyes Leaves juice—Teeth ,Ear pain sex passion
Rohan	Root—shwetpadar
Sag / sagwan	Seed—urine dsease Oil ---- for Hair ,Snake poison
Salai	Leaves powder+Butter+Coconut oil ,to Remove the burning scar .

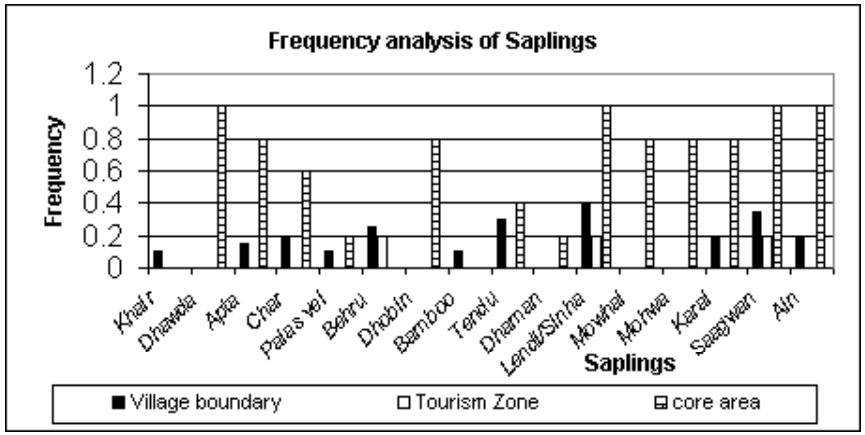
Local Name	Medicinal uses
Shisham	Leucorrhoea + with honey to improve Sperm , anemia
Siwan	Paste—on headache Juice—Urine disease, Assiduity
Sras(Black)	Skin powder—to strong the brain tonic, Night blindness
Sitaphal	Root—Tissue disease Leaves juice+sault= abolish the ringworm
Tendu	Fruit juice –Dirrhoea,on wound
Umber	Skin and leaves—To strong a gum, scorpion Bite Gum—Piles, to use in diabetes
Dudhi/ Kalakudi	Young leaves juice ----Jaundice Skin –Skin disease, piles,Tonic
Kaladhotra	Asthama, Heated leaves on scabies swell on bras
Katekoranti	Dry skin powder –use on monkey cough (with honey) Leaves juice—Scratches on leg, make a strong gum
Katumbar	Fruit- with boil milk (Goat) to reduce Jaundice
Kharasani/ Kharasi	Leaves & Skin juice on snake bite, Small vomit. Paste-To dilute cough. Seed-on piles, scabies, Skin disease.
Murad sheng/ Marorphed	Root- on diabetes Seed on stomach rheumatism; stomach ache
Neel	Leaves juice – Dog bite (with milk)
Nirgundi	Root paste- on piles; Leaves juice- on swell; as antibacterial; Seed- on skin disease
Rui	Dry leaves powder on wound
Sindhi/ chhindi	Digestive and excite (Juice)
Waghnakhi	For T.B.
Goakru	Root paste- urine stone
Kamarmodi	Clogged the blood, heel starches
Ratulsi	Seed- urine diseases Leaves- for fever
Rantur	
Tarpta	Leaves- Scabies Root- Seed- half headache
Bans/ Bamboo	Pickle, Root-cough of any type, Bamboo eye- T.B. cough, asthma, to clean m.c.
Durva/ Harialli	Root- Urine disease, Root juice- on piles
Tikhadi	Boiled leave juice on fever, Oil- for digestion to improve for hairdressing
Chilati	Boiled leave juice on leprosy
Dhimarvel/ Malkagni	Seed- To improve brain Oil – To improve memory Seed paste – Rheumatism Root- snake bite

Local Name	Medicinal uses
Gunj	Root- cough, urine diseases
Gulvel	Boiled juice- fever, Best tonic for digestion, to decrease rheumatism, to increase blood, on cough and T.B.
Kajkuiri	Root- on paralysis, mouth disease, Seed powder on worms, Hill scratches (leaves juice)
Khaynag/ Langali	Use in delivery period, Use in cancer
Kobarvel	All urine disease o snake bit
Mahulvel	Seed used as tonic
Palasvel	Gum tonic
Vasanvel	Root stomach ache Leaves juice- on night blindness

APPENDIX –IV.1 : Tables and Charts

Frequency of saplings

Botanical name	Local Name	Village boundary	Tourism Zone	core area
Acacia catechu	Khair	0.1	0	0
Anogiessus latifolia	Dhawda	0	0	1
Bauhinia racemosa	Apta	0.15	0	0.8
Buchanania lanzan	Char	0.2	0	0.6
Butea superba	Palas vel	0.1	0	0.2
Chloroxylon swietenia	Behru	0.25	0.2	0
Dalbergia paniculata	Dhobin	0	0	0.8
Dendrocalmus strictus	Bamboo	0.1	0	0
Diospyros melanoxylon	Tendu	0.3	0	0.4
Grewia tilifolia	Dhaman	0	0	0.2
Lagerstroemia parviflora	Lendi/Sinha	0.4	0.2	1
Lannea coromandelica	Mowhai	0	0	0.8
Madhuca longifolia	Mohwa	0	0	0.8
Streculia urens	Karai	0.2	0	0.8
Tectona grandis	Saagwan	0.35	0.2	1
Terminalia alata	Ain	0.2	0	1



Density of Saplings

Botanical name	Local name	Village boundary	Tourism Zone	core area
Acacia catechu	Khair	0.1	0	0
Anogiessus latifolia	Dhawda	0	0	2.2
Bauhinia racemosa	Apta	0.15	0	1
Buchanania lanzan	Char	0.2	0	1.2
Butea superba	Palas vel	0.1	0	0.2
Chloroxylon swietenia	Behru	0.25	0.2	0
Dalbergia paniculata	Dhobin	0	0	2.2
Dendrocalmus strictus	Bamboo	0.1	0	0
Diospyros melanoxylon	Tendu	0.4	0	0.4
Grewia tilifolia	Dhaman	0	0	0.2
Lagerstroemia parviflora	Lendi/Sinha	0.65	0.4	3

Lannea coromandelica	Mowhai	0	0	1.8
Madhuca longifolia	Mohwa	0	0	1.8
Streculia urens	Karai	0.25	0	1.8
Tectona grandis	Saagwan	0.55	0.6	2.4
Terminalia alata	Ain	0.3	0	1.6

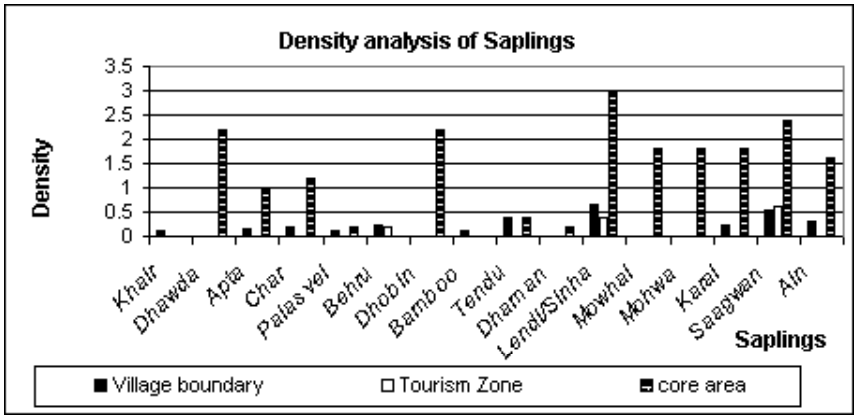
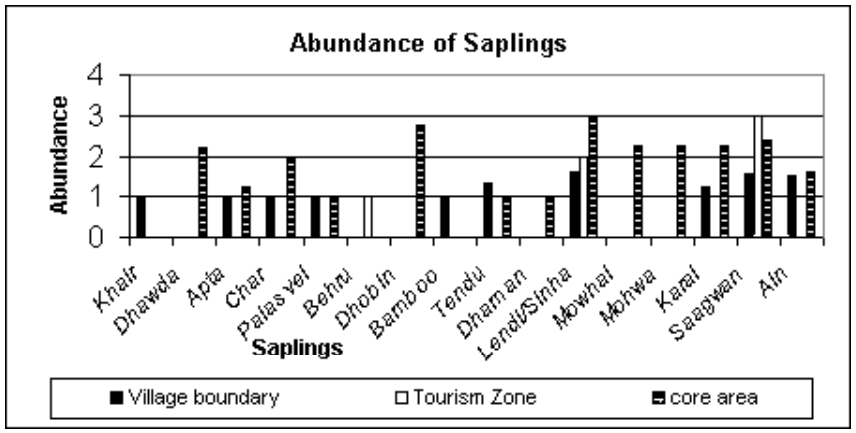


Table no-IV.3Abundance of Saplings

Botanical name	Local Name	Village boundary	Tourism Zone	Core area
Acacia catechu	Khair	1	0	0
Anogiessus latifolia	Dhawda	0	0	2.2
Bauhinia racemosa	Apta	1	0	1.25
Buchanania lanzan	Char	1	0	2
Butea superba	Palas vel	1	0	1
Chloroxylon swietenia	Behru	0	1	0
Dalbergia paniculata	Dhobin	0	0	2.75
Dendrocalmus strictus	Bamboo	1	0	0
Diospyros melanoxylon	Tendu	1.33	0	1
Grewia tilifolia	Dhaman	0	0	1
Lagerstroemia parviflora	Lendi/Sinha	1.63	2	3
Lannea coromandelica	Mowhai	0	0	2.25
Madhuca longifolia	Mohwa	0	0	2.25
Streculia urens	Karai	1.25	0	2.25
Tectona grandis	Saagwan	1.57	3	2.4
Terminalia alata	Ain	1.5	0	1.6



Frequency of Trees

Botanical name	Local Name	Village boundary	Tourism Zone	core area
Acacia catechu	Khair	0.15	0	0
Anogiessus latifolia	Dhawda	0.3	0.2	0.8
Bauhinia racemosa	Apta	0.15	0.4	0.4
Buchanania lanzan	Char	0.35	0.4	0.8
Butea superba	Palas vel	0.3	0.2	0
Chloroxylon swietenia	Behru	0.2	0	0
Dalbergia paniculata	Dhobin	0.2	0	0.8
Dendrocalmus strictus	Bamboo	0.1	0	0
Diospyros melanoxylon	Tendu	0.25	0.2	0.6
Grewia tilifolia	Dhaman	0.2	0.8	0.4
Lagerstroemia parviflora	Lendi/Sinha	0.25	0.8	1
Lannea coromandelica	Mowhai	0.45	0.2	0.8

Madhuca longifolia	Mohwa	0.2	0	0.6
Streculia urens	Karai	0.4	0.2	1
Tectona grandis	Saagwan	0.8	0.6	1
Terminalia alata	Ain	0.8	0.2	0.8

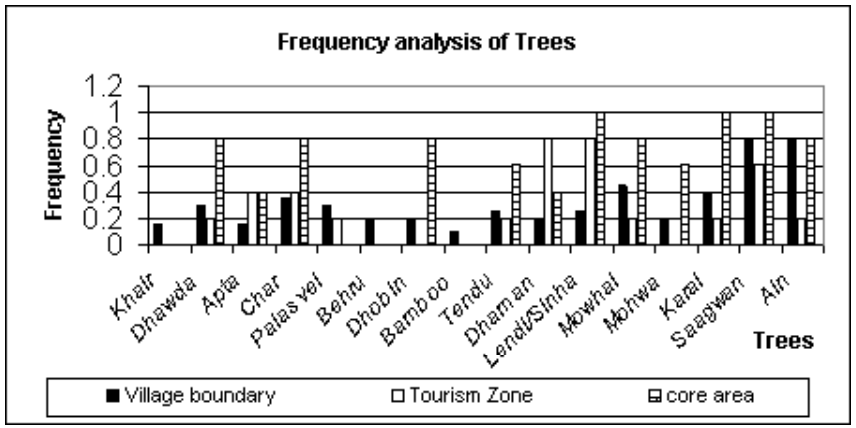


Table no-IV.5
Density of Trees

Botanical name	Local Name	Village boundary	Tourism Zone	core area
Acacia catechu	Khair	0.25	0	0
Anogiessus latifolia	Dhawda	0.45	0.4	2.4
Bauhinia racemosa	Apta	0.45	0.8	0.4
Buchanania lanzan	Char	0.7	0.4	0.8
Butea superba	Palas vel	0.3	0.2	0
Chloroxylon swietenia	Behru	0.35	0	0
Dalbergia paniculata	Dhobin	0.35	0	1.2
Dendrocalmus strictus	Bamboo	0.1	0	0
Diospyros melanoxylon	Tendu	0.25	0.2	1.2
Grewia tilifolia	Dhaman	0.25	1	0.4
Lagerstroemia parviflora	Lendi/Sinha	0.6	1.6	2.2
Lannea coromandelica	Mowhai	0.7	0.6	1.6
Madhuca longifolia	Mohwa	0.25	0	0.8
Streculia urens	Karai	0.5	0.4	2.2
Tectona grandis	Saagwan	1.95	1.2	3
Terminalia alata	Ain	0.9	0.2	2

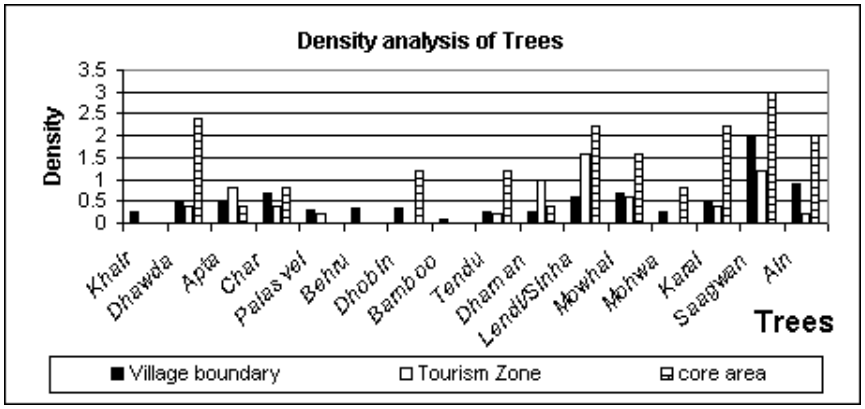

Density analysis of Trees
Density
3.5
3
2.5
2
1.5
1
0.5
0
Khair
Dhawda
Apta
Char
Palas vel
Behnu
Dhobin
Bamboo
Tendu
Dhaman
Lendi/Sinha
Mowhai
Mohwa
Karai
Saagwan
Ain
Trees
Village boundary
Tourism Zone
core area

Table no-IV.6

Abundance of Trees

Botanical name	Local Name	Village boundary	Tourism Zone	core area
Acacia catechu	Khair	1.67	0	0
Anogiessus latifolia	Dhawda	1.5	2	3
Bauhinia racemosa	Apta	3	2	1
Buchanania lanzan	Char	2	1	1
Butea superba	Palas vel	1	1	0
Chloroxylon swietenia	Behru	1.75	0	0
Dalbergia paniculata	Dhobin	1.75	0	1.5
Dendrocalmus strictus	Bamboo	1	0	0
Diospyros melanoxylon	Tendu	1	1	2
Grewia tilifolia	Dhaman	1.25	1.25	1
Lagerstroemia parviflora	Lendi/Sinha	2.4	2	2.2
Lannea coromandelica	Mowhai	1.56	3	2
Madhuca longifolia	Mohwa	1.25	0	1.33
Streculia urens	Karai	1.25	2	2.2
Tectona grandis	Saagwan	2.44	2	3
Terminalia alata	Ain	1.13	1	2

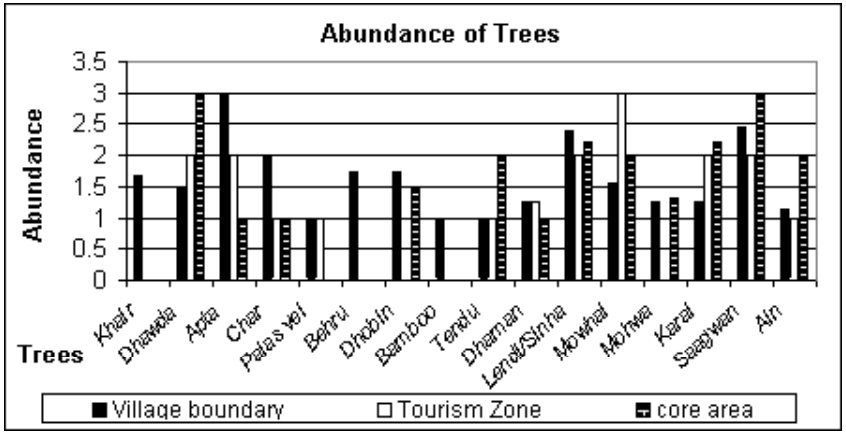


Table no –IV.7

Different D.B.H classes of Trees

Botanical name	Local name	Village boundary	Core area
Acacia catechu	Khair	14.1	0
Anogiessus latifolia	Dhawda	25.1	27.2
Bauhinia racemosa	Apta	20.3	22.3
Buchanania lanzan	Char	19.1	17
Chloroxylon swietenia	Behru	17.5	0
Dalbergia paniculata	Dhobin	27.3	41.7
Diospyros melanoxylon	Tendu	26.6	39.1
Grewia tilifolia	Dhaman	15.3	13.8
Lagerstroemia parviflora	Lendi/Sinha	21.5	27.9
Lannea coromandelica	Mowhai	22.9	26.3
Madhuca longifolia	Mohwa	21.6	25.4
Streculia urens	Karai	22.4	26.7
Tectona grandis	Saagwan	28.4	32.2
Terminalia alata	Ain	30.8	31.9

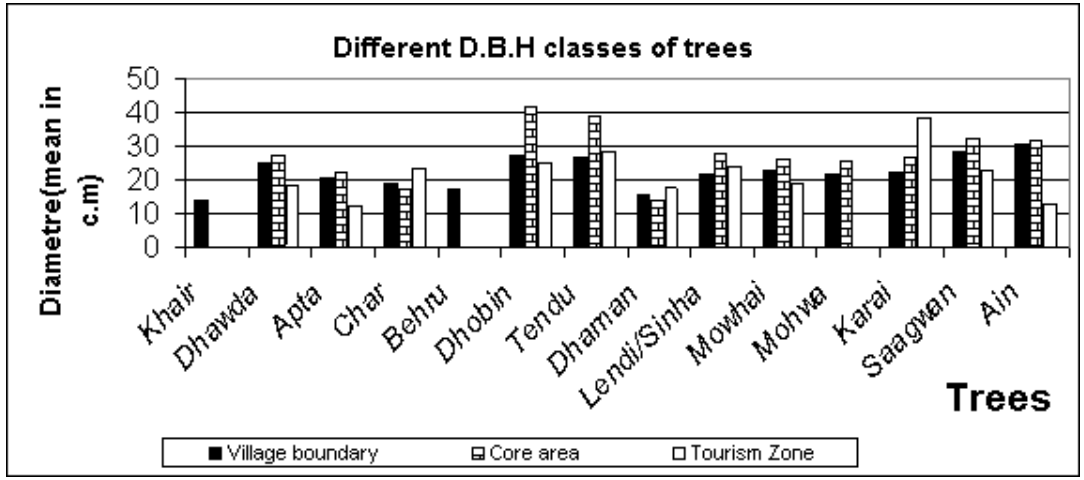

Different D.B.H classes of trees
Diametre(mean in c.m)
50
40
30
20
10
0
Khair
Dhawda
Apta
Char
Behru
Dhobin
Tendu
Dhaman
Lendi/Sinha
Mowhai
Mohwa
Karai
Saagwan
Ain
Trees
Village boundary
Core area
Tourism Zone

Table no –IV.8

Different Height classes of Trees

Botanical name	Local name	Village boundary	Core area
Acacia catechu	Khair	12.4	0
Anogiessus latifolia	Dhawda	17.9	18.2
Bauhinia racemosa	Apta	11.9	12.1
Buchanania lanzan	Char	13	16.1
Chloroxylon swietenia	Behru	14.3	0
Dalbergia paniculata	Dhobin	19	19
Diospyros melanoxylon	Tendu	14.4	16
Grewia tilifolia	Dhaman	12.4	12.5
Lagerstroemia parviflora	Lendi/Sinha	14.3	16.6
Lannea coromandelica	Mowhai	16.4	16.4
Madhuca longifolia	Mohwa	16.4	17
Streculia urens	Karai	16.2	17.2
Tectona grandis	Saagwan	18.1	21.2
Terminalia alata	Ain	18.6	20.1

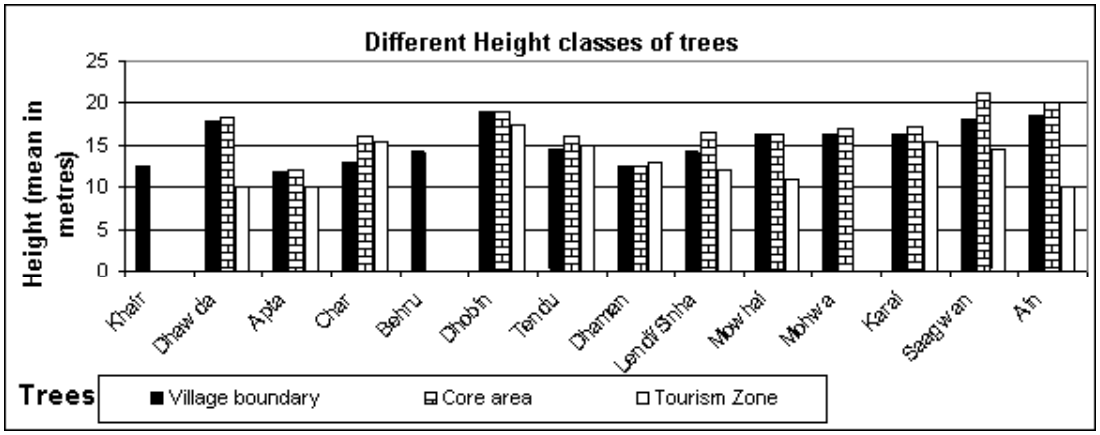


Table no –IV.9 Different D.B.H classes of Saplings

Botanical name	Local name	Village boundary	Core area
Acacia catechu	Khair	5.5	0
Anogiessus latifolia	Dhawda	0	3
Bauhinia racemosa	Apta	5	4.7
Buchanania lanzan	Char	6	5.5
Chloroxylon swietenia	Behru	6.8	0
Dalbergia paniculata	Dhobin	0	2
Diospyros melanoxylon	Tendu	5.3	5.6
Grewia tilifolia	Dhaman	0	7
Lagerstroemia parviflora	Lendi/Sinha	5.7	4.5
Lannea coromandelica	Mowhai	0	6
Madhuca longifolia	Mohwa	0	2
Streculia urens	Karai	7.3	9.8
Tectona grandis	Saagwan	5.6	5.7
Terminalia alata	Ain	4.5	6.6

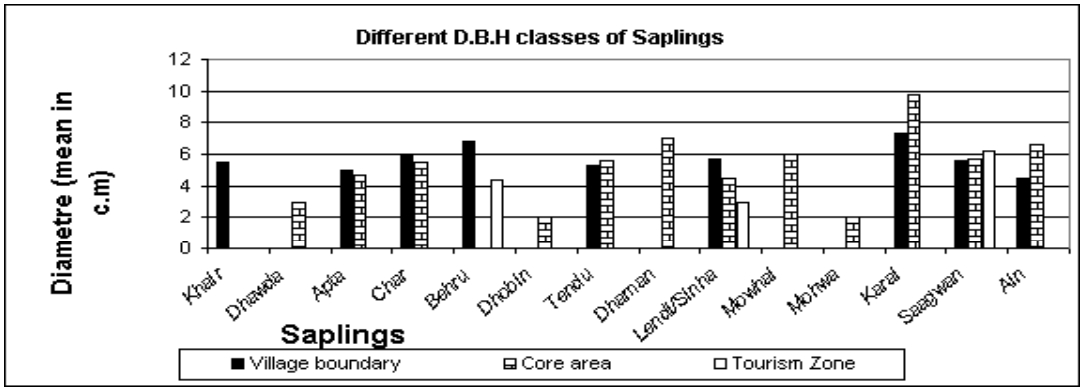
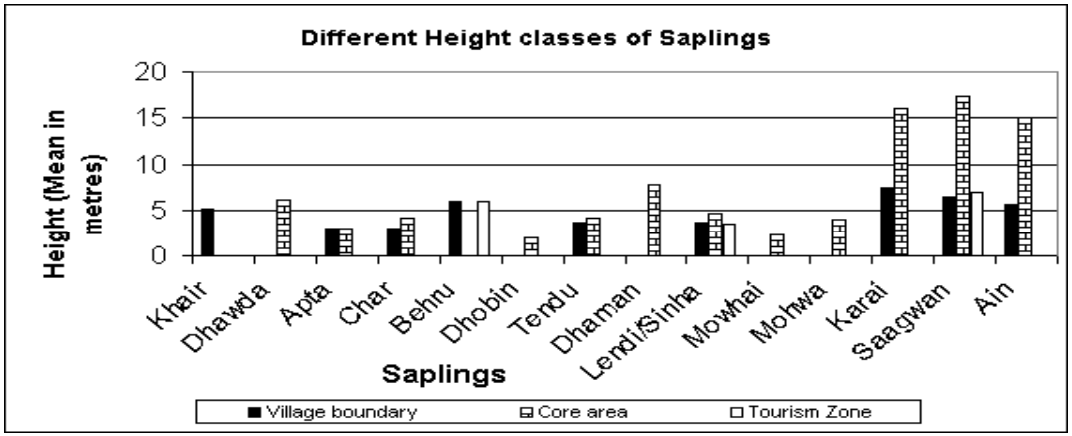


Table no -IV.10Different Height classes of Saplings

Botanical name	Local name	Village boundary	Core area
Acacia catechu	Khair	5.1	0
Anogiessus latifolia	Dhawda	0	6.1
Bauhinia racemosa	Apta	3	3
Buchanania lanzan	Char	3	4.2
Chloroxylon swietenia	Behru	5.9	0
Dalbergia paniculata	Dhobin	0	2
Diospyros melanoxylon	Tendu	3.6	4.1
Grewia tilifolia	Dhaman	0	7.7
Lagerstroemia parviflora	Lendi/Sinha	3.6	4.6
Lannea coromandelica	Mowhai	0	2.3
Madhuca longifolia	Mohwa	0	4
Streculia urens	Karai	7.5	16
Tectona grandis	Saagwan	6.5	17.3
Terminalia alata	Ain	5.6	15

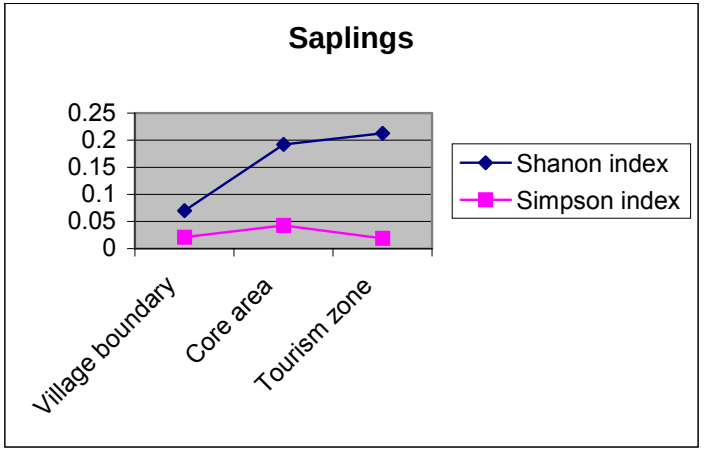


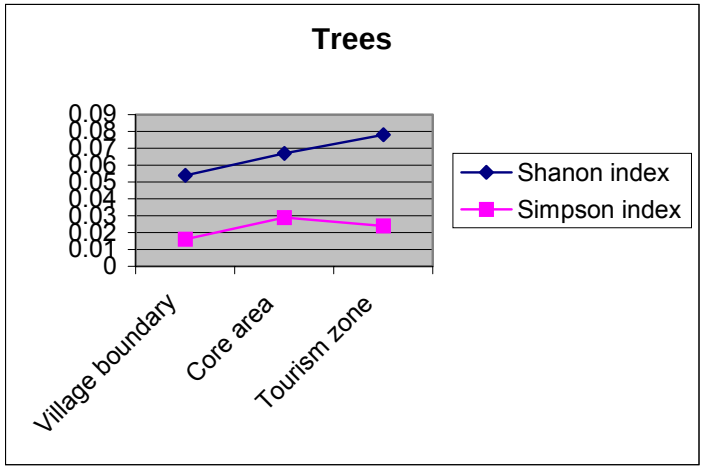
Saplings

	Shanon index	Simpson index
Village boundary	0.0698	0.021
Core area	0.192	0.043
Tourism zone	0.213	0.019

Trees

	Shanon index	Simpson index
Village boundary	0.054	0.016
Core area	0.067	0.029
Tourism zone	0.078	0.024





Biodiversity Status of PNP: For the sample plots, vegetation parameters such as density, frequency, dominance and Important Value Index (IVI) have been estimated to examine the status of biodiversity. IVI has been calculated for each species using integrated measure of relative frequency (rF), relative density (rD) and relative abundance (rd). Following formulae were used to calculate vegetation parameters;

$$\text{Density (no. ha)} = \frac{\text{Total number of individuals} * 100}{\text{Sample area}}$$

$$\text{Frequency} = \frac{\text{No. of plot species occurred}}{\text{Total number of plot studies}}$$

Dominance = Total basal area covered by a species * density of a species

Species Diversity has been calculated with the Shnnon and Wiener (1963) formula:

$$H = \Sigma^{s}_{i=1} (Ni/N) \log (Ni/N)$$

Where Ni = number of individuals of a species

N = number of individuals of all species

Species richness (R) has been calculate by using following formula:

$R = S\sqrt{n}$;

Where S = number of species in a community,

n = total number of individuals of all the species

Table - IV.11

Sapling analysis

Saplings		**Village Boundary**			**Tourism zone**			**core area**		
Botanical name	**Local name**	**RF**	**RD**	**A**	**RF**	**RD**	**A**	**RF**	**RD**	A
Acacia catechu	Khair	3.08	2.47	1	0	0.00	0	0	0.00	0
Anogiessus latifolia	Dhawda	0.00	0	0	0	0.00	0	9.43	4.39	2.2
Bauhinia racemosa	Apta	4.62	3.7	1	0	0.00	0	7.55	4.76	1.25
Buchanania lanzan	Char	6.15	4.94	1	0	0.00	0	5.66	5.26	2
Butea superba	Palas vel	3.08	2.47	1	0	0.00	0	5.56	4.76	1
Chloroxylon swietenia	Behru	7.69	6.17	1	20	12.50	1	0.00	0.00	0
Dalbergia paniculata	Dhobin	0.00	0	0	0	0.00	0	7.55	9.65	2.75
Dendrocalmus strictus	Bamboo	3.08	2.47	1	0	0.00	0	0.00	0.00	0
Diospyros melanoxylon	Tendu	9.23	9.88	1.33	0	0.00	0	3.77	1.75	1
Grewia tilifolia	Dhaman	0.00	0	0	0	0.00	0	1.9	0.20	1
Lagerstroemia parviflora	Lendi/Sinha	12.31	16.05	1.63	20	12.50	2	9.43	13.16	3
Lannea coromandelica	Mowhai	0.00	0	0	0	0.00	0	7.55	7.89	2.25
Madhuca longifolia	Mohwa	0.00	0	0	0	0.00	0	7.55	7.89	2.25
Streculia urens	Karai	6.15	6.17	1.25	0	0.00	0	7.55	7.89	2.25
Tectona grandis	Saagwan	10.77	13.58	1.57	20	37.50	3	9.43	10.53	2.4
Terminalia alata	Ain	6.15	7.41	1.5	0	0.00	0	9.43	7.02	1.6

F = Frequency
R.F = Relative Frequency
D = Density
R.D = Relative Density
A = Abundance

Table - IV.12 Tree analyis

Trees		**Village Boundary**			**Tourism zone**			**core area**		
Botanical name	Local name	**RF**	**RD**	**A**	**RF**	**RD**	**A**	**RF**	**RD**	**A**
Acacia catechu	Khair	4.62	6.17	1.67	0	0.00	0	0	0	0
Anogiessus latifolia	Dhawda	9.23	11.11	1.5	3.44	4.00	2	4.71	8.39	3
Bauhinia racemosa	Apta	4.62	11.11	3	6.89	8.00	2	2.35	1.40	1
Buchanania lanzan	Char	10.77	17.28	2	6.89	4.00	1	4.71	8.39	3
Butea superba	Palas vel	9.23	7.41	1	3.44	2.00	1	0	0.00	0
Chloroxylon swietenia	Behru	6.15	8.64	1.75	0	0.00	0	0.00	0.00	0
Dalbergia paniculata	Dhobin	6.15	8.64	1.75	0	0.00	0	4.71	4.20	1.5
Dendrocalmus strictus	Bamboo	3.08	2.47	1	0	0.00	0	0.00	0.00	0
Diospyros melanoxylon	Tendu	7.69	6.17	1	3.44	2.00	1	3.53	4.20	2
Grewia tilifolia	Dhaman	6.15	6.17	1.25	13.79	10.00	1.25	2.4	1.40	1
Lagerstroemia parviflora	Lendi/Sinha	7.69	14.81	2.4	13.79	16.00	2	5.88	7.69	2.2
Lannea coromandelica	Mowhai	13.85	17.28	1.56	3.44	6.00	3	4.71	5.59	2
Madhuca longifolia	Mohwa	6.15	6.17	1.25	0	0.00	0	3.53	2.80	1.33
Streculia urens	Karai	12.31	12.35	1.25	3.44	4.00	2	5.88	7.69	2.2
Tectona grandis	Saagwan	24.62	48.15	2.44	10.34	12.00	2	5.88	10.49	3
Terminalia alata	Ain	24.62	22.22	1.13	3.44	2.00	1	4.71	6.99	2.5

F = Frequency R.F = Relative Frequency
D = Density R.D = Relative Density
A = Abundance

Table no – IV.13

Importance value Index

Trees

Botanical name	Local name	Village Boundary	Tourism Zone	Core Area
Acacia catechu	Khair	10.79	0	0.00
Anogiessus latifolia	Dhawda	20.34	7.44	13.10
Bauhinia racemosa	Apta	15.73	14.89	3.75
Buchanania lanzan	Char	28.05	10.89	13.10
Butea superba	Palas vel	16.64	5.44	0.00
Chloroxylon swietenia	Behru	14.79	0	0.00
Dalbergia paniculata	Dhobin	14.79	0	8.91
Dendrocalmus strictus	Bamboo	5.55	0	0.00
Diospyros melanoxylon	Tendu	13.86	5.44	7.73
Grewia tilifolia	Dhaman	12.32	23.79	3.75
Lagerstroemia parviflora	Lendi/Sinha	22.5	29.79	13.57
Lannea coromandelica	Mowhai	31.13	9.44	10.30
Madhuca longifolia	Mohwa	12.32	0	6.33
Streculia urens	Karai	24.66	7.44	13.57
Tectona grandis	Saagwan	72.77	22.34	16.37
Terminalia alata	Ain	46.84	5.44	11.70

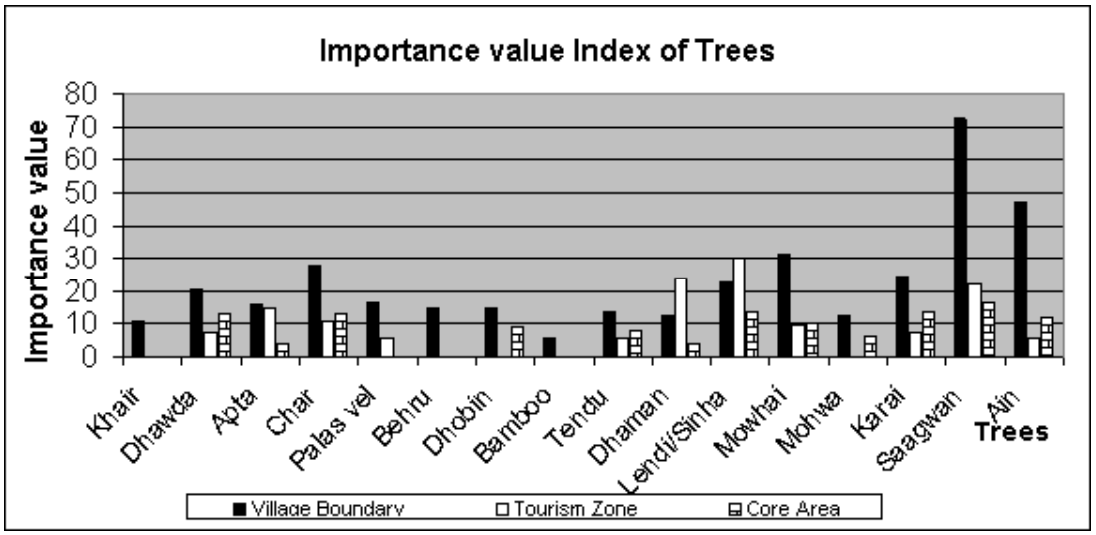
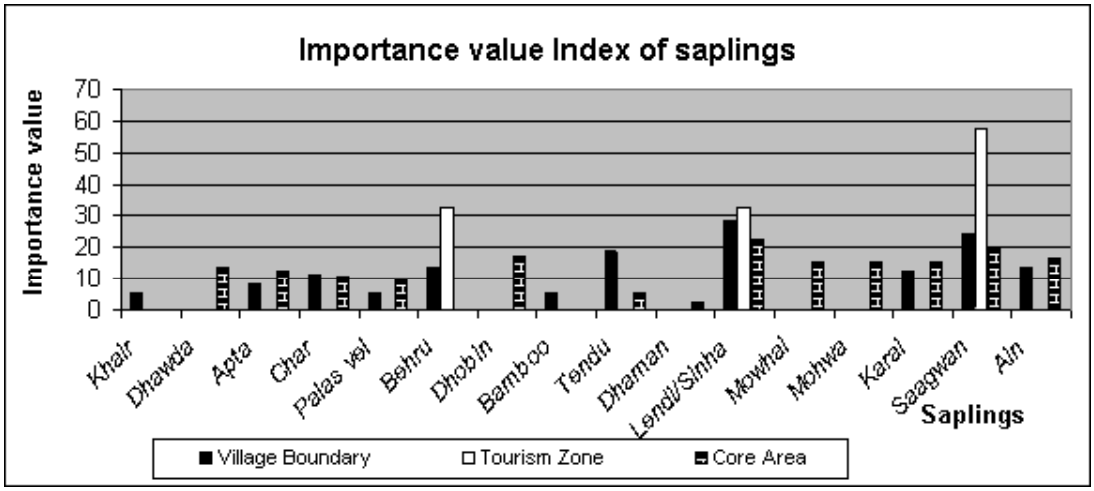


Table no - IV.14
Importance value Index

Saplings

Botanical name	Local name	Village Boundary	Tourism Zone	Core Area
Acacia catechu	Khair	5.55	0	0
Anogiessus latifolia	Dhawda	0	0	13.82
Bauhinia racemosa	Apta	8.32	0	12.31
Buchanania lanzan	Char	11.09	0	10.92
Butea superba	Palas vel	5.55	0	10.32
Chloroxylon swietenia	Behru	13.86	32.5	0
Dalbergia paniculata	Dhobin	0	0	17.2
Dendrocalmus strictus	Bamboo	5.55	0	0
Diospyros melanoxylon	Tendu	19.11	0	5.52
Grewia tilifolia	Dhaman	0	0	2.09
Lagerstroemia parviflora	Lendi/Sinha	28.36	32.5	22.59
Lannea coromandelica	Mowhai	0	0	15.44
Madhuca longifolia	Mohwa	0	0	15.44
Streculia urens	Karai	12.32	0	15.44
Tectona grandis	Saagwan	24.35	57.5	19.96
Terminalia alata	Ain	13.56	0	16.45



APPENDIX – IV.3 : Figures

Figure no. 1

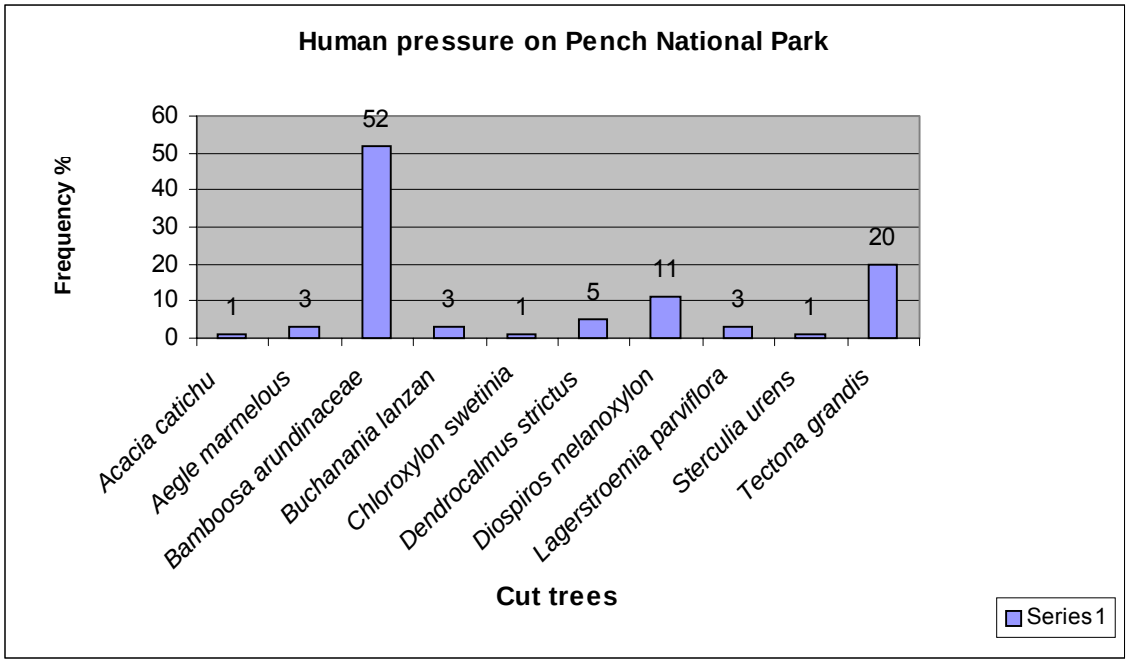


Figure no.2

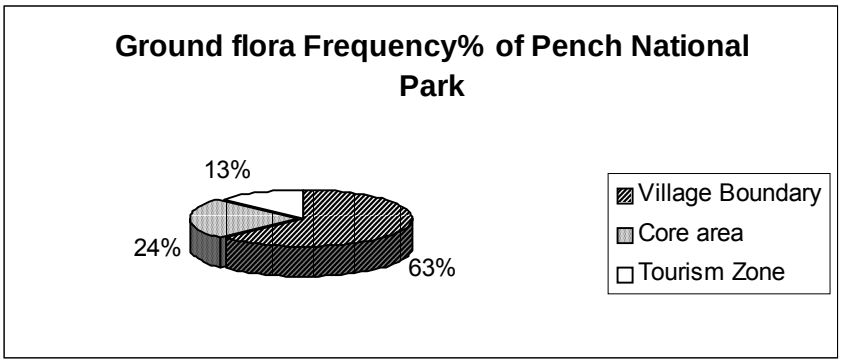


Figure no.3

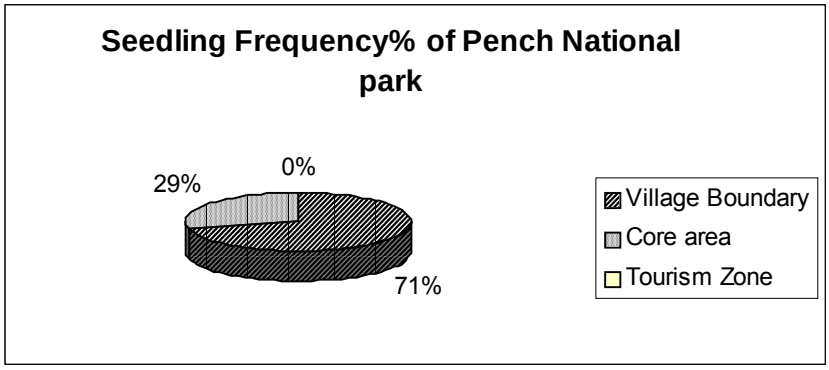


Figure no.4

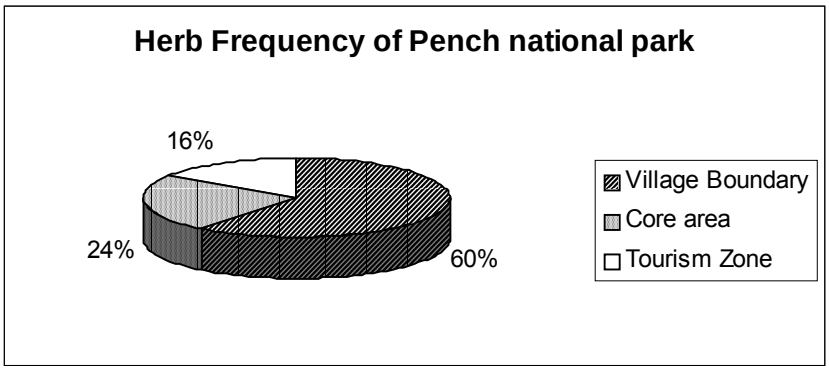


Figure no.5

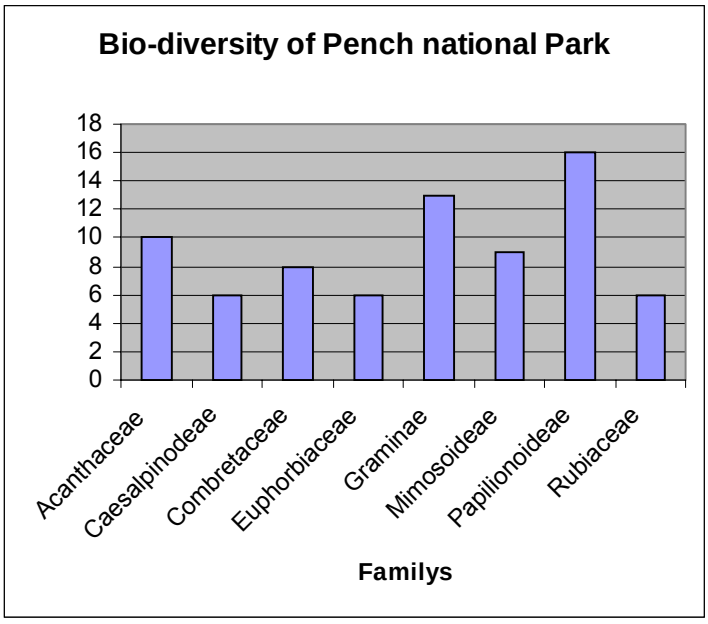


Figure no.6

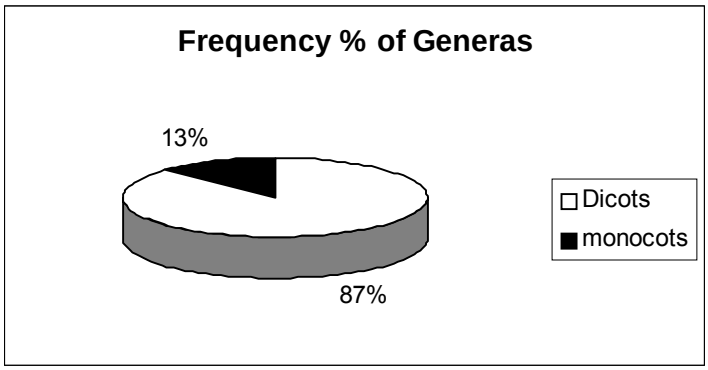


Figure no.7

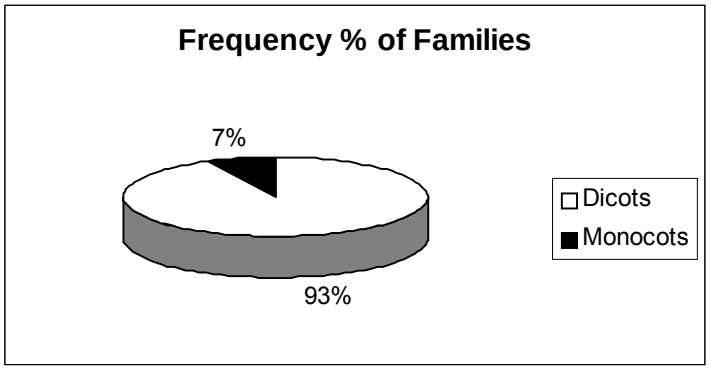
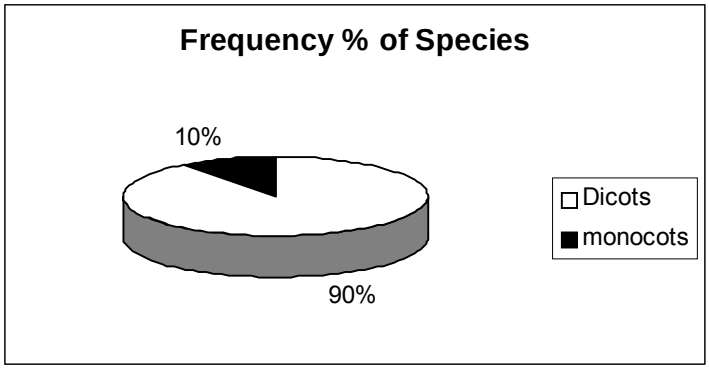


Figure no.8



END NOTE

[1] Measuring and Monitoring Forest Biodiversity; The SI/ MAB Model Francisco DA Limeir, ASI/MAB Bio-diversity Program

[2] Sale and Berkmuller (1998), Manual of Wildlife Techniques for India, Wild Life Institute of India Dehradun.

[3] S.K. Datta- Marketing of Wild Medicinal Plants Tribal Economy in India., EPW , Vol. XXXVI No. 38, Sept 22, 2001.

CHAPTER- V: TOURISM

Protected areas as major attraction can make a substantial contribution to the development of a region in general and rural areas of that region in particular because tourism can open new vistas of employment and income generation. The additional income earned by the local people will help to raise their living standards and will set into motion the process of multiplier effect. However, this requires a proper and careful planning for the development of the region and also appropriate motivation of the local people towards the changing scenario. In many tropical countries like Kenya, protected areas have brought significant economic benefits. They (PAs) are the significant foreign exchange earners. In Kenya, tourism is the largest earner of foreign exchange. Foreign exchange earning from tourism in the year 1977 was US $ 125 millions. Out of this almost one-third was from the seven National Parks. It is the experience that in tropical countries, there is a significant contribution to revenue generation due to internal travel, hotels, souvenir sales etc. However, in order to reap these economic advantages, it is necessary to attract the tourists to the protected areas. This requires creation of proper infrastructure and facilities.

5.2 POSITIVE ASPECTS OF PAs: Tourism as an industry with proper planning and investment can yield spectacular results in terms of economic growth and PAs can contribute a lot towards this. Tourism development in and around PAs can be utilised for attracting the tourists and thereby bringing economic benefits to remote areas by creating opportunities for local employment, stimulation of local markets, improvement of transportation and communication infrastructure, providing facilities of adventure tourism etc. However, this needs careful planning. It also requires dispelling the apprehension of the local people that the tourism development is being done for the foreigners and urbanites and they (local people) are not going to be benefited. Efforts should be made to strongly motivate the local people in this regard.

5.3 NEGATIVE ASPECTS OF PAS: Though the authorities, the local people, the NGOs are aware of the danger inherent in promoting tourism, unplanned development of tourism may create the problems which may endanger the conservation of ecological resources. If the primary objective of the park authorities is to maximize revenue from the park without consideration for preservation of

natural resources, it will certainly lead to the degradation of the environment and also depletion of environmental resources. This necessitates the appropriate strategies of development that will not only optimise the revenue but will also reduce the cost of conservation to a greater extent. Another negative effect of prompting tourism in PAs is the marginalisation of the local interests. Other dangers inherent in promoting the idea of PAs as places of tourist attraction are as follows:

1. Many areas of important conservation value like extensive tracks of tropical forest, mangrove swamps etc. have little appeal to the tourists.

2. If the decision-makers are led to believe that parks exists primarily for economic gain and if their expectations in this direction are not fulfilled, they may begin to look for more profitable uses of the available land.

3. The governments may seek to maximize economic returns from the parks through inappropriate development. Large hotels, highways, golf-courses etc,. designed to attract more and more tourists, can diminish park's natural values and eventually turn it into an area of mass tourism rather than conservation.

To control the negative impact of tourists, it is necessary to know the types of negative effects, which are likely to occur. Some of these negative effects are given in the Appendix 1. These will go a long way in planning and regulation of eco-tourism in the PNP.

5.4 DEFINING ECOTOURISM[i]: A small number of scholars have been attempting to define ecotourism for some time. Ceballos-Lacurian (in Ziffer, 1989) suggest that:

Ecological tourism implies a scientific, aesthetic or philosophical approach, although the ecological tourist is not required to be a professional scientist, artist or philosopher. The main point is that the person who practices ecotourism has the opportunity of immersing him or himself in nature in a way most people cannot enjoy in their routine, urban existence. This person will eventually acquire a consciousness that will convert him/her into somebody keenly involved in conservation issues (p. 5).

Boo (1990) and Lindberg (1991) define ecotourism as tourism that involves travelling to relatively undisturbed or uncontaminated nature areas with the specific objective of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural areas. Scace, et. al., (1992) and Wight (1994) also suggest that ecotourism is nature travel that actually contributes to conservation. Wight (ibid., pp. 39-40) provides the following principles on which the ecotourism experience must be constructed:

- it should not degrade the resource and should be developed in an environmentally sound manner;
- it should provide long- term benefit to the resource, to local community and industry (benefits may be conservation, scientific, social , cultural , or economic);
- it should provide first-hand , participatory and enlightening experiences;
- it should involve education in all parties – local communities, government, non-governmental organization, industry and tourists (before, during and after the trip);
- it should encourage all party recognition of the intrinsic value of the resource;
- it should involve acceptance of the resource on its own terms, and in recognition of its limits, which involve supply-orientated management;
- it should involve understanding and involve partnership between many players, which could include government, non-governmental organization, industry, scientists and locals (both before and during operations);
- it should promote moral and ethical responsibilities and behaviours towards the natural and cultural environment by all players.

Boo (1990) continues on to say that ecotourism development is the process of change to reach symbiosis between nature conservation, sustainable socio-economic development and nature tourism.

Perhaps an even more compelling ingredient in this definition is the notion of ‘spirituality ‘ which Jaakson (1997) introduces into the discussion he suggest that many of the defination of ecotourism leave out the human component which is the spiritual Jaakson (*ibid*) suggest.

An insistent equating of ecotourism with nature over shadows a human dimension of deep spirituality which I speculate is the motivation, consciousness or subconscious, for all ecotourism travel. This spirituality is akin to the travel of devout pilgrims to worships at sacred and holy sites. Ecotourism in pristine natural sites is a form of secular pilgrimage where nature is the sacred holy site. The premise here is that the essence of ecotourism is an ethic that makes ecotourism different from other types of tourism (p.34).

One additional consideration needs to be raised when discussing the meaning of ecotourism. That consideration is the definition of rural tourism, given that most, if not all, ecotourism occurs in the countryside or in small settlements. Reid, Fuller, and Haywood (1995, p. 23) suggest:

Rural tourism is distinguished buy its projection of traditional (authentic or unauthentic)rural life into the attractions which constitutes its core. It is generally constructed around the built or natural environment and includes programs such as festivals and cultural activities which often reenact or provide a flavour of the traditional local or rural culture and history.

While rural tourism quite often reconstructs either natural or human made environments that have been destroyed, ecotourism would not likely to participate in reconstructed or artificial interpretation of natural phenomena unless it was for the purpose of study or education. (Pp. 33-34)

Ecotourism is a term that is quickly being adopted by many tourism enterprises, whether their activity is driven by values of conservation and preservtion or not. The term cannotes notions of sustainability which all in the enterprise, either, those served or the servers, can embrace. It is often referred to as the feel-good term, which, in fact, can hide many sins. As Jaakson (1997, p.33) states” the popularity of ecotourism has backfired and the term ‘ecotourism’ has become jargon. ‘Eco-tourism’ has become a word-play on ‘eco-tourism’.” (Pp. 29)

5.5 ROLE OF PROTECTED AREA MANAGEMENT IN PROMOTING TOURISM: The role of Protected Area Management in providing infrastructure for tourists must be developed in close connection with the national, regional and local authorities. The Forests Boards may sometime even provide financial assistance for developing tourists facilities in reserves. The managers of the PAs are expected to advise the tourists authorities in respect of the limits of the PAs to be utilized for the tourists purposes. Unless carefully planned, the volume of visitors may have a deterous impact on Parks and eventually destroy the very resources on which tourism depends.

In Amsoli National Park, Kenya, for instance, heavy 'visitors traffic' concentrated in a small area and numerous vehicles located around single predator have resulted in such a severe stress on sensitive species such as cheetah, unnecessary habitat destination and deteriorating visitors satisfaction (Western, 1984).

5.6 ECO-TOURISM & FUNDING MECHANISM: Protected areas are a source of foreign exchange earnings through development of tourism. Expenditure of Nepal tourist whose visits are directly attributable to PAs and is very conservatively estimated to have been $ 9 million in 1988 while the annual protected area management budget was only about $ 3 million (Wells). This apparently high benefit to cost ratio implies that there is inadequate public sector investment to ensure effective management of these PAs due to insufficient appreciation of the economic contribution of PAs, and to significant imbalances between economic costs and benefits at local levels.

Filion, Foley and Jacquesmot[ii] estimated that in 1988, some 235 million people participated in international tourism to enjoy and appreciate nature generating economic benefit (or contribution to the national income of the countries involved) amounting to as much as $ 233 billions. This impressive figure can be put into perspective by considering that domestic tourism, which is not included in these figures is larger than international tourism by a ratio of 10:1.

The authors also indicated that some 32 per cent of tourists stated that scenery, nature and wildlife were the most enjoyable part of their trip, while approximately 80% of tourists come to Kenya and Zimbabwe primarily for wild life. In North

America, some 70% of Japanese and European tourists visit national parks. In five Latin American countries, 41 to 75% of foreign tourist visited PAs.

Birdwatchers visiting the Point Pelee National Park in Canada, a prime location for observing the spring migration of passerine birds, brings in at least $ 6 billion per year in net economic value (Butter, Hvenegaard and Kry stofiak[iii]).

5.7 ECONOMIC AND SOCIAL ASPECTS OF ECO-TOURISM: On the economic side , overall tourism is a major source of revenue for many developing nations; in 1988 alone, tourism generated 855 billion dollars for developing countries (South Magzine 1989). Mexico's tourist trade accounts for almost 4 percent of its GDP, surpassed only by petroleum exports (south Magzine 1989). Similar statistic could be given for countries such as Kenya, Costa Rica and Equador among others. Nor is tourism not only a third world trade; Travel and tourism to the United State generates higher revenue, from export of automobiles, agriculture goods or chemical products (the Washington post, May21, 1990)

While statistics do not separate mass tourism figures, the market for eco-tourism has been expanding rapidly. Witness to this is the growth in visiting rates to national park in Ecuador, for example, has gone from 7500 in 1975 to 32595 in 1987 (Lidberg 1989). The share of eco-tourism in overall tourism is also indicated by a recent study which found that natural history was an important motivating factors for international visitors to Ecuador, Costa Rica and Belize (B00 1990). In Ecuador, 76% of the international visitors surveyed reported natural history as a reason for this visit. Of the visitors surveyed in Belize 51 percent considered natural history an important factor in choosing that country and 63 percent toured a protected area during their stay (Bor 1998).

This interest in visiting natural parks often translates into appreciable revenues. In Rwanda's Park National des Volcans tourist going to see the gorillas generate annually about $1 million in entrance fee, and $2 million to $ 3 million in other expenditures. Costa Rica's Corcovado National Park; one of the many parks in that country generates over $ 1 million in foreign earnings per year (Heyman 1988).

Advocates of Eco-tourism assert that nature travel to the tropics fits well with other worldwide initiatives to protect biological diversity by making non consumptive use of

resources (Laarman and Dust 1987). Western and Henrry (1979) maintain that the economic exploitation of Parks need not be at odds with conservation. These authors use Kenya as an example to argue that an economic motivation for protecting wild life is not only compatible with conservation but adds greatly to its viability. In fact, Kenya's recent strong stand on ivory poaching can likely be traced to its need to maintain revenues.

In addition to generating foreign exchange and providing economic incentives for the establishment and protection of natural areas, proponents of eco-tourism list several other economic benefits. These include generation of employment, stimulation of local economic and the creation and improvement of infrastructure and recreational facilities for local use (McNeely and Thorsell 1988). Additionally, since nature tourism tends to occur in zonal areas it can lead to economic development in otherwise neglected regions.

5.8 PNP & TOURISM: There are a number of places in the PNP which are of interest to the tourists. Some of the tourists spots worth visiting are scattered around the PNP. Proximity of the PNP to a metropolitan city, Nagpur, well connected by the air, rail and road, should have resulted in making it one of the most favoured spots. However, the PNP development in respect of tourism is far away from the threat to disturbing the ecological balance. The visitors fevour this place primarily for picnic, merrymaking etc. Religious tourism also plays an important role in PNP. Wildlife tourism is a seasonal one and is mostly concentrated from March to June. Wildlife tourism is mostly concentrated in East Pench region because of a greater surety of spotting of wild animals on the Salama Kolalzira road.

Tourism resource inventory of the PNP reveals a number of areas and points of tourists' interests. Some of these are mentioned below:

1. Ambakhori: Naturally beautiful place called Ambhakhori situated in compartment no.538 at Totladoh attracts a large crowd of tourists, mostly fun and frolic makers on weekends and or holidays. It is a small waterfall located in low-lying area on the banks of river Pench. It shows various interesting rocks formations. There is certain religious area attached to this place. The local populace frequently visit this spot to worship Lord Shiva. Since last few

years locals congregates here on the eve of Mahashivaratri (Magha) for religious sentiments.

2. Totladoh: Totladoh dam and Meghdoot Jalashaya as the reservoir, named after the famous epic written by great Poet Kalidas, attracts a large number of tourists who appreciate the sheer grandeur and vast expanse of water spread up about 70 sq. km. cordoned with green hills.

3. Underground Power Generation House: Many people who visit this park are also interested in having a look of the underground power generation station, being managed by MPEB, which has underground approach tunnel of about 1 km. length

4. Owl Fall: A place called 'Owl Fall' in the opening of the 8 km. long underground tunnel which comes from the underground power house, an engineering marvel, at a place called Gavalighat situated in compartment No. 546. Where swirling water rushes to meet the main flow of Pench river which gives an occasional glimpse of crocodile, lots of birds, fishes etc.

5. Nagdeopahodi: It is a hillock located in compartment no.525 where all religious sentiments of tribal populace are attached to their deity, a reincarnation of Lord Shiva. Hoards of villagers throng this spot workship and prey for fulfilment of their cherished wishes especially in the months of Chaitra (April). This also happens to be highest peak in the Park with a height of 583 m. above MSL.

6. Guggusgarh: This is an ancient fort in region spread over an area of 2 sq. km. Situated in compartment. No. 671 of West Pench Range. After exploration of this area, the State Archaeological Department has determined its existence since 3rd or 4th century A.D. say 1700 years old. Research by Dr. Welsted has revealed that this fort happens to be the capital of 'Wakataka Dynasty'. The places as Nandpur and Kolitmara situated in its vicinity have also show evidences of historic habitation.

Places of tourists' interest in the vicinity of the PNP are:

1. Ramtek: Ramtek situated at a distance of 47 km from Totladoh is a burgoing tourist centre. It is a famous religious pilgrimage having Lord Ram's temple. It is belived that he stayed here in his days of exile. Kalidas Smarak is constructed here as the memoir to the great poet of Chandragupta era.

2. Khindsi: A reservoir on the river 'Sur' called Khindsi distanced at 54 Km from Totaldoh is a spot much sought after by tourists and picknickers which offers water sports, eatery, resort, camping facility etc.

3. Khekra Nalla: Khekra Nala Project situated in Parseoni Taluka is a medium irrigatin project, which attracts a lot of tourists.

4. Kaurav Bhimsen: A religious place called as Kuvara Bhimsen located in Parsivani Taluka also attracts a lot of tribal and other populace who throngs this area in the summer months of May.

5. Navegaon Khairi: The dam and reservoir at Navegaon Khairi also witness a lot of tourists and is slowly assuming nature of promising tourist centre with lot of ambitious plans for tourist on unveil.

6. M.P.side of PNP: Tourists are also interested in visiting adjoining Pench National Park of M.P.

5.8.1 TOURISTS INFLOW: Situation of this serene and clam place of tranquillity very near to a busy city attracts lots of tourists. On average 1,00,000 tourists visits this park per annum. Details of tourists inflow with month wise distribution is given in the following table.

Table – V.1:STATEMENT SHOWING NUMBER OF TOURISTS VISITING PENCH NATIOANL PARK

S. N.	Month	Year									
		89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99
01	April	--	--	--	--	1324	2186	2342	1579	1704	3466
02	May	--	--	--	--	1644	2093	3077	2151	2560	1717
03	June	--	--	--	--	2258	2765	2966	5013	4352	3815
04	July	--	--	--	--	2228	1466	1920	2481	2527	2776
05	August	--	--	--	--	4405	3738	5068	6048	7417	5987
06	September	--	--	--	--	4450	2106	2111	3563	4665	2492
07	October	--	--	--	--	3569	3341	4547	4717	3459	6776
08	November	--	--	--	--	5865	9086	9795	7538	9059	11256
09	December	--	--	--	--	15838	17182	20325	21952	11534	25291
10	January	--	--	--	--	25460	24476	28477	32172	20388	26669
11	February	--	--	--	--	12853	10823	10936	15245	12643	10334
12	March	--	--	--	--	4290	4220	--	5527	5292	3862
	Total	75510	47792	38218	90576	84184	83582	91564	107968	85600	104437

5.8.2 MONITORING OF TOURISTS INFLOW: The monitoring of tourist inflow is done at the Peoni Gate. Most of the tourists are only day visitors who come on the way after visiting various tourist spots. Only a small parentage of tourists makes night halt of a day or two for the sheer enjoyment of it. Tourists inflow increases on weekends and also on holidays seasonal fluctuations are markedly significant. The most preferred place of tourist interest is Ambakhori where visitors enjoy social gathering so much that at times in peak visiting period, the carrying capacity comes under pressure.

5.8.3 REVENUE FROM TOURISM: Forest department in its management plan has projected revenue from tourism or tourist related activities.

Table –VII.2 : Revenue from Tourism

Revenue head	Rs.
1. Entry Fees	50,000
2. Vehicle Entry fee	20,000
3. Camera fees	15,000
4.Binocular/ Telescope charges	05,000
5.Portable hide/ Machan charges	05,000
6. Minibus charges	1,00,000
7. Accommodation charges	15,000
8. Penalty for breach of rules	05,000
9. Other miscellaneous revenue	05,000
Total	2,45,000

The attempt has been made by the revenue team to estimate revenue generation in PNP on the basis of Travel Cost Method and demand for Tourism. The difference between the number of tourists who want to enter at PNP and actually allowed to enter in this park is very large especially in winter (November and December) still the revenue generation from the allowed tourists is not disappointing. This is given in the Appendix 2.

5.8.4 TOURISM ZONES: For the purpose of giving a wilderness experience recreation accompanied with duration through interpretations a separate zone is proposed to be carved out of the existing forest area and it is named as “Tourism Zone”. The description of tourism zone is given in the following chart. Tourism is allowed on following routs and in water body near Kolitmara. The tourism envisioned as low impact eco-tourism with emphasis on nature education.

Table –V.3 :Tourism Zones

Tourism Zone	Approach	Distance
1. Sillari	Totladoh Tat road	15 Km
2. Totladoh	Ambhakhori Tar Road	2.5 km
3. Salama Sataldam	No. 7 Murum Road	
4. Salama	Old Bodalzira Road Murum Road	3 km
5. Salam	Fefdikuna-Totladoh road	12 km
6. Navegaon Khairi	Water body near Kolitmara	
7. Nature-trail	West PNP	4 km
8. Salama	Bakhani- khapa-Sillare	12 km
9. Sillari	Kirangisara	13 km

5.8.5 EMPLOYMENT GENERATION FROM TOURISM:

A. An approximate average generation of 4000 man-days per year is estimated through tourism related activities. The employment generated is in the form of (1) Tourist guides (2) Vendors (3) Eateries (4) Shopkeepers (5) Vehicles for hire (6) Skilled and unskilled labour and (7) Sale of articles manufactured by local artisans viz. Burads, Kumchars etc.

B. Staff deployment for tourism:

For carrying out smooth operation of tourist activities, following staff is employed by the forest department.

1. Interpretation officer for overall control of tourist complex and tourism related activities- 1 No.

2. For controlling tourist activities- 1 No. who would also work as reception officer

3. For maintenance of tourist complex, monitoring and management of 'tourist' activities- 4 No. (Forest Guard)

5.8.6 TOURIST RELATED PROBLEMS: Ambakhori – a tourist place is heavily guarded due to tourist inflow on weekends and holidays. Garbage resulting from expensive pressure of tourists creates problems related to garbage disposal. Noise pollution from vehicles is another problem with far reaching environmental implications threaten sensitive species of wild animals, birds in PNP. This is more or less common in all the laces in the PNP.

5.10 THE CONTIGENT VALUATION (C.V.) METHOD:

To estimate the revenue generation figure, the following four variables are taken into consideration:

1. Wildlife watching

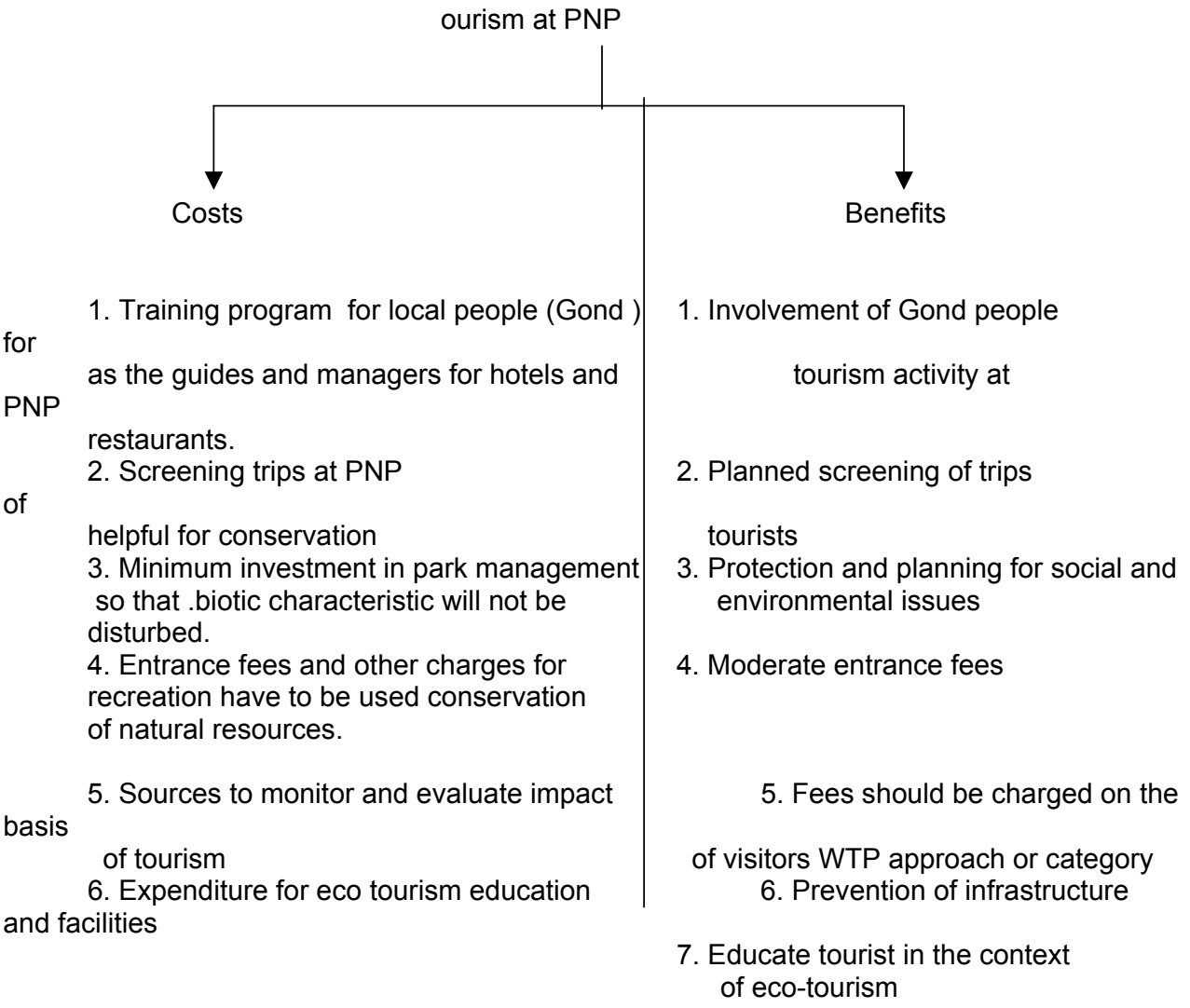
2. Expenditure on tea, coffee etc.

3. Time spent

4. Nature liking attitude

5.9 COSTS AND BENEFITS OF TOURISM IN PNP:

Following flow chart will be very useful to understand the costs and benefits of tourism in the PNP:



From the C.V. method, it is observed, based on the 72 tourists from Nagpur, 48 from M.P. and 29 from Mumbai (as given in the Appendix 2) that the tourists are prepared to spend the following amount on an average:

1) Wildlife watching: Rs. 550/-

2) Expenditure on tea, coffee etc.: Rs. 30/-

3) Time spent: Rs. 240/-

Nature liking attitude: Rs. 150/-

Hence, little increase in the basic facilities of the park will boost the revenue generation at very satisfactory level[1]. At present the lack of basic facilities is the main hurdle to avail the benefits from tourism. The tourist are definitely attracted by the scenic beauty of the park but their longer stay is restricted due to lack of facilities. They always prefer to come down to Nagpur or M.P. side. It is sure that this park is having its classical value in terms of above items. Proper planning and development will increase its commercial value in future

5.11 THE TRAVEL COST METHOD (TCM) FOR PNP:

Of the many reasons for having and demand conserving a National Park, the important one is that it provides recreational benefits to visitors. Although there are several dimensions of recreation in a national park (wilderness experience, photography, learning and educational etc) the primary one appears to be wild life viewing. Although a National Park provides recreational benefits to tourists, in turn tourists bring problems. The background to this is relatively simple to understand in terms of demand and supply. In recent years the demand for outdoor recreation in general and wildlife viewing in particular has grown rapidly. It has to do with rising income, a shift in value towards nature conservation and perhaps, education. It is also thought that demand for such recreation is income elastic. Although the demand for wildlife viewing has grown fast, the supply has diminished. Although some large national parks (Vidarbha and MP's) have a very small flow of tourists, there are other small parks, which experience a large in flow.

[1] This point is elobrated in policy recommendation chapter.

There are three main tourist related problems

1. Congestion
2. Wildlife disturbance
3. Eco -damage

The objective of in this paragraph is to evaluate the PNP on the basis of its benefits to individual users of three zones, namely

1. Nagpur

2. Madhya Pradesh

3. Mumbai

It is observed that in case of PNP congestion is not the problem. Even Eco damage is not on higher side. Wildlife disturbance can be considered as a minor problem, various steps have been taken to curb it from time to time. Illicit works has been reduced to a great extent

It is highly appreciating fact that approximate precise estimate of the optional number of tourists has been analysed by PNP management. Hence the certain number of tourists and vehicles are allowed to enter in PNP in the winter season. This shows that (table no 1) congestion is not the main problem of this park. This also shows that the question of tourists classification due to congestion doesn't arise in the case of PNP. The theory, related to this concept has been discussed many times but it is not applicable to this Park

It is postulated that if a National Park has use value then with free access and with an entrance fee held down, excessive congestion and disturbance could readily occur. Privately, the marginal individual may find a visit to park worth making but socially it reduces the aggregate economic surplus.

PNPs case is different from what normally we assume about national parks because of restricted entries of tourists and vehicles.

This shows that there are a couple of gaps between assumptions and practice. Apart from the distribution effects of the price changes, revenue earnings, categories

of the visitors, the importance has been not to permit the visitors to enter the park simply because the conservation part is more important than the recreation aspect. Hence the recreational benefit are supposed to be a part of the park with certain limitations. Though it is equally true that the demand for this park is very limited a small number of tourists are regularly visiting this park. The number of international tourists is also microscopic (elaborated in the Eco-tourism plan in last chapter).

5.12 TRAVEL -COST APPROACH

The travel cost approach estimates demand function for Pench National Park from obsessed visit rates corresponding to the travel costs (or supply price) from origins surrounding the site. In earlier studies this method was used by Clawson's (1959) work on Yosemite, Grand Canyon , Glacier by Knetsch's (1964) study of the Kerr reservoir in North Carolina and Brown, Singh and Castle (1964) study fishing in Oregon for Salmon - steelhead . The original work using contingent valuation an outdoor recreation is a study by Davis (1963) on the main woods. This was followed by Knestch and Davis (1966) study carried out in the same area.

In this method the following consideration are taken into account.

1. Travel cost must be an important determinant in visiting the site

2. The primary purpose of the recreation trip into visit the site

3. Recreationsist will view travel cost increases as being equivalent to entrance fee increases

Following functional forms has been used to estimate the total cost of visiting the site.

$$Zjm /nj = F (Yi, TCjm + Pm, Xj, TCjk + Pk, Qm, Qk, NL, TS)$$

where-

Zjm = total number of visits from zone ‘i’ to site m

nj = population of zone j users.

Yi = Mean income for zone j

TCjm = travel cost from zone j to site m.

Pm = Entrance fee at site m.

Xj = characteristics of individuals of zone j

TCjk =Vector of travel cost from zone j to substitute sites, K≠ M

Pk = Vector of entry fee from zone j to substitute sites, K≠ M

Qm = Vector of quality characteristics of wildlife viewing experience available at site m

Qk = Vector of quality characteristics of wildlife viewing experience available at substitute sites, K≠ M

NL = Nature likening attitude

TS = Time spent at site j / zone j

The three zones studied in the context of above-mentioned variables and the numbers of observations are:

1. Nagpur - 72 observations

2. Madhya Pradesh - 48 observations

3. Mumbai -- 29 observations.

The various functional forms like linear, log-linear etc. were estimated. The results are presented for the best fit. The details of the results which has been derived using SPSS package are shown in (Appendix - 3). The least square method is used.

The dependent variable is Zjmi and independent variables are c, NL, Qk, Qm, Tcjk, Tcjm, Ts, Xi, Yi.

5.13 INTERPRETATION OF RESULTS: The regression model given above defines a set of variables to capture the various aspects of tourism in the PNP. Since the estimated coefficients of the equations indicate the relative strength, direction and statistical significance of the performance impact of policy variables, they can be

used as basis for identifying some of the most desirable features of the tourism in the PNP.

The constant term in the equation is considered to capture the combined effects of general environment facing the process of tourism development within the PNP. This term also captures the intervening effects of factors exogenous to the PNP. The positive estimates of the constant inmost context suggests the synergy that the tourism in the PNP can derive from the general socio-economic, political, and resource-related environment within which tourism development occurs.

The endogenous variable is total number of visits from zone 'I' to site 'm'. The exogenous variables are population of zone, mean income of zero, entrance fee, characteristics of zone, of travel cost from zone 'j' to substitute site, of entry fee from zone 'j', to substitute site of quality characteristic of wild life viewing experiences available at site 'm', quality characteristics of wild life viewing experiences available at substitute sites, nature likening attitude and time spent at site.

The magnitudes of the coefficient bring out the direct and indirect effects of the exogenous variables. Similarly, the direction (positive or negative sign), of the coefficient throws light on the increasing or declining impact.

It may be observed from the result presented in the Appendix-3 that all the estimated coefficients are statistically insignificant. This implies that all the policy variables, for all the three samples, do not have perceptible impact on target variable, i.e. tourism in the PNP.

Speaking of the role of the general environment, the constant term that capture the joint effects of the factors exogenous to tourism in the PNP has a statistically significant positive effects. This implies that the general environment in the PNP has not been able to develop the tourism. However, the positive signs of the constant terms for all the three samples indicate the conducive situation for tourism development in the PNP. The conductive atmosphere along with weak effects brings out that serious efforts on the part of the authorities are needed to exploit the general environment.

There is another side of the story. The imperceptible effects of all policy variables indicate that the condition of the environment in the PNP is little disturbed. The tourism so far has not posed threat to the environmental aspects of the PNP.

5.14 LIMITATIONS : There are some limitations in the measurement of these variables and assumption related to it. Some main limitations are

1. Visits to this park are made by visitors from a wide variety of regions and for a wide variety of purposes. They are of different duration and different points at time. All those points are not covered though primary data in the study due to the duration of work is limited. However, from the secondary sources some information is possible to collect. But not from this method at one or two points of time clear identification of the measurement of value of time how to, and what time- travel time, on site time etc. are not fully considered. Because the travels are admitting that they had visited this place along with other works. And adjusted there time for visiting this park.

2. The limitations of taking account of substitute park is that the range of substitutes is dependent on the perception of the visitors.

3. The limitations of multipurpose trips at local level are difficult to solve. The cost can be associated with the circuit trip, but assigning cost of each park visited on the circuit is problematic. Similar limitations also arise out of different zones. The visitors coming form the long distance are more likely to be an a multipurpose trip whereas those nearer the park are more likely to be on a single destination trip.

5.15 SUGGESTIONS: Following suggestions are made for the proper planning of tourism:

1. There is a wide scope for improvement in the infrastructure related to tourist activity but due care must be taken while developing it related to the minimum disturbance to ecology of the park.

2. The tourists have to educate in the context of Eco-tourism and non-disturbance to wildlife.[2]

3. Creation of meadows at Fulzari and then opening it for tourist will take a lot of investment and time. Hence local and tribal people can be trained for employment and income generation purpose. At the same time they can protect the park assets if the tourist are non-co-operative.

4. Some development has been done for tourist to get the idea about park (See appendix- IV) similar pattern can be develop in the main entry point of the park.

While developing Eco-tourism activities local and tribal people must be invited and various local issues can be solved due to such discussion.

[2] Educating training and creating awareness among tourists and locals regarding this aspect has been covered in chapter on policy recommendations.

APPENDIX: 1

Potential environmental effects of tourism in protected areas (E. Africa): the types of negative visitor impact that must be controlled

Factor Involved	Impact on Natural Quality	Comment	Examples
Overcrowding	Environmental stress, animal show changes in behaviour	Irritation, reduction in quality, need for carrying-capacity limits or better regulation	Amboseli
Overdevelopment	Development of rural	Unsightly urban-like slums, excessive	
Mweya , development	Seronera, Manmade Structures		Keekorok, 01 Tuka
Recreation			
Powerboats	Disturbance of wildlife and quiet Murchison	Vulnerability during nesting seasons,	
		noise pollution	Falls
Fishing	None	Competition with natural predators	Ruaha, Nile
Foot safaris	Disturbance of wildlife	Overuse and trail	Mt
Kenya,		Erosion	Kilimanjaro
<u>Pollution</u>			
Noise (radios, etc.) areas	Disturbance of natural sounds	Irritation to wildlife and other	Many visitors
Litter	Impairment of natural scene	Aesthetic and health	Many areas hazards
Vandalism	Mutiliation and facility destruction	Removal of natural features, facility damage	Sibiloi
Feeding of animals	Behavioural changes of animals	Removal of habituated animals—danger to tourists	Masai Mara, Ruaha
<u>Vehicles</u>			
Speeding	Wildlife mortality dust	Ecological changes,	Amboseli, Mikumi

Off-road driving, night driving	Soil and vegetation damage	Disturbance to wildlife	Ngorongoro, Amboseli

Miscellaneous

Souvenir Collection	Removal of natural attractions	Shells, coral, horns, trophies, rare plants	All areas
Firewood Collection	Small wildlife mortality and habitat destruction	Interference with natural energy flow	All areas
Roads and murram pits	Habitat loss, drainage changes, natural scars if not well-sited and constructed	Aesthetic scars Ecotones damaged	All areas
Power lines	Destruction of vegetation	Aesthetic impacts	Tsavo, Bale
Artificial water holes and salt provision	Unnatural wildlife concentrations, vegetation damage	Replacement of soil required	Mts Aberdares
Introduction of exotic plants and animals	Competition with wild species	Public confusion	Many areas, Mt Kili-manjaro, airstrips

Source: Thorsell, 1984a

SOURCE: Pp. 84 – 88; Integrating Protected Areas in Regional Land-use Programmes; compiled by John and Kathy MacKinnon, Graham Child and Jim Thorsell; Natraj Publishers Dehra Dun; 1996

APPENDIX-2

Benefits from Tourists

	Observations Entered T.	Interested T. Not Entered	Allowed
(A) WILD LIFE WATCHING – Rs. 550/-			
Nagpur Tourists (NT)	72 (Rs. 3,96,000)	1,40,000 (77,000,000	8000 (4400,000)
M.P.T.	48 (2,64,00)	25000 (13,75,000)	3000 (5,50,000)
Mumbai via Ngp. T.	29 (15,950)	5000 (27,50,000)	1000 (5,50,000)
			Rs. 66,00,000
(B) INTERNAL EXPENDITURE TEA, COFFEE, ETC. – Rs. 30/-			
NT	72 (2160)	1,40,000 (42,000,000)	8000 (2,40,000)
MPT	48 (1440)	25000 (7,50,000)	3000 (90,000)
	29 (879)	5000 (1,50,000)	1000 (30,000)
			Rs. 360,000
(C) TIME SPENT Rs. 240/-			
NT	72 (17280)	1,40,000 (33,600,000)	8000 (1,920,000)
MPT	48 (11520)	25000 (60,000,000)	3000 (720,000)
MNT	29 (6960)	5000 (1,200,000)	1000 (240,000)
			Rs. 2,880,000
(D) NATURE LIKING ATTITUDE Rs. 150/-			
NT	72 (10800)	140,000 (21,000,000)	8000 (1,200,000)
MPT	48 (7200)	25000 (3,750,000)	3000 (450,000)
MNT	29 (4350)	5000 (750,000)	1000 (150,000)
			Rs. 12,600,000

APPENDIX- 3

TCM Method

Variables	Estimate of Co-efficient			t- Statistics		
	Nagpur (72)	M.P. (48)	Mumbai (29)	Nagpur	M.P.	Mumbai
C	1.717E-05	8.520E-05	8.028E-07	2.4705635	1.767719	0.1731983
NL	-1.316E-09	-2.300E-06	-1.2681E-07	0.4173075	-0.2448930	0.6138107
QK	-1.479E-09	1.412E-08	-1.096E-09	-0.2563477	0.1729480	-0.7069335
QM	-5.477E-09	-9.706E-09	-1.874E-09	-0.8704171	-0.1669829	-0.976557
TCjK	6.04E-10	-2.038E-08	-1.094E-10	0.3267938	-0.8767289	-0.0358222
TCjM	4.012E-09	-3.213E-08	-1.838E-09	0.426120	0.3290337	-0.9056609
Ts	1.512E-08	1.719E-08	1.9621E-09	0.3616712	0.3290337	0.419337
Xj	2.609E-09	1.408E-08	7.687E-09	0.6742372	0.2562435	1.1889988
Yi	-1.166E-10	2.703E-10	3.594E-11	-0.7155137	1.8038138	1.5422517

R^2 = Nagpur – 0.032143

M.P. - 0.173422

Mumbai – 0.272635

Notes & REFERENCES

[i] Ed. Reid Donald G.; Ecotourism Development;1999; Weaver Press., P.O. Box A1922, Avondale, Harare, Zimbabwe

[ii] The Economics of Global Tourism- Feres A Filian, James P Foley, and Andre J Jacquenemot- Protected Area Economics and Policy ed. By Mohan Munasinghe & Jeffrey McNeely distributed for the IUCN by World Bank Washington

[iii] Economic Value of Bird-watcher at Point Pelee National Park, Canada- Protected Areas Economics and Policy, ed. by Munasinghe, Jeferey Mcnaccty.

CHAPTER- VI : Fisheries

In India fisheries play a very important role as compared to other countries of the world. About 40% of the total harvest comes from inland fisheries. The bulk of which comprises of fresh water fishes, which inhabit ponds, tanks, rivers, and reservoirs spread over about 5.5 million hectares in India. The total production from fresh water in 1991 was about 1.54 million tons which rose to 1.85 million tons only by 1994. It has been estimated that Indian water can produce about 35-40% of this huge potential.

Fisheries are living resources like forests. It is also regenerative resource but migratory in character. Valuation of fisheries is difficult because of lack of data availability. However, with the help of limited data, one can estimate stocks of fishery to some extent. One may try to measure the productivity of lake, river, sea etc. of a particular area, just as we measure the productivity of soil. We measure yield of crops which is a function of soil quality and inputs of fertilizers, water, labour etc. Similarly, the fishery catch also depends on the stock of fish in the fishery grounds as well as on inputs in terms of fishing effort (No. of hours) and the quality of fishing gear used.

7.2 COMMON PROPERTY RESOURCE

Common property resources (by it we mean a resource that is not recognized as private property until it is captured) such as fisheries are a significant source of subsistence and livelihood, especially for poor people in developing countries. Normally fisheries are studied in terms of chronically over fishing problem. The problem arises when there is unregulated access and harvesting of this common property resource.

7.3 FISHERIES IN THE PNP

In case of Pench National Park over-fishing is not a problem. The problem is related to continuation of fishing in PA which has become a part and parcel of livelihood of tribal communities in the PA which needs to be sorted out. At present fishing activity is not a threat to the environment as it is not permissible under the norms of PA. The continuance of fishing in long run may result into the problem of

over-fishing. The situation regarding fishing constrained by the restrictions on fishing at PNP can be studied in the following ways:

1. Totladoh Reservoir of Nagpur district
2. Dependence on fishing at Fulzari village, and
3. Fishing in lower Pench.

7.4 TOTLADOH RESERVOIR OF NAGPUR DISTRICT:

The northern boundary of Nagpur district of Maharashtra state adjoins the Seoni and Chhindwara districts of Madhya Preadesh. The interstate boundary between Maharashtra and M.P. in the above mentioned districts is partly separated by a river called Pench river. Rest of the boundary is separated by boundary pillars. These forests are the reserved forest. They were reserved in 1879 under the provision of India, Forest Act 1878 and were known as Satpura Reserve. During that period the whole area was in the Central Provinces and Berar. After the reorganisation of states in 1956 the interstate boundary between M.P. and Maharashtra was drawn. The portion of the reserved forest lying in Maharashtra is covered in the gazette notification No. 917 9b0 and (g) issued by Chief Commissioner, Central Provinces. It was published in the Central Provinces Gazetteer dated 1st March, 1879. During the survey of these forests in 1975 by Survey of India they have been described as Sillari - Khapa reserved forest.

During the year 1968 an interstate agreement was signed between the Chief Ministers of M.P. and Maharashtra State for the construction of Pench Hydro Electric Project on the Pench river, at a site known as Totladoh. This site is located at a place where the Pench River forms the interstate boundary. As per the agreement the benefits from the power part of the projects are to be shared between the two states in the proportion of two thirds of the cost of Totladoh dam was to be charged to irrigation and one third to power. In the year 1971 supplementary agreement was singed. As per this agreement Pench Hydro Electric Project was taken up purely as a joint Hydro Electric Project. No cost of the Totladoh Dam was to be charged to irrigation.

All the forest area acquired for the dam is reserved forest.

For the construction of this Dam a colony was established at Totladoh in the reserved forest compartment No. 537 and 530 at the time of starting of construction work in 1974-75. In this colony, some permanent and some temporary structures were erected for powerhouse, office, residential and other ancillary purpose. The Irrigation Department of Maharashtra executed the dam construction and the M.P. Electricity Board executed the construction of under ground powerhouse. The water from the powerhouse is taken out through an underground canal, 8 KM. Long, and is released in the downstream of Pench river. This water is collected in the downstream of Pench River. This water is collected in another dam, constructed down below and is known as Navegaon Khairi. From this dam, water is distributed for irrigation, drinking and other purposes. This dam lies wholly in Maharashtra and is independent of Pench Hydro Electric Project at Totladoh.

Table- VII.1: Totladoh Dam: Area under various heads

Sr. No.	Particulars	Area (Ha.)		
		Maharashtra	**MP.**	**Total**
1	2	3	4	5
1.	Government Forest			
	a) Submergence	1993.78	3072.61 1724.00	6790.39
	b) Strengthening of hillocks	--	127.00	127.00
	c) Colonies	280.80	--	280.80
	d) Dam Seat and Quarries	120.74	--	120.74
	e) Approach Road	41.14	--	41.14
	f) Approach Road to Hattigota, Gawalighat and Saddle No.7	55.52	--	55.52
	g) Saddle No. 7 Tri Outfall Adit No. 2 etc.	19.21	--	19.21
		2509.19	4923.61	7432.80
2.	Govt. revenue Land	22.48	459.68.	482.16
3.	Private Land	25.24	278.93	304.17
	Total	**2556.91**	**5202.14**	**8219.13**

In the Totladoh dam, apart from forest area, seven villages have submerged. Out of this one village namely Bodalzira was in Maharashtra and rest of six villages were from M.P. All these village have been rehabilitated after proper compensation.

Prior to the construction of Totladoh dam (Pench Hydro Electric Project), Totladoh was a dense forest area. This area was clear felled along with the other areas required for dam, and the Temporary colony was constructed. The officers of Irrigation Department of Maharashtra and M.P. Electricity Board were posted here to look after the construction work. Labourers and skilled workers and other related experts came here from outside to work in the construction of dam and power house. Like in other project work, here also facilities like school, hospital, bank, market yard, police station etc. were created. All the matters related to dam are looked after by the Inter State Control Board.

With the enactment of Forest Conservation Act in 1980, no forest area can be diverted for non-forest purposes without the prior approval of the Govt. of India. Therefore, the project authorities were asked to submit the proposals for this project as per the provision of Forest Conservation Act, 1980. The proposal submitted by them was not correct, hence it has been returned to them.

As far as the portion of Totladoh dam falling in M.P. is concerned, as per the available information, this area is a reserved forest and is also a part of intended National Park. This is also known as Pench National Park. Govt. of India has already declared this area of National Park as a Project Tiger.

Since the area of Totladoh dam, including the colony is a reserved forest and it is a part of Pench National Park. and is also declared as Project Tiger area (1999), the provisions of Indian Forest Act 1927, apply to this area. As per section 2 (2) of wildlife (Protection) Act 1972, the definition of National Park includes intended National Park also. Therefore, the provisions of this Act also apply to this area.

The Pench Hydro Electric Project was physically completed in 1992. The power generated from this project, with 160 MW installed capacity, is fed into Vidarbha - Marathwada - Khandwa grid. The first of the two units of 80 MW each was commissioned in 1986 and the second unit was commissioned in 1987.

7.5 CONTROL OVER FISHING:

When the water storage started in reservoir, the fishing activity was also started in the reservoir first by Fisheries Department of M.P. and then from 1986-87, by the Fisheries Development Corporation of M.P. The head - quarter of the Manager of M.P. Fisheries Development Corporation for this reservoir was at Totladoh. The

fishing activity was started without due knowledge or permission from the Forest Departments of both the states. This fishing activity was constantly being objected by the Forest Department of M.P. The management of Pench National Park of Maharshtra was under the Nagpur Forest Division. It was transferred to the Deputy Conservator of Forest, Wildlife, Nagpur, with effect from 1/10/1989. When the fishing activity in Totladoh came to the knowledge of Deputy Conservator of Forests, Wildlife, Nagpur, he also asked the Fisheries Corporation to stop the fishing in Totladoh reservoir. But instead of stopping the fishing activity the M.P. Fisheries Development Corporation increased the production of fish by putting fish seed, artificially, in the reservoir. They were allowing fishermen from adjoining areas to catch fish and were charging royalty from them. This encouraged the fishermen to come to Totladoh for fishing and some of them started encroaching in the forest area at Totladoh. Similarly, some of the labourers, who had come to Totladoh for the construction of dam also started doing fishing. Not only this, the people living at Totladoh formed a co-operative society for fishing in Nov. 1994. The forest department was not informed about this. Neither any permission was sought for this purpose. Therefore, the record of fishermen is not available with the forest department. But this fishing activity was strongly opposed by the staff of the forest department. The reasons for opposing fishing activity are (I) it is illegal as per the various provisions of the Indian Forest Act 1927 and Wildlife (Protection) Act 1972 and (ii) it is a major water-hole of the National Parks of both the states. So, any biotic interference in this area is harmful for the conservation of Wildlife. Fishing activity is also a potential source of illicit cutting, poaching and fire. By constant persuasion the fishing activity in Totladoh reservoir, through M.P. Fisheries Development Corporation came to be stopped from 20/05/1995.

After the ban on fishing with effect from 20/05/1995 many of the fishermen have removed their boats from Totladoh reservoir. But still about 152 to 160 boats were lying there. After the Hon'ble Court admitted the petition on 26/09/1995 and did not grant any interim relief the Deputy Conservator of Forests, Wildlife, Nagpur, had issued notice to the Petitioners that they should remove their boats from Totladoh reservoir upto 15/10/1995, failing which, they would be seized. Many of the fishermen removed their boats from the Totladoh reservoir, but some of the fishermen mostly residing at Totladoh on "encroached land' did not take any

cognisance of this notice. On the contrary, they continued their illegal activity and whenever staff of Pench National Park tried to stop their activity, they threatened the staff. Due to this a joint campaign with the help of Police and Revenue Departments was launched during the period from 10th Feb/1995 to 11th Feb/1995. In this campaign, 62 boats, 35 fishing net and 48 oars were seized. During the above campaign, some of the fishermen had sunk their boats in the reservoir which could not be located. Later on these fishermen took out their boats and started illegal fishing.

The field staff of Pench National Park is trying their best to stop this illegal fishing. So far, 100 boats, 4 jeeps, 3 scooters and 108 cycles have been seized. In addition to this, 8.3 tonnes of fish was also seized and destroyed.

It is felt that some vested interests are working in continuing the illegal fishing at Totladoh. Otherwise, there are alternatives for the fishermen to do fishing elsewhere. The Divisional manager, Maharashtra Fisheries Development Corporation, Nagpur, has already reported to his Managing Director, Bombay, that all the fishermen at Totladoh can be accommodated at Navegaon Khairy tank which is just below and outside the National Park. Some of them have already been permitted by them to do fishing in that tank. During the winter session of the Legislative Assembly in December, 1995, the representative of the fishermen of Totladoh met the Hon'ble Minister of Forests at Nagpur. During the discussion the Hon'ble Minister also told the representatives of the fishermen that alternative arrangement for the fishermen of Totladoh can be made elsewhere. But the representatives of the fishermen were adamant to continue the fishing in Totladoh reservoir only. The intention of the fishermen at Totladoh not to carry out fishing activity, to earn their livelihood, any where else except at Totladoh indicated that some vested interested are misguiding the fishermen to continue illegal fishing at Totladoh.

About 50 to 70 women are engaged to carry fish from reservoir to the places, like Gupta Ganga / Bandra / Karwahi etc. located on Nagpur - Jabalpur Highway. Then onward they board the truck / jeeps etc. for further transportation of the fish to some place on highway to hand over the same to those vested interests involved in this trade. These traders load the fish in Matadors and transport it to Seoni / Nagpur. 40 - 50 persons are also busy in carrying the fish from reservoir to Highway through Jungle on bicycles.

These people frequently change their routes, place of collection of fish etc.

To curb this activity necessary infrastructure along with staff needs to be provided immediately. However, some measures like processing for identification of legal occupants, patrolling on routes are being taken up with the help of existing staff and available infrastructure to curb this activity. So also active co-operation from the Madhya Pradesh Forest department is most essential. Co-operation from Police department and Revenue department will be required to maintain the law and order situation in the National Park area.

7.6 FULZARI VILLAGE AND ITS DEPENDENCE ON FISHING :

Fulzari village is situated in the heart of PNP. It is also going to be shifted to Salma, which is near to the boundary of Madhya Pradesh.

About forty-two families are living in the village from 1970. The census of the village brings out that they came to PNP as workers for the work related to the protected area. The place has been allotted to them inside the PA. Gradually they started farming as well as fishing activity as an important source of their livelihood.

Most of the families are earning more from fishing. After agriculture, fishing is the next important activity. The details of dependence on fishing is analysed on the following paragraphs.

As this village is situated in the heart of PNP i.e., in between the upper and lower Pench Area of the National Park, the Fulzarians avouched that they are availing the facilities of fishing from both sides, i.e., upper and lower Pench river specially from Khairi dam. However, the fishing is not allowed at upper Pench. But some licenses have been issued at Khairi dam and lower Pench. Due to limited licensing the illicit fishing is going on from upper Pench area.

7.6.1 INCOME FROM FISHING:

About 20% of village people catch fish for self consumption. On an average a family needs 2 Kg. fish for self consumption purpose. It is their day to day activity. They spread net at night and in the morning they catch hold of fishes to cover their basic need of food.

Out of 42 families, 18 families are earning by way of fishing on an average Rs. 1800 to Rs. 5400 per month. The young members of these 18 families are having regular

license for fishing at Khairi dam. The income depends upon the fish catch in various seasons. Rest of the 20 families carry out agricultural activities.

The young generation is having traditional knowledge of fishing, which is percolated/ inherited from their fathers and grandfathers. They are totally unaware of the scientific techniques of management. There is a lack of necessary means of fish farming. Hence, they have to share the net as well as fish catch and variety of the fish. Normally three families are found sharing a net daily. It can be said as a cooperative type of fishing at Fulzari.

Fulzarians are earning Rs. 1800 to Rs. 5400 from 7-8 quintal to 20-25 quintal fish catch. The highest fish catch is possible in the rainy season. From July to Sept, they can earn about Rs. 5400/- because of the best availability of the fishes in the season. One more reason is – the water becomes heavily polluted in rainy season. Hence, the fish cannot save itself from entering into the net. Hence in this situation the big fishes can also be easily caught and Fulzarians are getting advantage of it. Three to four months are good for gaining income through fishing because after rainy season they cannot earn. The reason is that at winter the fish catch becomes lowest. They have to migrate temporarily to a short distance in search of whatever the work available at near by places.

They spread net in winter season, but throw back pregnant fishes in water. Hence, in this season they cannot depend more upon fishes. The indigenous knowledge of the villagers about fishing appears rich in terms of conserving environment and the people living in the Fulzari village automatically help in regenerating this way the common property resource.

They can catch and sell about 2-5 quintal fishes in winter. Hence, from fishing they earn about Rs. 1000- 1500 per month in the winter season. In summer 7-10 quintal per net is the average fish catch, which provides about Rs 1500 to Rs. 2500 per month. Due to highest mercury rise in this area this period cannot be said very fruitful for fisherman of Fulzari in terms of fish catch. In this season they migrate less for want of work. Hence, this time span is the lowest earning period of the people.

The fishermen can catch variety of fishes from khairi dam. They are Padan, Katla, Rohu, Mirgal, etc. The highest rated fish is Padan which is in high demand because

of its rich quality. They can earn Rs. 20 -25/- per Kilo from Padan fish while Rohu and Katla can fetch Rs. 15-20 /- per Kilo. The lower rate is given to Mirgal fish, because of its low quality. There are other variety of fishes available in the dam like Calbasu, Murrel, Tor Tor, Pawin etc. The weight of grown up fish varies from 5 Kg to 25 Kg. Such fish gives a lot of satisfaction to the fisherman in terms of earning the fishes having long horns in front of their mouth which cannot become a food for man, say local people. Due to this natural protection facility, such fishes can guess the danger from long distance and always stay away from the net. Clever fisherman are using Bhala (big sharp knife) to kill and catch such fishes.

After catching fishes in the morning the fisherman rushes to the local collection centre at Kolitmara. The rate is fixed per kg and on the quality of fish. The fishermen reported that whatever they catch is sold immediately and they never have to wait for a long time for selling it. Even they have not gone to any other market or long distance market to sell it. They do not have to bother about the market ups and downs. The demand and supply is almost fixed in their business context. If they wish, they can keep a part of harvested fish for their self consumption, otherwise that 'part will have demand at Kolitmara'. There is no need for preservation of fishes. Thus, the cost of preservation facilities is almost nil.

7.6.2 COST OF FISHING:

A cost of net (from purchase to use) is about Rs. 1000/- as stated earlier, about 3 families use a net daily. Naturally this cost is shared by these families. Four nets are needed for one year. Very less damage occurs in it. Hence one time investment of about Rs. 1400/- for four nets per year per family is not a costly affairs. Their livelihood is more or less dependent upon this small investment. They don't have to pay other charges like transportation, carrying, etc. At Fulzari the fishermen are very comfortable and happy due to less cost and more benefit from fishing. The family size is very large in Fulzari. The fishing business is as good source of income. At the present situation they cannot think of any other profession than fishing. Most of the Fulzarians are dropouts after 8^{th} standard. They are not having idea of any other training or skill to start new profession. The low education level and traditional knowledge about fishing prevents them to start any other work except traditional agricultural work or unskilled labour available to them at nearby places.

The real question will arise when Fulzari village will be resettled at Savara (much away from National park and Khairi dam) there they will not have the same facilities. In that eventuality the resettlement will be a hard blow to the Fulzarians. Their future seems to be bleak in terms of their source of livelihood.

7.6.3 FISHING AT LOWER PENCH:

Lower Pench Area is a zone of fishing. Near the boundary of National park, the Maharashtra Fisheries Development Corporation (MFDC) allows fishing through licensing. The MFDC is playing an important role by allowing fisherman by providing 375 licences for a particular time period. Fishermen have to renew their licenses weekly. This restriction over fishing is creating a revenue base to MFDC from Lower Pench area.

The authorities of the Corporation explain that about 8 lakh of fingerlings are stocked by the department. About 30% of this stock is converted into big fishes of about 2 Kg each. Rest of the fingerlings may migrate or die.

About 480 tons of fishing is done on this sight and about Rs. 7.20 lakh can be earned when the rate of per Kg fish is about Rs. 12 -15/-. This is the case of limited licenses issued zone for fishing, Kolitmara, Ghoti, Sarakho borda, Navegaon bandh, Parsheoni come under this zone.

The harvesting, stocking of fishes and fingerlings have been done on regular basis (please see Annexure 1, 2 and 3). According to the authorities it is not the case of over-fishing. Only 3% restricted fishing is done here. Hence it is not a threat to environment.

7.7 EMPIRICAL ANALYSIS:

This is substantiated by the empirical analysis based on the data given in Encl. No. 1. The data was provided by MFDC and relates to the period 1983-84 to 2000-01. In order to estimate the growth rate, we consider,

$\text{Log } S = a + bt;$

where,

S = stock

b = growth rate

a = constant

t = time.

The estimated equation is

Log S = 0.7979132 + 0.0593961

(1.4728652) (1.0577667)

R^2 = 0.073229

The estimated growth rate is 5.9 per cent and is statistically insignificant.

Another equation used to estimate the growth rate of harvesting of fishes and is

Log H = a + bt

Where,

H = Harvesting

b = growth rate

t = time

a = constant.

The estimated equation is follows:

Log h = 3.9942454 + 0.00483907

(21.937937) (0.2657615)

R^2 = 0.004395.

The estimated growth rate indicates that inspite of sufficient stocking of fishes and fingerlings the harvesting is very low. This further implies that it is not at all a threat to the water bodies or environment.

There were various ups and downs during 1983 to 2001 in terms of stocking and harvesting of fishes. There is slight improvement from 1995-96 in stocking of fishes though the position of harvesting of fishes was almost stable from 1998-2001.

There are various types of fishes available in the reservoir. Some of these are having fine demand due to its good quality. The year-wise production is increasing for major crop and local major types of fishes (Annexure No. 2 and figure No. 2).

The primary survey and secondary sources clearly indicate that about 450 (Annexure 3 and fig. No 3) fisherman are engaged in the fishing. Still they are not over extracting the fishes. Thus this is not an anti-environmental activity. The authorities are also taking due care of this precious specie. This kind of conservation of nature is an important activity in Lower Pench. The livelihood of local poor is also intact. The interdependence of fisherman on nature and source of income through nature to fisherman is balanced.

7.8 VALUATION OF FISHERIES AT PNP-

In valuing fishery ground the main problem is lack of data on stocks in the seas/lakes etc. the fishery catch also depends on the stock of fish and fingerlings in the fishry grounds as well as on inputs in terms of fishing efforts (number of hours) and the quality of fish gear used.

Lt C^{gt} and C^{gt} be catch of fish per unit gear and catch for the total stock of gear type g in period t respectively. $G^{g't}$ is stock of gear type g in period so that –

$C^{gt} = C^{gt}\ G^{g't}$

Quantifying them

C^{gt} = 20 quintel per net (rainy seasons, the best catch season)

C^{gt} = 23560 quintal per stock of all types of fishes

$G^{g't}$ = 1178 quintal of all types of fishes in rainy season.

Therefore, 23560 = 20* 1178

This estimate is calculated with the help of information given by the local people of PNP. It shows that sufficient number of verities of fishes (mentioned above) is available in the reservoir. As the local people are using traditional methods for fishing they are not over extracting the fishes.

Recently the Totladoh village which was situated in PNP was totally shifted. The question of livelihood of fisherman is one of the part of this action. The fishermen of Totladoh have to search some other source of living at their new settlement area.

The other part this action is in favour of norms of PA where the various species of fishes as well as plants will have its natural growth without human disturbances.

However, the government is successful in achieving the goals of PNP by this action, which is in the favour of protection of the national park. This work will be useful for wild animals safety purpose in near future. Because the authorities are preparing various plans for this place which unable them to manage this park well and make it environmental friendly.

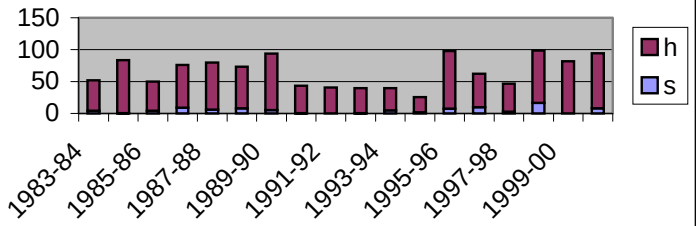
ANNEXURE- 1

MAHARASHTRA FISHERIES DEVELOPMENT CORPORATION LTD.

RESERVOIR PENCH

Year	S	H
1983-84	4.10	48.00
1984-85	0.47	82.88
1985-86	4.25	45.88
1986-87	9.00	66.85
1987-88	6.00	73.51
1988-89	8.00	65.31
1989-90	5.00	88.98
1990-91	0.50	42.80
1991-92	--	40.49
1992-93	0.34	39.10
1993-94	4.50	35.05
1994-95	2.00	23.51
1995-96	7.67	90.16
1996-97	10.00	52.49
1997-98	2.72	44.14
1998-99	16.49	82.265
1999-00	-	81.779
2000-01	8.156	86.171

Figure- I
Maharashtra Fisheries Developmetn Corporation Ltd. Resevior Pench



S= Stock of Fish / Fingerlings no. in lakhs
H = Harvesting of fish in metric tones.
10Rs. / Kg. - For a fisherman.
12 Rs. / Kg. - Maharashtra Govt.
log y = A+BT

ANNEXURE- 2

MAHARASHTRA FISHERS DEVELOPMENT CORPORATION LIMITED

NAGPUR DIVISION NAGPUR

YEAR WISE PRODUCTION OF FISH

CROPS	1995-96	96-97	97-98	98-99	99-2000
Major Crop	36.521	21.181	23.604	42.020	55.429
Local Major	5.600	2.000	4.507	0.758	1.496
Local Minor	55.193	29.225	19.027	36.651	20.243
Others	1.842	0.076	-	3.836	4.609
TOTAL	**99.156**	**52.482**	**44.138**	**82.265**	**81.777**

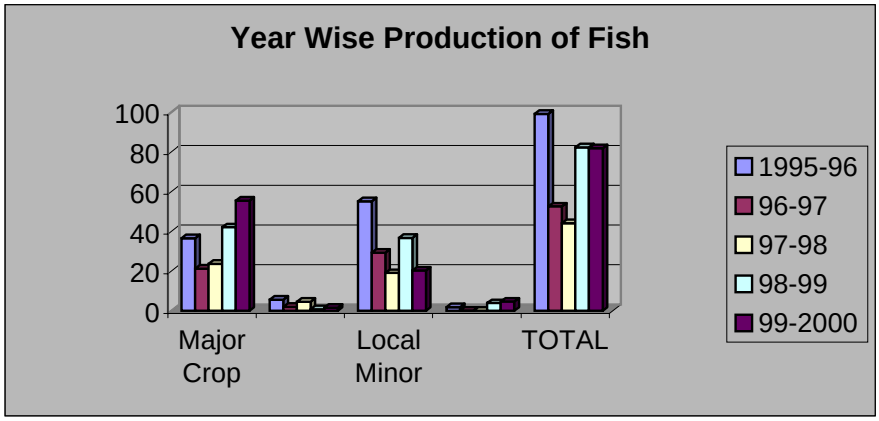
Major Crop - Catla, Rohu, Mrigal

Local Major - Calbasu, Murrel, Tor Tor, Pawin, Singta (Cot fisher mostly)

Local Minor - Persi, Katwe, Pabda, Balm.

Others - Rotten Major Carps

Figure- II



ANNEXURE- 3

MAHARASHTRA FISHERIES DEVELOPMENT CORPORATION LIMITED

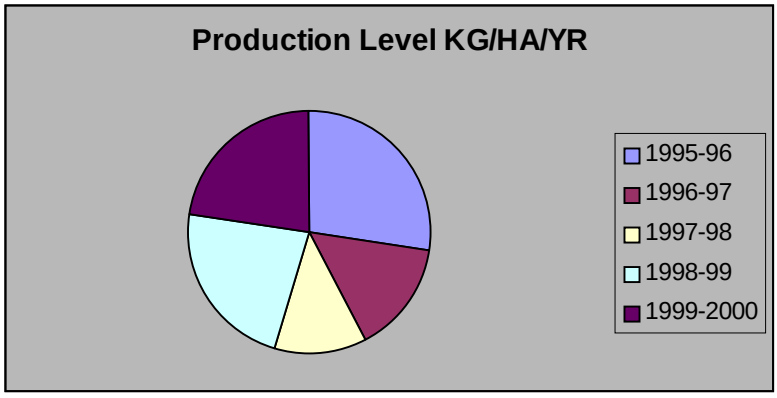
NAGPUR DIVISION NAGPUR

Nagpur Region	Reserivor	W.S.A. in Hectares	Approx. number Fishermen engaged as on today99-2000
Nagpur	Pech	1600	450

The Statement of Production Level In Kg. Per hectare per Year in Totladoh Reservoir

Year	Pench 1600 Ha
1995-96	62.00
1996-97	32.800
1997-98	27.580
1998-99	51.410
1999-2000	51.110

Figure- III



CHAPTER- VII:COST - BENEFIT ANALYSIS

7.1 An attempt has been made to identify, quantify or measure the various benefits and cost of PNP for which information could be obtained It is often difficult to place values on many a benefits of PA. and the future demand for these benefits due to incomplete and inadequate information .In most cases, there is incomplete knowledge of what resources the area contains. Uncertainty exists on both the supply and demand side with respect to biological and genetic recourses (Jacobson and Dragon 1989,Bishop 1978). Market failure adds to the information problems. Their presence makes it hard to assign accurate values to many of uncertainty problems. Moreover, PAs are complex systems whose natural resources have adapted to their individual environment and the overall system over long period of time. If the area is disrupted by harvesting some of these resources or is converted to another use, it may take centuries, if ever, to return to its normal state. So a more cautious approach needs to be taken when results of a decision may be irreversible (Krutilla and Fisher 1985). In a sense, any decision once implemented, is irreversible.

7.2 Biological changes resulting from many uses may also be irreversible. For example the generated forest may superficially resemble the original forest; but the changes in species composition and other factors may be so great that the replaced forest cannot be considered to be the same as original forest (Jordan 1986).

7.3 Destruction of habitat may also have resulted in local or even global extinction of animal species. In the former case, restocking from other areas may be possible; but if global extinction has occurred, the changes are surely irreversible. Irreversible changes may also result in a loss of existence and optional value.

Many people derive a sense of wellbeing simply from knowing that these areas (PAs) exist (So called existence value); others hope that they may some day have the opportunity to visit a certain area (PAs) or observe a certain species in wild. (Option value). If these opportunities are no longer available due to development and the consequent irreversible loss of the resource, there will be a loss in term of social welfare. Such losses, though difficult to quantify may be significant. Most of the benefits of PAs are considered intangible

Since most PAs are social or public investment made by governments on behalf of society, undervaluing or failing to estimate monetary benefits result in insufficient government funds being provided for the management. There seems to be lack of appreciation and recognition on the part of the community to give correct assessment of PNP. Rather than regarding PAs as valuable resources with measurable economic and ecological benefits, they are commonly considered 'welfare cases' and a drain on the public treasury. Yet monetory estimates of many of these benefits can be made in order to indicate their true value to the society.

7.4 VALUATION OF COST OF PNP:

Two types of costs are associated with establishment of PNP. (1) Direct cost (2) Indirect costs.

(1) Direct Cost- They can be classified into i) Capital cost ii) Establishment cost iii) Maintenance costs. Table: VII.1 presents in a synoptic view the direct costs mentioned above, and their details and limitations

Direct cost of PA includes cost of establishment and maintenance. Sometimes, the government acquires land to establish P.A. This cost may be treated as cost of acquisitions of land for P.A. For creating permanent infrastructure in PA some expenditure is to be incurred. Cost of Nalla building, water holes etc. may come under this. Expenditure on salaries of forest department working for the Tiger Project may come under establishment and maintenance cost.

The non-plan budgetary expenditure of the forest department as given in various budgets of the forest department can give us idea about the establishment cost, maintenance cost and other type of cost. The estimates of non-plan expenditure on Pench Tiger Project by the forest department are given at Rs. 207.83 lacks in 2001. This can be taken as direct cost of PNP for maintenance. The cost of salary, T.A., D.A., has been given in Table: VII.2. The Table: VII.2 gives the cost of maintaining PNP for the year 2002-03 it is estimated at Rs. 2crores10 lacks (including salary, allowances etc.). From Rs. 1 crorers 35 lacks in 1998-99 it showed rise to Rs. 2 crorers 10 lacks in 2002-03 .

Table: VII.1:VALUATION OF DIRECT COST OF PNP

Cost	Details	Remarks/ Limitations/ Assumption
Direct Cost i) Capital cost	The cost of developing the infrastructure/ permanent assets in PAs may be taken in this category	The budgetary allocation under central assistance may be taken under this cost of construction of roads and other infrastructure mainly in tourism zone may be taken into consideration. However, the capital cost of PA may be taken as zero as it is given by nature and no cost of acquiring land is incurred in PNP.
ii) Establishment cost	This includes establishment expenditure for the PA	The pay and salaries of the permanent and temporary staffs, office expenses, travelling allowances and medical-reimbursement of staff etc.
iii) Maintenance costs	This cost generally includes the expenditure incurred in the maintenance of Roads, buildings, water resources, etc. in the PA. It also includes 10% interests on the capital costs.	Non-plan expenditure
Indirect Cost or Externality	If compensation NOT paid for the damage by wild life to crop, injury and details of human / cattles etc., it is indirect cost or externality.	Since no compensation is paid by the forest department estimates of crop damage on the basis market value can be used as a proxy for indirect cost

Table: VII.2
Maintenance cost of PNP

Sr.no.	Year	Amount (in Lacks Rs)
1.	1998-99	1,33,00,000
2.	1999-2000	1,50,00,000
3.	2000-01	1,68,00,000
4.	2001-02	1,90,00,000
5.	2002-03	2,10,00,000

7.5 COST OF RESETTLEMENT OF VILLAGE FULZARI: As per the norms of P.A, no human settlement is allowed in P.A. Village Fulzari located within the geographic limits of PNP, will be resettled in village Sawara outside PNP. The cost of resettlement of village Fulzari has been estimated at Rs. 1,79,47,500. or 1.79 Crorers. As has already been mentioned earlier, village Fulzari located within the geographical limits of the protected area of National Park will be rehabilitated at village Sawara. The total land of 85 Hectares is to be acquired from the (compartment no. 495) Reserve Forest would be as follows:

Table: VII.3

H E A D	Area	Total Area
a. Land for house construction		2.16 Ha.
b. Land for Agricultural Purpose i) Land for holder families ii) Land for landless families Total	 30.53 Ha. 46.20 Ha.	 76.73Ha.
c. Land for other civic amenities Total		6.11Ha. 85.00Ha.

ii) FACILITIES PROPOSED TO BE PROVIDED AT REHABILITATION SITE AND THEIR ESTIMATED COST: The following set of works will be initiated for the resettlement of the village:

Land Development: Since at present a varying density of bushes, shrubs and trees are standing at relocation site, for making the area fit for raising agricultural crops and housing, clearance of vegetational growth, uprooting of stumps and levelling is proposed to be done in areas demarcated for crop land formation, habitation purposes and civic amenities.

Break up of the total expenditure on various items of work involved for land development

Table: VII.4

Item	Expenditure (Rs.)
i. Clearing includes marking of trees, extractions of forest produce	16,60,000
ii. Uprooting of stumps including remaining of stumps from the site of levelling wherever necessary	4,80,000
Total	21,40,000

7.6 INDIRECT COST OF PNP: Indirect costs involve damages caused by the existence of a forest and are usually born by the local communities in the form of conflict between predators and domestic livestock, loss of crop fields to the larger

grazing mammals and other perceived threats to human welfare. The interviews with the forest department showed the costs of compensation at minimum due to skilful management of Pench National Park. Maintaining balance between the population of carnivores and herbivores has ensured sufficient supply of food to both type of population. Maintaining meadows near village boundaries have also restricted the encroachment of wild life in the villages and helped them to minimize the damage of crops and incidence on life. So far no compensation is paid by the Forest Department for crop damages.

However, household surveys in Fulzari have reported crop damage ranging from 25% to 50% of the crop yield. In village Fulzari it was stated to be almost 50 percent by the wild bore. About 50% crop damage by deers and wild boars in the boundary villages. The total annual value of the crop in village Fulzari is estimated at Rs. 1,74,337.00. The value of the crop damage may be estimates at Rs. 87,168.50 (50 percent of the crop yield).

Inspite of denial by the forest department about crop damage by the wild animals in PNP discussions with the NGOs have also indicated the phenomenon of crop damage by the wild animals in PNP. There by substantiating the estimate of loss of crop (in valus terms) made by us on the basis if household surveys.

For the sample villages, the estimates of crop damage are given in table no: VII.5

Table: VII.5 : Estimates of Crop Damage

Name of Village	Loss due to encroachment of Wild Life (Rs.)	Name of Village	Loss due to encroachment of Wild Life (Rs.)
1 to 5 KM		5 to 7 KM	
Ghatpendhari	60,250	Tuyapar	40,134.37
Kolitmara	03,800	Ghoti (Dahoda)	56,925
Narhar	23,200	7 to 10 KM	
Kirangisarra	41,775	Ambazari	04,500
Khapa	38,775	Kadbikheda	21,145
Wagholi	1,03,475	Chargaon	36,850
		Total	4,30,829.37

A cursory glance at table shows that for the villages in close proximity of PNP, the crop damage is very high. It is reported to be almost 50 percent. For six villages in vicinity of PNP the value of crop yield is estimated at Rs. 5,42,550 and the estimated crop damage is at Rs. 2,71,275 annually.

For two villages within 5 to 7 Km from the boundary, the estimated crop damage is 35 percent of the crop value, which is Rs. 9,7059.37 annually.

For Ambazari, Kadbikheda and Chargaon it is estimated at 25% of the crop yield which comes to Rs. 62,495 annually.

Thus the total cost of the crop damage is estimated at Rs. 4,30,829.37 or 4 lakh 30 thousand for the sample villages within 0 to 10 Kms of PNP.

7.7 OPPORTUNITY COST OF INCOME EARNED THROUGH NTFP COLLECTION:

The opportunity cost of income through collection of NTFPs can be estimated for the sample villages under investigation. Opportunity cost is defined as the income foregone in the next best alternative use. In the present context it is a loss of income from alternate sources when village communities spend their labour time for collection of NTFPs in the forest of PNP The labour time spent in collecting NTFPs for the 365 days in the year can be estimated for these sample villages. Seasonal nature of agriculture, lack of adequate irrigation facilities, and small and uneconomic size of operational landholdings, coupled with lack of other opportunities of self-employment have compelled the village communities to depend on forest of PNP for livelihood purpose.

In the absence of income augmented through NTFPs from the forest of PNP, the local communities would have resorted to short distance migration for unskilled labour work either in mining, construction or other non-forest based work, which would have offered them an alternate source of income. A study of educational status of local population in proximity of PNP (Chapter-IV Table No.IV.5) has shown lack of adequate educational attainment on the part of the native communities, which has restricted their employment opportunities outside the villages. The only opportunity for them is to work on daily wages.

Methodology: It is presumed that minimum one member from each household is engaged in the collection of NTFP. The member is assumed to spend minimum one to two hours in the forest for collecting fuel wood, Tendu (two months), Moha (two months), honey from the forest of PNP. The time required to reach the forest would vary depending upon the distance of the village from PNP boundary. It is assumed that working population within three kilometres would spend daily 1 hour in travelling (walking) to reach PNP, within 3 to 5 KMs two hours daily in travelling to reach PNP and 5 to 10 KMs three hours daily.

The above table gives details of labour time spent and the daily wages earned by village community in the absence of PNP. Working for eight hours a day would have earned for them a wage income of Rs. 40/- Two hour's labour time spent (One hour in NTFP collection and 1 hour in travelling) would give them 1/4th of the minimum wage for unskilled work.

Table: VII.6: THE OPPORTUNITY COST OF LABOUR SPENT IN NTFP COLLECTION

Sr no	Name of the village	Distance from PNP boundary	Surveyed HH	Hrs spent in forest (Per HH)	Total hrs (per day)	Total Days (Hrs /8)	Total Days *Rs 40	Opportunity cost per HH Total/No of HH (surveyed)
1	Fulzari	0	42	1	42	275*42=11550/8 =1443.75	57750	Rs 1375
2	Ghatpendhari	1to 3	10	1	10	275*10=2750/8 =343	13750	Rs 1375
3	Kolitmara	1to 3	3	1	3	275*3/8=103.125	4125	1375
4	Narhar	1to 3	5	1	5	275*5/8=171.875	6875	1375
5	Kirangisarra	1 to 3	3	1	3	275*3/8=103.125	4125	1375
6	Khapa	1 to 3	10	1	10	275*10/8=2750	13750	1375
7	Tuyapar	3 to 5	8	2	16	275*16/8=550	22000	2750
8	Ghoti	3 to 5	14	2	28	275*28/8=962. 5	38500	2750
9	Ambazari	5 to 10	7	3	21	275*21/8=721.87	28875	4125
10	Kadbikheda	5 to 10	9	3	27	275*27/8=928.125	37125	4125
11	Chargaon	5 to 10	6	3	18	275*18/8=618.75	24750	4125
	Total (excluding Fulzari)						10,22,125	

7.8 ENVIRONEMTAL LOSS DUE TO DEFORESTRATION: Entire protected area of the Park shows that, around 622.94 hector forest area is cleared for construction of approach roads, saddle dam, colonies, stores, powerhouse and quarries. Around 1993.78 hector area is under submergence.

The environmental loss for forest with one density is considered as Rs. 126.74 lacks per hector. Hence, for the forest land of 622.94 hectors of area deforested; the environmental loss for fifty year period is estimated at Rs. 78,951.415 lacks (This loss is for construction of approach roads, saddle dam, colonies, stores, power house, and quarries). The estimated loss of area for submergence is 1993.78 hectors (area under submergence comes to Rs. 2,52,691.677 lacks) (1993.78 * 126.74 lacks).

Table: VII.7: Total Environmental Loss

P A R T I C U L A R S	Rs. (Lacks)
Construction Purpose	78,951.415
Submergence	2,52,691.677
Total	3,31,643.092

Thus, the total loss of area, (622.94 hectors +1993.78 hectors) is estimated at 2616.72 hectors. The estimated total environmental loss comes to Rs. 331643.092.

7.9 BENEFIT ANALYSIS:

The benefits associated with Protected Areas[i]:

Diverse benefits are associated with PAs which flows from various conservation objectives, (Dixon & Sherman 1991) viz.

1. Maintenance and conservation of environmental resources,
2. services and ecological processes;
3. Production of natural resources such as timber and NTFP;
4. Provision of recreation and tourism services;
5. Protection of cultural and historical sites and objects;
6. Provision of educational and research opportunities.

Some of these benefits are the result of direct resource use and can be valued according to the market prices, fishing, timber fuel, NTFP, etc. The other benefits, viz.; recreational uses, which depends on direct human use of the PAs can also be valued in various ways. Most of the benefits from the PAs, however, are hard to measure in monetory terms. These benefits to individual or society at large are frequently referred to as social benefits and a primary justification for PAs as shown below:

BENEFITS ASSOCIATED WITH PROTECTED AREAS

These benefits to individuals or society at large are frequently referred to as social benefits and are said to be a primary justification for PAs.

1. *Recreation/Tourism:* These are services not only yield direct financial benefits from PAs but stimulate employment and rural development in surrounding areas, as well.

2. *Watershed Protection:* Maintaining the natural vegetative cover helps control erosion, reduces sedimentation and flooding down stream and regulates stream flows. The extent of the benefit depends on the type of the soils, topography, and natural cover in PA, the alternative usage available and the type of investment and land-use down stream. These benefits include erosion control, local flood reduction, and regulation of stream flows.
3. *Ecological Processes:* In their natural state, PAs provides a number of environmental services, viz., fixing and cycling of nutrients, soil formation, circulation and clearing of air and water, and global life support.
4. *Biodiversity:* By protecting habitats, one protects the variety of species they contain and these biological resources form the basis of numerous industries and are major sources of food, medicines, chemicals and other products used in both traditional and industrial societies. A lot of benefits are related to biodiversity conservation, viz., gene resources, species protection, ecosystem diversity, and evolutionary processes.
5. *Education and Research:* PAs instill people with an understanding and
6. appreciation of the environment, making them more aware of the harmful consequences. Certain types of behaviour research is often integrated with education, the PAs provide fertile ground for field study by students at all level.
7. *Consumption Benefits:* PAs can lead to various (timber and NTFP) products including timber, forage, food, wildlife, fish, herbs and medicines that may only be harvested on sustainable basis.
8. *Non-consumption Benefits*: These benefits include the values people derives from PAs that are not related use, viz., aesthetic, spiritual, cultural/historical existence value.
9. *Future Values*: The protection of certain areas ensures a variety of benefits from their potential use in future, viz., optional value, quasi-optional value.

7.9.A.1 OBSTACLES TO VALUING BENEFITS OF PAs

Many of the benefits of protected areas, such as their ecological, biological, or aesthetic value, etc. are subject to the “market imperfections”. Biological diversity,

for example, is recognized as one of the most important benefits from PAs but exceptionally difficult to value in monetary terms. Other benefits are much more concrete but, owing to their location or other factors, do not have easily determined monetory values- forest products that are collected and used by local inhabitants but not sold commercially, or the down-stream impact on water regulation and water quality created by maintaining forest cover in a watershed (Dixon & Sherman, 1991).

For non-rival goods, one person's consumption does not affect the amount available to anyone else and the total amount of the goods available can be enjoyed by anyone without diminishing the supply, e.g., *a beautiful view or clean mountain air*. Some goods, for example recreation, are non-rival upto certain point and beyond that point there is indeed rivalry and congestion sets in. The problem with non-rival good is that the market cannot set an efficient price for them. As Box VII.1 indicates almost all the benefits of the PAs are non-rival. When an area is designated as protected, many of the benefits provided are then available to all, and one person's use does not detract use by other person (with the exception of overcrowding and congestion).

Sometimes it is not feasible to exclude anyone from consuming the good because the cost of excluding them would be greater than the benefits received. Consider the example of clean air or a view of a distance mountain to exclude people would be impossible or very expensive at the least. These are known as non-excludable goods. Once these are provided, everyone received the same level of benefits. But these often involve external effects or externalises (Samuelson 1954, 1955) that is, the production or consumption of a good of service by one person affects another person involuntarily or consumption of a good or service by one person affects another person involuntarily without benefit of consumption. Consider the case of biodiversity, a country is asked to preserve natural areas in order to maintain genetic stocks for future use. Given incomplete knowledge and weak patent regulations, it may be very difficult for the country to reap the benefits (by excluding others) from the development of a new medicine or plant cultivator derived from the PA. Consequently, the incentives to preserve natural areas are reduced because of non-excludable and external effects. Box- VIII. Shows that almost all the benefits associated with PAs are non-excludable to some degree. The one exception is the benefits that require on-site use of PA-eg., *tourism, recreation*, and *research*. Normal

market mechanisms, therefore, will not supply the desired amount of PAs even if they promise net social benefits.

Box- VII.1:Characteristics of benefits from the PAs

Sr. No.	Benefits	Non-rival	Non-excludable	Of-site Effects	Prevention of irreversible loss	Estimation of value
1.	Receration/Tourism	XC	P	-	P	S
2.	Watershed values					
	* Erosion control	X	X	X	-	S
	* Locl flood reduction	X	X	X	-	E
	* Regulation of stream flows	X	X	X	-	E
3.	Ecological processes					
	* Fixing and cycling nutrients	-	X	X	-	S
	* Soil formation	-	-	-	-	S
	* Cleansing air and water	X	X	X	-	S
4.	Biodiversity					
	* Gene resources	X	P	X	P	E
	* Species protection	X	X	X	P	E
	* Evolutionary processes	X	X	X	X	E
5.	Education	X	P	X	X	E
6.	Research	X	P	X	X	E
7.	Aesthetic	X	X	X	P	S
8.	Spiritual	X	X	X	X	E
9.	Cultural/ historical	X	X	X	X	E
10.	Optional values	X	X	X	X	E
11.	Quasi-optional value	X	X	X	X	E
12.	Existence value	X	X	X	X	E
13.	Global life support	X	X	X	P	E

C= Congestible, P= possibly, S= somewhat difficult, E= extremely difficult, X= attribute is present

(Source: Dixon & Sherman, 1991)

Although many important benefits remain within the PA itself, other benefits extent beyond the boundaries are known ads the off-site benefits. There may be benefits to nearby farmers. For example, from protecting important watershed land and regulating water supply. Although many off-site benefits are also non-excludable, not all non-excludable benefits occur off-site. These two properties often overlap, but they are separate issues. Nevertheless, the same valuation problem arises with both-since individuals do not request these services and do not control their provision, they are not required to pay for them.

Following benefits of PNP have been discussed.

1. Consumptive Benefits of PNP: Benefits to local communities in the form of income and employment have been discussed in chapter III and IV. Income earned (expenditure saved) from NTFP collection is a major benefit from PNP. Village Fulzari as well as eleven villages (Sample villages) surrounding PNP have benefited immensely from collection of Tendu leaves, Moha, firewood/ fuel from the forest of Pench. Their dependence on PNP for grazing purpose also indicates benefits appropriated by them for maintenance of livestock.

The estimates of their income from NTFP, fodder, and fuel wood are given in the following table:

Table: VII.8: Income from Forest

Income from (in Rs.)	Fulzari	11 Villages
NTFP Collection	2,31,441	7,08,086.75
Hunting	25,750	1,500
Fishing	1,10,296	31,650
Forest Labour	26,135	5,13,995.05

2. Recreation Benefit: The expenditure made by tourist on PNP may be taken as a proxy for benefits from recreation.

3. Biodiversity Benefits: An attempt has been made to quantify the benefits from various tree species in PNP. A sample of biodiversity plot adopted by Forest Department has been taken for valuation of benefits by taking their market price (Quotation received) Table IV.1 in Chapter IV gives a glimpse of benefits from biodiversity. They are estimated at Rs. 4,84,684.59

4. Environmental Benefits: The environmental benefits of sample plots are given in the table VII.9.

Fishing- Fishing within the national park and on the border of national park is restricted by the government offices as well as the local are also cooperating on this issue. Thus the regenerative capacity of fishing is not disturbed. Rather the efforts are made to maintain the regenerative order of fishing in all seasons specially in winter season.

Earlier this park was famous for game fish for entertainment of local people and tourists. But the species like Mirgal, Katla, Minar and major corps has been inserted in the floating water. Hence except that game fish other species are showing well maintained growth.

Table: VII.9 :Environmental Benefits

Valuation of ENVIRONMETL SERVICES Over a period of 50 years
31 TREES- girth size 90-120 cm.
Preservation plot = 250 m * 400 m

Benefits	Value in Rupees	Value in Rupees
Production of Oxygen	2,50,000	77,50,000
Conservation to animal protein	20,000	6,20,000
Soil conservation and maintenance of soil fertility	2,50,000	77,50,000
Recycling of water and control of humidity	3,00,000	93,00,000
Sheltering of bids, squirrels, insects and plants	2,50,000	77,50,000
Control of air pollution	5,00,000	1,55,00,000
Total	**15,70,000**	**48,67,00,000**

Source: Lal J. B.- Economic Value of India's Forest stock p. 46. The Price of forest- Edited by Anil Agrawal

In the context of fishing at local as well as global level, no environmental damage has been done. Hence this area is one of the best locally and globally managed park.

Tourism- In and around PNP the tourism is developing at a faster rate. Good road and staying facilities are available. In the national ark tourism is kept strictly restricted from over crowding. The carrying capacity with the help of no. of tourists, ehicles, wild life watching has been identified of the area and developments done accordingly. Like only few parts of the PNP are opened for tourists for wild life watching. Some wonderful exhibitions have been performed to get the knowledge of various species of the park as well as entertainment facilities like games, boating etc.

Very less disturbance has been seen from tourism for biodiversity, infrastructure development, hydropower generation etc. Thus we can say that this activity is not at all disturbing the environmental norms, rather it is a revenue generation activity and amicable approach towards local people provided various employment potentials to them like, forest guards, guides, stall keepers etc.

Due to non-availability of time-series data the benefits as well as costs have been quantified by taking cross-section data.

7.9.A.2 INCIDENTAL BENEFITS: They are those benefits which arises not by the virtue of the status of P.A. for a particular area but are appropriated by the local

communities even otherwise i.e., in the absence of PNP. PNP contributes in maintaining or raising the water level of the reservoir and water tables of the surrounding area. The reservoir at Totladoh Dam in PNP confirms following benefits to the communities in and around PNP:

1. Water supply to Nagpur city
2. Irrigation benefits to Nagpur district
3. Power supply to Nagpur district

Water Supply from Pench :

Pench is a lifeline for Nagpur city. Water supply from PNP for domestic, commercial and industrial use has vital importance for the economy of Nagpur Region.

The total supply of water to Nagpur city (Raw water + Pure water) is 493.15 million litters per day. Almost 70 per cent of this total supply of water is obtained through Pench (342.46 million liters is supplied (69.44%)from Totladoh irrigation dam). The per capita availability of water in Nagpur city is estimated at 2401 ltrs.

The benefits of water supply to Nagpur may be estimated either on the basis of number of beneficiaries of water supply for various purposes or total revenue collected from supplying water as user charges. No doubt, water rates may not fully reflect the use value of this valuable source, it may help in quantifying partial benefits to the water users of Pench.

Irrigation Facilities[↗]:

Benefits of water supply for irrigation purpose can be estimated on the basis of total beneficiaries of irrigated water from Pench, the total area under Pench irrigation as well as growth in irrigated area and resulting growth in production and productivity of major crops in Nagpur and changing cropping pattern in the region from double cropping due to extension of irrigation facilities.

The benefits of Pench irrigation have been appropriated by Nagpur district from 1987-88, which get reflected in impressive growth in area irrigated from the waters of Totladoh irrigation dam.

[↗] Estimation of benefits from irrigation is based on secondary source.

In 1987-88, total area under irrigation in the district was 25,733 hectors. In 1996-97, it registered a growth of 55.19 percent in irrigated area reporting irrigated area under Pench to 39,005 hectors.

Growth in yield per hector: For estimating net benefits of irrigated water from Pench the difference in productivity of major crops in Nagpur district for irrigated as well as unirrigated area—have been estimated. In 1988-89, the composite yield of paddy and wheat was 24.78 quintal per hector (QPH) for the area irrigated by canal irrigation, whereas for unirrigated area, the composite yield has been estimated at 17.25 Q.P.H., which is 42.64 percent lower, compared to yield from irrigated area. The difference in productivity (yield per hector) for irrigated and unirrigated land has shown a remarkable growth in 1992-93 reporting productivity differential of 65.02 per cent. (The composite yield of paddy and wheat for 1992-93 was estimated at 19.295 Q.P.H. whereas for unirrigated land it was estimated at 6.75 Q.P.H.) If productivity differential is taken as an indicator of net benefits it shows a rising trend over a period of 1988-89 to 1992-93.

However, a disquieting trend in yield per hector is observed for the principal crops in Nagpur district for the area under Pench irrigation. From 24.78 Q.P.H., it showed a fall to 19.29 Q.P.H. in 1992-93, registering a fall of 23.2% for the irrigated area. For the unirrigated area, the fall in yield per hector is estimated from 17.25 Q.P.H. to 6.75 Q.P.H. over a period of 1988-89 to 1992-93, a fall of the order of 60.67%. An inference may be drawn from the above analysis that fall in productivity of major crops (paddy and wheat) has been smaller due to benefits of irrigation from Pench. No major change in cropping pattern for the irrigated area is observed in Nagpur district, cultivation of wheat has been made possible by irrigation in the region.

Benefits from Pench irrigation on the basis of revenue collected by irrigation department as user charges (water rates) have been estimated at 5.25 crores. Water rates are taken as a proxy for benefits from irrigated water. However, water rates are highly subsidized and benefits are disproportionate to the revenue generated from the use of irrigated water.

A representative sample of beneficiaries (cultivators) from Nagpur district is drawn to estimate growth in income resulting from double cropping of area due to availability of irrigated waters from Pench. Most of the beneficiaries showed no significant

growth in income either from extension of area under irrigation or from change in cropping pattern.

The benefits of irrigation are mainly appropriated by other than Nagpur District (Bhandara) and some regions in M.P. due to topography of PNP. Hence the agricultural activities have developed at limited level in Nagpur District.

PENCH HYDRO ELECTRICITY PROJECT

The Pench Hydro Electric Project is a joint venture of Maharashtra and Madhya Pradesh, which is located at Totladoh. Initial investigations were taken up in 1955 when the entire area was in C.P. and Berar province. But later, after the reorganization of the states in November 1956, an Interstate Agreement was drawn in 1968. Accordingly, the benefits are shared. Thus, MS gets full irrigation benefits of 1,04,476 a area, power generation is shared 1/3rd by Maharashtra state and 2/3rd by M.P. In Maharashtra, water supply to Khaperkheda and Koradi Thermal Power stations and drinking water supply to Nagpur Metropolis is assured from Pench. The first full storage of reservoir was achieved in monsoon of 1989.

The reservoir named as “Meghdoot Jalashaya” submerged an area of 6790.08 hq. Out of which MH part is 1993.78 ha. And MP part is 4796.30 ha (Chhindwara 3072.30 and Seoni 1724.00 hga).

In MS total 16 compartments of reserved forest have gone under submergence either fully or partly. In MS, only one village called, as ‘Bodalzira’ located in compartment no 521, came under submergence, which had a population of 52 and revenue land area of 49 ha. They are resettled in forest village Fulzari by paying compensation.

The irrigation department has constructed various buildings like offices, residential colonies etc. at Totladoh. Similarly, various other constructions were done which were needed for the viability of the hydro project such as dam seat, quarries, borrow areas, roads etc. The forest department cleared the reserved forests, which existed over these lands.

BENEFITS OF ELECTRICITY GENERATION FROM PNP

The information regarding power generation (hydro) from PNP has been obtained from M.S.E.B. for last 15 years to focus the benefits of PNP in this respect. The data

pertaining to the use of power for domestic, commercial, industrial and other purposes has been collected to identify the beneficiaries of the power generation from PNP. The indirect benefits of power generation have been worked out by obtaining the information of power consumption by industrial undertakings in Nagpur city and their average production. The revenue from power generation at Pench may be a taken as a proxy for benefits flowing from PNP.

There are two sets of 80 M.W. capacities each in Pench. From 1986-87 to December 2001, total power (Hydro) generated from Pench is estimated at 5265.7990 million units (MP + Maharashtra). The share of State in this is estimated at 1755.2665 million units (1/3rd share in power generation). The cost of power generation is estimated at Rs. 4.5 lacks per million unit (Rs.0.45 per unit). The cost of power generation per unit (1 unit = Rs. 0.45) or Rs. 4.5 lac per million unit is based on the average of 1997-98 – (50.50 paise per unit), 1998-99 – (41.70 paise per unit), and in 1999-2000 – (42.89 paise per unit) (Average of three years). Thus the total cost of power generation comes to Rs. 78.98 crores

The total peak load demand for power in Nagpur district is estimated at 540 m. watts. The share of Pench in the total peak load demand is estimated at 53 m. watts (9.8%).

The total beneficiaries of power generation and their distribution for different uses are given in Table No.-VII.4.

The total number of the beneficiaries from Pench is estimated at 7,49,390. The share of Pench in peak load demand is only 9.8 per cent. Thus the benefits of power generation from Pench may be estimated in the same proportion. If the approximate share is assumed at 10%, in each category, the total beneficiaries from Pench Power generation can be estimated at 74,939.

The Table –VII.5 explains use wise distribution of Power from Pench:

Table 4: Distribution of Beneficiaries of Power Generation in Nagpur District
(Use wise distribution) (2001)

No. of Beneficiaries

(1) Domestic	(2) Street lighting& Commercial use	(3) Agricultural Use	(4) Industries	(5) Others	(6) Total
6,55,916	2340	72635	15338 LT 779 HT 16,117	2382	7,49,390

Table – 5
Beneficiaries of Hydro Power Generation from Pench (December 2001)

Domestic & Commercial use	Street lighting	Agricultural consumer	Industry	Other	Total
65591.6	234.0	7263.5 77.9 1611.7	1533.8 LT HT	238.2	74939

NOTES & REFERENCES

[i] Adopted from Economics of Protected areas and its effects on biodiversity Pp. 104 - 107

CHAPTER-VIII : GREEN SHOOT

The present chapter is divided into two sections namely Section-I it discusses the present management plans of PNP while Section-II discusses the summary and conclusion as well as policy recommendations.

Section-I

MANAGEMENT/ ECO-AGRO-TOURISM /ECO- DEVELOPMENT PLAN OF PNP

Management of living resources in protected areas involves steering the ecosystem. This requires an understanding of ecological principles, an appreciation of ecological process operating in the protected area, and acceptance of the concept that that P.A. management is a specialized form of land use. Conservation of gene pools of species of value or potential value is a primary objective of management of P.A. To ensure the survival of rare and endangered species of flora and fauna is a major worldwide preoccupation of nature conservation. In case of PNP, which is considered as custodian of PNP, this objective of management assumes over riding importance.

The management plan of P.A. also needs to take into consideration the role of vegetation cover in maintaining hydrological regimes. Water is vital to human survival, human agriculture and human industry. In many cases the protection of water sources is the most valuable use that can be made of upland catchments. Good management of PAs help in protecting water generating capacity of a catchment by controlling soil erosion and preventing siltation of waterways, dams, canals and irrigation channels. They also function to reduce the incidence and scale of flooding and provide water flow during dry periods. In case of PNP, the water reservoir at Totladoh prolonging its life expectancy and catchment area of water reservoir needs a good management plan. Totladoh water pool constitutes a major source of supply of water for drinking purpose to Nagpur city. It is also a source of power generation and good management of PNP can help in generation of electricity.

1. Protected area management as a science has emerged only recently with the development of various methodologies and techniques to enhance the natural environment. The primary objective of protected area management is to provide

protection for a sufficient proportion of the flora and fauna that represent the bio-geographic sense in which the P.A. is located. P.A. management also tries to create conditions favourable for these populations to reach a natural optimal density. Further, inventorying and monitoring of the species needs to be undertaken as it provides the base line data on the status of bio diversity existing within the P.A. This also helps in planning strategies for effective P.A. management as well as aids in assessing the influence of changes in the environment on flora and fauna. Preparing management or eco-development plan also provides base line information and contributes to the national and international monitoring and inventorying programmes.

2. Management Functions :

The administration and management of a National Park involve two important aspects. One is related to the protection of the natural flora and fauna and the entire physical habitat which forms the base for determining the degree of diversity, the health and the robustness of the eco- system. This aspect is related to the Wildlife (Protection) Act-1942, and the other relevant regulations and conventions which restrict human presence and activities to a level which is in consonance with the objectives of nature conservation that are explicit in law. This can be termed as "Policing" aspect.

3. The second and the more important part of the task is related to the positive conservation and enhancement of the quality of habitat, the study and analysis of important plants and animals, the appreciation of the behavioural relationships, the documentation of the scientific and aesthetic values, training nature 'interpreters' and guides who can not only understand and explain the forest to visitors, but who are passionately committed to its conservation and who respect the fundamental right of these species to exist.

While the protective function mostly deals with stopping man from indulging in undesirable activities, the conservation and enhancement aspect delves deeper into the forest and other ecological variables. It looks at the floral and faunal responses to changing senses each year, the migration of species from secondary areas, the adjustments to man-made lakes, the radar stations and even the ancient rock cut caves.

4. Protection, conservation and Eco-development: Although for the sake of practical convenience one may separate and understand these two functions (protection and conservation) as mutually exclusive, in fact they have considerable interdependence, which makes it conceptually difficult to distinguish one from another.

Discussions with the Forest Department and a study of management and administrative practices at the Pench National Park show that lots of efforts are being made by the forest department to conserve the natural resources and to maintain the biodiversity of Pench.

Only recently, Forest Department has completely evacuated Totladoh human settlement- an encroachment within PNP, which bears a testimony to the protective functions of the Department. The interpretation centre at Sillari is also a good attempt on the part of forest dept to educate people - loads as well as tourists the valuable contribution of PNP as a 'treasure house' of biodiversity.

Development of meadows in Totladoh after evacuation of encroachment for promoting wildlife conservation is a right step in maintaining eco-system - a balance between the population of herbivores and carnivorous.

THE SALIENT FEATURES OF EXISTING MANAGEMENT PLAN OF FOREST DEPT: Existing management plan of PNP takes into account both the protective as well as conservation objectives of natural resource. They are given below:

Zonation: Within P.N.P. the designation of various zones has helped to segregate management objectives and uses that may be incompatible and identify management activities by area.

The area of P.N.P. is divided into (a) Core Zone (b) Tourism Zone. (c) Buffer Zone. The forest area surrounding the P.A. will act as a Buffer Zone. This zonal classification is not permanent. It is subject to re-organization depending upon the management needs, which may necessitate change in the management, prescription due to change in situation. The surrounding area of the National Park is proposed to be a sanctuary. This proposal is being processed by the Forest Dept., Govt. of Maharashtra.

PROTECTON MEASURES

Eco - development /management plan of PNP has to frame protective measures by way of demarcation of boundaries and entry points. A Plan has been prepared for the first hand survey of the boundary with respect to top sheet. All the external boundaries would be repaired in phased manner extending over a period of five years.

Internal Boundaries: - The round and beat boundaries fall along the compartment boundaries, which would be maintained as fire lines.

Check Naka / Barrier:

In East Pench Range, small structures would be constructed at (1) Salama (2) Bakhari (3) Starting Point of old Bodalzira level near Sadal dam (4) Point near Sadal dam.

Communications and Buildings:

The road network existing in the P.A. needs to be strengthen mostly by making it all weather.

Timely maintenance of roads is a must as this prevents any further deterioration and also ensures smooth crossing. The roads of hilly and undulating areas are swept away in monsoon. Therefore, a closure of Park for certain period is proposed which would start from July and end in September. **Existing roads from Narhar to Kolitmara and Narhar to Ghatpendhari should be suitably upgraded to facilitate communication round the year**. This will help in effective patrolling of the area. Proper mapping of all the roads, showing their classification should be done.

Culverts / Bridges:

Any amount of road repairs would make an area inaccessible if the cross drainage work under the road is not taken care of.

The remoteness of West Pench and considerable portions of East Pench Range, especially in monsoon season is attributed to the lack of proper cross drainage works.

The following measures on priority basis are recommended to ensure accessibility of the P.A.

1. In East Pench Range, cross drainage works should be constructed on Kirangisarra road, Bakhari - Sadal dam road, Fefdikund road.
2. In West Pench range, CD works would be taken up on priority basis on Ghatpendhari, Narhar road, Ghatendhari - Dongardes road near Chichban bore-well, Dadhyoyen Satladeo road, Ghatpendhari to Kolitmara via Zlmili watch tower.
3. Low cost and durable CD works viz, pipe culverts, Irish bridges should be constructed in order to make accessible a larger area in the limited financial outlay.
4. Construction of a bridge on Pench river to facilitate crossing over from East Pench to West Pench range is strongly recommended.

Waterways: The reservoir at Totladoh and backwater of the Navegaon - Khairy reservoir which stretches up to Gavalighat are the major water bodies in the Park. These are very strategic from protection point of view.

In order to add a different dimension to the effective management of the Park, two motor launches should be acquired. These should be big enough to carry at least 8 persons. These would be effectively used for patrolling in order to:

I. Put a curb on illegal fishing activity
II. Achieve greater accessibility to the interior of Park area, which would otherwise have been un-approachable for want of roads.
III. Keep a watch on other illegal activities, as mobility would increase.
IV. Carry out research activities on aquatic life, birds, wetland vegetation etc.

It is recommended to make available funds for the purchase of sufficient number of life saving Jackets.

Two skilled persons should be engaged for operating these boats who would also take care of maintenance aspect one boat would be anchored at Totladoh whereas the other at Kolitmara.

Horses: Looking at the difficulty in approaching many parts of the P.A., such as forests along the M.P. border on western side, portions where roads are absent, two horses of good breed should be acquired. Both these animals would be stationed

at Ghatpendhari. Health monitoring, feeding schedule would be routinely looked after.

Wireless System and Telephone:

There is a need to strengthen up the wireless system network in PNP. This would be done by implementation of the lines as given below:

I. At least one handheld unit would be supplied at each fire station or protection hut.

II. Low frequency fixed station should be established at Kolitmara.

III. "Handheld" units should be made available to Asstt. Conservatior of forests, Round officer so that all the Round officers should have a handheld unit.

Telephone: - Though wireless system network in the Pench National Park takes care of communication links, provision of low cost telephones which work on solar power are recommended to facilitate two way communication.

Illicit Felling / Poaching / Fishing:

In order to achieve a well-controlled Protection Status of the P.A. 'Protection Squads' have been created by the forest dept. However the number of squads appears to be insufficient.

Additional squads should be created at the following compartment:

Sr. No.	**East Pench**	Compt. No.	**In-charge**
01.	Sadal Dam	517	1 Forester
02.	Bakhari	574	1 Forest Guard
03.	Ramdoh	546	1 Forest Guard
04.	Bhivsen Zopdi	515	1 Forest Guard
	West Pench		
05.	Bod Kimetta	675	1 Forest Guard
06.	Khekdinalla	688	1 Forest Guard
07.	Jamunmod Nalla	687	1 Forest Guard

In the fire season, when the fire stations become operational, these protection squads are shifted to round headquarters.

These squads are under the overall control of Range Forest Officer. (Anti Poaching Unit - Pench National Park) who would control the overall protection works.

Protection for Plantations:

No new plantations except for those under village eco-development and habitat improvement are allowed. The Plantations under village eco-development works should be protected for the plan period i.e. 3 years by engaging a watchman and thereafter it would be handed over to the village executive committee constituted under the eco-development scheme.

Grazing Control:

In the PNP, a major portion of the forest is under core zone wherein grazing is strictly prohibited. The following steps should be taken to stop the encroachment of animals from buffer zone to core zone.

1. The areas, which are more prone to grazing, would be identified. E.g. forest area close to villages situated on the Park boundary.
2. Provision of the law against grazing would be imposed after serving the concern villages with the notices to stop grazing in the P.A.
3. Cattle Pounds should be prepared at Pipariya and Ghatpendhari.
4. Resettlement of Fulzari outside P.A should be materialized.
5. Strict Prohibition over the grazing of migratory cattle like goats, sheep, and camels would be imposed.

Encroachment:

Determination of P.A. boundary would be taken up on priority basis at following places:

1. Village area of Fulzari
2. Village area of Kirangisarra
3. Village area of Ghatpendhari
4. Village area of Kolitmara and Narhar

Fire Stations and Fire Protection

Scheme - A detailed fire protection scheme has been prepared by the forest dept: fire stations have also been established keeping following points in mind.

a) It is accessible by a four wheeler

b) Adequate drinking water supply for the crew is available

c) The site of the fire station would be on plain land or on the foot of hill

d) A watchman would be built near it on the highest peak with the help of local

Man - Animal Conflict

Damage to crops from in and around the P.A. is the main area of man-animal conflict. Stray cases of cattle lifting from inside the P.A have been noticed. As per reporting of the forest department, damage to human and cattle in the villages in not so far been reported. Steps on the following lines should be taken to keep this confrontation under control.

i) Strict prohibition of grazing in the P.A. area should be imposed.

ii) The villagers would be persuaded to graze their cattle in the allotted grazing unit area or stall feed the cattle.

iii) The matter of shifting of village Fulzari to outside the P.A. would be perused.

iv) Compensation or medical help for any damage done would be immediately paid as per the guideline of Government of India.

v) In order to capture wild animals straying outside the P.A. and causing problem squeeze cages (for large and small carnivore) small mammal traps, tranquillising equipment's etc. should be purchased on priority basis.

vi) Adequate, perennial water and food sources would be developed inside the P.A. through strict protection and adequate habitat improvement measures in order to limit the management of wild animals to outside the park. A large-scale meadow development would ensure adequate forage to herbivores. The food availability

inside the park will prevent incidences of wild herbivores straying outside the park.

Booking of offences equipping and necessary protection would be done carefully within appropriate legal assistance.

Habitat Improvement Measures

A separate habitat improvement plan is under implementation by the Forest Dept. However, some modifications in the plans are suggested.

Water Management:

i) Make water available to the wild animals within a reasonable distance.

ii) Limit the movement of animals outside the P.A. for water by providing water inside the P.A. , thus avoiding coughed with human and cattle.

iii) Create a good distribution of perennials water sources to tide over the pinch period.

There is good distribution of waterholes in the P.A. But the availability of water in the nulls and waterholes steadily decreases after December. This results into very small percentage of perennials waterholes. More over, there are certain water gaps in the P.A., which needs to be augmented

In the East Pench range, distribution of perennial sources of water is very less. Water gap exists in the Southern West portion of the P.A. above Kirangisarra village. Similarly, another water gap is there in the area, which falls between Sadal dam rood and Bakhari ring road. This results into heavy dependence of wild animals on the Totladoh reservoir.

Creation of New Waterholes:

1. Sunken ponds would be dug up in the beds of various nallas in plain topography by removal of sand from the nalla bed in a certain gradient to avoid disliking.
2. Creation of new waterholes by construction of cement structures is not recommended because of the in accessibility of area for the transportation of construction material etc; Instead, creation of dugout ponds on a plain topography and having a good catchment area would be done.

3. Inverted puddle dams should also be constructed in the stream beds of nallas flowing through the compartments i.e. Bivsen nalla (515) Chikalkhari nalla (517), Kutuniba nalla (514), Golaikhari nalla (549), Mungazodi nalla (534), Ghogra nalla (569), Fefdikund nalla (572/574).

Till reliable status of water availability is immaterial if permanent watchtower is not available.

The existing set of fire stations is satisfactory and is in accordance to the vulnerability of that area, at present. However, these sites are subject to change depending on the management strategy. For example, there is a need to establish a fire station near Kirangisarra on Mama-Bhacha Pahadi (Compt. No.681) need to be shifted amidst forest.

It is desirabe to construct new fire stations in compt. no.517, 529, 540, 574, 570, 546, 542, 552, 544, 511 and 514 in East Pench and 676, 690, 685, 671 662, 683, 694,in West Pench. (for details refer appendix)

In addition to these new fire stations protection squads stationed at Totladoh, Salama and Sillari rounds would also be mobilized.

ECO-DEVELOPMENT WORKS:

The people from in and around the P.A. are dependent upon the forests of the Pench National Park for fuel, fodder and MFP. For ecologically sustainable economic development of this population, measures under eco-development programme as guided by the Central and State Government would be taken.

Before giving prescriptions, careful survey of the target villages would be done in order to quantify extent of their dependence on the P.A. forests. Participation of the people including women folks is a must at every step whereas participation of Non Government Organization would also be welcomed.

Deliberations with other Government agencies viz. Soil and Moisture conservation Department, irrigation Department, Tribal Department, Revenue Department, etc. should be done in order to achieve comprehensive inter-agency co-operation. Thus, benefits of schemes through other agencies would be brought to the target village. E.g. various schemes could be implemented through the Block Development Officer for the villages falling under MADA pockets.

TOURSIM SUB - PLAN

The Pench National Park has assumed a place of prime importance in the tourist's agenda. These tourists prefer to pay a visit to the P.A. while visiting other nearby places, too. Thus, "Tourist Golden Garland" in the shape of Pench National Park - Ramtek - Khindsi - Navegaon Khairy - Khekra Nalla Project is in store in future.

Even though, the number of visitors pouring in the park speak volumes of the popularity of the Pench National Park, visitors preference indicate that wildlife related activities takes a backseat.

Nevertheless, attention should be given to education and interpretation of park resources to the visitors and also to the local community with objectives of putting an emphasis on increasing public support for wildlife conservation by creating understanding and fostering awareness and concern with respect of conservation needs.

The thresholds for physical carrying capacity needs to be worked out either by research or by observation of indicators of habitat and wildlife in order to know the tolerable limits of tourist visitation to the park. The present inflow of visitors, which are mostly day visitors, seems to be adequate and needs a modification in is nature by putting in controls, over their movements, activities etc.

TOURISM ZONE:

For the purpose of giving a wilderness experience, recreation accompanied with education through interpretation, a separate zone is proposed to be carved out of the existing forest area and it is named as "Tourism Zone " In its composition a constitution, it is proposed to be of the following description.

The tourism is allowed on following routes and in water body near Kolitmara. The tourism envisaged is low impact eco tourism with emphasis on nature education.

i)	Sillari - Totladoh Tar road	13 Km.
ii)	Totladoh - Ambakhori Tar road	2.5 Km.
iii)	Salama - Sadaldam No. 7 Murrum road	12 Km.
iv)	Salama - Old Bodalzira road Murum road	3 Km.
v)	Salam - Fefdikund - Totladoh road	12 Km.

vi)	Navegaonkhairy water body near Kilitmara	-------
vii)	Nature trail - West Pench National Park	
	Dhobigota nalla.	4 Km.
viii)	Salam - Bakhari - Khapa - Sillari	12 Km.
ix)	Sillari - Kirangisarra	13 Km.

DEMARCATION

Proper warning that "Tourism zone ends here" would be affixed at the ends where tourism zone ends and core zone starts eg. Sadal dam no. Seven.

In the Tourism Zone, the compartment numbers on both sides of the roads would be shown as written on a tin plate in bold white colour with olive green background fixed a little higher on the tree trunk.

MAINTENANCE

The maintenance of Pauni - Totladoh Tarred Route, Salama -Sadal dam No.7 metal road and Totladoh - Ambakhori Tourism route lies with the Irrigation Department a Totladoh. They would be pressured to expeditiously undertake periodic maintenance of these important routes along with the repairs of cross drainage etc. by the wildlife authorities. Presently, the Salama to Sadal Dam no. 7 tourism route needs immediate attention for its repairs. Similarly, the Totladoh - Ambakhori road though tarred in the year 1995, dearly needs repairs of its cross drainage's. There is a need to construct number of speed breakers on Pauni - Totladoh road in order to restrict speeding vehicles.

The remaining Tourism routes as murum roads would be maintained by the park authorities, periodically as per the scheduled rates.

REGULATION:

In order to control the tourist movement and activity, management will formulate rules & impose regulation. However, to illustrate, following regulations are listed as guidelines to be imposed over the tourism zone.

i) All tourists would be bound by the rules and regulations as framed by the park.

ii) The present regulation regarding prohibition of entry in the National Park and also to the tourism zone during 7.30 p.m. to 4.30 a.m.

iii) (1930 Hrs to 0430 Hrs) would continue further.

iv) All the tourists should pay the entry permit/s fees before entering the National Park. They would be given permits, which should be kept carefully for further checking. The rates for entry fees would be as given below or as may be fixed by the Government from time to time.

v) Entry to tourists in the open period would be given only after payment of entry fees.

vi) The management shall impose restricted entry to visitors' vehicles. The Total number of visitors vehicle would be limited to:

1)	Four wheelers	-	50
2)	Tourist bus / minibus	-	05

i) On interior Tourism Routes no heavy vehicles as tractor, truck, and big buses would be allowed. Two wheeler, bicycle and also tourists on foot would not be allowed on these routes. Because, all these routes pass through the interior of forests and are mainly for wildlife viewing.

ii) Routes for movement at a given time would be allotted by issuing a Token by the Park Management from the reception to avoid crowding.

iii) No vehicle would be allowed to move over any tourism route which do not have such token issued from the reception.

iv) The tourist activity would remain confined to the road only and moving into the forest would not be allowed.

NATURE TRAIL:

Imparting a sense of awareness and concern towards the interdependence and relationship between plants, animals and biotic ecosystem components in the visitors' minds would be aimed at through nature trail.

The nature trails previously created at Ambakhori and Fefdikund are presently almost do not exist. So there is a need to develop nature trails on following routes:

i) Ambakhori - Lamandoh - Ambakhori

ii) Salama to Sadai Dam No. 7

iii) Salama - Sadai Dam Road T Junction (old Bodalzira road)

iv) Dhobnala - Dudhakhori - Usmal

TREKKING ROUTES:

Though the Park is located in the Satpuda hill ranges having a hilly and undulating area, which could always be trekker's paradise, this tourist activity is proposed to be limited in order to provide an undisturbed habitat to the wildlife.

A strictly regulated trekking route of about 5 km. Length would be operated which would start from Totladoh and go through the forests in compartment no. 530. It would touch the Old Bodalzira Road at times going alongside the Totladoh reservoir and come back to Totladoh. Preferably, small groups would be allowed accompanied by a trekker of the Park. Similarly, a trekking route would be developed near Narhar - Kolitmara and also near Ghatpendhari of West Pench range.

LODGING / BOARDING ARRANGEMENT PROPOSED:

The Park in itself is low on facility carrying capacity having only tour widely scattered rest houses with limited accommodation. Barring the rest houses at Totladoh and Kolitmara, rest are situated deep inside the core area and hence not proposed to be made available to the visitors. The rest house at Kolitmara is situated in West Pench National Park range; near Kolitmara tourist facility is developed. In all 10 tents platforms are constructed. Toilet and drinking water facility with chainlike fencing is required to be done.

Shortage of accommodation for visitors is being compensated by rest houses of Irrigation department, MPEB at Totladoh and also at rest houses of Forest Department. But these facilities are almost in the heart of the National Park. The noise, litter and traffic created by tourist inflow has conflicted with the Parks conservation objectives. Relocation of the accommodation to the periphery of the Park is the only solution.

TOURIST COMPLEX

A tourist complex is proposed to be created on the periphery and outside the P.A. near village Sillari. This location would be suitable because tourist activities would be confined to outside the Park area. More so, they would not be under the pressure of strict regulations and therefore can have enjoyable time.

FACILITIES:

The following lodging and boarding facilities are proposed to be constructed at a suitable site near village Sillari outside the boundaries of Pench National Park.

i) Six cottages each with two beds and attached bathroom and toilets.

ii) A dormitory

iii) A canteen which serves snacks as well as meals on order

iv) A Toilet Block

v) A well and a borewell for adequate water supply to visitors as well as the garden.

vi) Adequate parking place should be provided away from the accommodation area.

TRANSPORT FACILITIES:

Minibus - use intensity of the places of interest by the visitors would be identified and more emphasis would be laid on permitting lesser number of use unit or vehicles in tourism zone. Viz. Mini buses, Jeeps, Vans etc. that are capable of carrying more number of visitors. This would ensure lesser disturbance to the affected area and helps en-masse interpretation, too.

Hence, a minibus of about 20 seat capacity is proposed to be purchased it would pick up tourist from the tourist complex after payment of a suitable charge for having

a round of the tourism routes, both in the morning and evening . This would be fitted with public address system to facilitate easy communication between the guide and the visitors.

Local four wheeler (Jeep, Vans) operators would be authorized to make their vehicles available to the visitors on hire. Private vehicles would also be permitted.

Tourist Guide - It is proposed to impart training to local unemployed youths who would work as authorized "Tourist Guides" after successful completion of the training. These guides would accompany the tourist vehicles for fees as fixed by Park Manager on per hour basis. No vehicle would ply on the tourism route without a guide. One tourist guide may accompany more than one vehicles if the situation demands so. Conductor of the Park minibus would also act as Guide. The tourist influx would be regulated form the tourist complex.

One day in a week would be fixed for the maintenance of park minibus, the day on which it would not ply.

No boating, water sports, white water surfing etc. is proposed to be developed in Totladoh Reservoir as well as in the Pench Reservoir.

INTERPRETATION CENTRE / MUSEUM:

In 1999-2000 under Maharashtra Forestry Project an interpretation centre has been developed near Sillari. This centre has facilities for displaying exhibits showing audio-visuals accommodations, tent camping etc.

Hide and machans have also been created for wild life watching. There is a need to identify suitable spots on tourism routes for establishment of collapsible machans.

The need for generating employment opportunities has been indicated in tourism plan.

Thus the existing management plan of the Forest Department though ensures sustainable economic development of PNP with emphasis on Eco-tourism and Eco-development it needs to be modified in light of changing circumstances. Globally, the trend towards participation of local communities in management of forest has shown a better conservation of natural resources. The management plan of PNP needs to take cognisance of the above global trend and accordingly necessitates

restricting the management plan to fulfil the goal of conservation with survival strategy of local communities.

Section- II

SUMMARY AND CONCLUSION

The entire exercise in 'Economics of Protected Area – A case study of Pench National Park' has been undertaken to focus issues associated with PNP like the dependence on PNP, biodiversity of PNP, tourism, fishing and cost-benefits to the local as well as global community at large. Rising importance of PA as means of biodiversity conservation has led to a policy of announcing higher proportion of forest being reserved with representative flora and fauna as National Park or Tiger Reserves. Pench National Park (PNP) has been declared as 25th Tiger Reserve. The study mainly aims at the following objectives.

- Identification of the stake holders of PNP
- To estimate the dependence of local population in and around the
- National Park for biomass consumption and examine the impact of human intervention on biodiversity status of P.A.
- To identify the benefits and costs of PNP
- To suggest short terms as well as long term policy measures for
- management of PAs and conservation of natural resources sustainable economic development.

Philosophy of Conservation and World Conservation Strategy

1) This study focuses the importance of Protected Area and justification for conservation of natural resources and wild life through Tiger Projects or National Parks. The diversion of private cost from social cost and failure of market mechanism to reflect true economic value of biodiversity initiated this type of environmental movement. The argument based on Philosophical view behind creation of National Park as a transition from Anthropocentric (human centered) to bio-centric (human as only one element in the ecosystem) philosophy. Emerging from this view is that intervention in nature should be guided primarily by the need to biotic integrity than the need of human beings

has been discussed briefly. The arguments against wholesale transfer of this conservation crusade from West to East or from Developed to Underdeveloped countries and its social impact have also been the main issues for discussion in poverty ridden counties.

2) The main feature of World Conservation strategy and genesis of Protected Areas. The categorization of Protected Areas with revised IUCN classification has been discussed in chapter II. The major benefits falling under ecological process, biodiversity, education and research, consumptive, non-consumptive, future values have been described along with identification of various direct and indirect costs.

3) **The main findings**- the study spells out dependence of Fulzari village lying within the geographical limits of PA and eleven (11) villages (sample) in proximity of PA. The main goals of this entire exercise is to investigate the economic dependence of local / tribal communities for biomass consumption as reflected in their resource use pattern. The following hypotheses have been tested.

    a. There is a heavy dependence of local communities on PA
    b. Dependence of local communities for biomass extraction has
    c. inverse relationship with the distance from PA boundary.
    d. The dependence of the local communities is determined by their economic status or their ability to purchase alternate fuel resources.

To test the above hypotheses, following criteria have been used to show their dependence

I) Income Criteria

a. Income from forest or forest related activities
b. Income from agriculture or agriculture related activities
c. Income from subsidiary sources

II) Asset ownership Criteria

a. Ownership of land as reflected in proportion of small and marginal farmers.

b. Ownership of livestock population by small and marginal farmers

c. Proportion of landless population with livestock

III) Accessibility Criteria

a. Other forests outside PA are easily accessible and are used frequently.

b. Forest outside PA are nearer and accessible but rarely used

c. No other forest except the forest of PNP is available

IV) Fuel use Criteria

a. Availability of alternate source of fuel eg. Gobar gas, LPG

b. Accessability of alternate sources

c. Capacity to purchase alternate sources of fuel.

On the basis of above criteria, the dependence of local communities on PNP has been estimated. The dependence of Fulzari Village on the basis of income criteria i.e. income from forest or their dependence on forest of PNP for biomass consumption was found to be very high. The reported consumption of biomass however, appears to be a gross underestimation, as in the absence of accessibility to non PA forest and non availability of alternate sources of fuel, their dependence on PNP for firewood is bound to be very high. The livestock population owned by the village community is self evident to explain their dependence on forest of PNP for grazing purpose. The per capita income variations within the households of Fulzari do not explain in a major way variation in per capita consumption of fuel wood or fodder. Almost entire village is found to be dependent on forest for meeting its biomass requirements.

The surrounding villages within the distance of 10 km. of PNP boundary were surveyed to examine the relationship between dependence of the village and its distance from PNP. Almost all villages exhibited a negative relationship between dependence and distance from Pench National Park (Table III.III.1, 2)

The dependence was also assessed by taking income and asset ownership criteria, accessibility to PNP and availability of alternate sources of fuel. To test the first and second hypotheses, multiple regression analysis has been used. This analysis is carried out at three levels-

a. For the households of Fulzari village

b. For the sample households of the sample villages

c. For all the households of the Fulzari and the sample villages.

The regression model employed for investigating the dependence of the households in and around the PNP -

P1 = f (NTFP, hunting, forest labour, fishing, livestock, P_2, qtynumbers, firewood-1, firewood-2)

The estimates of correlation co-efficient indicate interlinkages between variables. The NTFPs, hunting and forest labour are direct contributors to the dependence as correlation of these variables with the dependence is positive. For households of other villages and the combined sample they are also statistically significant.

The regression results show that all the variables have significant impact on the dependence. Though P_2 and fishing have negative impact whereas firewood-2 (firewood collection from core forest) has positive impact. The three variables fishing, income from agriculture plus agricultural labour (P_2) and collection of firewood together explain more than 87 percent of the dependence of Fulzari households on the PNP.

The regression results in the case of other villages (within the distance range of 0 to 10 K.m.) shows that the exogenous variable NTFP, seems to be playing a very important role in determining the dependence on PNP. But the impact of other variables is statistically insignificant.

The regression results for combined sample shows that all the exogenous variables together explain about 27 percent variation in the dependence of the households of villages in and around PNP.

The estimates of multiple regression also explain that longer the distance of villages from PNP lesser is the dependence on PNP and vice-versa.

The criterion of accessibility to non-PNP forest and dependence showed that, villages having reserve forest in the proximity have shown lesser degree of dependence on forest of PNP. However, in most of the villages inability of the respondents to report correct information regarding their sources of biomass

extraction either from PNP or from non-PNP forest has restricted to some extent the scope of the analysis.

The criterion regarding availability and accessibility to alternate sources of fuel showed uniform degree of dependence for all the sample villages as no other sources of fuel were observed to be available and accessible to the local communities nearby PNP (with exception of one household). Thus three main criteria i.e. income and asset ownership criteria, accessibility to non-PNP forest and availability of alternate sources of fuel have been mainly used to examine dependence of villages on the PNP.

Third hypothesis that dependence of local community is determined by their economic status or their ability to purchase alternate fuel resources is also tested. In the present analysis it is assumed that economic status of the village community is reflected in occupational status. Almost all households revealed same economic status as majority of them were cultivators. Next to cultivation, their subsidiary source of income was labour. Their ability to purchase alternate source of fuel, fodder or other natural resources was determined by their income from the above occupations. Almost all the communities showed a high degree of dependence on forest irrespective of their economic status.

However, dependence, in case of Fulzari was observed to be related to socio-cultural factors. Influence of traditions and customs on these communities even now propels them to collect fuelwood and fodder from forest (Caste distribution of population Table III.II.4)

The intensive study of the resource utilization pattern of the sample villages revealed that the amount of biomass extracted by the people is not necessarily a function of purchasing power or physical access to resources only. These merely determined the level of dependency. The pressure on biomass resources of a forest were also a function of ease with which these are available, the socio cultural milieu, the human and livestock population and the proximity to market.

The findings based on observations also showed that the degree of dependence of some of the households in the sample villages on the forest for their biomass requirements was greater owing to their low purchasing power and lack of access to the alternatives, however, in many cases the amount of biomass extraction from the

forest for fuel wood and fodder was less than the less dependent, economically better off villages. An important cause for this is the socio-cultural and caste background of people. From this study, it can be concluded that, dependence is not only a function of economic status or accessibility alone.

The socio cultural factors may explain the dependence of long distance villages on PNP.

4. The study describes, the biodiversity status of PNP by giving a check list of fauna and flora in PNP. To test the fourth hypothesis internationally accepted IFRI method has been employed to examine the impact of human intervention on the vegetational structure and status of PNP. A sample of plots from core zone, tourism zone and other zones with high probability of intervention has been drawn to test the above hypothesis. The study shows that Pench biodiversity is negatively affected by tourism, but not necessarily due to grazing and construction and other extraction by the people living close to the Park boundary. Because of the proximity of revenue forest, the locals fulfil their basic needs from there. They are utilizing natural resources only for small timber fuel and for other non timber forest products like fruits, leaves, gum, medicinal plants, grass for thatches etc.

The study also attempts quantification of some major tree species for the sample plot of 250 m*400 m hectors by taking market value of these tree species and separate quantification of timber and fire wood value is attempted for Tendu, Dhawada, Salai, Moie, bija, Haldu, Kalam, Shiwan and Saja .The estimated timber value comes to Rs.4.52 lack and fire wood value of Rs.32 thousand giving total timber and fire wood value at Rs. 4.84 lack for the plot. The inventory of medicinal plants in PNP and their medicinal use have also been attempted to show their use in curing various diseases and its valuable potential contribution in the preperation of life saving drugs.

5. The tourism aspect of the study focuses on the role of protected area as a source of recreational benefits. Both negative as well as positive aspects of eco tourism have been discussed at length. The Travel Cost Method has been used to estimate demand for tourism. The visitors to Pench have been divided into three tourism zones. Various functional forms like linear, log linear etc. were estimated to find out the best fit. The endogenous variables used in the model i.e., total number of visits from zone I to site m, exogenous variables are population of zones, mean income of

zones, entrance fee, characteristics of zones, travel cost from zones (TC) to substitute site, entry fee in substitute site, quality characteristics of wild life viewing available at substitute site. The following functional form is used to estimate the total cost of visiting site

Zjm /nj = F (Yi, TCjm + Pm, Xj, TCjk + Pk, Qm, Qk, NL, TS).

The constant term that captures the joint effect of the factors exogenous to tourism in the PNP has a statistically significant positive effect. This implies that the general environment in the PNP has not been able to develop the tourism. However, the positive signs of the constant terms for the entire three samples indicate the conducive situation for tourism development. The conducive atmosphere along with weak effects bring out that serious efforts on the parts of the authorities are needed to exploit the general environment. This also shows that tourism, so far, has not posed threat to the environmental aspects of the PNP.

6. The role of fishing in PNP and dependence of local communities on fishing for their livelihood is also an important issue of the study. The following model was used to estimate the growth rate.

Log s= a + bt ; Where

S= stock, b = growth rate, a= constant, t= time

The estimated growth rate of fishing comes to 5.9 per cent. The value of R^2= 0.07.

Another equation used to estimate the growth rate of harvesting of fishes is log H = a + b t

The estimated growth rate indicates that inspite of sufficient stocking of fishes and fingerlings the harvesting is very low. This further implies that it is not at all a threat to the water bodies or environment.

7. Quantification of the various benefits and costs of PNP at cross section data set has been attempted. The benefits from forests in the form of income from NTFP, grazing of livestock, environmental benefits- oxygen, soil conservation etc. Income from tourism or benefits from recreation in PNP, biodiversity benefits, etc. have been quantified as far as possible. The incidental benefits from water supply; irrigation and power supply have been estimated.

Direct a well as indirect cost of PNP have been estimated. The cost of maintaining PNP, establishment cost, opportunity cost of PNP, cost of resettlement, crops damage by wild animals have been measured to focus the cost of PNP.

8. Summary and Policy conclusions**:** Policy of conservation of natural resources by exclusive management of PNP is not considered desirable. Involvement of people in management of P.A. would help not only in conserving biodiversity but will minimise the social cost of PNP. The long term goal of conservation and maximizing the benefits of tourism need to be balanced in the interest of sustainable economic development. The potential benefits flowing from medicinal plants need to be properly focused to promote their conservation as a 'treasure house'. Last, any attempt at conservation devoid of livelihood considerations will be a futile exercise in the interest of sustainable economic development.

Policy Recommendations

1. Dependence of local communities on PNP has roots in low agricultural income and lack of alternate sources of livelihood as reflected in occupational structure of the population in and around PNP (Tale III.I.8, 10). In Fulzari village almost 74 per cent of the population is engaged in agriculture (Cultivator + Agri. Labour). However, agriculture contributes less than 25 per cent income (Table III.I.10). The proportion of landless pollution is also equally high (47.6 per cent, Table III.I.9). Lack of lucrative self employment opportunities or other developmental works (due to suspension of working plan in Fulzari) has compelled them to depend heavily on PNP as a major source of livelihood. Sample villages around PNP also shows almost same scenario where employment opportunities arising from other developmental works supplement their slender income from land. Landless population (47 percent in Fulzari and 19.1 per cent in other villages) as well as small and marginal farmers constitute the target group for policy recommendations. A meaningful programme for their economic upliftment through eco-development or eco-tourism plans should be devised so as to reduce their dependence on PNP. These target groups may be provided technical, financial, logistic support to improve the yield from land or some agro-based industry training programmes may be conducted to equip them with skill and expertise to undertake non-agricultural activity.

The demographic profile of village Fulzari shows low literacy status of the local population with high proportion of population in younger age group (Table III.I.5) as well as in working age group. This is indicative of the high social cost of their resettlement and providing them with meaningful income/employment opportunities. Development of Agro-Eco-Tourism activities in a major way may help to solve this problem. However, improving their literacy status and introduction of vocational training cum education programme in and around PNP based on local skills and local resources need to be designed and implemented on priority basis. Special training programmes in Agro-eco-tourism are strongly recommended to exploit the potential of local communities as guides with socio-cultural heritage of the Region.

Fulzari Village:

Villages around PNP, and Fulzari village specially is an example of poverty in the midst of plenty. Since it will be shifted to Sawara village, no plans of economic development, even on ad hoc basis, are designed or implemented to improve their economic status. Since last 25 years, their status has been reduced to a suffocating village with almost all development activities paralysed. It is strongly recommended either to shift the village Fulzari immediately to Sawara (new location of resettlement) where various eco-development eco-agro tourism plans to involve local participation may be implemented through the financial support of State/Central Govt. or to prepare some ad hoc plans for their economic upliftment till their final settlement at Fulzari gets materialized.

Ownership of livestock by locals is a major threat on PNP. The socio-cultural ethics of tribal communities do not permit use of milch animals for the development of dairy industry. However, use of animal residue for organic fertilizers/ manures can be made scientifically for which local communities may be given special training. It is difficult to change the socio-cultural traits of the tribal communities. However, gradually; they may be educated about the role of dairy industry in income and employment generation, which may be instrumental in making them self-sufficient. The long term impact of this important source of livelihood may be visible in reducing their dependence on PNP.

The major threat to conservation of natural resources in PNP arising from the local communities is from local communities demand for fuelwood like LPG, gobar gas or

solar cooker. If they are made available to them, their dependence on forest will be significantly reduced. Creating sufficient purchasing power to enable them to purchase these alternate sources through the schemes of income and employment generation and training in the use of solar cooker or gobar gas seems to be a sensible solution.

Rehabilitation of villages: Rehabilitation of village Fulzari should be done within a specific time limit. The case of Fulzari village is a case in point. Since last 25 years the entire development of the village in paralysed, suffocated due to its status as being 'shifted' to village Sawara. This has lead to suspension of working plans for the village and deprived the village communities of all benefits of development schemes or activity.

Employment in Forest Department: From all the villages under study, only one member has been found employed in government service. Forest department should employ at least one member of every tribal family. Watchmen, guards, peons should be appointed from the villages in proximity of protected areas only, as they have complete knowledge of that area and their appointed should be made mandatory.

Eco-development programmes implemented by the forest dept, are no doubt very helpful in generating income/employment opportunities around PNP. However, it seems to have created only marginal impact in their economic upliftment. Other rural development programme by multiple govt. and non-govt. agencies have also benefited the local communities. But have failed to generate perennial source of income. The lack of funds, which suspended Village Eco Development Programme is indicative of need for mobilization of local resources, may be through local participation or through implementation of time-bond programmes through the financial support of Govt, non-govt. agencies.

2. The regression results paint a clear picture for policy- makers. In order to reduce the dependence of households on the PNP, the government should give high priority to increasing income from agriculture and agriculture related activities, self-employment, fishing etc.

The total income of a family in and around PNP is the sum total of income from agriculture, wages of agricultural labourers, income from self-employment and

income from fishing (non-forest income) on one hand and income from NTFP, income from hunting, wages of the forest labourers (forest income) on other hand. Hence, it is obvious that the dependence on the PNP, defined as the percentage share (p1) of forest income in the total income, will decline if the percentage share of non-forest income increases sufficiently. The negative sign of the regression coefficients of p2 in all the equations is a pointer towards this. Therefore, the efforts will have to be made to increase non-forest income of the households in the PNP.

Among the non-forest income sources, high priority should be given to development of agriculture. Agriculture, if properly developed, is the one sector that can generate employment and income. Of late, when industries are in recession, the soil of the region is suitable for raising different crops. This potential has to be fully exploited. In addition to agricultural development there is an urgent need to develop rural infrastructure like rural roads, marketing facilities for agricultural produce. The farmers in the region may be trained in commercial floriculture and horticulture. Commercial floriculture has vast marketing potential not only in the domestic market but also in the foreign markets. There is a strong likelihood that enhancement of agricultural and agriculture related activities would generate additional employment. Commercial floriculture and horticulture also have the potential to generate self-employment. Another sector that has immense potential to create self-employment is tourism (the details are given in Agro-Eco-Tourism plan).

3. Cultivation of medicinal plants in the agricultural fields of local population may be popularised by emphasising their value in life saving diseases. Establishment of Herbal Research Institute may help them to transmit their traditional knowledge of medicinal plants. The knowledge of these traditional plants is on the verge of extinction in the absence of intergenerational transmission. Special Institutions may be created to preserve this knowledge as a custodian if family institutions no longer serve this purpose.

The biodiversity status has shown no adverse impact on regenerative potential of vegetation in the sample plots due to human intervention. In-spite of non-involvement of local communities around PA in management of PA (exclusive management of P.A. by Forest Department), they are seen using the natural resources rationally avoiding its excessive use. Involvement of local communities in

the management of PAs may further improve the situation by ensuring optimal, sustainable use of forest resources.

Involvement of local communities in the management of PAs needs to be adopted as a major policy tool of conservation. The model of 'exclusive' management by state preventing intervention by human beings needs to be modified to promote participation of local communities.

No conservation strategy will succeed in India unless the biomass requirements of local communities are harmoniously integrated into the strategy. The present conservation strategy emphasizing exclusive management of PA has an inbuilt dimension that alienates the local communities. Any sustainable conservation strategy must aim at an integrated and interdependent natural system of which flora, fauna and human beings are integral constituents.

4. The tourism in the PNP is much below the optimum level. This has been demonstrated with the help o the Travel Cost Method (TCM). Expansion and development of tourism in collaboration with the private entrepreneurs, will go a long way in opening new vistas for the local populance for self-employment. The government of Madhya Pradesh (M. P.) has recently introduced new water games to attract the tourists to the MP side of the PNP. The region has predominantly tribal population. With proper orientation and training, the youth belonging to the community can serve as the tourist guides. Their familiarity with the history and geography of the tourists places in the region will be a boon for their being the tourists guides. Tourism can boost the Adivasi Arts, culture and traditional medicine. These in turn may boost up the tourism.

Like tourism, the fishing activity in the PNP has not attained the optimum level. This has been demonstrated in the VI th chapter. There is ample scope for expansion and development of fishing activity in the PNP. The negative sign of the regression coefficients of fishing in all the equations is indicative of the fact that increase in income from fishing will reduce the dependence of the households in the PNP on the forest.

ECO-TOURISM PLAN

The information regarding the various places of tourists' interest has already been provided in the Chapter V. The primary purpose of giving the status of P.A. to the

park is to conserve the flora and fauna of the region. However, the development of the sites of tourists' interest is under consideration for tourism without disturbing the core area.

Wildlife tourism is one of the most preferred activities of the tourists. The basic purpose of the tourists – tiger watching – is not fulfilled because of the under development of the activities related to tourism. The Forest Department is planning to develop some meadows for attracting tourists and spotting tigers near meadows.

Limitations in Developing Meadows

The park is located in the southern lower reaches of the Satpura Hill ranges which forms the catchment area for the river Pench. The Pench river flows almost through the center of the park in North South direction. The folding and upheavals in the past have resulted in formation of a series of hills and villages. The hilly and undulating terrain of the park poses various problems in its managements. Even the various species belonging to wildlife prefer different kind of terrain. The *Sambar* prefers hilly terrain, Chital and Gauss have a liking for moderate undulating terrain with gentle slopes and Chital, Nilgai favour flatter areas. The meadows can be developed on flatter areas for tourists' attraction and for spotting tigers and the compartments where the meadows can be developed are 525, 685 and 565. These areas can be opened to the tourists but they will be limited in number because of more hilly topography.

Visitors' Preferences

It is essential to identify the tourists' preferences to develop package programmes. The identification of tourists' preference should relate to:

- Picnic and merry-making
- Education and Research
- Religious Tourism

Plan for Providing Package

Plan for attracting the tourists should include

- Audio-visual publicity through media for three types described above.

- Conservation of flora and fauna by allowing limited number of visitors and vehicles at a time.
- Availability of separate information, prepared by the experts, for different types of tourists
- Educating the tourists according to their category.
- The visitors to be divided into subgroups on the basis of the demand for various activities like trekking, desire to see historic places, rafting, various water games etc.
- Organisation of Nature camps, especially for school children, supplemented by the education of eco-tourism.
- Imparting training to local people, particularly youth, to work as guides.
- Educating the tourists for not harming the natural resources.
- Providing information about Gavlighat where swirling water gushes out to meet the main flow of Pench (Compartment No. 546). This will avoid disturbance to the core area and provide more enjoyment to the tourists.
- Identifying the religious sentiments of the tourists and the local populace to work out specific arrangements like separate spaces for offerings to the God, seating arrangements and special zones for hawkers.
- Southwest side of the Park may be utilized for developing ideal facilities for tourists, as the region is less hilly than the North side of the park.

Facilities for tourists

The number of tourists to a site depends on the kind and quality of facilities available. This is a major determinant for attracting the tourists. The facilities required for attracting the tourists to the PNP can be developed on BOT (Built, Operate and Transfer) basis. This will result in attracting the tourists and creating employment for the local people. The facilities to be made available to the tourists should include

- Camping facilities about 30 kms. Away from the PNP: Cottages,
- Dormitories, Tentage, Camping grounds, Rest Houses, Canteens

- Machan and Hides
- Transport facilities
- Development of scenic spots, Parks, Botanical Garden
- Museum for Forest Products, Tribal Art and Craft Centres
- Children Park/ Amusement Park
- Nursery: Ornamental/Medicinal plants for sale to visitors
- Water Sports*
- Facilities for adventure tourism: Trekking, climbing. Hang Gliding
- Nature cure and Yoga Camps
- Animal rides: Elephants, Horse, Camel etc.
- Information Centre: Audio-visual shows, Library, Printed matter, Maps, Guides, Laminated photos showing forestry activities.
- Provision of package according to the liking of tourists.

Employment to Locals;

The tourism activities are likely to create demands of different nature. The local people can be trained to meet the demands. This will provide self-employment to the locals and will help reduce unemployment. Some of the avenues are:

- Repairs of various vehicles
- Driving and hiring of vehicles
- Package provision and guides for tourists
- Boating and fishing

Plan for Eco-tourism at PNP:

The plan for Eco-tourism at PNP is detailed in the following paragraphs. This consists of the objectives, zones to be developed and other details.

* No boating, water sports, white water surfing etc. is proposed to be developed in Totladoh Reservoir as well as in the Pench Reservoir

Objectives:

The objectives of the plan for Eco-tourism at PNP are:

- A basic understanding of ecological issues.
- Conscience and limited tourism.
- Employment .to the Locals.

Zones to be developed:

Some zones near to Nagpur (Maharashtra) and Seoni (M.P.) can be selected and developed for eco-tourism as these areas are less hilly terrain than the northern part of the park. The basis for selection should be:

- Demand from tourists.
- Season wise arrangements.
- Eco-tourists' capacity to pay more than general tourists.
- Involvement of locals in manufacturing and marketing of Handicrafts, traditional items, natural activities, guides etc.

Two Types of Visits Plan for tourists:

Two types of visit plan for tourists can be arranged in a year. The details are as follows:

1. The first type of visit plan can be arranged from February to July. This is the "leaves shading (fall)" period. Since the PNP is deciduous type of forest, this season is most suitable for observing the wildlife. Those tourists interested in watching wildlife can be attracted in this season by providing a package to the effect.
2. The second type of visit plan can be arranged from August to January "the lush green (Spring)" period when the tourists would desire to stay near nature, i.e., flora protected area. The nature liking and studying purpose for flora can be developed for tourists according to their demand. This may be:
    - Two or three compartments from North side of the Semi and Totaladoh (M.P.) may be selected for establishment of the spring visit plan.

- Five or six compartments on the Nagpur (Maharashtra) may be selected for the purpose.

Proposed Framework for involvement of Local populace:

While the PNP's primary focus on bio-diversity is most welcome and desirable, it must be balanced by emphasis by involvement of local people at various levels. For example, the local people have knowledge of rare species of the medicinal and other plants. This should be utilised by getting the photographs with the local names otherwise it may not be possible to identify such species and also to record their utility. Otherwise such species may get extinct. Such importance given to the local population at various levels will be more useful to change their attitudes towards preservation and conservation of flora and fauna. This will also help them to understand the importance of it to a greater extent. This will certainly go a long way in improving the standard of living of the local people.

AGRO-ECO TOURISM DEVELOPMENT PLAN

The development of pleasure activities in and around PA with agro based surrounding in developing countries that involves traveling to relatively undisturbed or uncontaminated nature areas with specific objective of studying, admiring and enjoying the scenery, plants and wildlife as well as involvement of farmers as one of the important players for generating employment from existing agro-materials. The agro-eco development plan for the PNP should have the following elements:

- The local people particularly the tribal (deeply embedded in agriculture) should be motivated for agro-eco tourism activities.
- The plan should aim at improving the material life of the local populace.
- Residue of jawar, bajra, wheat etc. can be utilized for fertilizer purpose, building huts and manufacturing decorative items and utilizing them. The displays of such items in different seasons will be useful for tourism activities.

Basis for Designing Agro-Eco Tourism Plan:

The basis (principles) for designising an agro-eco tourism plan be as follows:

1. It should provide long-term benefits to the farmer community and cottage/agro industries.

2. It should not degrade the resources and should be developed in environment friendly social manner.
3. It should provide first-hand, participatory and enlightening experiences especially to farmers and fishermen.
4. The plan should aim at making the tourism enjoyable for the visitors and should also aim at motivating the tourists to purchase the locally produce articles from the local people. This will benefit both the tourist as well as the local people as the middlemen are eliminated.
5. Camping facilities can be developed with help of private investors on BOT basis. For these investors, it should be made compulsory to purchase food grains, vegetables etc. from the local population. In this connection suitable mechanism may be developed to benefit both the local people and the investors.
6. It should involve educating all the players; farmers, local communities, government officials, NGOs, industry, tourists etc.
7. It should encourage all-party recognition of the intrinsic values of the resources.
8. It should be pro farmers and related local people.
9. It should aim to promote social, moral and ethical responsibilities and behaviours towards the natural and cultural environment by all the players.
10. Eco-agro tourism development is the process to change to reach symposia between nature conversation tourism and sustainable socio-economic development with the main focus on agro-based activities.

Management Plan of PNP:

There is a need to execute Management Plan (2000-01 to 2009-10) of the Forest Department on priority basis. This plan prepared by the Forest Department is exhaustive with a vision to conserve the natural resources of PNP. It covers almost all aspects of sustainable development of PNP with Eco-tourism and Eco-development as its thrust area. AS study of this plan shows following policy matters to be incorporated in the management plan of PNP:

a. Clear demarcation of PNP as core, buffer and tourism zones and their development as per the management objectives.

b. Strengthening of interpretation center at Sillari which would aim at increasing people's interest in conservation issues by making them understand Park's value by providing information about its history, ecology, habitat, wildlife, management problems, etc.

c. Funds collected through the entry fee should be exclusively used for the maintenance and development of Park and its infrastructure.

d. Construction of auditorium with audio-visual interpretative media.

e. Development of library adjoining the interpretation center well equipped with periodicals, journals, magazines related to nature conservation.

f. Creating audio-visual aids a regular library of audio and videocassettes, films, slides, photographs carefully classified into different topics should be established. Video camera with remote microphone and CD compatibles audio systems should be purchased to ensure bringing on records various seasonal observations- bird and animal calls.

g. Interpretative aids should be used not only for tourists but also for extension work, education and interpretation of subjects to the local populace in nearby villages and students in schools.

h. Publicity material to be updated- pamphlets, handouts, brochures etc. need to incorporate all details regarding tourists spots, composition of flora fauna, various forest type, habitat should be published . Checklist of birds should be made up to date. Park emblem should be designed and letter heads envelops should be printed.

i. Beautification of Ambakhori should be done on priority basis. Ambakhori is proposed to developed as an area of nature interpretation of drinking water supply to visitors, erection of shades, raised platforms at the base of trees with shades, benches, retaining walls to arrest future collapse of soil debris, and construction of approach steps.

j. Habitat improvement and manipulation should be expedited.

k. Training should be imparted to the staff engaged in various activities related to the management of PNP.

l. Research and monitoring is the key stone to scientific management of PNP upon which management and administrative prescriptions should be based. Research and monitoring activities on various aspects of wild life management and health should be taken up:

- Research on floristic and faunistic forest wealth
- Regeneration survey of PNPO with special emphasis on endangered plants
- Field survey to assess the status of flora and fauna as per IUCN Red data listing.

Creation of proper infrastructure for research

a. Establishing linkages with Institutes/ Universities for taking up research activities, which would help management of, PNP.

b. Conservation of Ranidoh Forest Rest House as Ranidoh Research Center

c. Creation of Research cell in the forest department with collaborative efforts of different agencies and Govt. Depts.

d. University- Forest interaction and nomination of university representatives on the research cell.

e. Existing administrative set up of the Forest Dept. to be modified to accommodate inclusive management of PNP.

The above policy recommendations if translated into policy decisions, Pench National Park will be a “paradise” of flora and fauna and model “Tiger Project” for the region.

REFERENCES

Agrawal, Arun and Ostrom, Elinor. 1999. “Collective Action, Property Rights, And Devolution in Forest and Protected Areas Management.” W99-11, Working Paper, Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington.

Alagh, Y.K (1999) ‘Macro Economic and Sectoral Policies and Forestry Sector in India–Role of the World Bank’. Draft. World Bank document.

Andersen, K.E. (1995) ‘Institutional Flaws of Collective Forest Management’. *Ambio* 24(6): 349-53.

Arora, H., and Khare, A. (1994) ‘Experience with the Recent Joint Forest Management Approach’. Paper prepared for the IN workshop on India’s Forest Management and Ecological Revival, New Delhi, February 1994.

Balakrishnan, Mundanthra, and Ndhlovu Dora E. 1992. “Wildlife Utilization and Local People: A Case-Study in Upeer Lupande Game Management Area, Zambia.” Environmental Conservation 19(2):135-143.

Bist, M S, [2000]; Monitoring of Vegetation Cover and land use planning in Nanda devi Biosphere Reserve. The Indian Forester Vol. 126 [6] : 664-673

Borrini-Feyerabend, G. 1996. *Collaborative Management of Protected Areas: Tailoring the Approaches to the Context,* Issues in Social Policy, IUCN, Gland (Switzerland).

Bromley, Daniel W., David Feeny, Margaret McKean, Pauline Peters, Jere Gilles, Ronald Oakerson, C. Ford Runge, and James Thomson, eds. 1992. *Making the Commons Work: Theory, Practice, and Policy.* ICS Press, San Francisco, CA.

Chaudhary, Ashok. 1996. “Conservation, Conflitct and Struggle: Rajaji National Park.” In sustainable Development: Ecological and Sociocultural

Dimension. K.G.Iyer, ed. New Delhi: Vikas Publishing House.

Chopra, K. 1995. “Forest and other sector: Critical role of Governemnt policy.” *Economic and Political Weekly*, Vol.30 (25): 1480-1482.

Compiled by John and Kathy MacKinnon, Graham Child and Jim Thorsell; Categories of Protected Areas; Managing Protected Areas in the Tropics; Natraj Publishers; Dehra Dun; 1996.

Datta, S and Varalakshmi, V. 1999. “Decentralization: An effective method of finanacial Management at the grassroots (evidence from India).” Sustainable Development 1999, Vol 7 (3): 113-120.

Dixon & Sherman, 1991

Dore, E. 1996. “Capitalism and Ecological Crisis:Legacy of the 1980s”, in *Green Gurrillas* (ed.) Helen Collinson, Latin American Bureau (Research and Action) Ltd., London.

Economics of Protected areas and its effect on biodiversity

Ed. Mohan Munasinghe & Jeffrey McNeely The Economics of Global Tourism- Feres A Filian, James P Foley, and Andre J Jacquenemot- Protected Area Economics and Policy distributed for the IUCN by World Bank Washington

Ed. Munasinghe, Jeferey Mcnaccty; Economic Value of Bird-watcher at Point Pelee National Park, Canada- Protected Areas Economics and Policy,

Ed. Reid Donald G.; Ecotourism Development;1999; Weaver Press., P.O. Box A1922, Avondale, Harare, Zimbabwe

Fortin, MJ and Gagnon, C. 1999. “An Assessment of Social Impacts of National Parks on Communities in Quebec, Canada.” Environmental Conservation 1999, Vol 26, Iss 3, pp 200-211.

Gadgil, M. (1998) ‘Conservation: Where are the People?’ in N. Ravi (ed.)

The Hindu Survey of the Environment, 1998. Chennai, India: National Press.

Gadgil, M. 1998. “Conservation: Where are the People?” In *The Hindu Survey of Environment 1998*, ed. Ravi, *The Hindu*, Chennai Edition, India, p.107-137.

Gadgil, Madhav. 1998. “Conservation: Where are the People.” In *The Hindu Survey of the Environment 1998.* (Ed) Ravi, The Hindu, Chennai, India, p 107-137 .

Gaikwad, V.1995. “Tribal and the Tiger: A Case Study of the Kanha National Park.” Centre for Managament in Agriculture, Ahmedabad, India.

Ghate R. and Kulkarni, M. 1998. “A major setback to Participatory Efforts: A story of Tragic Success”, Tiger Link, Vol 4, No.2, September 1998.

Ghate, R. (2000b) ‘Global Gains at Local Costs: Imposing Protected Areas: A Case Study From India’, working paper. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Ghate, R. 1998. “Andhari Tiger Sanctuary (Maharashtra): A Case study for people’s Participation in the Management of Protected area”, The Indian Forester, Vol. 124, No.10, October 1998: 853-860.

Gibson, Clark. Forthcoming. “Dependence, Scarcity, and the Governance of Forest Resources at the Local Level in Guatemala.” In Joanna Burger, Richard Norgaard, Elinor Ostrom, David Policansky, and Bernard Goldstein, eds. *The Commons Revisited: An Americas Perspective*. Island Press, Washington, DC.

Gichuki, F.N. 1999. “Threats and Opportunities for Mountain Area Development in Kenya.” Ambio 1999, Vol 28, Iss 5, 430-435.

Gillingham, S. and Lee, P.C. 1999. “The Impact of Wildlife-related Benefits on the Conservation Attitudes of Local People around the

Selous Game Reserve, Tanzania." Environmental Conservation 1999, Vol 26, Iss 3, pp 218-228.

Govt. of India (1987)

Green Michael J.B. and Paine James. 1997. "State of the World's Protected Areas at the end of the Twentieth Century." Paper presented at the IUCN World Commission on Protected Areas Symposium on 'Protected Areas in the 21st Century: From Island to Networks', Albany, Australia, 24-29 November, 1997.

Greig-Smith, P. [1957]. Quantitative Plant Ecology. Butter-worths, London.

Guha, R. 1989. "Radical American Environmentalism and Wilderness Preservation: A third World Critique." *Environmental Ethics*, 11:71-83.

Hooker, J.D. [1872-1897], "The Flora of British India", VoL 1-VII, London.

Hurni, H. 1999. "Sustainable Management of Natural Resources in African and Asian Mountains." *Ambio*, Vol 28, Iss 5, pp 382-389.

Ite, U.E. 1997. "Community perception of the Cross River National Park, Nigeria", *Environmental Conservation,* 23(4): 351-357.

IUCN 1994): Guidelines for PA management Categories. CNPPA with the assistance of WCMC, IUCN, Gland: Switzerland.

IUCN, 1994. *1993 United Nations List of National Parks and Protected Areas.* Prepared by WCMC and CNPPA. IUCN, Gland, Switzerland and Cambridge, UK.

Jattan, S S and Pratima, [2001] Participatory Forest Management objectives in India. The Indian Forester Vol. 127 [5] : 505-511.

Jena, Nalin R. 1996. "National Parks and Sanctuaries vs people's Rights: Some Issues of Concern." In Sustainable Development: Ecological and Sociocultural Dimensions. K.G. iyer, ed. New Delhi: Vikas Publishing

House.

Kershaw, K A [1973] Quantitative and Dynamic Plant Ecology. Edward Arnold ltd. London, 308 pp.

Kevin Bishop, Adrian Phillips and Lynda Warren (1995): "Protected for ever? Factors shaping the future of protected areas policy" Land Use policy Vol. 12 No. 4 pp. 291-305. Elsevier Science Ltd.

Kulkarni, S.D. 1979. "Encroachments on Forest Lands-The Experience in Maharashtra." *Economic and Political Weekly* 19(45): 1846-49.

Lee, P.N. 1993. "Market-State relations and Environmental policy: Limit of State Capacity in Senegal." In The State and Social power in Global Environmental Economics, ed. R.D.Lipschutz and K. Conca. New York: Columbia University.

Ligon, E., Narain, U. (1999) 'Government Management of Village Commons: Comparing Two Forest Policies', *Journal of Environmental Economics and Management* 37(3):272-89.

Locke, C. (1999) 'Constructing a Gender Policy for Joint Forest Management in India', *Development and Change* 30(2):265-85.

Maria Dulce M. Cacha (): "Starting Resource Accounting in Protected Areas " Protected Area Economics And Policy,

McGinnis, Michael, ed. 1999. *Polycentric Governance and Development: Readings from the Workshop in Political Theory and Policy Analysis.* Ann Arbor: University of Michigan Press.

McKean, Margaret A. 2000. "Common Property: What Is It, What Is It Good For, and What Makes It Work?" In Clark Gibson, Margaret McKean, and Elinor Ostrom, eds. *People and Forests: Communities, Institutions, and Governance*. MIT Press, Cambridge, MA.

McNeely, J.A., Miller, K.R., Reid, R.W., Mittermeier, R.A., and Werner, T.B. (1988) 'Economics and Biological Diversity: Developing and Using Economic Incentives to Conserve Biological Resources', Gland, Switzerland: IUCN.

Measuring and Monitoring Forest Biodiversity; The SI/ MAB Model Francisco DA Limeir, ASI/MAB Bio-diversity Program

NS Chauhan (1998): " Conserving Biodiversity of Medical And Aromatic Plants In Himalayan Region" Biodiversity of Forest Species (A Community Forestry Approach) R. Bawa

Odum, E.P.[1971].Fundamentals of Ecology. W.B Saunders Co. Philadelphia.

Ostrom, E. (1990) *Governing the Commons*. Cambridge: Cambridge University Press.

Ostrom, Elinor, Roy Gardner, and James Walker. 1994. *Rules, Games, and Common Pool Resources.* University of Michigan Press, Ann Arbor.

Ostrom, Elinor. 1990. *Governing the Commons*. Cambridge University Press, Cambridge.

Ostrom, Elinor. 1999. "Coping with Tragedies of the Commons." *Annual Review Political Science*. 2:493-535.

Ostrom, Elinor. 1999. "Institutional Rational Choice: an Assessment of the Institutional Analysis and Development Framework." In Paul A. Sabatier, ed. (1999) *Theories of the Policy Process.* Bolder, CO: Westview Press, 35-71.

Ostrom, Elinor. Forthcoming. "Reformulating the Commons." In Joanna Burger, Richard Norgaard, Elinor Ostrom, David Policansky, and Bernard Goldstein, eds. *The Commons Revisited: An Americas Perspective*. Island Press, Washington, DC.

Pathak, N. and Kothari, A. 1998. “Sharing benefits of wildlife conservation with local communities: Legal implications.” *Economic and Political Weekly*, Vol. 33 (40): 2603-2610.

Praveen Pardeshi ‘Conserving Maharashtra’s Diversity through Ecodevelopment, published in People and Protected Areas Ed. By Ashish Kothatri, Neena Singh and Saloni Suri

Rakesh Shukla (1996): “Pench Timeless Jungle” ; Santury Asia

Randall Kramer, Mohan Munasinghe , Narendra Sharma , Evan Mercer , and Priya Shyamsundar ( ): “Valuing a Protected Tropical Forest: A Case Study in Madagascar” Protected Area Economics And Policy,

Report on Wood Consumption Study of Nagpur District, Forest Survey of India Ministry of Environment and Forests, GOI 2000-2001

Resources. University of Michigan Press, Ann Arbor.

Ribot J.C. 1993. “Market-State relations and Environmental policy: Limit of State Capacity in Senegal.” In The State and Social power in Global Environmental Economics, ed. R.D.Lipschutz and K. Conca. New York: Columbia University.

Roshni Kutty and Ashish Kothari; Concept and Administration of Protected Areas; Protected Areas in India- A Profile; Kalpavriksh (2001)

Rudolf S. de Groot (): “ Function And Values of Protected Areas: A comprehensive Framework for Assessing the Benefits of Protected Areas to Human Society” Protected Area Economics And Policy,

S.K. Datta- Marketing of Wild Medicinal Plants Tribal Economy in India., EPW , Vol. XXXVI No. 38, Sept 22, 2001.

Sale and Berkmuller (1998), Manual of Wildlife Techniques for India, Wild Life Institute of India Dehradun.

Sarin, M.[1996] From conflict to collaboration: Institutional issues in community management. Village voices, Forest choices [Eds. M

Poffenberger and B. McGean] Oxford University press, New Delhi.

Sekhar, N.U., Ulrik A.M., and Shanmugratnam N. 1996. “Park Management, Land Use Patterns and People’s Perceptions: the Case of Desert National Park, Rajasthan, India.” Presented at “Voices form the Commons,” the Sixth annual Conference of the International association for the Study of Common Property, Berkeley, CA, June 5-8, 1996.

Sharpe, B. 1998. “’First the Forest’: Conservation, ‘community’ and ‘participation’ in southwest Cameroon.” *Africa*, Vol. 68 (1): 25-45.

Singh K.R.[1997] Participatory approach to relocate villages from protected area: A lesson from Chandka-Dampara Wildlife Sanctuary, The Indian Forester Vol. 123 [6] : 556-564.

Singh, J.S. and P.S. Yadav[1974]. Seasonal variation in composition, plant biomass and net primary productivity of a tropical grassland at Kurukshetra, India. Ecol.Monogr. 44:351-357.

Srivastav, A [1997] People's participation: A vital component in management of Gir Protected Area, The Indian Forester Vol. 123 [6] : 503-511.

Townsend, Amy K. 1992. “Protected Areas as Common Property and India’s Sundarbans National Park.” Presented at “Inequality and the Commons,” the third annual conference of the International Association for the Study of Common Property, Washington, D.C., Sept. 17-20, 1992.

Ugemuge. N.R. [1986], “Flora of Nagpur District, Maharashtra State”, Shree Prakashan, Nagpur

Valuing Biodiversity: Economic Estimates; Pearce David and Dominic Moran; The Economic value of Biodiversity; Pp 106-110; IUCN –The world Conservation Union; Earthscan Publications Ltd, London

Venter, A K. and Breen Charles M. 1998. “Partnership Forum Framework: Participative Framework for Protected area outreach.” Environmental Management vol. 22, No.6: 803-815.

Wells, M. 1992. “Biodiversity conservation, affluence and poverty: mismatched costs and benefits and efforts to remedy them.” Ambio 21(3): 237-243.

Wells, M. 1995. “Biodiversity conservation and local peoples’ development aspirations: New proprities for the 1990s.” Rural Development Forestry Network, Network Paper 18a, Winter 1994-Spring 1995.

William F. Hyde Keshav R. Kanel , and Ernest D. Misomali ( ): “ The Marginal Costs of Endangered Species Management” Protected Area Economics And Policy,