Project Document

Panna

Potential

Biosphere Reserve

Environmental Planning &
Coordination Organization
Bhopal
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CONTENTS

CHAPTER - 1

INTRODUCTION

1.1 THE BIOSPHERE RESERVE

Biosphere Reserve (BR) is an International designation made by UNESCO for representative parts of natural and cultural landscapes extending, over large area of terrestrial or coastal/marine ecosystems or a combination thereof. BRs are designated to deal with one of the most important questions of reconciling the conservation of biodiversity, the quest for economic and social development and maintenance of associated cultural values. These areas are internationally recognized within the framework of UNESCO's Man and Biosphere (MAB) program after receiving consent of the participating country.

1.2 BIOSPHERE RESERVE CHARACTERISTICS

Typically, Biosphere Reserves would have the following characteristics:

- Representative terrestrial, aquatic or coastal environments, recognized for their value in conservation and providing scientific knowledge and human values, to support sustainable development.
- Biosphere reserve is a land or coastal / marginal or aquatic areas wherein people are an integral component of the ecosystem.
- Be part of a worldwide network, which facilitates information sharing relevant to conservation and management of ecosystems.
- It is a system where planners, scientists, managers and local participate in evolving a programme for mapping land and water to meet human needs and at the same time conserving natural processes & ecological resources.
- Include representative examples of natural or minimally disturbed ecosystems e.g. centers of endemism, genetic richness, unique natural features, areas suitable for experimental manipulation, harmonious landscapes resulting from traditional patterns of land use, modified or degraded ecosystems suitable for restoration, i.e. providing area framework for carrying out the scientific and management functions of Biosphere Reserves.
- The area should be large enough to be a conservation unit, and have value as a benchmark for measurements of long-term changes in the biosphere.
- The area should provide opportunity for ecological research, education, demonstration and training.

1.3 BIOSPHERE RESERVE FUNCTIONS

The function of the biosphere reserves includes:

Conservation: To ensure the conservation of landscapes, ecosystems, species and genetic variations; to encourage the traditional resource use system; to understand the pattern and processes of functioning of ecosystems and; to monitor the natural and human cause changes on spatial and temporal scales.

Development: To promote, at the local level, economic development which is culturally, socially and ecologically sustainable and; to develop the strategies leading to improvement and; management of natural resources.

Logistic support: To provide support for research, monitoring, education and information exchange related to local, national and global issues of conservation and development; sharing of knowledge generated by research through site specific training and education; development of community spirit in the management of natural resources; it provides platform for understanding of the patterns and process that are involved in functioning of the ecosystems and; it is providing developmental strategies that lead to the improved management of the natural resources.

The beneficiaries of the biosphere reserves are the local people, scientists, Government decision makers and the world community.

1.4 BIOSPHERE RESERVE – INDIAN APPROACH

The National BR programme was initiated in 1986. The Indian approach to biosphere reserves is in keeping with the international concept.
The aim of the programme is, to serve as wider base for conservation of vide range of living organism; to bring representative ecosystem under conservation and sustainable use on long term; to ensure participation of local inhabitants for effective management and; to integrate scientific research with traditional knowledge for conservation, education and training.

The main objectives of BRs is to conserve biodiversity and integrity of plants and animal with in the natural ecosystem; to save gene pool & genetic biodiversity of species and; to provide area for multi-faceted research & monitoring; to provide facilities for education and training and; to ensure sustainable use of natural resources.

It is this ecological diversity that makes India as one of the mega diversity regions on the globe. Efforts are on to designate at least one Biosphere Reserve in each of the 10 biogeographic zones.

So far 17 Biosphere Reserves have been designated all over the country. Out

of these, 2 viz., Pachmarhi and Achanakmar-Amarkantak BRs lies in the State of Madhya Pradesh, the later being the interstate BR. Out of total BRs in India, 7 have been recognized by UNESCO. The Pachmarhi BR is one of them.

1.5 CRITERIA FOR SELECTION OF SITES

The primary criteria is that a site must contain an effectively protected and minimally disturbed core area of value of nature conservation and the core area should be a typical of biogeographic unit and large enough to sustain variable population representing all traffic level.

The **secondary criteria is** that the areas may have rare and endangered species; having diversity of soil and climatic conditions and all indigenous varieties of the biota, and areas has potential for preservation of traditional tribal or rural modes of living for harmonious use of environment.

1.6 ZONATION OF BIOSPHERE RESERVES

In order to undertake complementary activities of biodiversity conservation and development of sustainable management, the BRs are designated into core, buffer and transition zone as per UNESCO's guideline.

The core zone is kept absolutely or minimally undisturbed. It contains suitable habitats for plants and animals species and also may contain centre of endemism. The buffer zone, which adjoin the core zone, the use and activities are managed in such ways that it protect the core zone, The transition zone is the outmost zone of BR and zone of cooperation where conservation knowledge management skills are applied and uses are managed in harmony with the propose BR. It includes settlement, crop lands, managed forests etc.

1.7 ROLE OF CENTRAL GOVERNMENT

The Central Government has constituted an Indian National Man and Biosphere (MAB) Committee to advise on policy and program formulation of BRs in the country, to lay down guidelines for preparation and approval of Management Action Plans, to oversee implementation, monitoring, evaluation and approval of new BRs etc. The Central Government assumes responsibility for the financial assistance for implementation of the approved items of the program; technical expertise and know-how including trained personnel and; detailed guidelines covering all aspects of management for implementation by the State/Union Territory's machinery followed by the effective monitoring and supervision.

1.8 ROLE OF STATE / UNION TERRITORY GOVERNMENTS

As per the constitutional framework, the States are the proprietors and custodians of 'Land' and 'Forests'. Accordingly, the local management of the

BRs is the responsibility of the concerned State Governments. The management activities are to be implemented involving effectively the local communities, local government agencies, economic interest groups, cultural groups and other stakeholders. The State Government must ensure that each BR will have effective management policy or plan and an appropriate authority or mechanism to implement it.

1.9 LEGAL FRAMEWORK

At present BRs are established within the framework of existing laws including Wildlife (Protection) Act, 1972. The respective State Governments can examine rules and regulations specifically for BRs, if existing laws are inadequate to deal with the requirements of the Biosphere Reserves.

1.10 BIOSPHERE RESERVE VIS-A-VIS PAs

BR is not intended to replace existing protected areas (viz. national parks and sanctuaries) but it wider the scope of conservational approach of protection and further strengthening the protected networks. The existing legally protected areas may become part of BR. On the other hand inclusion of such areas in a BR will enhance their national values. However, it differs from PAs due to their activities in conservation of overall biodiversity and landscapes rather than some specific flagship species. It includes various components like landscapes, habitats, species and landraces. It gives emphasis on development activities, increase in broad basing of stakeholder, sustainable research and monitoring to understand the structure and function of ecosystem.

1.11 NEED FOR BIOSPHERE RESERVE IN INDIA

At present 1.7 million species have been recorded so in the world (Global Biodiversity Assessment 1995). India's contribution to this record stands at 7%. There are about 49,000 species of plants and 81,215 species of animals. As of now only 70% of the area has been surveyed. The survey and inventorisation of India's biodiversity is still far from complete especially the lower plants and invertebrate animals.

The recorded plant species of India represents about 12% of the world's flora. Out of the total plant species, the angiosperms plant species are about 17,000. Significant diversity has been recorded in Pteridophytes with 1022. The animal species found in India account for 6.67% of world fauna. Of this vast majority are insects with over 60,000 species. The vertebrate fauna is also diverse and varied. The other animal are: mollusks 5050, other invertebrates 8329, fishes 2546, amphibians 204, reptiles 446, birds 1228, and mammals 372. Endemism of Indian biodiversity is significant. About 4900 species of flowering plants or 33% of the recorded flora are endemic to the country. It is estimated that 62% of the known amphibian species are endemic to the India. Nearly 50% of the lizards found in India are endemic.

In order to support a large population in times to come, it is necessary to increase the agricultural production within limited areas available for the purpose. This would mean to obtain new strains of crops/plants with higher productivity and also obtain resistant varieties. Such breakthrough can be achieved only through the use of genetic resources, conservation of gene pools in their natural biogeographic zones for meeting our food security and survival.

The rich biological diversity in India can be attributed to immerse variety in physiographic and climatic conditions. The habitat diversity is reflected in 25 biogeographic provinces 10 biogeographic regions representing five biomes and two natural realms in Indian sub continent. It is because of this magnitude of ecological diversity India harbours variety of ecosystems and a rich biological wealth. There is rapid erosion of diversity at the landscape level.

The Central India Region is inhabited by large tribal populations, which have undergone thousands of years of natural selection. Their traditional life styles, agricultural and husbandry systems are results of such natural selection. Ironical as it is, these very resources are now endangered by 'development', which aims to bring in more productive strains of crops and cattle, eliminating indirectly the traits that have resulted in the extinction of cultivators and animal breeds.

Vast numbers of wild plants exist in some of the remotest areas of our forests. All cultivated plants originate from wild species. The primordial species contain many survival traits e.g. resistance to pests, diseases, stress conditions etc., which get eliminated in selection for higher economic productivity, rendering the cultivators susceptible to various natural enemies. Now with the new techniques of gene implantation, the maintenance of the primordial strains assumes crucial importance.

CHAPTER – 2

WHY THE PROPOSED SITE IS CHOSEN?

2.1 GENERAL

The project document, the proposed Panna Biosphere Reserve area lies between 24^0 21' 8" to 24^0 59' 3''latitude N and 79^0 38' 6''to 80^0 29' 15'' longitudes E, falling under Panna & Chhatarpur districts of Madhya Pradesh. Total area of proposed Panna BR area is 2998.98 sq km. Out of this an area of 1924.07 sq km (64.16%) falls in Panna district and the remaining area of 1074.91 sq km (35.84%) in Chhatarpur district. It includes three Protected

Areas (PAs) *viz*., Panna National Park, Gangau and Ken-Gharial Sanctuaries.

2.2 CRITERIA FOR BIOSPHERE RESERVES

As per BR guideline issued by the Ministry of Environment and Forests, the project document, the primary criteria is that a site must contain an effectively protected and minimally disturbed core area of value of nature conservation and the core area should be a typical of biogeographic unit and large enough to sustain variable population representing all traffic level.

The **secondary criteria is** that, the areas may have rare and endangered species, the areas having diversity of soil, climatic conditions and all indigenous varieties of the biota as well as areas having potential for preservation of traditional tribal or rural modes of living for harmonious use of environment.

2.3 BIOGEOGRAHY

The area falls under bio-geographic zones of Deccan Peninsula 6 and covering Biotic Province of Central highlands 6(A). However, it is nearer to confluence of Deccan Peninsula (Central Highlands 6 (A), Upper Gangetic Plain 7 (A)) and Semi-Arid Gujrat Rajputana (4B). Therefore the area is unique, reflecting the influence of three bio-geographic regions. From agro-climatic zone point of view it falls under Bundelkhand and Kymore plateau of Satpura hill ranges.

2.4 PROTECTED AREAS

The area includes three PAs. Out of this the area based on satellite imagery for Panna National Park is 561.22 sq km, Gangau Sanctuary is 85.84 sq km (Part I =21.37, Part II=45.88, Part III= 1.84 and Part IV=16.75) and Ken-Gharial Sanctuary is 60.89 sq km. The respective areas as per Forest Department record are 542.66, 78.53 and 45.20 sq km. Thus there is a slight differences in the data received from two different sources.

Panna National Park and Gangau Sanctuary are adjacent to each other while Ken - Gharial Sanctuary is located about 8-9 km along Ken river towards northern boundary of Gangau sanctuary (Part-I). The entire area of Panna National Park and part I, III and IV of Gangau sanctuary together has also been notified as Panna Tiger Reserve. The Critical Tiger Reserve Habitat Area, which includes entire part of Panna NP and I, III and IV parts of Gangau sanctuary, is 576.12 sq km as per information given by Field Director, Panna Tiger Reserve. Thus the proposed Biosphere Reserve consists of effectively protected and minimally disturbed areas.

2.5 THE AREA AND LANDUSE

As mentioned above the total area of proposed Panna BR area is 2998.98 sq km. A landuse of the proposed Biosphere Reserve includes built-up land, agriculture land, forest land, waste land and water bodies. The maximum (56.98%) of the total area is represented by forests followed by agriculture (37.43%), water bodies (3.02%), waste land (2.22%) and build up land (0.35%). Out of the total forest 48.95% is covered with dense forest. The overall quality of the forest of the proposed area is very good. Thus the area is large enough and contains different types of landuse for implementation of effective management tools. The different type of landuse provides ample scope for research and management.

2.6 CLIMATE, TOPOGRAPHY & GEOLOGICAL ASPECTS

- Typical topography, climate and provide unique characteristics to the area. The proposed Biosphere Reserve includes high hill ranges of Vindhyan and Bundelkhand. The area lies between 135.35 to 651.05 m above mean sea level. Most of the area is undulating and full of mountains of varied dimension.
- Climate is hot and dry for about 7 months. The area comes under semi-arid to dry sub- humid. The rain occurs from southwest monsoon, and it starts from about June-end till mid-September, brings much pleasure in the sense that weather then becomes milder with average relative humidity rarely crossing 95%. The average annual rainfall is almost 1100 mm. However, it varies from 757 to 1884.6 mm at Panna and slightly lesser 493 to 1449.4 mm at Chhatarpur. On the whole, it is evident that there is a variation in topography, rainfall and soil conditions of Proposed Biosphere Reserve making the challenge for implementation of the management tools and conservation of biodiversity.
- In proposed area of Panna Biosphere Reserve, Archean system, Bijawar group, Vindhyan system, Semri system, Kaimur system, Deccan traps, and Alluvium types of rock systems have been distinguished. The typical bench topography of the core zone- with three plateaus on the right bank and two distinct, almost completely hilly portions on the left bank of Ken - have given rise to large numbers of gorges, cliffs, overhangs, etc. Large number of small but significant caves and rock shelters are also spread all over the area making ideal places of shelter to all kinds of animals and birds.
- The Ken river is one of the sixteen perennial rivers of MP and is truly the life-line of the reserve. It offers some of the most spectacular scenic view.
- Majority of the area is covered by lateritic soil. Heavier black cotton soil is restricted to some depressions, and in vicinity of water bodies. Besides this loamy soil is also found in the area.
- The typical bench topography of the core zone- with three plateaus on the right bank and two distinct, almost completely hilly portions on the left bank of Ken - have given rise to large numbers of gorges, cliffs, overhangs, etc. Large number of small but significant caves and rock shelters

are also spread all over the area making ideal places of shelter to all kinds of animals and birds.

- The Geo-morphological and geological variations coupled with various soil types make the suitable habitats for variety of floral and faunal species

2.7 ZONATION AND LEGAL ASPECTS

As per guideline the entire has to designated into core, buffer and transition zone and the core zone should be kept minimally disturbed and legally well protected. In case of Proposed Panna BR the entire area of Panna National Park and three parts of the Gangau sanctuary along with RF and PF of North Panna Division have been included in the core zone. In core zone, the total area covered under forestland is 92.05%. The area represented by dense forest is 61.43% (w.r.t. total geographical area)

The National Parks and Sanctuaries are well protected under Wildlife Protection Act, 1972 and that RF/PF forest of North Panna Forest Division well protected and conserved under Indian forest Act, 1927 and its subsequent amendment. A of total 06 villages lies in proposed core zone of BR. Out of this 4 villages are located within PAs and only 2 are located within RF/PF of north Panna Division. Thus the human interference is supposed to be minimal and existing rules will provide conservation of flora and fauna of the area.

The proposed buffer zone is surrounding the core zone. There are 159 villages in this zone. The agricultural land is about 34.38%. Therefore the buffer zone will provide ample scope for development on sustainable basis for benefits of the local communities and thereby indirectly minimizing the likely adverse effect on the biodiversity of the core zone.

In the transition zone, the maximum (61.05%) is covered under agriculture use while the forest is only 32.11%. Thus, there is ample scope for manipulation in this zone.

2.8 MINERAL RESOURCES

Panna is famous for extraction of diamonds (Panna) from rocks. Though the main mining area falling under proposed BR for extraction located at Majhgaon, is closed at present but diamonds are extracted from shallow areas at several places manually by the local people. In fact the name of the Panna district and the proposed Panna BR has been taken due to occurrence of Panna (diamond) in the area.

2.9 FLORA

- The proposed area is represented by dry deciduous forest. However, based on vegetative composition it may be further divided into six forest types viz., southern dry deciduous teak forest, northern dry deciduous mixed forest, dry deciduous scrub forest, Salai forest, dry bamboo forest and Kardhai forest.

- The proposed Panna BR area has a rich diversity of flora. It provides an ideal habitat for floral biodiversity. A total of 1255 species under 699 genera belonging to 158 families have been reported in this area. Out of these, 982 belonging to 587 genera covering 136 families comes under angiosperms. About 56.67% of the total flora is confined to 12 dominant families.
- The dicot species versus monocot species is 74.03% and 25.97% while, same for the world flora is 81.30 % and 18.70%. Thus the percentage of monocot in the proposed Panna BR is higher compared to world flora. One of the most significant ecological aspect of the area is that it almost makes the northern most boundaries of natural distribution of teak (*Tectona grandis*) and the eastern limits of Kardhai (*Anogeissus pendula*) forests.
- The entire proposed Panna BR comprises a very diverse of vegetation, ranging from sprawling grass land through mixed and pure stands of teak, of Khair (*Acacia catechu*) and Kardhai.
- Amongst angiospermic plants, 69 species belonging to 24 families are observed to be rare in the area. Among 69 rare species, 3 species viz. *Eriocaulon parviflorum*, *Oropetium roxburghianum*, and *Themeda laxa* are found to be endemic to India.
- Some of the rare plant species viz., Nirmali (*Strychnos potatorum*), Safed-Musli (*Chlorophytum tuberosum*), Kalihari (*Gloriosa superba*), Bach (*Acorus calamus*), which are of high medicinal value, is also found in the area.
- As many as 108 species of medicinal plant are found in the Proposed BR. Amongst these, Giloy, Gokharu, Bel, Bija, Arjun, Mandukparni, Chitrak Harra, Mahua, Gudmar, Ashwagandha, Patthar chatta, Adusa, Kalmegh, Katsaraiya, Nirgundi, Kali musli, Guarpatha, Satawari, Dhawara, Kullu, Achar, Bahera, etc., are valuable medicinal plant and are used in preparation of various medicines. A wide variety of secondary products i.e. Kattha, Gum and resins are also obtained from the forest area which are used in various cures and ailments. The wild variety of Aonla (*Emblica officinalis*) growing in natural forest of BR area is highly valuable as compared to cultivated variety.
- The floral covers possess immense potential for good open grasslands. The blue bull, axis-axis, four-horned antelope, wild boar etc., are found their way for natural reproduction.

From the above it is also evident that, the area is rich in plant diversity and there are several rare, endangered and threatened floral species in the proposed BR. Thus, this also fulfills the basic criteria of BR.

2.10 FAUNA

- The proposed Panna Biosphere Reserve has a rich natural heritage with long history and tradition of wildlife conservation. The area is rich in wild animals- both by variety and by numbers. As many as 20 species of animals

listed in Schedule I, II, III and IV are found in the area. The area has been included in Tiger Reserves of India as it contains 'tiger' (now rehabilitated).

- Tiger in Panna is perhaps the major population of the national animal in dry teak – miscellaneous forests of north central India. Its survival here is crucial for safe passage of the animal in the country through twenty- first century. The flag ship species viz., tiger of scheduled species viz, tiger is almost wiped out in the area.
- Presently, three tigresses and one tiger have been reintroduced in the Panna Tiger Reserve on account of local extinction of tigers in the said reserve. In the subsequent year tigresses gave birth to 7 cubs. Out of them only 5 cubs were left surviving. Thus the number of tiger population has increased to 9 after the successive case of tiger reintroduction in the Proposed BR. The propagation of this species in the area will be an extreme challenge for management authorities in this area.
- The proposed area has great potential to provide an ideal habitat and breeding ground for several wild animals.
- Siyah Gosh (*Felis caracal*) found in the area is one of the rare cats and the closest cousin of the extinct Panther (Cheetah).
- The Ken river, which flows through the entire area from south to north, is the home for Long snouted Crocodile (Gharial) and Marsh Crocodile (Maggar) and other aquatic fauna. The Crocodile (*Crocodilus palustris*) and long snouted Crocodile (*Gavialus gangeticus*) both co-exist in river Ken. This is rare occurrence as both species are generally found separately.
- Panna Tiger Reserve is one of the most important PA in the north-central highlands of India, as it links the eastern and western populations of wild animals through the NE-SW running Vindhyan ranges.
- The area is rich in bird life. A total of 281 species of commonly seeing birds covering 50 families reported in the area. There are several vulture species which are on the brink of extinction are found in the Panna Reserve courtesy favourable. Amongst the total 09 species of vultures in wild, 02 species viz, Cinereous Vulture (*Aegypius monachus*) and Himalayan griffon vulture (*Gyps himalayensis*), along with one species of *Halcyon pileata* (black-capped kingfisher) have been sighted in the Panna Tiger Reserve during a wildlife census. As per the latest census of vultures organized by Panna Tiger Reserve, there are about eight species of vulture found in the reserve. As per the, latest census of vultures of Panna Tiger Reserve there are about eight species of vulture found in the reserve. Out of which, long billed Vulture are White-backed Vulture threatened species.
- The Ken river attracts a number of avian species both pretty and good songsters. The Panna National Park can boast up the highest density of paradise flycatchers 'the State Bird of Madhya Pradesh'.
- Black buck (*Antilope cervicapra*), a rare species, is also found in the southern

part of the proposed BR area.

- The Ken river is full of fresh water fishes and crabs, forming a perfect aquatic natural ecosystem. **Mahseer**, a threatened fish species, is also found in river Ken.
- A native breed of cattle '**Kenkatha**' is also found in the area. They get their name from the River Ken, as they are bred along the banks of this river in the hilly area of Bundelkhand. These cattle are bred in territories of Panna, Charkhari, Bijawar and Ajaigarh, which are part of Vindhya region of India.

Thus the Propose Biosphere Reserve is capable of sustaining viable population representing all traffic level in ecosystem. From the above it is also evident that, there are several rare, endangered and threatened faunal species in the proposed BR.

2.13 HUMAN SETTLEMENTS

A total of 306 villages urban agglomerations are located within Proposed BR. Out of them, there are only three urban agglomerations. These are basically located buffer and transition zones.

Thus, Panna BR is basically having rural settings. It contains many villages, which are having their own tradition and culture. There are many tribes like Gond (Rajgond, Nandgond and Saurgond) and Khairuas and Yadavas (Dauvas).

The scheduled tribes population account 13.14% of the total population (Census, 2001) while that of scheduled caste population is 16.50% Thus, slightly lesser than one third of the population is covered by SC & ST.

The zonewise analysis indicates that SC population is lesser (11.57%) in core zone compared to buffer and transition zone (16.50 & 16.52, respectively) while ST population is highest (36.98%) in core zone followed by buffer zone (22.52%) and least in transition zone (8.81%).

Thus the area has potential for traditional tribal or rural modes of living for harmonious use of environment

2.14 ARCHAEOLOGY

- Panna is an archaeologist's delight; its archaeological importance would defy the limitations of expression through language. From pre-history to the present, a continuous unbroken chain is found. The area has Mesolithic rock/cave paintings at Vrihaspati Kunda and Barachh, of the prehistoric man as well as the best sculptural and architectural imprints of the Gupta period.

- A great defensive fort at Ajaigarh and the ruins of another fort at Rajgarh stand testimony to the historicity and grandeur of Panna's past.
- Vrihaspati Kunda and Barachh, are archaeological treasures, invaluable chronicles in the history of man, and present an eloquent testimony of Panna being a heritage of great civilizations.

The area also covers **Khajuraho, a UNESCO World Heritage Site**, once the original capital of the Chandela Rajputs, a Hindu dynasty that ruled this part of India from the 10th to the 12th centuries. The Khajuraho temples were built over a span of a hundred years, from 950 to 1050.

2.13 TOURISM

- Khajuraho, famous for its unique chains of temples of Chandela Raj and listed under World Heritage site located in the transition zone of proposed BR area provides ample scope for tourism. It attracts million of tourists every year from all over the country. Panna has transformed a royal past into a vibrant, lively present. Thus the area is already under international scenario
- The scenic splendor of the proposed Panna BR area is unmatched especially in the monsoons. The entire forests become lust green with many beautiful waterfalls. The river Ken meanders & winds its way through the heart of the Park. Alternating valleys and plateaus, grassy maidans, steep gorges and escarpments, down which the waterfalls cascade in glittering streams during the monsoon, present a breath-taking variety of views. While Caimasan fall is the tallest, the Pandav falls is serenity herself, the Gehrighat where the river Ken enters the gorge after a short flat stretch, is a scene which may not have a match elsewhere.
- Two sanctuaries i.e. Gangau and Ken-Gharial, are famous for rare wildlife and avifauna
- Wildlife watchers will be rewarded by fascinating glimpses of the animal and bird kingdom, for the Panna National Park, which is the natural habitat of a wide variety of birds and wild species.
- Ken - Gharial sanctuary along the river ken near the spectacular Raneh Falls is an added attraction for the tourists.
- The proposed area still possesses pre historic rock/cave paintings at Vrihaspati Kund and Barachh belonging to Mesolithic period. Thus these sites provided an ideal place for eco-tourism.
- A trekking route from Raneh Fall to Chhapara and Ajaigarh via Piparaghat has been identified for the tourists. The trekking route is full of nature"s treasure.

2.14 POLICY, PLANNING & MANAGEMENT MECHANISM

As per guideline, there is need for development of mechanism to protect the core zone. In case of proposed BR, the National Parks and Sanctuaries are well protected under Wildlife Protection Act, 1972 and the RF/PF forest of North Panna Forest Division and Chhatarpur Forest division are well protected and conserved under Indian forest Act, 1927 and its subsequent amendment. In the proposed PAs of core zone there are 04- villages and only 02 are located within RF/PF north Panna Division. Thus the human interference is supposed to be minimal and existing rules will provide conservation of flora and fauna of the area.

For management of Proposed BR at State level, two management committees have been proposed to be constituted. State Level Steering Committee is to be constituted under the Chairmanship of Chief Secretary. This committee would be representative by Secretaries/ senior officials of the line department at state level. Similarly at district level, District Level Field Coordination Committee has been proposed to be constituted under the chairmanship of respective District Collectors. The line field Department/ Organisations/ NGOs/ experts would be member of the committee. The EPCO, the proposed Nodal Agency for Panna Br is already coordinating the management aspects of Pachmarhi and Achanakmar-Amarkantak BR since 1999 & 2005 respectively. There would be no management problem in case of proposed management of Panna BR.

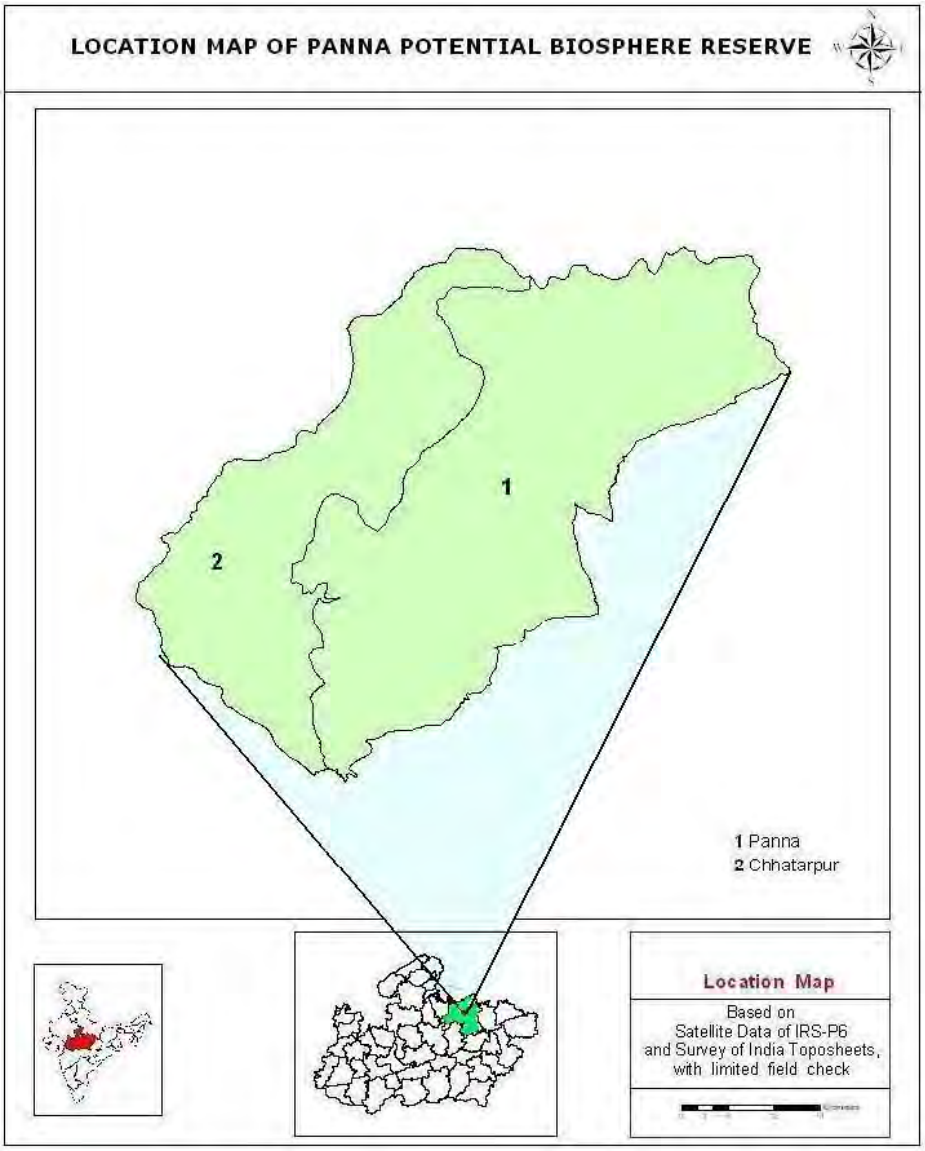
CHAPTER – 3

AN OVERVIEW OF PROPOSED SITE

3.1 LOCATION, CONFUGURATION AND LINKAGES

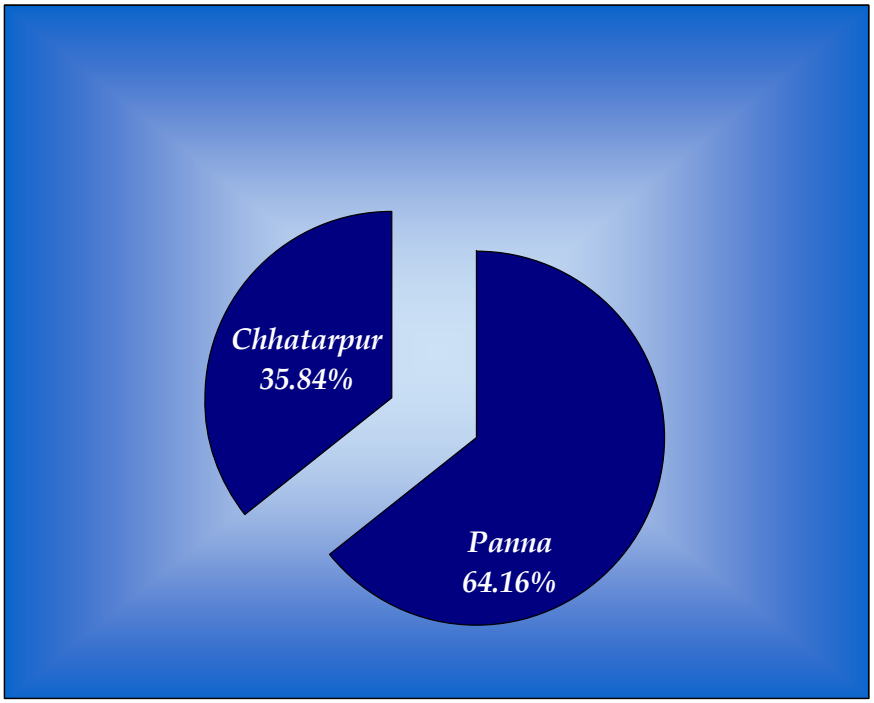
The proposed Panna Biosphere Reserve area lies between 24^0 15′ 8″ to 24^0 59 3′′ latitude N and 79^0 38′ to 80^0 29′ 15′′ longitudes E, falling under Panna & Chhatarpur districts of Madhya Pradesh (Map 3.1).

Map: 3.1



Total area of proposed Panna BR area is 2998.98 sq km. Out of this an area of 1924.07 sq km (64.16%) falls in Panna district and the remaining area of 1074.91 sq km (35.84%) Chhatarpur district (Fig. 3.1). It includes three Protected Areas (PAs) *viz*., Panna National Park, Gangau and Ken Gharial Sanctuaries.

Fig: 3.1 – District-wise area profile of Panna potential biosphere reserve



The area is well connected by all weather roads to Satna and Chhatarpur and is 75 km and 70 km away, respectively. The National Highway No. 75 passes within the BR area. The nearest airport is Khajuraho and railhead is Satna junction on the Allahabad - Jabalpur main broad-gauge line of West-Central Railway. The area is also connected with Mahoba – Khajuraho railhead. The construction of railway line from Lalitpur- Chhatarpur-Khajuraho-Panna-Satna is proposed. The important places within the proposed area are well connected by all weather roads, metal roads, footpaths etc., with Panna and Chhatarpur. The linkage map is given in Map 3.2.

Panna National Park and Gangau Sanctuary are adjacent to each other while Ken - Gharial Sanctuary is located about 8-9 km along Ken river towards northern boundary (Part-I) of Gangau sanctuary. The Gangau sanctuary consists of 4 parts. The entire of Panna National Park and parts I, III and IV of Gangau sanctuary together has also been notified as Panna Tiger Reserve. The Critical Tiger Reserve Habitat Area, which includes entire part of Panna NP and I, III and IV parts of Gangau sanctuary, is 576.12 sq km and 601.18 as per Satellite imaginary, respectively. The details of P.A. areas as per information provided by Forest Deptt., and also based on Satellite imaginary compiled by RSAC, MP Council of Science & Technology are given in Table 3.1

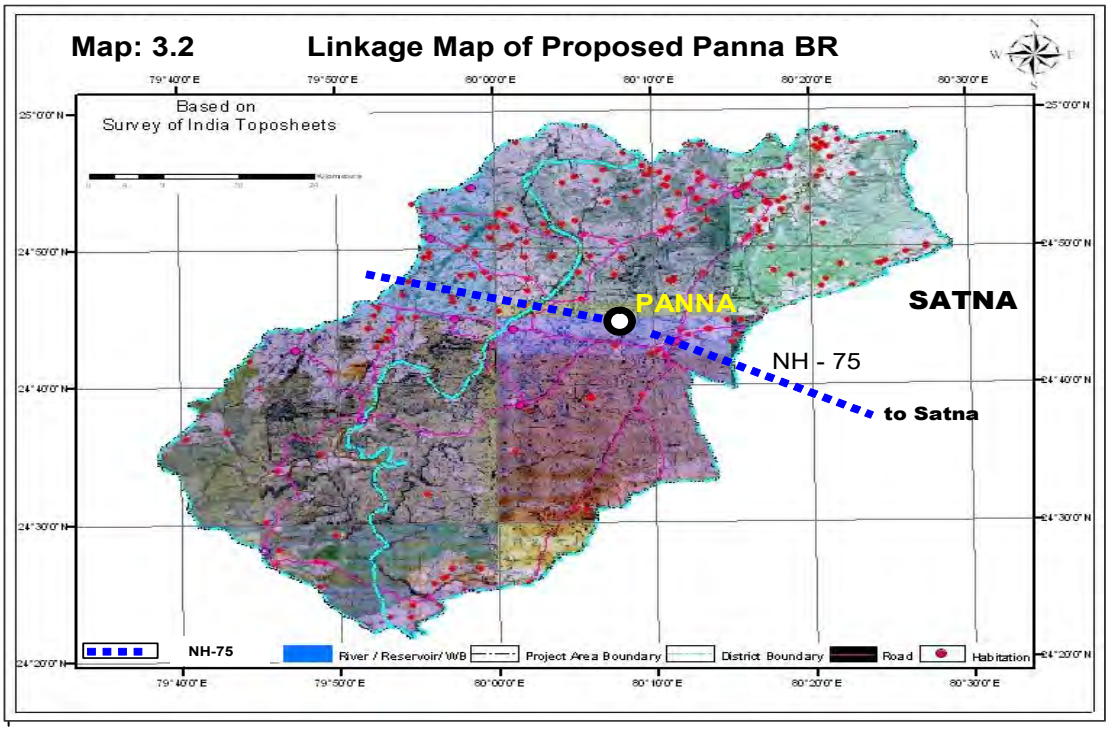


Table: 3.1 Details statement of Protected Areas covered under Panna Area as Potential BR

S. No.	Name of PAs	Area (sq km) Based on Forest Deptt.	Area (sq km)Based on Satellite Imaginary (Oct 06 & Jan 07)
1.0	**Panna NP**	542.66	561.22
2.0	**Gangau Sanctuary**	78.53	85.84
2.1	Part I	18.19	21.37
2.2	Part II	45.07	45.88
2.3	Part III	1.28	1.84
2.4	Part IV	13.99	16.75
3.0	**Ken-Gharial Sanctuary**	45.20	60.89

The Boundaries: The detailed description of the boundaries of proposed BR as read from the survey of India toposheets (clockwise) is as follows:

East: Starting from the western boundary of Dharampura towards south along forest road passing through Dharampura PF, Simaria PF then joining Baghen Nadi at Phutjhir then towards south west side along the Baghen Nadi near Brijpur (excluding), then turning south along a small drain joining Pharikhera-Panna road at Badgadi Kalan, then along Paharikhera – Panna road via Itwan, Hardua, upto Laxmipur, then in southern direstion along Nallah via Tilgawan, upto Bahera (including) joining at Satna – Panna road (NH - 75), then in NNW direction along NH – 75 upto the crossing of the road leaving Janwar (excluding Janwar), then along road in southern direction

upto Janwar, then along jeapable road via Murachh joining high tension power transmission line near village Bhagipur.

South: From western direction along power transmission line (including Bachhaun) via Barachh (include), Itwan (including), then in SSW direction via Nayapura, Bhanpura joining Jharkua, Hinouta - Bher road near Bandhikalan then southern direction, along Jharkua – Hinouta – Bher road joining river Mirhasan near Hinouta – Bher, then in NS direction along Mirhasan river crossing the river near Amanganj, then along Amanganj – Kishangarh road in western direction joining river Ken near Singura then along Ken River at confluence of Ken and Sonar river then along Sonar river near Sunwari Kalan.

West: From Sunwari Kalan in N-W along Sunwari Kalan – Deora PWD road via Jaitpur, Kishangarh and Basudha upto Deora. Along Deora – Amraiya road upto Amraiya then along cart track in NNW direction joining Banne Nadi in NNE direction. Along banne nadi upto crossing of Jhamtuli – Deogaon road, then along Pakka road passing via Ghunta- Ghura road joining NH – 75 then along NH – 75-road upto Bamitha (including).

North: From Bamitha to Khajuraho (including town), along PWD road upto Rajnagar, then again in N-E direction to Pratappur upto Bachhaun along the non – metallic road, then in S – E direction in Bhaareaur near crossing of Ken canal then in N- E direction along the Ken canal near to Sanguraia then in E-S direction along a drain through Deopahar RF upto Pista, then in S-E direction along the forest road up to joining of Ajaygarh – Naraini PWD road, then in N-E direction along Ajaygarh- Naraini PWD road up to nearby Sikharia, from Sikharia to Nayagaon along footpath road, then from Nayagaon to the western boundary of Dharampura along PWD road.

3.2 METEOROLOGY

With its general monsoonal character, the area falls in the Tropical Thermal Belt in the first classification of Thornthwaite. The average distribution of climatic elements with respect to time indicated the prevalence of four main seasons of unequal duration; dry summer (pre-monsoon season) March-May, wet summer (the monsoon season) June-September, transitional period (post-monsoon season) October-November and winter season (December to February) which are marked by distinct characteristic of the weather elements.

The climate of the BR area is semi-arid to dry sub-humid. It is generally tolerable except during the months of January, May and June. The airs being mostly dry except during southwest monsoon season. Summer is hot and winter is generally mild.

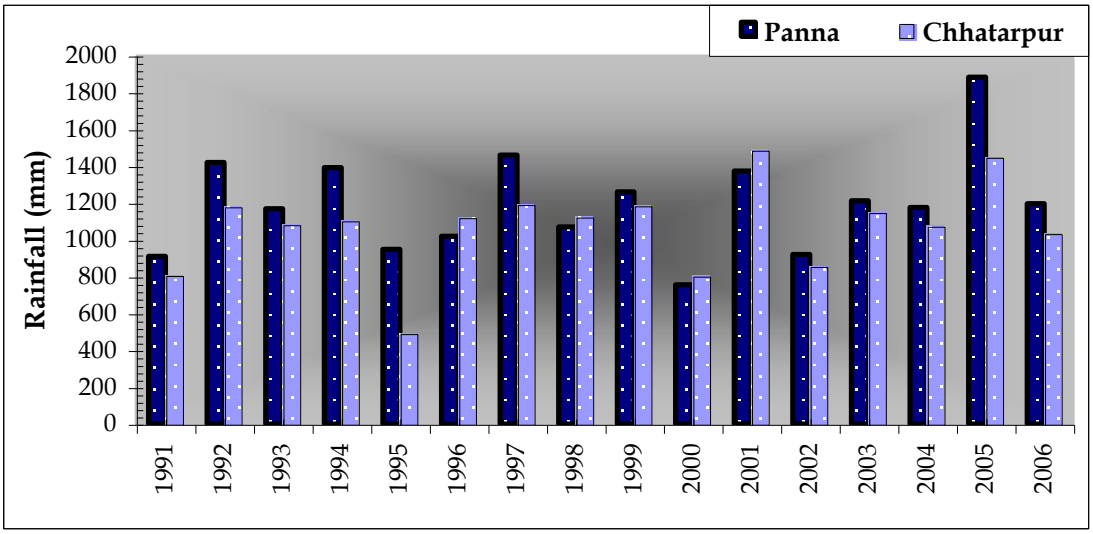
Rainfall: Climate is hot and dry for about 7 months. Rains from southwest Monsoon, from about June-end till mid-September, bring much pleasure in the sense that weather then becomes milder with average relative humidity rarely crossing 95 %. A little winter rain from northeast monsoon is received

generally during December-January, though it is patchy and not very regular.

The annual rainfall data of Panna and Chhatarpur district during the period 1991to 2006 has been presented in Fig 3.2. Average annual rainfall for Panna district is 1176.4 mm and that of Chhatarpur is 1074.9 mm. The annual rainfall varies from 757 mm in 2000 to 1884.6 in 2005 at Panna and 493 mm in 1995 to 1449.4 mm in 2005 at Chhatarpur.

It is noticed that out of 16 years only 6 years in Panna and 5 years in Chhatarpur have more than the average annual rainfall while rest of the 10 /or 11 years have normal /or less than the average. Analysis of the rainfall data reveals that the highest rainfall received during 2005.

Fig 3.2: Total Annual Rainfall (mm) at Panna and Chhatarpur



Temperature: A close look at the records of the last 27 years shows that for 6-8 months of the year, the maximum temperature remains above 32^0 C, its peak coming in the months of May/June, when the mercury crosses 41^0 C or above. December/January is the coldest months when mercury dips to 5-6^0 C or below (Fig 3.3).

The mean monthly maximum and minimum temperatures as recorded at Panna Meteorological Station, for the years from 1980 to 2007 is given in Annex-3: I. It is observed that the temperature begins to rise rapidly from March. The maximum temperature of 44.4^{o}C was recorded in the month of May in the year 1999 and the minimum temperature of 5.1^{o}C was recorded in the month of January in the year 1991.

Humidity: Proposed Panna BR area, lying a little north of Tropic of Cancer, well within the landmass and remote from the sea, have dry climate, except for about three months of the rainy seasons, when it becomes damp. At Panna, the relative humidity is highest (around 95%) during July to September and lowest (55% to 60%) during April-May, the annual average being 86% (Fig 3.4). On the other hand, Chhatarpur is comparatively drier.

The relative humidity on the higher side goes to 85% and on the lower to 35%. Due to good humidity in winter season, mist and fog occur in both the districts. Ground frost occurs in open grassy areas of the forest during December-January.

Fig 3.3: Monthly Variation in Temperature (Max & Min) and Relative Humidity (%) of Panna

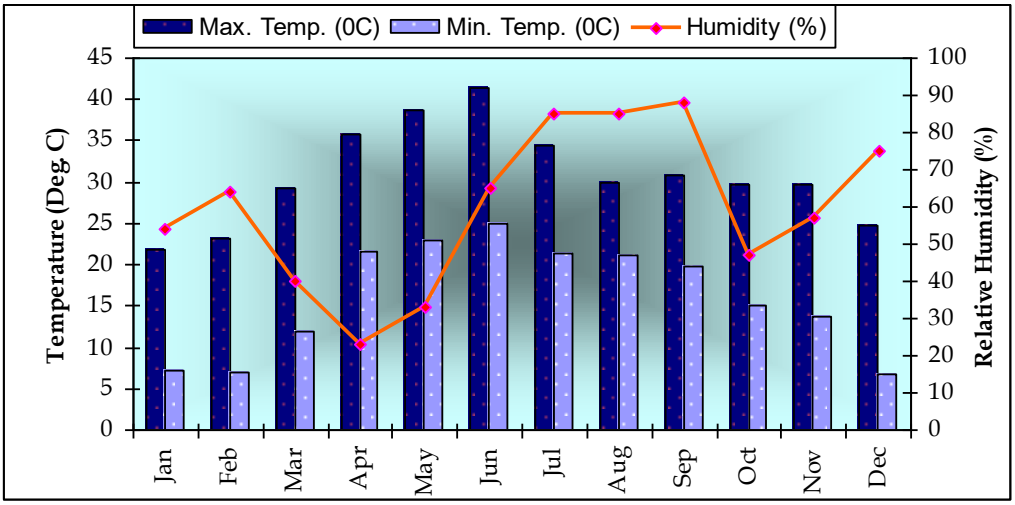
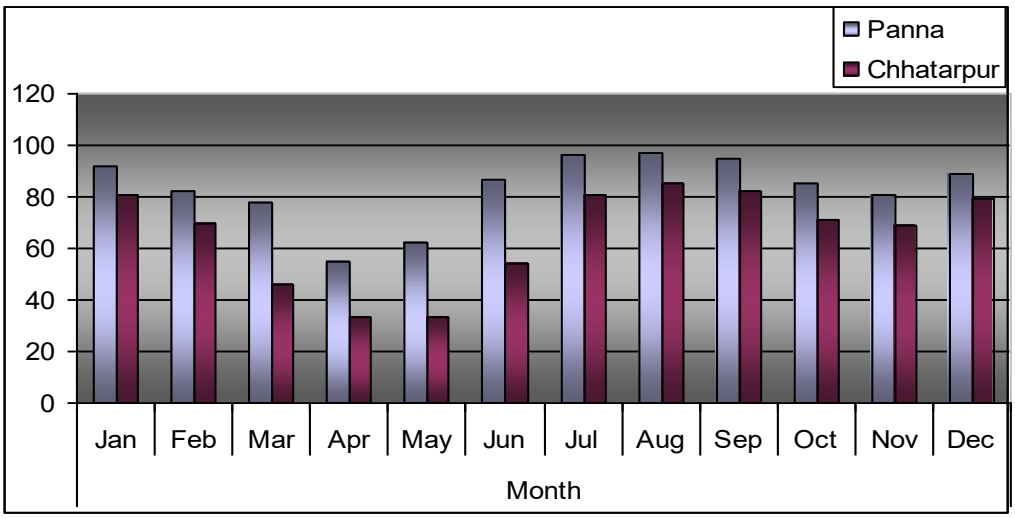


Fig 3.4: Monthly Average Relative Humidity (%) at Panna and Chhatarpur



Cloud cover: Clouds prevail during the south-western monsoon season (i.e.) from June-September to the degree of about 6 oktas as recorded by the IMD Station at Nowgon. The sky is generally overcast during July-August. During the summer and post-monsoon months it is moderately, cloudy and in the November-March the sky is mostly clear. The maximum cloud cover occurs in July or August whereas the minimum cloud cover occurs in December.

Sunshine: The monthly average coefficients of sunshine values at IMD station Satna is considered. The sunshine values vary between 0.469 and 0.736.

Wind velocity: The normal monthly wind velocity data for the two Indian Meteorological stations namely Satna and Nowgon are considered. The details are given in Annex- 3: II. The maximum and minimum wind

velocities are 9.2 & 8.2 km/hr and 2.7 & 2.1 km/hr, respectively at Satna and Nowgon IMD stations.

November to January is the period of calm for winds. According to Beau Fort's scale of wind force, the wind velocity in winters varies between 2-4 km/hr. During the remaining months, the velocity ranges from 4 to 6 km/hr and can be termed as light. During summer, local storms and anti-cyclonic winds are common, when the wind velocity crosses these limits.

3.3 GEOMORPHOLOGY

The upper reaches of Ken river are flanked by undulating plateau with sandstone, shale and limestone. Down below, recent Alluvium engrosses the river up to the Gangau dam. The stratigraphy of rock formations found in the region is mostly alluvial soil, Deccan traps, Lameta beds and Vindhyan system.

The Bundelkhand plateau has unique physiographic features, which makes its landscapes extremely picturesque. In proposed area of Panna Biosphere Reserve, Archean system, Bijawar group, Vindhyan system, Semri system, Kaimur system, Deccan traps, and Alluvium types of rock systems have been distinguished. The typical bench topography of the core zone- with three plateaus on the right bank and two distinct, almost completely hilly portions on the left bank of Ken, has given rise to large numbers of gorges, cliffs, overhangs, etc., large number of small but significant caves and rock shelters are also spread all over the area making ideal places of shelter to all kinds of animals and birds.

The typical rock of the region is popularly termed as 'Bundelkhand gneiss', which is a misnomer. Infact the granite and gneiss are both conspicuous in which the former predominates. The gneisses of area are 'bedded' ones, which had been subjected to powerful external force and are slightly folded and largely fractured. In the south west part of the area rocks of Bijawar series are present. The series present a contorted arrangement of very hard and soft rocks and are chiefly composed of massive quartzite sandstones and granitic sandstones. On the northern and north eastern edges of the area there lie Kimberlite Breccia rocks, which bear the diamonds.

The part of the dissected plateau on which the area lies has undulating topography. In its south west part there are deep gorges. The averages altitude of the area is 400 m above MSL. However, the entire Panna BR looks as if it has three altitudinal levels. The Northern hills have an average height of 380 m. The Central part of the BR is even higher and attain an averages height of 440 m, but the South Western hills attains more than 470 m height. Although the entire region is highly dissected but there are flat plains in the different levels. The high peaks 480 m are dispersed all over the Park. From the west bank of river Ken near Raipura village if one moves towards south eastern part, three different mountainous successive heights are clearly discernable. At Raipura the river flows at 200 m altitude, an abrupt height of more then 200 m is within 2 km distance of the eastern bank of the river

where a small flat area with an altitude of 430 m is seen. Another altitudinal layer of 475 m is to be found in another 10 km, and then comes the highest layer of 480 m. In this way the first attitudinal difference is relatively more pronounces. In the area of Panna National Park, Ken descends about 150 m from south to north. Most of the area is undulating and full of mountains of varied dimensions. The overall altitudinal variation ranges from 135.35 m to 651.05 m above msl.

3.4 SOIL

The underlying rock formation and local topography play important role in the formation of soil. Major underlying rock formations of the area are sand stone, traps, granites and the gneisses. The soils are of three kinds. Majority of the area is covered by lateritic soil. These are spread over large areas in Panna, Hinouta and Chandranagar ranges. Heavier black cotton soil is restricted to some depressions, and in vicinity of water bodies in three ranges, (not so much BC soil in Panna range). Most of the river side areas are stony and bouldary. Vindhyan conglomerate has disintegrated to give rise to thin but quite productive soil layer which is coarse and mixed kind. This third category is loamy soil, which is found mostly in Madla and Hinouta ranges and to some extent in Chandranagar range. Interestingly, almost all the areas with better/productive soil cover are still occupied or have been occupied in the past by habitations. This is seen from the fact that on both the banks of Ken in its entire course through the park are located cultivated lands of one or the other village as is the situation 'outside'. This typical agri-social set-up has special significance so far as village relocation is concerned. The available alternate lands in revenue areas- and to some extent forest areas are also un-irrigated and poorer as compared to rich irrigated riverside soils.

The granitic terrain around Madla, Bagoha, Harsa, Salaiya and Sabdua., Deora, Bhapatpur supports thick soil cover with a few rock exposures. The soils are acidic in character. Close to the escarpment basaltic and doleritic rocks have produced thick soil cover with thickness varying up to more than 15 m.

In contrast to granites, the sandstones of Vindhyan Super group are resistant to erosion and hence do not support thick soils cover. The thickness of soil seldom exceeds 1 m. However, due to development of laterites veneer over sandstone, forests have developed in some patches. This laterites cover (like one around Hinouta pipe, north of Hinouta village) can be quite effectively for afforestation. A few soil patches have been marked within sandstones. These patches can support good cultivation, forest vegetation and ground water and can be used to construct pools for wild animals.

In general, land is uniformly composed of mixed red and black soil of light and friable kind. In the smaller valleys among the hill ranges to the south, the land consists of light sandy soil and in low-lying areas black soil is found. In some regions yellows or red yellows soils are also present.

Soil types: Although, the soil type is mixed red and black as per the general classification. The soil of the area have been broadly grouped into five

categories by the National Bureau of Soil Survey and Land Use Planning (under Indian Council for Agricultural Research), Nagpur, as given below:

1	Soil on hill and hill ridges (Entisols)
2	Plateau soils (Entisols, Inceptisols and Alfisols)
3	Pediment soils (Entisols and Alfisols)
4	Soils of level alluvial plain and undulating flood plain (Inceptisols and Vertisols)
5	Soils of Dissected flood plain (Inceptisols)

A brief description of these soils is given in the following paragraphs:

Soils on hill and hill ridges (Entisols): These soils are fine, loamy to course loamy in texture and greyish brown to dark reddish brown in colour. These soils are highly erodible, excessively drained, stony and gravelly in nature. These soils are of shallow depth with low nutrient status and are slightly acidic to neutral in reaction. They are low in organic matter content and have poor water retention capacity. These soils are unsuitable for normal crop husbandry. However, they may be utilized for the purposes of forestry, pasture development and growing grasses.

Plateau soils (Entisols, Inceptisols and Alfisols): These soils occur on level to gently undulating terrain. They are yellowish brown to dark brown in colour. These soils are shallow to deep course with medium textured and low nutrient status. These soils are moderately eroded. The water retention capacity varies with the soil texture and organic matter content. In this category too, the shallow soils are unfit for normal crop husbandry whereas deep soils are suitable for growing kharif crops like sorghum, millets, pulses and Bajra.

Pediment soils (Entisols and Alfisols): These soils occur on gently to undulating gneisses terrain comprising the vast pediment and piedmont plains characterised by intermittent rocky wastelands and shallow water bodies. They are shallow to deep, coarse to medium in texture and poor in nutrient status. They are moderately eroded. The deep soils in this category are fit for cultivation of crops like sorghum, Til, Bajra, millets and groundnut. Shallow soils are best suited for raising pastures.

Soils of level alluvial plain and undulating flood plain (Inceptisols and Vertisols): These soils occur on level to undulating terrain. These are deep to very deep, fine to fine loamy, well to moderately well drained and contain calcium carbonate deposits. They are neutral to slightly alkaline in reaction. They are low in organic matter content, fairly rich in nutrient status and are moderately eroded. These soils are best suited to crops like jowar, Arhar, Soyabean and Moong under dry land and sugarcane under irrigated conditions. Wheat, gram and linseed are grown during the rabi season.

Soils of dissected flood plain (Inceptisols): These soils are very deep, well drained, calcareous, and gravelly with abundant lime nodules in the soils.

These are fine loamy in texture, yellowish brown in colour with low organic matter content. They possess moderate water retention capacity. These soils are severely eroded during floods and need extensive conservation measures. Lands situated away from the streams can be put under cultivation for kharif crops viz. Jowar, Bajra and Arhar.

3.5 HYDROGEOLOGY

The proposed Panna BR lies in the Ken basin, which form part of the Ganga basin, are varied in its geological setting. As per the report on Ground Water Resources and Development Prospects of Madhya Pradesh, prepared by the Central Ground Water Board, North-Central Region, Bhopal, in March 1994, the following types of hydro-geological formations are found in the area.

The older metamorphies occur in entire biosphere reserve area. Ground water occurs in them only in the weathered mantle and the fractured zone underlying them. The wells are recorded to be generally upto 25 to 30 m in depth with water levels in the lean part of the year exceeding 10 m.b.g.1. Specific capacity of the wells in these formations ranges from 20-100 lpm/m of draw down, where the thickness of the aquifer is commendable. Hydraulic conductivity is generally less than 1 m/d and the specific yield is generally less than 5%.

The Purana formations of both Vindhyan and Cuddapah age comprise of orthoquartzites, limestones and shale sequence are found in part of Panna district area. The wells located in this area are easily capable of yielding 100-500 m^3/d for a draw down of 3 m. Specific capacity is in the range from 100 to 300 lpm/m of draw down and the hydraulic conductivity varies from 5-15 m/d. Similarly specific yield is generally in the range of 5 to 15%.

The Deccan trap covers the Chhatarpur district. This is generally simple and a type of flow, where each flow is separable into vesicular and massive units. These flows are generally 10-20 m in thickness, of which 25 to 40 % is generally vesicular. The characteristics red bole beds generally form the masker horizons between the successive flows. The wells of these areas are capable of yielding 250 to 750 m^3/d for a draw down of 3 to 6 m. The specific capacity ranges from 50 to 150 lpm/m of draw down. Hydraulic conductivity ranges from 5 to 15 m/day. The specific yield in the area is generally in the range of 5 to 10%.

3.6 DRAINAGE

The hills of the proposed BR area are of medium to steep gradient. The entire area is spread along a length of bank of river Ken, which form type border between Panna and Chhatarpur districts. The entire area of proposed core zone is drained by the river Ken, meandering at the heart of the area. The Ken river is a major tributary of river Yamuna.

The river Ken has its origin in Bhander ranges of Vindhyan Scarp land. The river flows northwards where a tributary Mirhasan joins the river near Pandavan Gaon. This is the southern end of the area. River Ken forms a gorge named Gehrighat, which is picturesque place. The averages annual discharge of the river Ken is 800 cusecs, but the seasonal fluctuations are abnormal for example the discharge of river Ken in winter is reduced to only 300 cusecs and in May it dwindles to practically nothing.

Within the BR area many 'Nallas' such as Simardo Nalla, Sambhua Nalla, Mohar river, Burana Nalla, Banne Nalla, Shyamari Nadi, Salgur Nalla, Nandi Nadi, Urmal Nadi, and Kilkila Nalla etc., also flow which join the river. All of these small rivulets are rain fed and become almost dry in the summer. The wildlife has to move towards Ken when these Nalla are dried up in the last week of May. Jhirias are nature's gift and boon to animals, for without these sources, it is next to impossible to get water in the bench terraces of the area during summer season. These streams which, though remain dry at surface on their long courses, have small surface springs or superficial cracks through which oozes out water slowly but steadily throughout the year. Water sometimes makes tiny pools at these spots and attracts animals.

CHAPTER –4

LANDUSE & FOREST COVER

4.1 GENERAL

A detailed study of landuse and forest cover of the proposed Panna potential area was carried through the Remote Sensing Application Centre, Madhya Pradesh Council of Science & Technology (MPCST), Bhopal using digital analysis of the satellite data and creation of database in GIS environment. The satellite data is IRS – IC, P6 for two periods viz. October 2006 as pre date for the entire toposheet involved and January 2007 as post date for toposheet no 54/ P- 09, 10, 11, 13, 14, and 15, and that of Feb. 2007 for remaining toposheet viz. 63 D- 1, 2, 3, 5, 6, 7. The secondary and ancillary data, used are Survey of India, topographical sheets on 1:50,000 scale and available maps/ literature from forest department.

Forest cover and landuse map was prepared by on screen digital interpretation of satellite data based on standard image interpretation techniques. A generalized classification scheme was developed based on local knowledge and ancillary information based on standard photo interpretation elements like tone, texture, size, shape, association pattern, location etc. An interpretation key was also developed to identify and differentiate land use cover. Preliminary interpreted map were refined on the ground for doubtful area. After reconciliation with ground truth data, final map was prepared and area statistics was generated. For preparation of different layers and thematic map/area statistics generation, Erdas Imagine 8.7, Arc/Info 7.2.1 and Arc GIS 8.0 software were used.

4.2 LANDUSE / LAND COVER

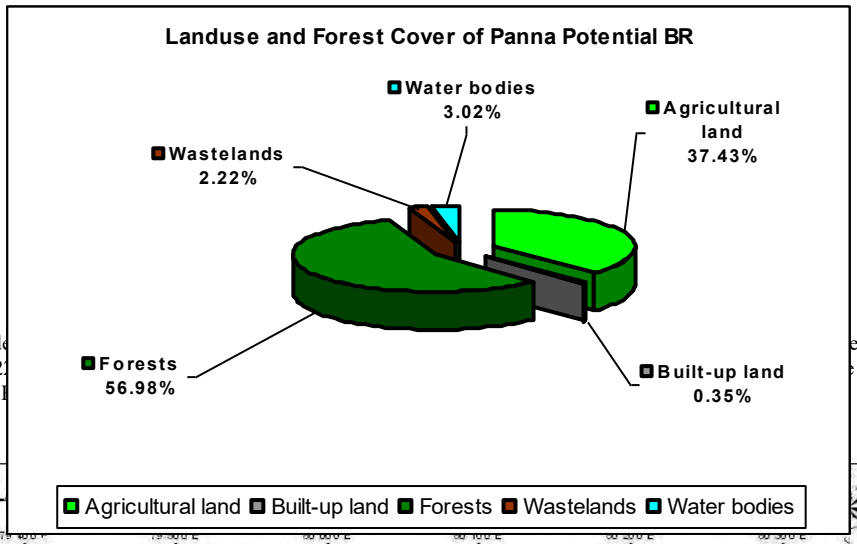
The major landuse/land cover categories identified in proposed Panna Biosphere Reserve are - Built-up land, Agriculture land, Forest land, Waste land and Water bodies. The area occupied by various categories is shown in Table - 4.1 and their percentage is shown in Fig- 4.1.

Table -4.1: District wise area statistics of Proposed Panna Biosphere Reserve

S No	Category	Area in sq. km		
		Panna	Chhatarpur	Total
1	Agricultural land	610.11	512.55	1122.66
2	Built-up land	8.62	1.80	10.42

3	Forests	1229.03	479.84	1708.87
4	Wastelands	31.50	34.98	66.48
5	Water bodies	44.81	45.74	90.55
	Total	**1924.07**	**1074.91**	**2998. 98**

Fig - 4.1: Landuse and forest cover of Panna Potential Biosphere reserve



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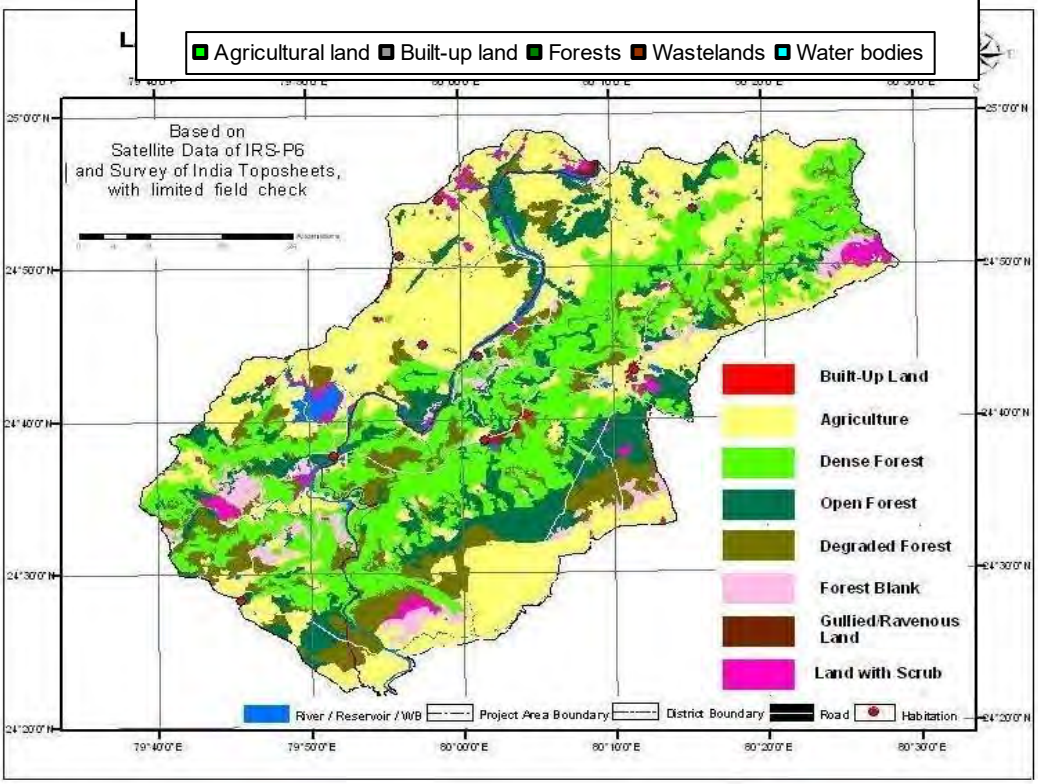
Map – 4.1



In Panna Potential BR, most of the dense, open and degraded forests are covered between north-western and south-eastern sites surrounded by agricultural land making a sandwich like appearance (Map-4.1). Forest blanks and land scrubs cover are very few in south, southwest and eastern area of Panna Potential BR while gullied/ Ravenous land and build up land are rare and almost negligible in the BR area. The detail landuse /forest cover statistic of the proposed Panna Biosphere Reserve is given in Table– 4.2. The brief about various aspects are given in subsequent paras.

Table – 4.2: Detailed Landuse / Forest cover statistics of proposed Panna BR

S No	Category	Total Area (sq km)	% w.r.t. Total Area
1.0	Built-up land	10.42	0.35
2.0	Agricultural land	1122.66	37.43
3.0	Forest		
3.1	Dense	836.53	27.89
3.2	Open	391.49	13.05
3.3	Degraded	364.06	12.14
3.4	Forest Blank	116.79	3.90
4.0	Wasteland		
4.1	Gullied/ravenous land	2.34	0.08
4.2	Land without scrub	5.83	0.19
4.3	Land with scrub	43.30	1.44
4.4	Stony Waste	15.01	0.50
5.0	Water bodies		
5.1	River/Stream/Canal	68.45	2.28
5.2	Reservoir/Tank/Pond	22.10	0.74
	Total	**2998.98**	**100.00**

4.2.1 Built up land

This category includes only those large settlements, which are identifiable on the satellite data. The major townships identified are Panna, Majhgawan (63 D-2), Ajaigarh (63 D-5), Khajuraho (54 P-13), Kishangarh (54 P-15), and Rajnagar (54 P-13). The area occupied by this category is 10.42 sq km or 0.35% of the total BR area.

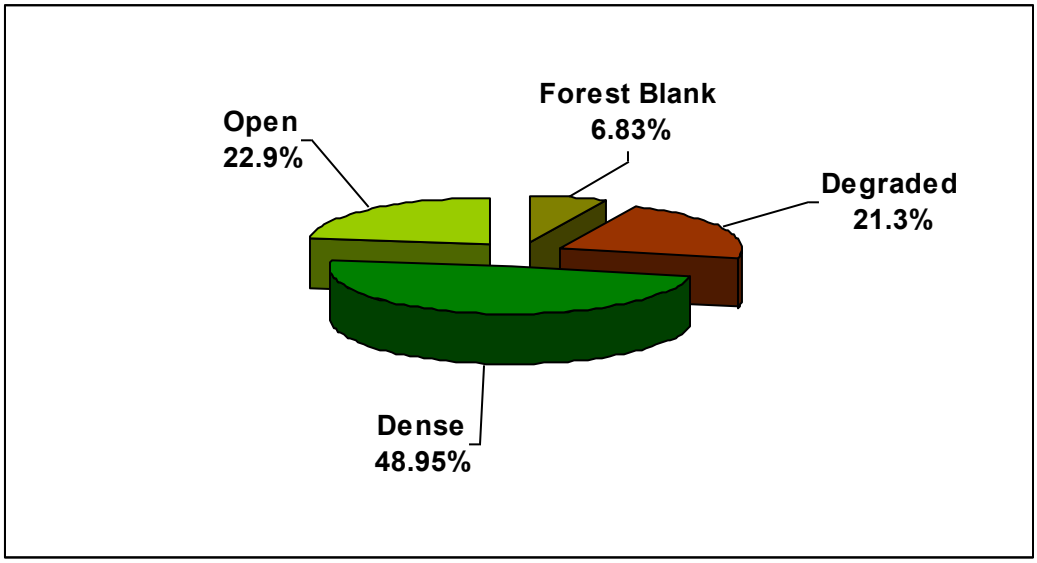
4.2.2 Agricultural land

Almost all the area outside notified forest is under crop. Some of the area inside forest is also under cropland. The main Rabi crops grown in the area are wheat, gram and mustard. Rice, Soybean, and Jowar are main Kharif crops. The total area under this category is 1122.66 sq km, out of which 224.21 sq km (19.97%) is within forest area and remaining 898.45 sq. km is outside forest area.

4.2.3 Forest Cover

This category includes both notified as well as the forest outside the notified forest boundary. The main forest covers identified in the proposed BR are- dense, open, degraded and forest blank. The total area under forest cover is 1708.87 sq. km, which is 56.98% of the total area. The breakup of the forest cover is given in Fig- 4.2.

Fig - 4.2



Dense Forest: This category, having crown cover of 40% and above, consisting of teak and mixed forests can be noticed on plain and undulating land of the area. Major area under this category has been noticed in Palkohan Reserve Forest, Kishangarh Reserve Forest (54 P/15), Rajgarh Reserve Forest, Patan Reserve Forest, Pipartola Boraur Reserve Forest (54P/14), Vishranganj Protected Forest, Dongwa Protected Forest, Akohna Protected Forest (63 D/1) and Rampura Protected Forest (63 D/2). The total area under dense forest is 836.53 sq km, which is 48.95 % of the total forest area.

Open Forest: This category, having crown cover of 10-40% has been encountered in the hilly as well as undulating track and to some extent on the fringes of forest boundaries near the villages. The area under this category is 391.49 sq km which is 22.90% of the total forest. This category is observed in Kishangarh Protected Forest just near Palori (54 P/15), Palkohan Reserve Forest (54 P/14) and Rampura Protected Forest (63 D/2).

Degraded Forest: This category, having crown cover of less than 10%, has been found scattered in the proposed Biosphere area. The degradation is mainly due to natural factors like thin soil cover, stone gravels and steep slope of the area.

The total degraded forest area is 364.06 sq km, which is 21.30% of the total forest. This class can be noticed in Panna, Marala, Majhgawan (63 D/2), Bhilgawan, Pahari and Harsha (63D/1), Gangwaha, Ranguwan, Silon, Kadawara (54P14) and near Kamtana, Sunwani villages (54P/15).

Forest Blank: This category, having no tree within forest area can be observed all around as scattered patches within the notified forest area and near the fringes of other forest. The total forest area is 116.79 sq km, which is 6.83% of the total forest. This category can be noticed near Gorokhar (54P/15), Jhamtuli, Kharyani, Sukhwaha (54P/14), Majgawan, Kupi (54P/10), Hirapur and Hardua (63D/5).

4.2.4 Agriculture Vis-a- Vis Notified Forest

The notified forest area is 1933.10 sq km, out of which 71.57 % falls in Panna district and the remaining (29.43%) under Chhatarpur district (Table-4.3). Of the total notified area the actual forest cover is 1708.87 sq km. Thus in the remaining area (224.21 sq km) which workout to be 11.59%, agricultural practices are being carried out. This seems to be the serious issue and may be looked upon. The maximum agricultural areas (144.01 sq km) falls within notified area and the remaining areas (80.22 sq km) has been enclosed within other areas. The maximum area has been encroached upon in Chhatarpur district.

Table No - 4.3: Statistics of Agriculture and Forest Cover within proposed Panna BR (Area in sq km)

S. No.	Category	Panna			Chhatarpur			Total
		Notified	Other	Sub Total	Notified	Other	Sub Total	
1.	Agriculture Land	118.49	36.03	154.52	25.52	44.19	69.71	224.21
2.	Dense Forest	622.02	6.94	628.96	200.01	7.56	207.57	836.53
3.	Open Forest	275.84	9.07	284.91	89.48	17.10	106.58	391.49
4.	Degraded Forest	237.45	6.88	244.33	85.51	34.22	119.73	364.06
5.	Forest Blank	62.60	8.23	70.83	34.77	11.19	45.96	116.79
	Total	**1316.40**	**67.15**	**1383.55**	**435.29**	**114.26**	**549.55**	**1933.10**

4.2.5 Wastelands

This is an area which is degraded, unutilized, under utilized due to certain constraints. It can be made productive by growing vegetation and can be utilized for other productive purposes after certain reclamation and management practice. This category occupies an area of 66. 48 sq km (2.21% of the BR area). The major subclasses identified are - stony wastes, gullied/ravinous land and land with or without scrub.

Gullied / Ravinous Land: This category has been noticed along drainage/rivers and occupies 2.34 sq. km. The area under this class can be seen near Tikri, Bilhari and Ganpatkhara villages (63 D/1).

Land with or without Scrub: This category occupies higher topography like uplands or high grounds with or without scrub and occupies 49.13 sq km. Land with scrub has been encountered near Gahara (63 D/1), Panna (63 D/2), Majota, Raipura and Ranguwan (54 P/14), Amrauniya (54 P/10) and Land without scrubs were observed near Jagatpura (63 D/1), Mohanpura (63 D/2), Palkhohan and Gangau (54 P/14).

Stony Wastes: These are reported near Nadaura, Rampur (54 P/13 & 15) and Bahadurganj (63 D/1) consisting area of 15.01 sq km.

4.2.6 Water Bodies

Both natural and artificial water bodies including river, steams etc., of the area have been included in this category. The area under this class is 90.55 sq km. or 3.03% of total study area. The main water bodies of the area are Ranguwan Sarowar (54P/14), Kusham Sagar, Chandra Sagar (63 D/6), Lokpath Sagar and Dharam Sagar of Panna township (63 D/2) and Ken River.

4.3 LANDUSE & FOREST COVER OF PANNA NATIONAL PARK

The spatial distribution of landuse and forest cover of Panna National Park falling within proposed core zone of Panna BR is given in Map- 4.2 and the percentage of the areas for various uses is given in Fig– 4.3. The area statistic is given Table- 9.2 of Chapter- 9. It reveals that 91.64 % of the area is covered under forest and followed by agriculture (4.32 %) and water bodies (3.25%). The major part of agriculture areas lie at proposed Daudhan Dam in Chhatarpur district. In other areas, it is found in small proportion in 8-10 locations. The water bodies are basically located along a river Ken. The major chunk (58.79% of total NP) of the forest comes under dense category. The forest blank and scrub (degraded) land together constitute (17.29% of total NP). The open forest also lies at several places. The degraded forest is mainly located in almost central part of the National park. Maximum number of pockets of forest land lies in Chhatarpur district and in northern part of the Panna NP near Ken River. Thus the overall quality of the forest area can be said to be excellent.

Map - 4.2

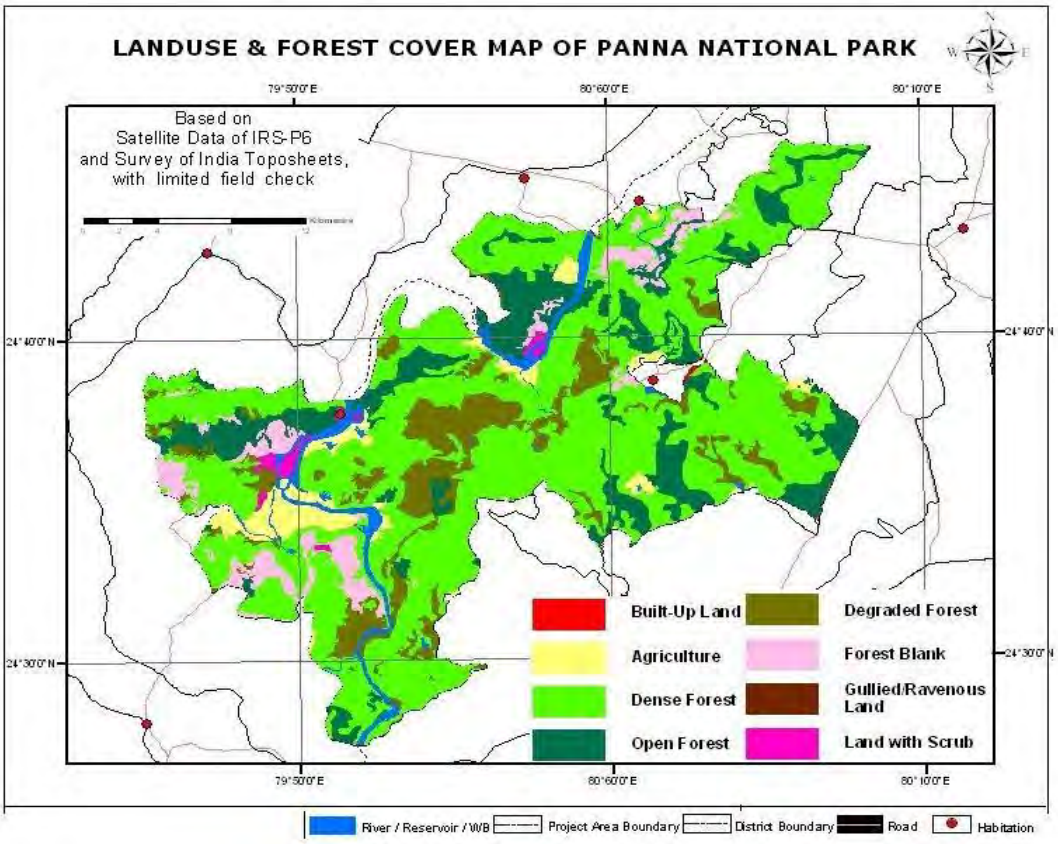
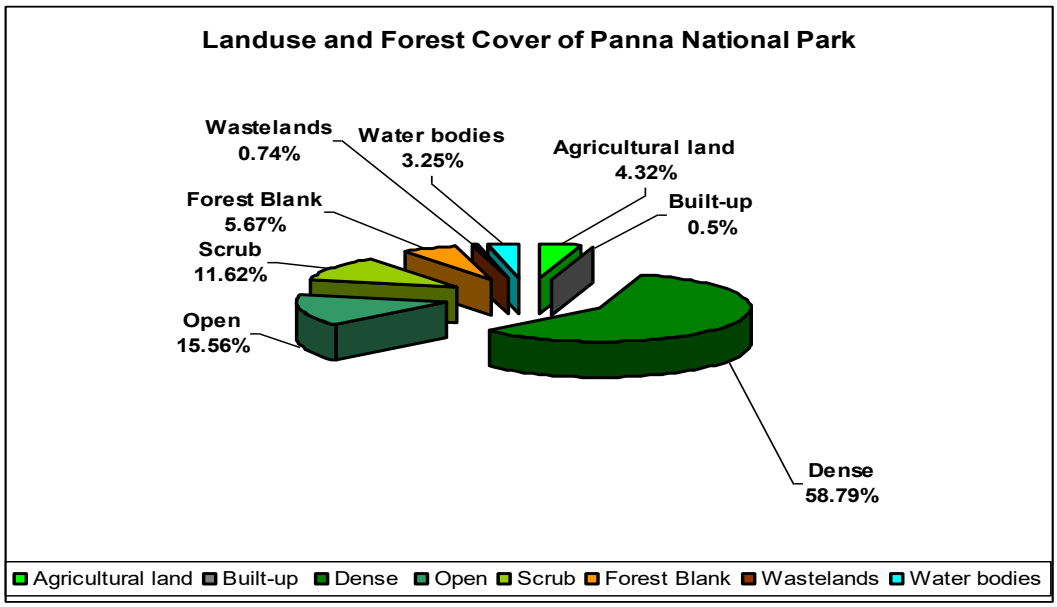


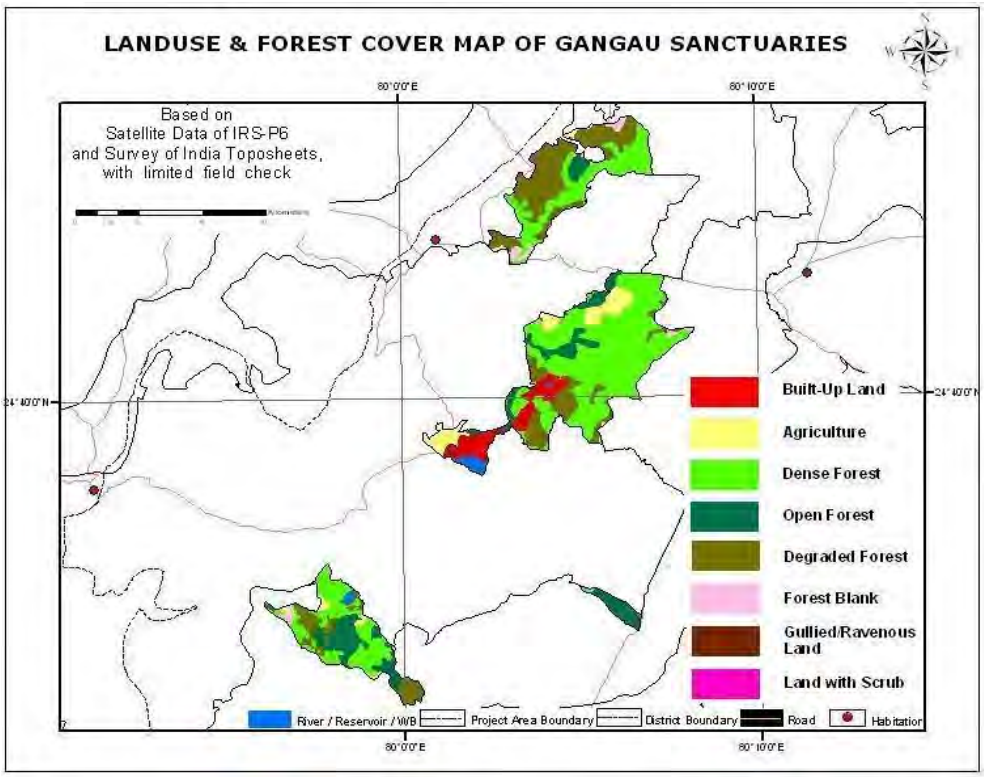
Fig- 4.3



4.4 LANDUSE & FOREST COVER OF GANGAU SANCTUARY

The spatial distribution of landuse and forest cover of 4 parts of the Gangau Sanctuary falling within proposed Panna BR is given in Map- 4.3 and the percentage of the areas for various uses is given in Fig 4.4. The area statistic of the same is given in Annex- 4:I

Map- 4.3



The sanctuary consist of 4 parts- Part-I, II, III & IV. These are located at the periphery of Panna National Park. It reveals that 86.69% of the area is covered under forest which is comparatively lower than the Panna National Park. The land covers under agriculture is 6.20% relatively higher than the Panna National Park. The agriculture is mainly confined to Part II and IV of the sanctuary. The built up land (5.62%) is only confined to Part II. The water bodies constitute 1.35%. These are only located in Part II and IV. The major chunk (49.30% of total Gangau sanctuary) of the forest comes under dense category. The open and degraded (scrub) forest together constitute (35.44% of total Gangau Sanctuary). Open forest is mainly confined to Part II and IV of the Sanctuary. Maximum area under degradation comes under Part I followed by Part II and IV. Thus the overall quality of the forest area can be said to be medium.

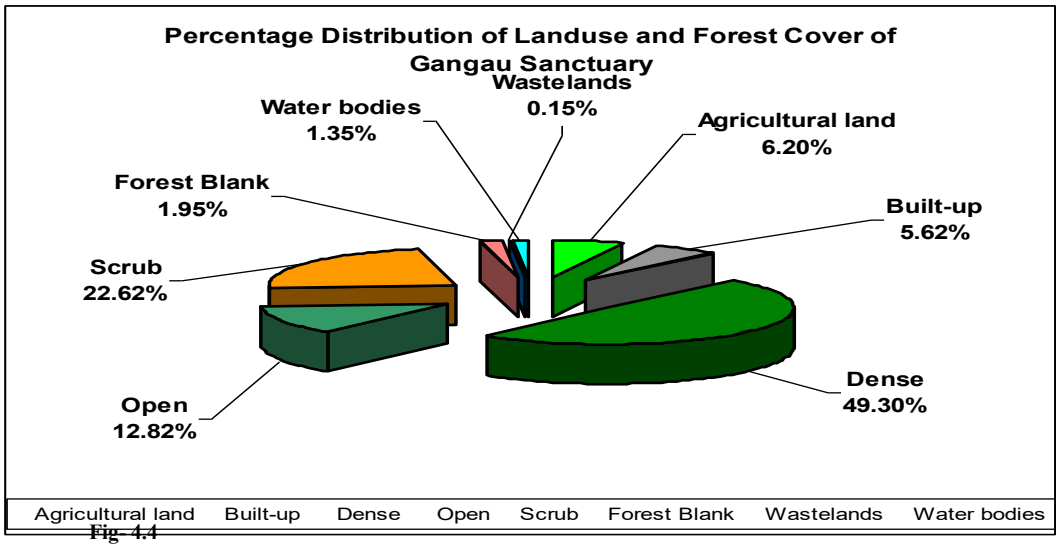
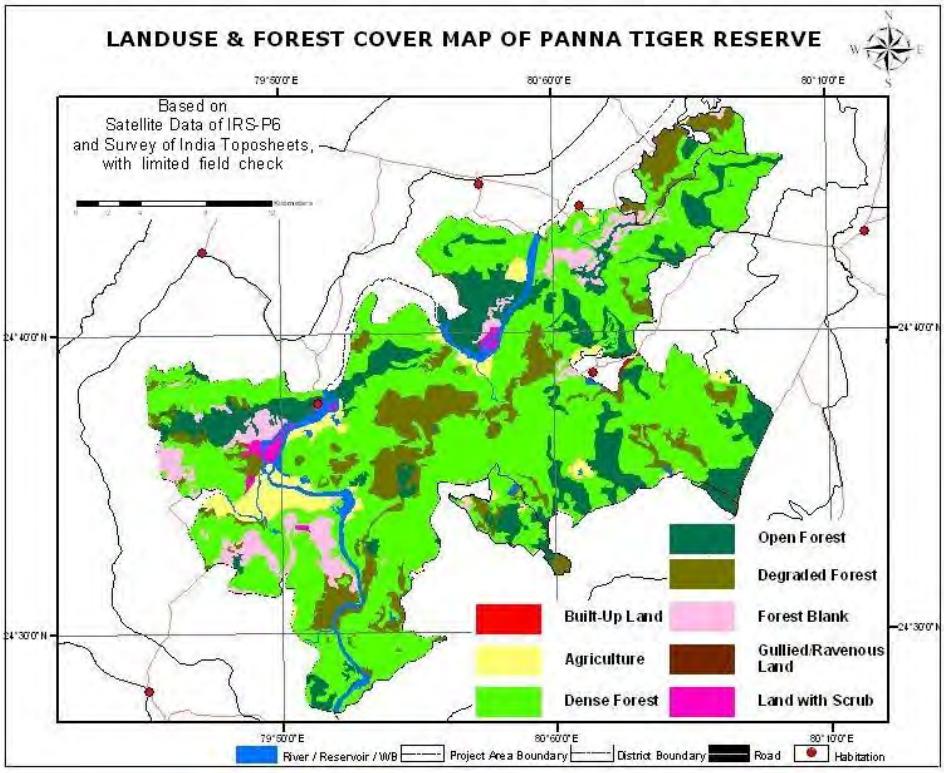


Fig. 4.4

4.5 LANDUSE & FOREST COVER OF PANNA TIGER RESERVE

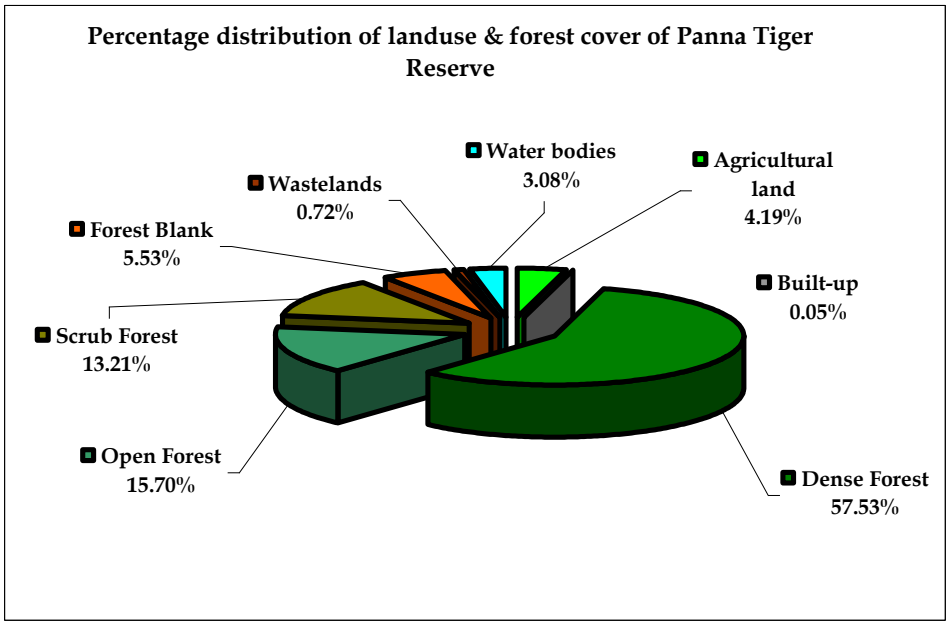
The spatial distribution of landuse and forest cover of Panna Tiger Reserve viz. entire part of Panna National Park and Part I, III and IV of Gangau Sanctuary falling within proposed Panna BR is given in Map- 4.4 and the % of the areas for various uses is given in Fig– 4.5. The area statistics is given in Annex- 4: II.

Map-4.4



It reveals that 91.97 % of the area is covered under forest and followed by agriculture (4.19 %) and water bodies (3.08%). The major chunk (57.53% of total area) of the forest comes under dense category. The open and scrub forest together constitute (28.91% of total Panna Tiger Reserve). Thus the overall quality of the forest area of Panna Tiger Reserve can be said to be excellent in line with Panna National Park.

Fig- 4.5



4.6 LANDUSE & FOREST COVER OF KEN- GHARIAL SANCTUARY

The spatial distribution of landuse and forest cover of the Ken- Gharial Sanctuary falling within proposed Panna BR is given in Map-4.5 and the percentage of the areas for various uses is given in Fig– 4.6. The area statistic of the same is given in Annex-4: III. It reveals that 56.66% of the area is covered under forest which is comparatively low as compared to Panna National Park and nearer to Gangau sanctuary. The land covers under agriculture is 27.87%, which is very high compared to Gangau sanctuary and Panna National Park. The agriculture is mainly confined towards eastern and southern Part of the sanctuary. The water bodies constitute 15.29%. This is also very high compared to both Gangau sanctuary and Panna National Park. These are confined to Ken River. The dense forest is only 6.67 % while the open type of forest covers 34.03 %. The dense forest is basically confined towards the central part and also within island due to bifurcation of the Ken River. The open forest is mainly confined to the central part of the sanctuary and also a small patch of the southern sanctuary. The There is no forest blank. The scrub type of forest constitutes 16.00% of the total area. On the whole quality of the forest can be said to be poorer.

Map- 4.5

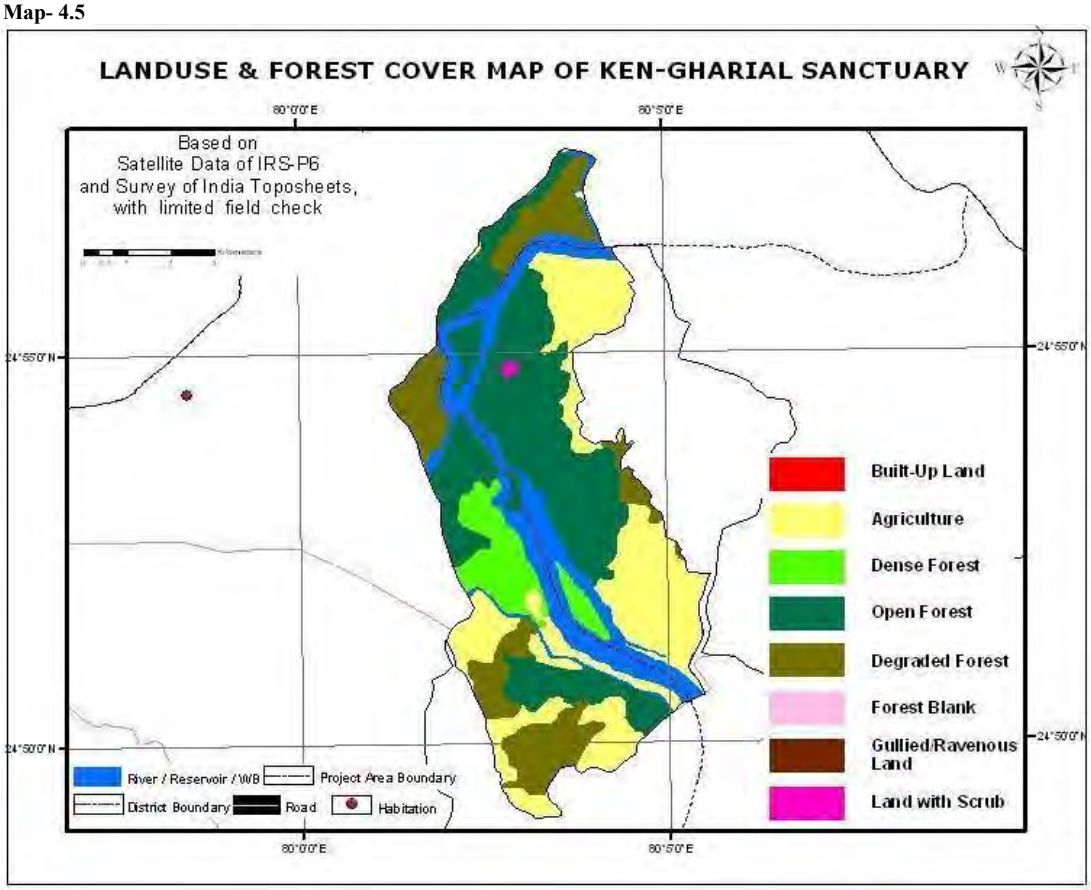
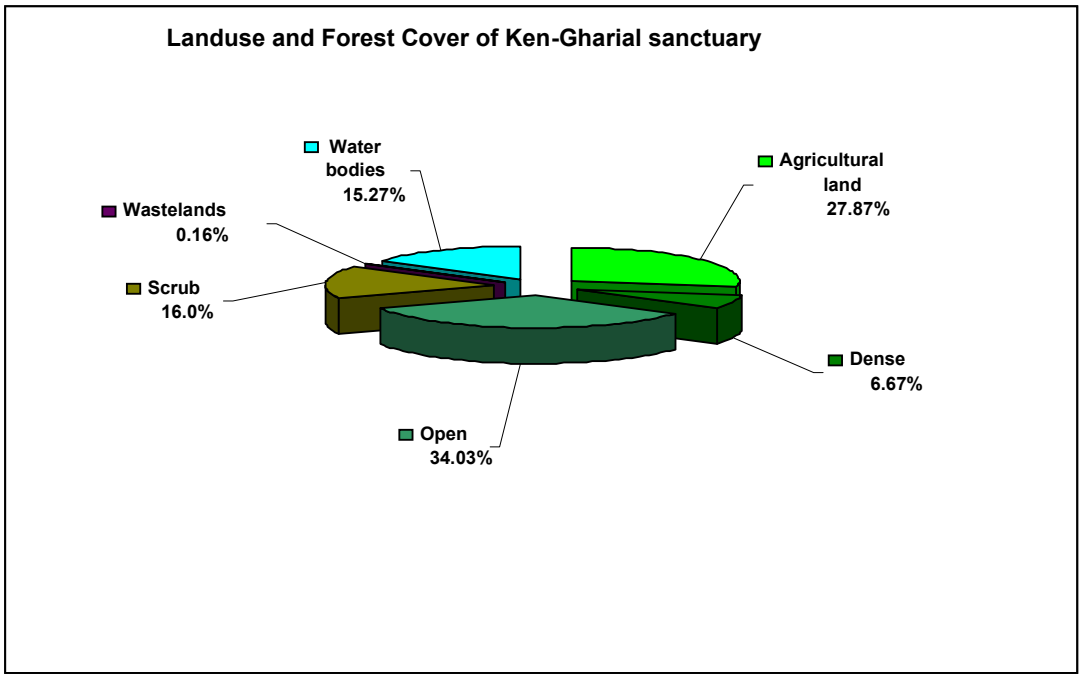


Fig- 4.6



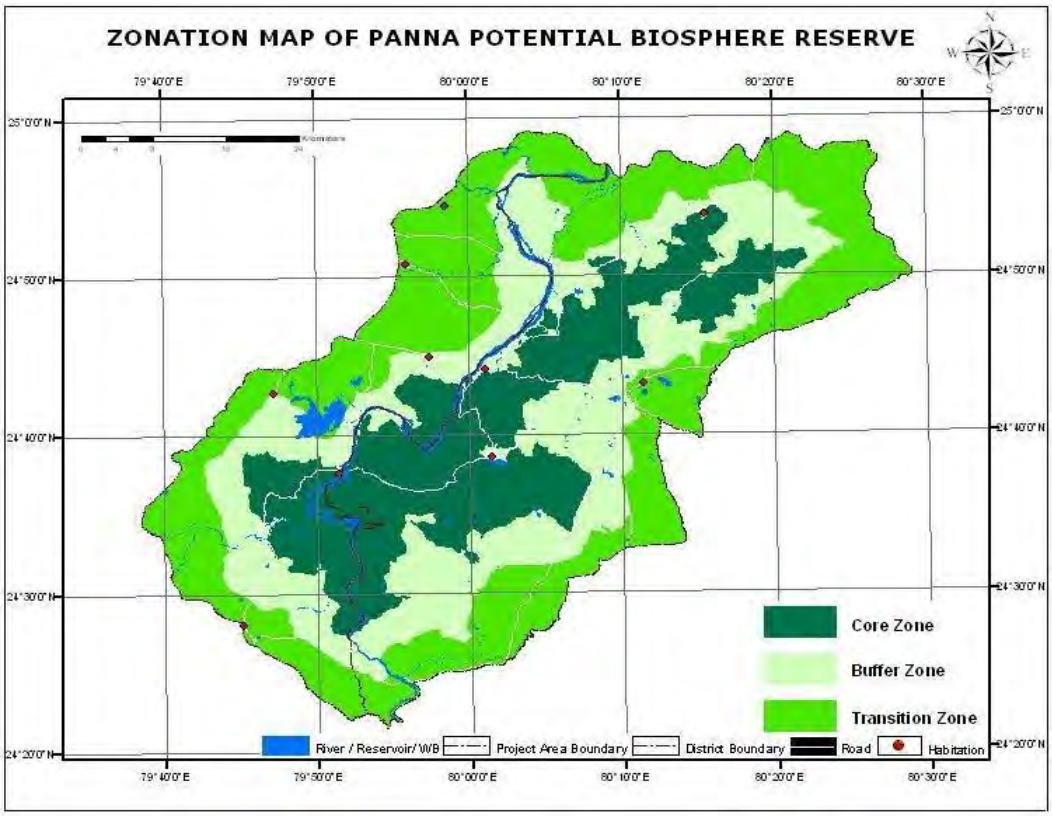
CHAPTER – 5

PROPOSED ZONATION

5.1 GENERAL

In order to undertake activities relating to biodiversity conservation and development of sustainable management aspect the BRs are the demarcated into 3 to 5 inter related zones. These are natural or core zone, manipulation or buffer zone, transition or restoration zone and stable cultural zones. In India three zones viz. core, buffer and transition zones are demarcated as per UNESCO's guidelines. Accordingly the entire area of proposed Panna BR has been divided into three zones viz. core, buffer and transition zones. The total area of core zone is 792.53 sq km viz. 26.43% total of BR while that of buffer zone is 987.20 sq km (viz. 32.92%). The remaining area of 1219.25 sq km (viz., 40.66% of total BR) comes under transition zone. The demarcation of the area is shown in Map-5.1 and Fig-5.1.

Map-5.1



5.2 *PAs AND RF/PF WITHIN PROPOSED BR*

The entire area of Panna National Park (18.71%) and parts I, III and IV of the Gangau sanctuary (1.33%) has been include in proposed core zone. Thus these PAs together constitute 20.05 % of the total BR area. Besides this, 6.38% area consisting of Reserved and Protected forests of North Forest Divisions of Panna has also been included in this zone thus covering 26.43 % of the total BR areas within PAs and forest areas. The entire areas of Ken - Gharial sanctuary (2.03%) and part II of Gangau sanctuary (1.53%) have been included in the proposed buffer zone. The areas other than PAs constitute 29.36%. It also includes reserve and protected forests. The remaining area (40.66%) of the proposed zone constituting forest, revenue and other areas is known as transition zone. The details of PAs and other areas are given in Table-5.1 and Map- 5.2.

Fig – 5.1

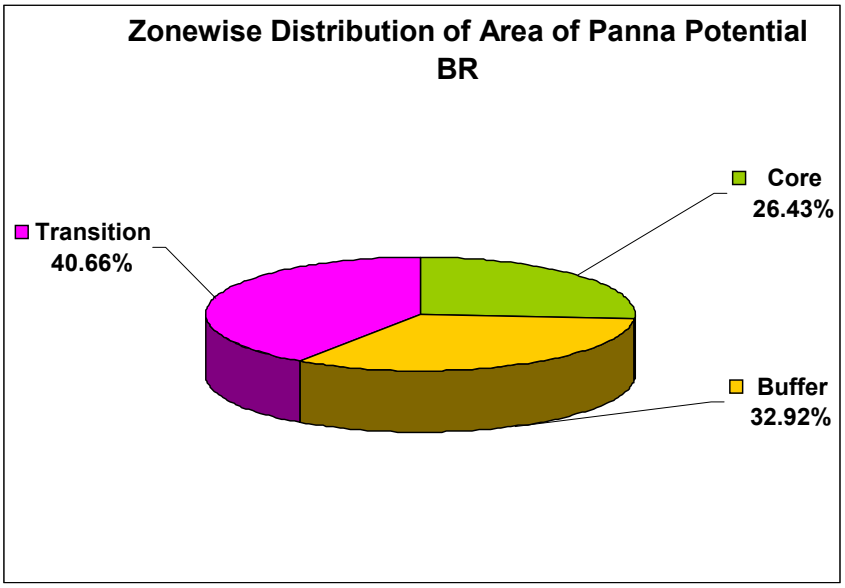
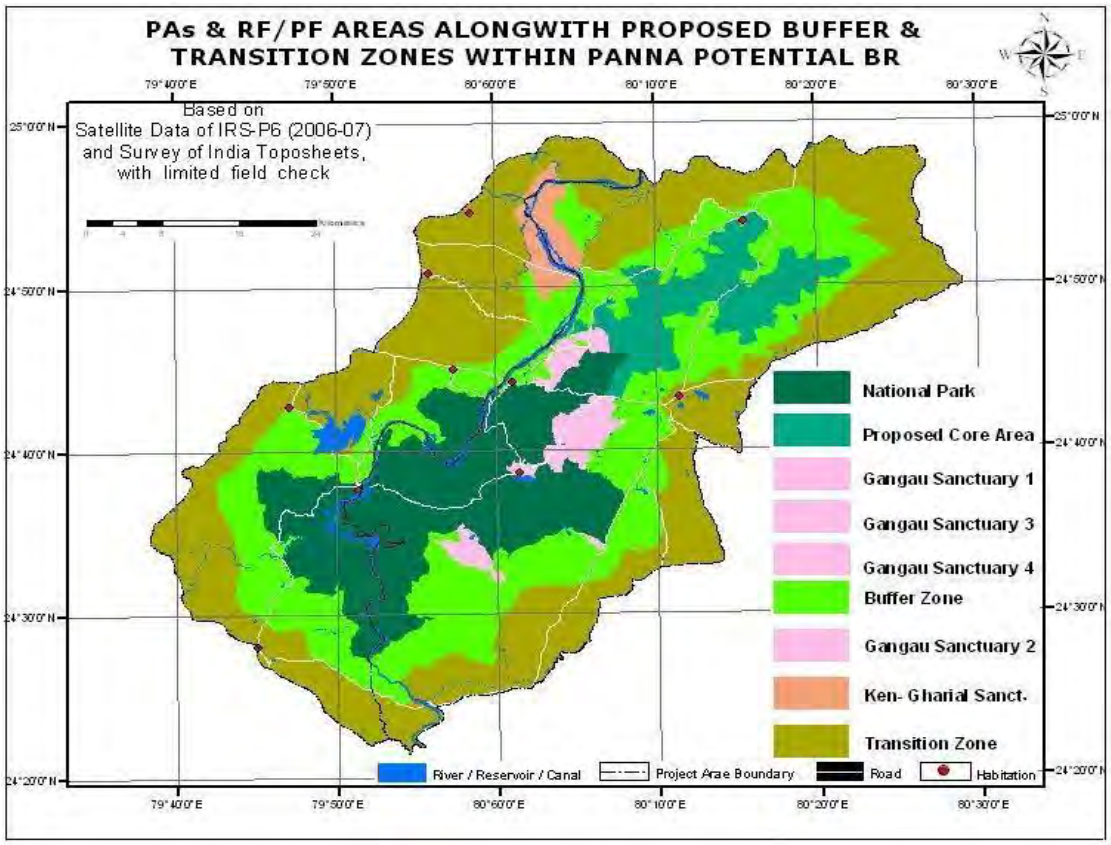


Table 5.1: Area details of PAs and other areas in various zones

S. No.	Name of zone	Area (sq km)	% (w.r.t. Total BR area)
A	**Core zone**		
1.0	Panna NP	561.22	18.71
2.0	Gangau sanctuary		
2.1	Part I	21.37	0.71
2.2	Part III	1.84	0.06
2.3	Part IV	16.75	0.56
	Total of Gangau Sanctuary	39.96	1.33
	Sub-total of PAs	601.18	20.05
3.0	Other areas falling in North Panna division	191.35	6.38
	Total area of core zone	**792.53**	**26.43**
B	**Buffer zone**		
1.0	Ken-Gharial Sanctuary	60.89	2.03
2.0	Gangau sanctuary Part II	45.88	1.53
3.0	Other areas	880.43	29.36
	Total area of buffer zone	987.20	**32.92**
C	**Transition zone**	1219.25	**40.66**
	Grand total	**2998.98**	**100.00**

Map - 5.2



5.3 CORE ZONE

The total number of villages lying in this area is 06 only. Out of this, 04 villages are located within Panna NP and remaining 02 within RF & PF. Of the total area 77.42% lies in Panna district and the remaining in Chhatarpur district (Fig-5.2). The area is mostly hilly. The landuse analysis of the area is given in Table – 5.3 and their percentage is given in Fig - 5.3. Of the total dense forest area 82.63% lies in Panna district and the rest in Chhatarpur district. In core zone, the area is dominated with forest cover (92.05% of the total area). Most of the area belongs to dense forest (61.43%). The open type of forest constitutes 13.63 % of the total area and that of degraded forest is 12.50%. Thus in core zone the overall quality of the forest is said to be excellent. Agriculture areas are only 4.91 % of the total area. In scattered area agriculture is being practiced. The area covered under river/ stream/canal constitutes only 2.21 % of the total area.

5.4 BUFFER ZONE

It surrounds the entire area of core zone. Overall numbers of villages are Ajaygarh. Like core zone maximum area (67.15%) comes under Panna district and rest in Chhatarpur district (Fig- 5.4). The details of the landuses of the buffer zone are given Table- 5.3 and the same is shown in Fig- 9.5. Of the total area 59.54 % is covered with forest. The dense forest cover is 22.34 % and that of open type of forest is 15.41 % while the degraded forest is 17.71%. Thus the

overall quality of forest can be said to be medium type. The agriculture area constitutes only 34.38% of the total area. The agricultural area is comparatively higher in this zone as compare to core zone while it is almost half compared to transition zone. The area covered under river/ stream/ canal constitute 3.03 % of the total area.

Fig – 5.2

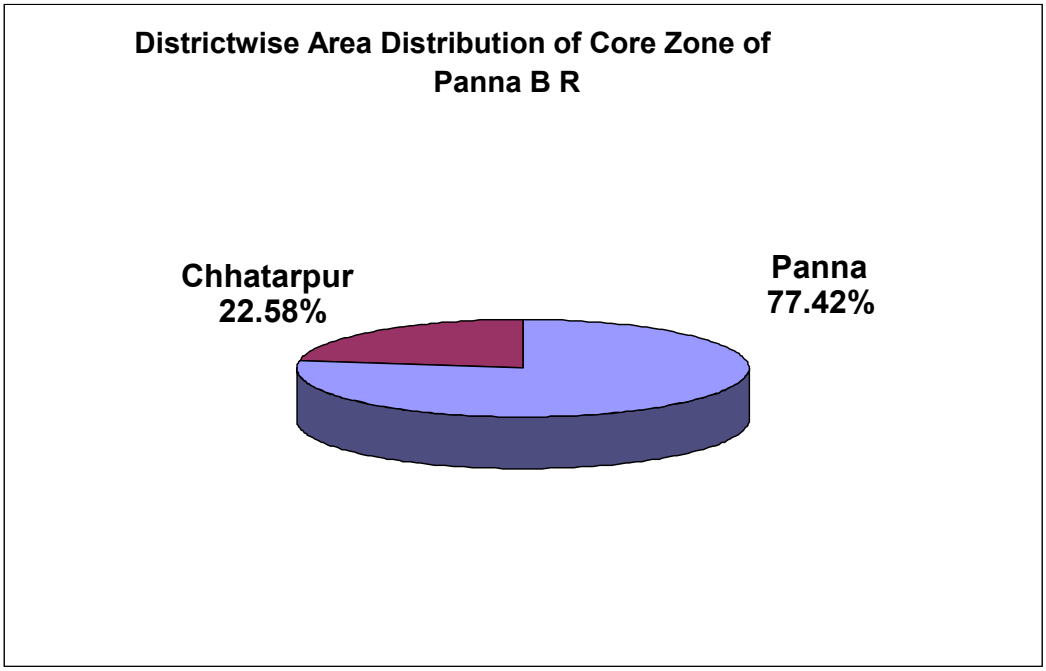


Table-5.2: Districtwise landuse/ forest cover of core zone of proposed Panna BR (Area in sq km)

S. No.	Category	Panna	Chhatarpur	Total
1.0	Built-up land	0.31	-	0.31
2.0	Agricultural land	23.88	15.07	38.95
3.0	Forest			
3.1	Dense	402.27	84.58	486.85
3.2	Open	75.66	32.35	108.01
3.3	Degraded	86.93	12.12	99.05
3.4	Forest Blank	12.97	22.64	35.61
4.0	Wasteland			
4.1	Gullied/ravenous land			
4.2	Land without scrub	0.05	1.19	1.24
4.3	Land with scrub	0.67	2.52	3.19
4.4	Stony Waste			
5.0	Water bodies			
5.1	River/Stream/Canal	9.18	8.30	17.48

5.2	Reservoir/Tank/Pond	1.64	0.20	1.84
	Total	**613.56**	**178.97**	**792.53**

Fig-5.3

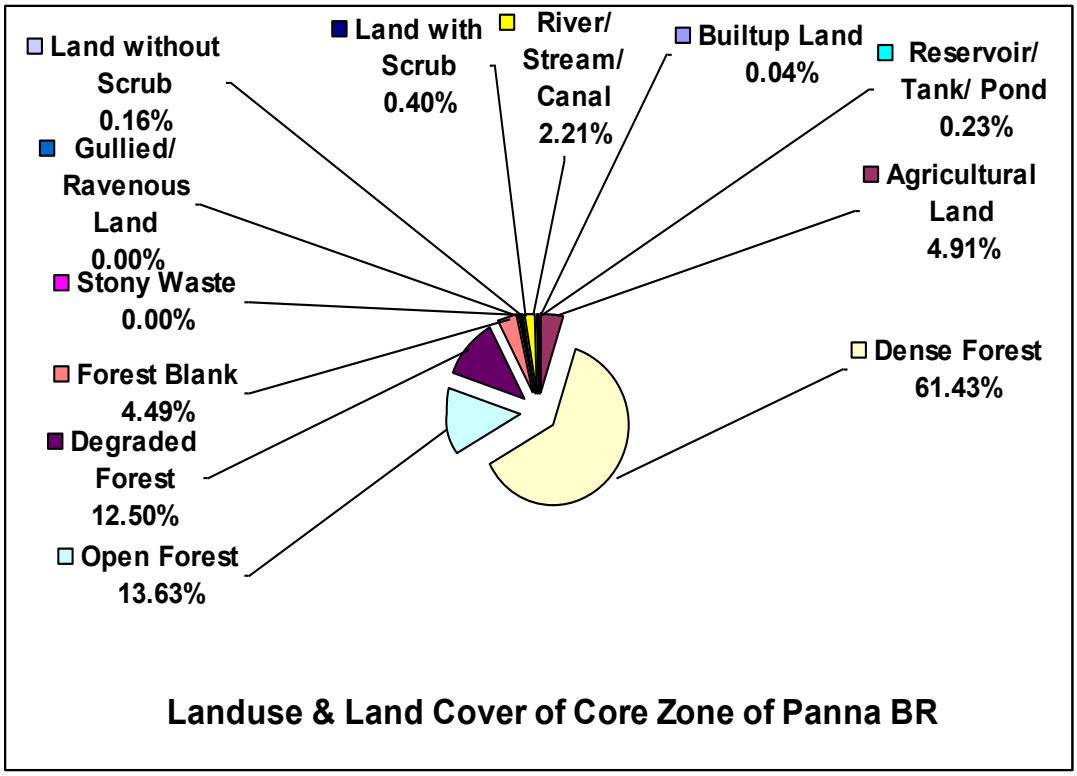


Fig –5.4

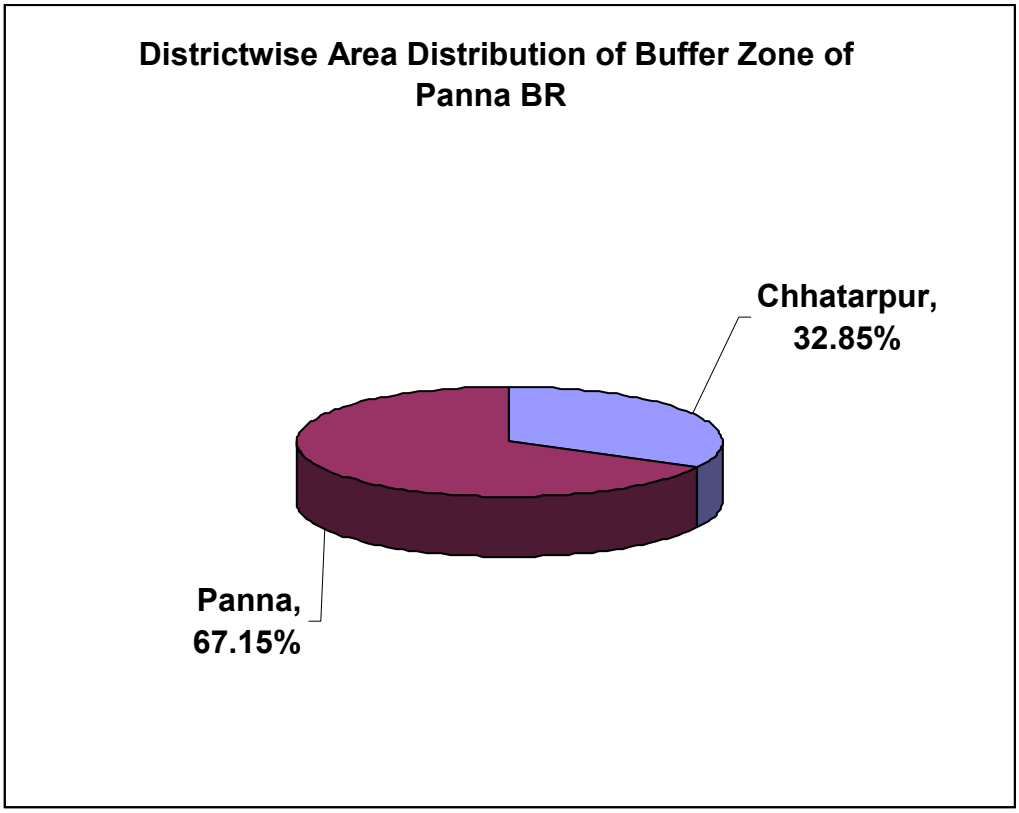
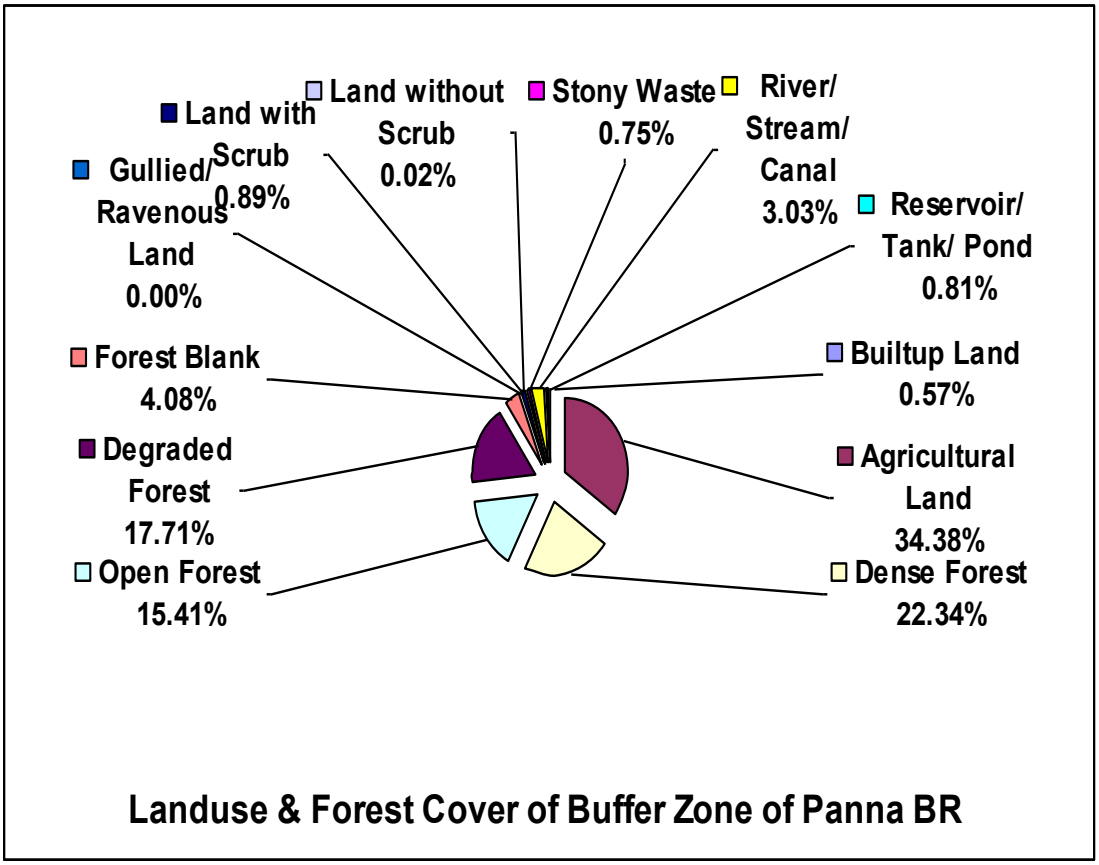


Table- 5.3: Districtwise landuse/ forest cover of buffer zone of proposed Panna BR (Area in sq km)

S.No.	Category	Panna	Chhatarpur	Total
1.0	Built-up land	5.55	0.09	5.64
2.0	Agricultural land	218.67	120.71	339.38
3.0	Forest			
3.1	Dense	143.82	76.76	220.58
3.2	Open	122.92	29.25	152.17
3.3	Degraded	119.66	55.19	174.85
3.4	Forest Blank	19.59	20.66	40.25
4.0	Wasteland			
4.1	Gullied/ravenous land	-	-	
4.2	Land without scrub	0.20	-	0.2
4.3	Land with scrub	2.95	5.83	8.78
4.4	Stony Waste	7.39	-	7.39
5.0	Water bodies			
5.1	River/Stream/Canal	17.86	12.09	29.95
5.2	Reservoir/Tank/Pond	4.32	3.69	8.01
	Total	**662.93**	**324.27**	**987.20**

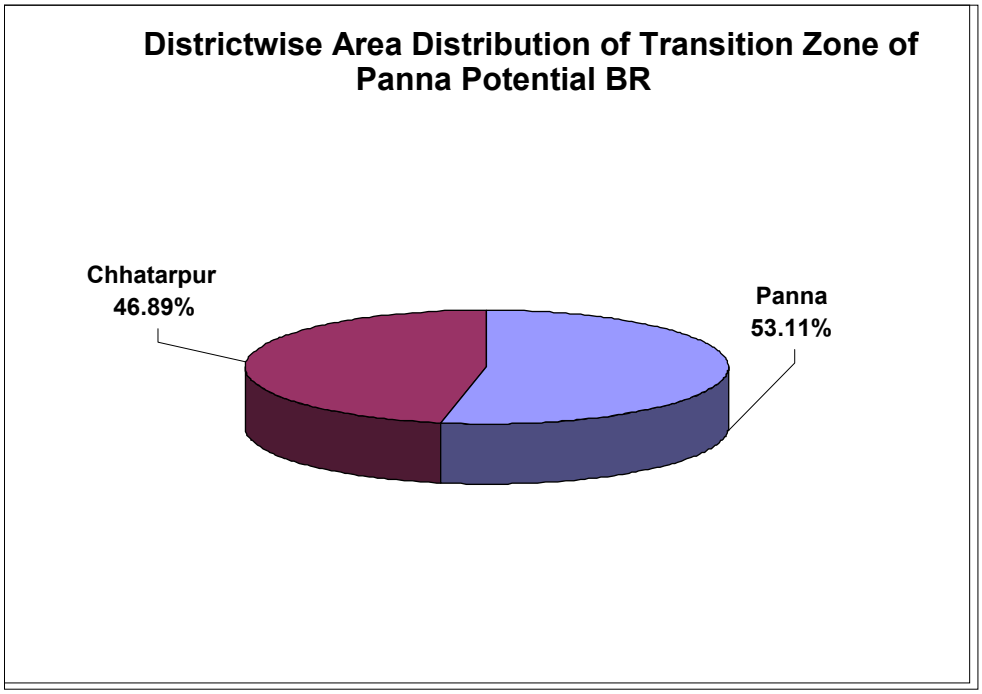
Fig – 5.5



5.5 TRANSITION ZONE

It is the outermost zone of the proposed BR. The human habitation is comparatively very high in this zone. The main urban area is Khajuraho which lies on outer periphery of the zone. Of the total area 53.11 % lies in Panna district ad the remaining 46.89 % lies in Chhatarpur district (Fig - 5.6).

Fig – 5.6



The landuse of the transition zone is given in Table- 9.4 and the same in graphical form is shown in Fig-5.7. Of the total area only 32.11% is covered under forest. In the transition zone the dense and open type of forest is almost in equal proportion (10.59% and 10.77 %, respectively). This is followed by degraded type of forest (07.39%).

The overall forest quality is very poor in this zone. The forest blanks are almost equal proportion in core, buffer and transition zone. Agriculture area constitutes 61.05 % of the total area. Thus agriculture practices are dominant in this area. Agricultural crops are extensively grown within this zone.

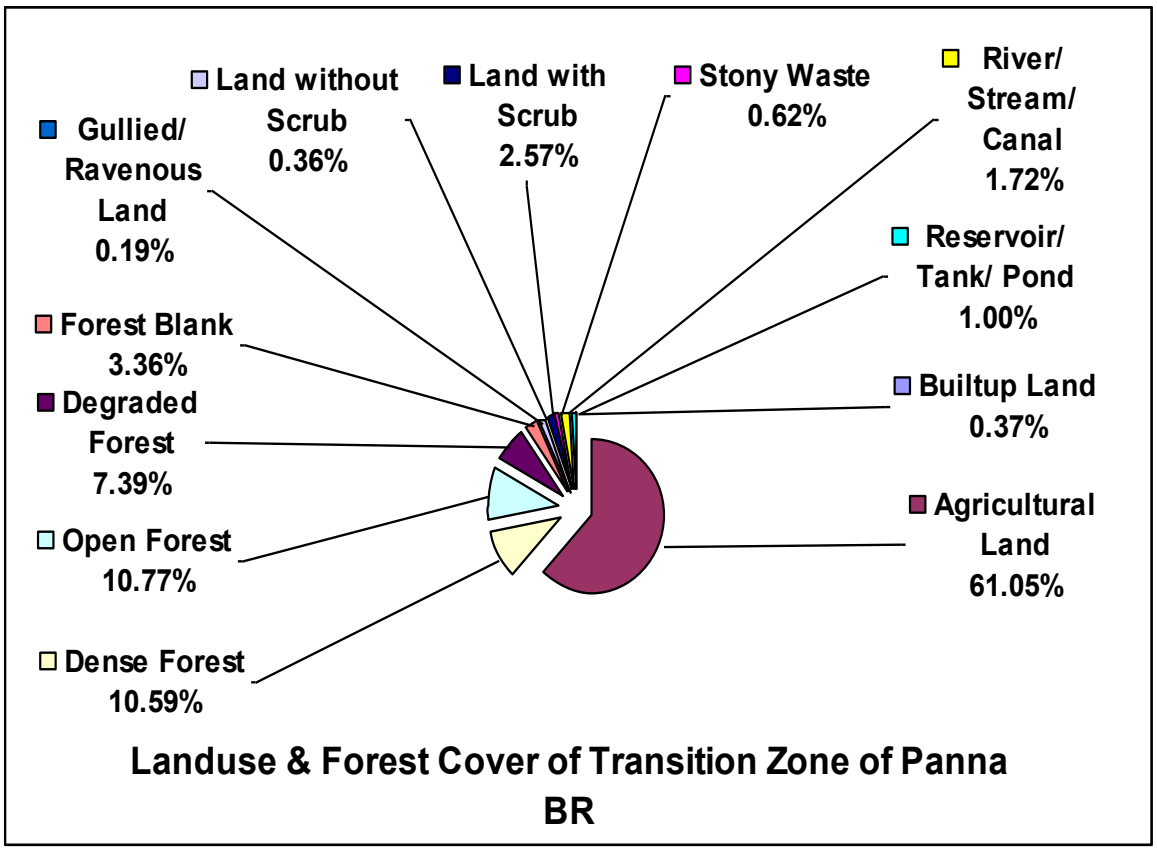
The areas occupied under river/ streams/ canals constitute only 1.72 %. Thus it is comparatively lower than the buffer zone. The maximum area covered as wasteland is recorded (3.75%) in the transition zone, followed by buffer zone (1.66%) and the least (0.56%) in the core zone. The area under water bodies account maximum (3.85%) in buffer zone, followed by transition zone (2.73%) and the least 2.44% in core zone.

Table- 5.4 Districtwise landuse/ forest cover of transition zone of proposed Panna BR (Area in sq km)

S. No	Category	Panna	Chhatarpur	Total
1.0	Built-up land	2.76	1.71	**4.47**
2.0	Agricultural land	367.56	376.77	**744.33**
3.0	Forest			
3.1	Dense	82.87	46.23	**129.1**
3.2	Open	86.33	44.98	**131.31**

3.3	Degraded	37.74	52.42	**90.16**
3.4	Forest Blank	38.27	2.66	**40.93**
4.0	Wasteland			
4.1	Gullied/ravenous land	-	2.34	**2.34**
4.2	Land without scrub	0.79	3.60	**4.39**
4.3	Land with scrub	18.14	13.19	**31.33**
4.4	Stony Waste	1.31	6.31	**7.62**
5.0	Water bodies			
5.1	River/Stream/Canal	8.68	12.34	**21.02**
5.2	Reservoir/Tank/Pond	3.13	9.12	**12.25**
	Total	**647.58**	**571.67**	**1219.25**

Fig –5.7



CHAPTER – 6

BIO-GEOGRAPHY, FLORA & FAUNA

6.1 BIO-GEOGRAPHY OF THE AREA

The area falls under bio-geographic zones of Deccan Peninsula 6 and covering Biotic Province of Central highlands 6(A). However, it is nearer to confluence of Deccan Peninsula (Central Highlands 6 (A) Upper Gangetic Plain 7 (A)) and semi-arid Gujrat Rajputana (4B) Biotic Provinces. From agro-climatic zone point of view, it falls under Bundelkhand and Kymore plateau of Satpura hill ranges. The entire area falls under Survey of India toposheets nos. 63 D/ 1, 2, 3, 5, 6, 7and 54 P/9,10, 11, 13, 14 & 15.

The proposed Panna Biosphere Reserve is narrow belt of flat topped 'Vindhyan Hill Ranges' and part of 'Bundelkhand' region locally known as Panna, Ajaigarh and Vindhyachal hills in different places. Beveled summits and steep valleys mark the dissected plateau in Panna and Chhatarpur area. Panna and Ajaigarh ranges are mere prominences left standing while the surrounding parts have disappeared in prolonged denudation, which these regions have undergone (Wadia, 1961).

The typical rock of the region is popularly termed as 'Bundelkhand gneisses', which is a misnomer. Infact the granite and gneisses are both conspicuous in which the former predominates. The gneisses of area are 'bedded' ones, which had been subjected to powerful external force and are slightly folded and largely fractured.

In the South West part of the proposed area rocks of Bijawar series are present. The series present a contorted arrangement of very hard and soft rocks and are chiefly composed of massive quartzite sandstones and granitic sandstones.

On the Northern and North Eastern edges of the area, there lie Kimberlite Breccia rocks, which bear the diamonds. The part of the dissected plateau on which the area lies has undulating topography. In its South West part there are deep gorges. The averages attitude of the area is 400 m above MSL. However, the entire Panna BR looks as if it has three altitudinal levels. The Northern hills have an average height of 380 m. The Central part of the BR is even higher and attain an averages height of 440 m but the South Western hills attains more than 470 m height. Although the entire region is highly dissected but there are flat plains in the different levels. The high peaks 480 m are dispersed all over the Panna National Park area. From the West bank of river Ken near Raipura village if one moves towards South Eastern part, three different mountainous successive heights are clearly discernable. At

Raipura the river flows at 200 m attitude, an abrupt height of more then 200 m is within 2 km distance of the eastern bank of the river where a small flat area with an altitude of 430 msl is seen. Another altitudinal layer of 475 m is found in another 10 km, and then comes the highest layer of 480 msl. In this way the first attitudinal difference is relatively more pronounces. In the proposed Panna BR area, Ken descends about 75 km from South to North. Based on agro-climatic classification the area is represented by Bundelkhand and Kymore plateau of Satpura hill ranges.

6.2 FLORAL ATTRIBUTES

The vegetational area of the proposed Panna BR covers Panna North Forest Division and South Forest Division (partial area of Amanganj range) of Panna District and Chhatarpur Forest division (Partial areas of three ranges namely Bijawar, Rajnagar and Laundi) of Chhatarpur and two sanctuaries namely Ken- Gharial and Gangau along with Panna National Park. The onset of winter results in the defoliation of most of the forest trees. As the weather warms up in March, new foliage appears which flowering and fruiting follow. The seasonal vegetation mainly consists of annuals and biennials. In broad sense vegetation of the area may be classified as forests, seasonal vegetation and, aquatic and marshy vegetation.

6.2.1 Forests

Referring to the classification of Champion and Seth (1968) forest type of proposed area falls under Tropical Dry Deciduous Forest. These forest are not very dense and the trees height vary from 12-15 m. Overgrazing, unrestricted felling of trees for fuel, timber and agriculture resulted in formation of dry deciduous scrub forests as secondary serial type. Based on vegetation composition, the forest area may be divided into following types:

- Southern Tropical Dry Deciduous Teak Forest
- Northern Tropical Dry Deciduous Mixed Forest
- Dry Deciduous Scrub Forest.
- Salai Forest
- Dry Bamboo Brakes
- Kardhai Forest

Southern Tropical Dry Deciduous Teak Forest: Dry Teak forest occurs on trap, shales, granites, gneisses and sandstones. The growth is good in the Ken valley where soil is sandy loam and water table is high. But shallow soil and low water table on the plateaus produce stunted and sparse tree growth. Percentage of teak varies from about 65% of the crop in better site quality areas to around 25% in poor quality areas. The proposed BR is almost the northern boundary of natural teak forest in the country.

The associated tree species are Dhaora (*Anogeissus latifolia*), Saja (*Terminalia tomentosa*), Tendu (*Diospyros melanoxylon*), Lendia (*Lagerstroemia parviflora*),

Amla (*Emblica officinalis*), Tinsa (*Ougeinia ogeinensis*), Bija (*Pterocarpus marsupium*), Moyan (*Lannea coromandelica*), Salai (*Boswellia serrata*), Achar (*Buchanania lanzan*) etc. The underwood consists of Kari (*Saccopetalum tomentosum*), Papra (*Gardenia latifolia*), Bel (*Aegle marmelos*), Dudhi (*Holarrhena antidysenterica*), Amaltas (*Cassia fistula*), Khair (*Acacia catechu*), Ghont (*Zizyphus xylopyra*). The undergrowth is composed mainly of Karonda (*Carissa opaca*), Siharu (*Nyctanthes arbortristis*), Marorphali (*Helectris isora*), Thuar (*Euphorbia neriifolia*), Dhawai (*Woodfordia fruticosa*), Bamboo (*Dendrocalamus strictus*), Lantana (*Lantana camara*). The common herbs are Chhind (*Phoenix sylvestris*), Neel (*Indigofera* spp.), Makor (*Zizyphus oenoplia*), Chilaiti (*Acacia caesia*), Gumehi (*Abrus precatorius*). The main grass species are Kusal/ Lampa (*Andropogon contortus*), Bhurbhusi (*Eragrostis tenella*), Gunher (*Anthesteria ciliata*).

Northern Tropical Dry Deciduous Mixed Forest: Dry mixed forest occurs mainly on sandstones, shales and laterites where the soils are shallow to fairly deep, sandy, lateritic and red loam. These forests are more prone to fires and have been subjected to heavy cattle grazing in the past. The common tree species include Saja (*Terminalia tomentosa*), Dhaora (*Anogeissus Latifolia*), Seja (*Legerstromia parviflora*), Tendu (*Diospyros melanoxylon*), Mahua (*Madhuca latifolia*), Haldu (*Adina cordifolia*), Rohan (*Soymida febrifuga*), Kaim (*Mitragyna parvifolia*), Moyan (*Lannea grandis*), Ghont (*Zizyphus xylopyra*), Salai (*Boswellia serrata*), Kahua (*Thespesia populnea*), Jamun (*Syzygium cuminii*), Kusum (*Schleichera oleosa*) and some teak (*Tectona grandis*). The underwood consists of Amla (*Emblica officinalis*), Achar (*Buchanania lanzan*), Kari (*Saccopetalum tomentosum*), Amaltas (*Cassia fistula*), Khair (*Acacia catechu*), Kardhai (*Anogeissus pendula*), Bamboo (*Dendrocalamus strictus*), Ghont (*Zizyphus xylopyra*), Papra (*Gardenia latifolia*), Reonjha (*Acasia lencophilis*), and Palas (*Butea monosperma*). The undergrowth consists of Siharu (*Nyctanthes arbortristis*), Dhawai (*Woodfordia fruticasa*), Marorphali (*Helicteres isora*), Karonda (*Carissa opaca*), Jharberi (*Zizyphus rotundifolia*), Thuar (*Euphorbia neriifolia)* and Baikal (*Gymnosporia montana*). Makor (*Zizyphus oenoplia*), and Palasbel (*Butea superba*) are common climbers while common grasses are Bhurbhusi (*Eragrostis tenella*), Lampa (*Andropogon contortus*), Phulai (*Apluda mutica*), Gunher (*Anthesteria ciliata*), Marwel (*Dicanthium annulatum*) and Doob (*Cynodon dactylon*).

Dry Scrub Forest: Dry scrub forest is the degradation of teak and mixed forests and is met within areas adjacent to villages and cultivation. Retrogression due to heavy felling, clearance of land for cultivation, heavy cattle grazing and browsing and frequent forest fires can be easily seen. Soil erosion by formation of gullies is common. The under stocked areas of the above mentioned two types of forest generally give rise to this type of forest. Most of the tree species are stunted and sparsely grown. Overwood and underwood are not differentiable due to stunted growth. Grasses in the mixed forests mentioned above are more prominent here as they attain good height

and good density wherever protection is better. Palash (*Butea monosperma*) is more common and appears to be increasing. These forests occur on flat to gently sloping plateaus.

Salai Forest: Salai (*Boswellia serrata*) forest occurs on dry upper slopes of hills having dry shallow and stony soils. Salai sometimes becomes pure on the ridges like in parts of Talgaon and Kawar beats. The common associates are Kaim (*Mitragyna parvifolia*), Moyan (*Lannea grandis*), Dhaora (*Anogeissus latifolia*), Saja (*Terminalia tomentosa*), Seja (*Legerstromia parviflora*), Dhoban (*Dalbergia paniculata*), Tendu (*Diospyros melanoxylon*), Tinsa (*Ougeinia ogeinensis*), Amla (*Emblica officinalis*), Rohan (*Soymida febrifuga*), Ghont (*Zizyphus xylopyra*), Dudhi (*Calotropis procera*), Papra (*Gardenia latifolia*), Phetra (*Gardenia turgida*), Amaltas (*Cassia fistula*), Achar (*Buchanania lanzan*), Khair (*Acacia catechu*) etc. Makor (*Zizyphus oenoplia*), and Gumeihi (*Abrus precatorius*) are common climbers while Bhurbhusi (*Eragrostis tenella*) and Lampa (*Andropogon contortus*) are the common grasses.

Dry Bamboo Brakes: Dry bamboo brakes are represented by the only bamboo species- *Dendrocalamus strictus* which is found as under storey of teak and mixed forests. Bamboo does not occur in pure stands. It occurs on the slopes of hills, in the upper reaches of Nallas and occasionally along the banks of streams. Well protected valleys and certain other areas of beats like Manour, Pipartola, Raipura, Patan, Sukwaha, etc., have started showing better growth and healthy clump formation in bamboo, but the areas which were over exploited in the past and which are closer to habitations still have poorly developed clumps with quickly drying culms.

Kardhai Forest: Kardhai (*Anogeissus pendula)* forest is an edaphic sub-type. It occurs mainly in a long strip of small width in the foothills from Pipartola to Gangau dam along Ken River on both the banks. Teak intrudes in some patches to break the strip. Here the growth of teak is not significant but that of Kardhai is very good which is often gregarious with almost full crown density. Growth of Kardhai is luxuriant in Sukwaha Ghat and in North Khamri beat, near Gherighat. The area is almost the eastern most limit of Kardhai natural forest.

6.2.2 Seasonal Vegetation

A remarkable feature of the vegetation is the change that sets in with the advancement of season. Basically rainy, winter and summer seasons have been distinguished for the study of seasonal vegetation.

Rainy Season: Following the first fall of rains towards the end of June or early July, the almost barren ground begins greening up in patches. Among the invaders species the mention may be made of *Euphorhia prostrata, E. thymifolia*, *E. hypericifolia*, *Tribulus terrestris*, *Cleome viscosa, Cyperus triceps*, *C. rotundus*, *Eclipta alba*, *Phyllanthus fraternus*, *Brachiaria ramosa*, *Cynodon dactylon*. About

two or three weeks later a variety of grasses sprout up and the whole ground appears a green carpet. By the middle of July several species of other groups are also found growing with the grasses. Some of the common species viz., *Acalypha ciliata, Azadirachta indica, Acanthospermum hispidum*, *Achyranthes aspera*, *Aeschynomene indica*, *Alysicarpus hamosus*, *Alysicarpus monitifer* etc., become abundant and are most noticeable plants because of their flowers.

On the boundaries of fields and gardens and on roadside thickets, a number of twiners and climbers inhabit. These provide protection, beauty and reduce the wind velocity. Conspicuous among them are: *Canavalia virosa*, *Cardiospermum ha;ocacabum*, *Cayratia trifolia*, *Clitoria ternatea*, *Coccinia grandis*, *Cuscuta reflexa*, *Ipomea* spp., *Momordica dioica*, *Mucuna pruriens*, *Mukia maderaspatana*, *Pergularia daemia*, *Teramnus labialis* and *Trichosanthes cucumerina*, A beautiful orange red flowered herbaceous climber *Gloriosa superba*, also occurs in roadside hedges and thickets. Flowering shoots of most of monocots die off by the middle of the rainy season after flowering.

The optimum temperature and moisture conditions for plant growth are obtained during the rainy season when the vegetation attains a luxuriant growth. Most of the species of this season complete their flowering and fruiting by the end of September or October when the sky gets cleared and provides longer hours of sunshine. The bulk of rainy season vegetation disappears towards the end of October with the same rapidity as it came up during the rains.

Winter Season: With the commencement of winter season, temperature goes down and top soil as atmosphere become dry. By this time mostly species of high altitude make their appearance. Notable among are: *Alternaria* spp., *Anagalis arvensis*, *Argemone maxicana*, *Asphodelus tenuifolius*, *Blumea* spp., *Canscora diffusa*, *Centipeda minima, Cochlearia cochleariodes*, *Gnaphalium* spp., *Lathyrus aphaca*, *L. sativa*, *Launaea procumbens*, *Medicago polymorpha*, *Melilotus alba*, *M. indica*, *Phalaris minor*, *Polypogan monspeliensis*, *Salvia plebeia*, *Sonchus oleraceous*, *Spergula fallax*, *Sutera dessecta*, *Tenagocharis latifolia*, *Verbascum chinense*, *Vicia hirsuta* and *V. sativa*.

Towards the end of winter season, the seasonal ponds ditches and most of the Nallas dry up. The moist swampy soil along their edges is very rich in organic matter. The common species growing in these habitats are: *Ammannia baccifera*, *Bergia ammannioides*, *Eragrostis gangetica, E. unioloides, Hemiadelphis polyspermus*, *Oldenlandia corymbosa*, *Potentilla supina*, *Rotala indica*, *Rumex dentatus*, and *Sacciolepis interrupta*.

Summer Season: The decreasing moisture content, increasing temperature and high velocity of winds during March and April result in disappearance of most of herbaceous flora except those growing in somewhat moist habitats. Very few plants grow during summer months and thus most of the open

areas appear barren. Most of the plants in dry habitats show various xerophytic features such as thorns, coating of wax, thick cuticle, leathery foliage, woolly tomentum or stellate hairs. Typical plants in this season include *Alternanthera pungens*, *Chrozophora prostrata*, *C. rottleri*, *Crypsis schoenoides*, *Echinops echinatus*, *Glinus lotoides*, *Glossogyne bidens*, *Gomphrena celosiodes*, *Grangea maderaspatana*, *Heliotropium ovalifolium*, *H. supinum*, *Oligochaeta ramosa*, *Phyla nodiflora* and *Solanum surattense*. Some species persist under the shade of trees shrubs and hedges. These are: *Abutilon indicum*, *Ageratum conyzoides*, *Amaranthus spinosus*, *A. viridis*, *Biophytum sensitivum*, *Blumea eriantha*, *B. oxyodonta*, *Cancora diffusa*, *Chenopodium murale*, *Emilia sonchifolia*, *Hoppea dichotoma*, *Lindernia ciliata*, *Oxalis corniculata*, *Tridax procumbens*, and *Vernonia cinerea*.

6.2.3 Aquatic and Marshy Vegetation

The common habitats for aquatic and marshland species are rivers, lakes, ponds and several Nallas. Besides, these rainy season pools, ditches and depressions along the roads and villages also provide good habitat for many water plants. Based on the habitat and location, these plants may be placed in any group as listed below:

Free floating forms: These plants are in contact with water and air only. They are represented by: *Spirodela polyrhiza*, *Pistia stratiotes*, *Eichhornia crassipes*, *Trapa natans* var. *bispinosa*.

Attached forms with floating plants parts: These are in contact with soil and water as well as air. Roots are fixed in mud. The species falling in this category are: *Nymphaea nouchali*, *N. pubescens*, *Netumbo nucifera*, *Nymphoides hydrophylla*, *N. indica*, *Ottelia alismodies*, *Sagittaria guayanennsis*, *Aponogeton natans*, *Potamogeton nodosus*, *Hygroryiza aristata*, *Ipomoea aquatica*, *Pseudoraphis spinescens*, *Ludwigia adscendens*, *Panicum paludosum*, *Paspalum vaginatum* etc.

6.3 FLORISTIC DIVERSITY

The proposed Panna Biosphere has a rich diversity of flora. The inventory on floristic survey is basically based on Doctoral works of Ramesh Kumar (2004), publication of Sharma (1997), Sexena (1980), Upreti (2002), the floristic diversity of Chhatarpur and Damoh district (Hooker, 1904) and other published literature. Besides these the information related to vegetational spectrum has also been taken from Management Action Plans of Forests Division of both the districts, National Park and Sanctuaries falling in BR.

The area is very rich in several species belonging to Thallophytes, Bryophytes and Angiospermic plants species (Table - 6.1). Out of these algae comprises of 241 species in 5 families (Sharma, 1997). There are 14 species of lichens belongs to 6 families in the area (Upretti, 2002). Saxena (1980) had reported 10 species of bryophytes belonging to 6 genera in the area. A total of 982 species of angiosperms found belonging to 587 genera and 136 families have been reported. Out of these 255 species belonging to 136 genera and 31 families are related to monocots while 727 species belonging to 587 genera and 105

families are related to dicots. The study carried out earlier on floristic diversity of Chhatarpur & Damoh district recorded 881 species of 128 families in 529 genera (Hooker, 1904). This reveals that the flora of proposed BR is overall much diverse and rich in floristic diversity of the adjoining areas. The detailed list of all plant species of the area is given at Annex – 6: I.

Table 6.1: Total plant species recorded in the Proposed BR area

S. No	Group	Family	Genera	Species
1	Thalophytes			
	Algae	05	90	241
	Fungi			
	Lichens	06	08	14
	Sub-total	11	98	255
2	Bryophytes	04	06	10
3	Pteridophytes	04	04	04
4	Gymnosperms	03	04	04
5	Angiosperms			
	Dicotyledons	105	451	727
	Monocotyledons	31	136	255
	Sub-total	136	587	982
	Grand Total	**158**	**699**	**1255**

The ratio of monocotyledons to dicotyledons is 1:3.38 for the families, 1:3.32 for the genera and 1:2.85 for the species. The percentage of dicotyledonous species and monocotyledon is 74.03% and 25.97%, respectively while the percentage of the world flora is 81.30% and 18.70%, respectively. Thus the percentage of monocotyledons in Panna BR is relatively higher as compared to the percentage of monocotyledons of the world flora. It is due to the larger number of grass species in the area.

Table 6.2: Percentage distribution of Angiospermic plants

Particular	Dicotyledons (%)	Monocotyledons (%)
Families	77.21	22.79
Genera	76.83	23.17
Species	74.03	25.97

The number of genera and species found in 12 dominant families are given in Table 6.3. Out of these 10 families are represented by dicot and the remaining are represented by monocot. The detailed list of genera and species distributed in each family is given in Annexure– 6: II. Amongst them 22 families are adequately (more than 10 species) represented in case of dicot while the same is represented by only 4 families of monocot viz., Poaceae (134 spp), Cyperaceae (45 spp), Liliaceae (10) and Commellinaceae (10).

Table 6.3: Twelve dominant families w.r.t. descending order of species of Proposed Panna BR

Family	Genera	Percentage	Species	Percentage
Poaceae	72	12.27	134	13.65
Leguminosae	41	6.98	90	9.16
Asteraceae	39	6.64	57	5.80
Cyperaceae	7	1.19	45	4.58
Euphorbiaceae	18	3.07	41	4.18
Lamiaceae	15	2.56	26	2.65
Convolvulaceae	10	1.70	26	2.65
Acanthaceae	19	3.24	25	2.55
Malvaceae	12	2.04	24	2.44
Rubiaceae	15	2.56	20	2.04
Caesalpinaceae	07	1.19	20	2.04
Scrophulariaceae	14	2.39	19	1.93
Total	**269**	**45.83**	**527**	**53.67**

The perusal of table reveals that 53.67% species and 45.83 % of genera are confined to 12 dominant families. The proportion of genera to species for the proposed Panna BR is 1: 1.68. The same is approx. 1: 13 for the world, 1:7 for India. However, it is more or less in conformity with the ratio of 1: 2.45 for Madhya Pradesh, 1: 1.50 for Bhopal. This shows the small proportion of species to the number of genera in study area. This is in accordance with the general law that flora of small area and remote islands are respectively richer in orders and genera than species.

6.4 FLORISTIC GENE POOL RESERVE

The proposed BR area has ideal habitats and is abode of many rare and medicinally important species. However, these areas are also heavily impacted by unregulated exploitation of these uncharted resources without concern for the perpetuation and with disregard to possibility of extinction of the resources due to over exploitation and therefore need urgent measures for *in situ* conservation and protection.

Topography and other physical features combine to produce bewildering variety of edaphic conditions. Mountain slopes are intersected and much cut by watercourses and ravines. At places, the ridges are steep and there are narrow valleys with cliffs, gorges and all sorts of exposures. The aspects vary considerably providing a variety of macro and micro-habitat conditions. Perennial streams and dark shady valleys have created micro-climatic conditions in the area to provide diverse environmental conditions,

encouraging luxuriant growth conditions for several moisture loving species e.g. orchids, bryophytes, algae and several herbs, shrubs and climbers, which have immense ecological as well as economical values. Some of the important and rare species that are found localized may be considered as gene bank of these localities.

Though, most of the gymnospermic plants viz., *Araucaria spp., Cycas spp., Thuja orientalis, Cedrus deodara* etc.' are planted in the past but presently these are localized in the Bundelkhand plateau and have adapted to the local environmental conditions of the area. The growth of these species is good and can be considered as gene bank amongst gymnospermic species.

Amongst angiospermic flora, 69 species belonging to 24 families are found to be rare. The detailed list is given in Annex– 6: III. Amongst them 3 species *viz. Eriocaulon parviflorum, Oropetium roxburghianum* and *Themeda laxa* are found endemic to India also. About 14 species of lichens, 4 species of pteridophytes and 10 species of bryophytes have also been reported. The detailed list is given in Annex –6: I. Amongst them *Anthoceros crispulus,* a bryophyte, is rare.

The area is also rich in medicinal plants. As per the information collected from regional office of the forest department and other sources 108 species of important medicinal plants are found in the region. Amongst them, 34 species are categories as rare and endangered (Table 6.4). There are 7species viz., *Acorus calamus*, *Andrographis paniculata, Centella asiatica, Chlorophytum tuberosum, Curculigo orchiodes, Curcuma aromatica, Gloriosa superba* which are also commercially important. Thus these species needs some urgent conservation measures. The detail list is given in Annex 6: IV.

Table-6.4: Important Medicinal Plants found in Panna BR

S. No	Scientific Name	Local/ Common Name	Status
1.	Acorus calamus*	Bach	Rare
2.	Alangium salvifolium	Ankol	*Rare*
3.	*Andrographis paniculata**	Kalmegh	*VU*
4.	*Aponogeton natans*	Haiti	*Rare*
5.	*Argemone ochroleuca*	Kateri	Rare
6.	***Bergia capensis***		Rare
7.	***Borassus flabellifer***	Talavruksha	Rare
8.	*Careya arborea*	Kumbhi	VU
9.	*Caryota urens*	Mari, Mari ka jhat	Rare
10.	***Centella asiatica****	Mandukparni	EN
11.	*Chlorophytum tuberosum**	Safed Musli	Rare
12.	***Cleome viscosa***	Kateri	Rare
13.	*Corchorus fascicularis*	Bahuphalli	Rare

14.	*Curculigo orchiodes**	Kali Musli	Rare
15.	*Curcuma aromatica**	Jangli Haldi	VU
16.	*Dendrocalamus strictus*	Lathi Bans	Rare
17.	*Didymocapus pignae*	Patthar chata	*EN*
18.	Eleocharis dulcis	Chinese water chestnut	*Rare*
19.	*Eragrostis viscosa*	Sticky love grass	Rare
20.	*Erythrina suberosa*	Madar	Rare
21.	*Gloriosa superba**	*Kalhari*	Rare
22.	*Glossogyne bidens*	*Kamraj*	Rare
23.	*Hymenodictyon orixense*	*kala bachnag*	Rare
24.	*Marsdenia tenacissima*	Dudhia bela	VU
25.	Mnesithea laevis	Kurki	Rare
26.	***Naringi crenulata***	Kawath	Rare
27.	*Ougeinia oojeinensis*	Bandhan	Rare
28.	*Panicum maximum*	Guinea grass	Rare
29.	Polygala elongata	Narrow-Leaved Milkwort	Rare
30.	***Schleichera oleosa***	Kusum	Rare
31.	***Sida cordifolia***	Bala	Rare
32.	***Smilax zeylanica***	Chobchini	Rare
33.	*Sterculia foetida*	Jangli badam or Pinari	Rare
34.	*Sterculia villosa*	Udal	Rare

VU: Vulnerable, EN: Endangered, * commercially important

A recent bio-chemical study reveals that, the wild variety of Aonla (*Emblica officinalis*) growing in natural forest of BR area is highly valuable, as it contains higher level of ascorbic acid content as compared to cultivated variety (Mishra, *et al*., 2009). Thus the special stain of Aonla makes the area unique.

A few villages lying within Panna NP have been rehabilitated in the past elsewhere. In these areas several grass species have grown naturally making areas as natural grasslands, thus providing excellent habitat for with bulk food like grass or hay for grazing animals and excellent habitat for wildlife especially for Chinkara.

6.4 FOREST RESOURCES

The main forest resources are Teak (*Tectona grandis*), which is the dominant species. Other important plants are Dhaora (*Anogeissus Latifolia*), Saja (*Terminalia tomentosa*), Tendu (*Diospyros melanoxylon*), Lendia (*Lagerstroemia parviflora*), Aonla (*Emblica officinalis*), Tinsa (*Ougenia ooginensis*), Bija (*Pterocarpus marsupium*), Moyan (*Lannea coromandelica*), Salai (*Boswellia serrata*), Mahua (*Madhuca indica*). The main under-wood resources are Achar (*Buchanania lanzan*), Kari (*Saccopetalum tomentosum*), Papra (*Gardinia latifolia*), Bel (*Aegle marmelos*), Dudhi (*Holorrhena antidysentrica*), Amaltas (*Cassia fistula*),

Khair (*Acacia catechu*), Ghont (*Zizypus xylopyra*). The undergrowth resources are mainly composed by Karonda (*Carissa opaca*), Siharu (*Nyctanthes arbortristis*), Marorphali (*Helecteres isora*), Thuar (*Euphorbia nerifolia*), Dhawai (*Woodfordia fruiticasa*), Bamboo (*Dandrocalamus strictus*), Lantana (*Lantana camara*). The common herbs are Chhind (*Phoenix sylvestris*), Neel (*Indigofera* spp.), Makor (*Zizypus oenoptia*), Chilati (*Acacia caesia*), Gumehi (*Abrus precatorius*). The main grass species are Kusal/ Lampa (*Andropogon contortus*), Bhurbhusi (*Eragrostis tenella*), Gunher (*Anthesteria ciliate*).

6.5 FAUNAL ATTRIBUTES

The area is rich in faunal diversity. The Panna National Park, Gangau and Ken-Gharial sanctuaries have a much better population of wildlife than the other Reserved Forest areas included in the proposed Biosphere Reserve, due to the better protection and improved habitat conditions resulting from conservation actions therein. The multiple use forests are heavily grazed and along the periphery exploited for fuel, minor produce and even usual forest operation, all rather unsettling to wildlife.

6.5.1 Diversity of Wildlife

Wildlife is an essential part of the forest ecosystem. The proposed Panna Biosphere Reserve has a rich natural heritage with long history and tradition of wildlife conservation. It has been included in Tiger Reserves of India.

Distribution of wild animals in proposed area shows that the areas of Panna National Park, Gangau and Ken-Gharial Sanctuaries and adjoining area have ample potential for supporting various wild animals in the area.

The entire part of Panna NP and most part of Gangau sanctuary have been notified as Panna Tiger Reserve. Once the status of this area is raised to BR, it would provide additional ideal habitat for wildlife conservation. Tiger being the top carnivore is generally confined to the deep forests.

Other wild animals, frequently found in the area are spotted dear, Sambhar, wild boar, monkeys, fox, black buck, four horned antelope etc. The best-known areas of animal distribution occur in Madla, Hinouta and Ajaigarh ranges. Open and peripheral plateaus of these ranges in particular have good populations of Chinkara and Nilgai, sloth bear and pigs. The other animals include jackal, hyena, Langur and leopard. A list of wild animals and their census report ranging from 1988 to 2004 of proposed Panna BR is given in the Annex -6: V. The classification of wildlife (Wildlife Protection Act, 1972) as per Schedule I, II, III and IV is as follows:

Schedule I: Signifying their especially protected status due to conservation needs.

Tiger - *Panthera tigris*

Panther	-	*Panthera pardus*
Sloth bear	-	*Melursus ursinus*
Four-horned antelope	-	*Tetracerus quatricornis*
Indian Gazelle	-	*Gazella gazella bennetti*
Caracal	-	*Felis caracal*
Honey badger (Ratel)	-	*Mellivora capensis*

Schedule II: Enjoying full protection but only a lesser penalty for infringement.

Wild dog	-	*Cuon alpinus*
Jackal	-	*Canis aurens*
Common Langoor	-	*Presbytis entellus*
Mongoose	-	*Helogale parvula*
Fox	-	*Vulpes bengalensis*
Wild cat	-	*Felis chaus*
Oriental rat snake	-	*Ptyas mucosus*
Rhesus macaque	-	*Macaca mulatta*

Schedule III: Signifying still lesser category of protection.

Chital	-	*Axis- axis*
Blue Bull	-	*Boselaphus tragocamelus*
Black buck	-	*Antilope cervicapra*
Sambhar	-	*Cervus unicolor*
Hyena	-	*Hyaena hyaena*

Schedule IV: Includes the Indian Porcupine (*Hystrix indica*) and all birds other than those included in the earlier schedules.

Panna Tiger reserve, which once had more than 30 big cats, lost its entire tiger population during 2007-09. The reason for loss of entire population of tiger is still debatable. Subsequently, two tigresses (one tigress from Kanha National Park and one from Pench National Park), along with one tiger from Pench National Park of Madhya Pradesh were relocated there from March to November 2009. These have given birth to 7 new cubs. Out of them 5 are still surviving. In March 2011 one more tigress from Kanha National Park has been introduced. Thus the tiger population has been increased to 9 in BR area. This indicates that the conservation measures taken after rehabilitation of tigers have resulted in increase in their population. Thus it now becomes unique rehabilitated tiger population experimentation in the natural habitats in the state of Madhya Pradesh.

6.5.2 Diversity of Vertebrates

The diversity of vertebrate's fauna of the proposed Panna BR is as follows:

Mammalian Diversity: As mentioned above the ecology of Panna BR sustains many mammals. It comprises of 35 species in 21 families and covers 7 orders of mammalian wildlife fauna. The number of species commonly seen species is given Table 6.5 and detail of the same is enclosed as Annex- 6: VI.

Table 6.5: Number of species commonly seen in Proposed BR

Order	No. of families	No. of species
Primates	02	02
Insectivora	02	02
Chiroptera	01	02
Pholidota	01	01
Carnivora	06	11
Rodentia	04	07
Ungulata	04	10
TOTAL	**20**	**34**

This is, however, not complete compendium of mammalian species. The commonly seen mammals include two species of Antelope - the Nilgai (*Boselaphus tragocamelus*) and Chowsingha (*Tetracerus quadricornis*); the lone Indian Antelope - Chinkara; three species of deer – Sambar (*Cervus unicolor*) and Chital (*Axis axis*). One can easily see Nilgai and Chinkara in most open areas in the grasslands, especially on the periphery. The wooded areas are dotted with Sambar, the largest of Indian deers, Chital and Chowsingha. Rock escarpments and undisturbed valleys are the most favourite places where sloth bear (*Melursus ursinus*) can be seen easily. In addition to this, five species of cat, which include the king of the jungle- tiger (*Panthera tigris tigris*) leopard (*Panthera pardus*) and other smaller cats; and four species of canids (dog family) of which Indian fox (*Vulpes bengalensis*), jackal (*Canis aureus*) and wild dogs (*Cuon alpinus*) are found in the area, Besides, there are several other large and small creatures are also found in the proposed BR.

Siyah Gosh (*Felis caracal*) found in the area is one of the rare cats and the closest cousin of the extinct Panther (Cheetah).

Livestock: Large numbers of domestic cattles are found in the proposed BR area. These include buffaloes, cows, goat etc. Everyone in the village, a cultivator, a cattle herder or even landless labourers has few heads of cattle. It is not strange because the areas around the villages have big grasslands. This grassland is found especially on the top of the table land and also on the blanks of rivulets and the Ken river. All the animals living at and around forest area grazes within forest area.

A special native breed of local cattle (cow) named as 'Kenkatha ' is found in the proposed BR. These are found mainly along the Ken river. This makes the area unique with respect to livestock of the proposed BR area.

Avifauna: The area has a rich bird life. The variety of vegetational spectrum, the scatter of water resources and wetlands and the climatic range from warm humid to cool and dry in the plains and hills found in Panna BR offers a complete gamut of habitat niches to bird life. However, these habitats have

been much mismanaged in past through unlimited grazing, minor produce exploitation and fires, resulting in deterioration. Yet the variety of reproductive niches and feeding niches is very wide, and is reflected in the large variety of birds seen in the area.

House sparrow, hill prinia, red-vented bulbul, common myna, red jungle fowl are also commonly found in almost all localities of project area. The above list, however, is not a complete compendium. These are only the ones that have been considered as index of conservation efforts.

As per the, Action Plan for Vulture Conservation in India (MoEF, GoI, 2006) there are nine species of vultures in the wild. These are the Oriental White-backed Vulture (*Gyps bengalensis*), Slender billed Vulture (*Gyps tenuirostris*), Long billed Vulture (*Gyps indicus*), Egyptian Vulture (*Neophron percnopterus*), Red Headed Vulture (*Sarcogyps calvus*), Indian Griffon Vulture (*Gyps fulvus*), Himalayan Griffon (*Gyps himalayensis*), Cinereous Vulture (*Aegypius monachus*) and Bearded Vulture or Lammergeier (*Gypaetus barbatus*). The population of three species i.e. White-backed Vulture, Slender billed Vulture and Long billed Vulture in the wild has declined drastically over the past decade. The decline of Gyps genus in India has been put at 97% by 2005.

Several vulture species which are on the brink of extinction are found in the Panna BR courtesy favourable. Amongst the total 09 species of vultures in wild, 02 species viz, Cinereous Vulture (*Aegypius monachus*) and Himalayan griffon vulture (*Gyps himalayensis*), along with one species of *Halcyon pileata* (black-capped kingfisher) have been sighted in the Panna Tiger Reserve during a wildlife census. These two vultures make their nest amidst the Dhandua Seha crags. Other species of vulture are, Red Headed Vulture (*Sarcogyps calvus*), Indian Griffon Vulture (*Gyps fulvus*), Egyptian Vulture (*Neophron percnopterus*), Oriental White-backed Vulture (*Gyps bengalensis*) King vulture (*Sarcoramphus papa*) and long billed Vulture (*Gyps indicus*). As per the, latest census of vultures organized by Panna Tiger Reserve, there are about eight species of vulture found in the reserve. Out of which, long billed Vulture and White-backed Vulture are threatened species.

A total of 281 species of commonly seen birds covering 50 families are found in the area. This is again not the complete compendium. Ecological distributions of these birds are given in Table- 6.5 and the detailed list showing common name, scientific name and ecological distribution is given in Annex- 6: VII.

Table 6.6: Ecological distributions of Birds of the proposed Panna BR

S No	Ecological Distribution	Abbreviation	No. of Species
1	Common	C	10

2	Local Resident	L	10
3	Widespread	W	165
4	Widespread Uncommon	WU	6
5	Widespread Scares Resident	WS	1
6	Widespread Common	WC	6
7	Common Winter Visitors	CWV	1
8	Sparse Winter Visitors	SWV	2
9	Widespread Winter Migrants	WWM	1
10	Widespread Winter Visitors	WWV	50
11	Wild & Sparse Winter Visitors	W & SWV	1
12	Local & Widespread Winter Visitors	L & WWV	11
13	Sparse Winter Visitors & Local Resident	SWV & L	1
14	Widespread Winter Visitors & Local Resident	WWV & L	7
15	Widespread Winter Visitors & Migrant	WWV & M	1
16	Widespread Winter Visitors & Resident	WWV & R	8
	TOTAL		**281**

A perusal of the table indicates that 165 species are widespread in the area followed by widespread winter visitor species (50) and local & widespread species of winter visitors (11). However, common and local resident together constitute 20 species (10 in each category). Further, the population of local resident belongs to widespread winter visitors category are estimated to be 7 species. Thereafter, widespread uncommon and widespread common category was estimated to be same (6 each).

Reptiles: As per information collected from various sources, the commonly seen reptiles of the area are listed in table 6.7. This needs detailed assessment and such studies could form part of BR programme. As per information collected the mortality caused by reptiles and other wild animals are seen to be significant in the area.

Both Crocodile (*Crocodilus palustris*) and Gharial (*Gavialus gangeticus*) co-exist in the River Ken. This is the rare occurrence as they are generally found separately. No complete study of reptile has been done for the area and such studies could form part of Biosphere Reserve programmes.

Table 6.7: List of Reptiles found in Panna BR

S No	Indian Name	Common Name	Scientific Name
1.	Maggarmachch	Crocodile	**Crocodilus palustris**

2.	Gharial	Gharial	*Gavialus gangeticus*
3.	Ajgar	Indian Python	*Python molurus*
4.	Nag	Indian Cobra	*Naja naja*
5.	Goh	Monitor lizard	*Varanus bengalensis*
6.	Kachua	Tortoise, turtle	*Lissemys poructata*
7.	Girgit	Chameleon	*Chameleo zeylanicus*
8	Chhipkali	Lizards	Various spp. *eg. Hemidactylus leschenatti, H. brooki, Calotes versicolor*
9.	Green snake		*Opheodrys. Aestivus/ O. vernalis.*
10.	Karait	Karait	*Bungarus caerulans*
11.	Dhaman	Oriental rat snake	*Ptyas mucosus*

Amphibians: Some of the amphibians in the area are *Rana limnocharis* (the cricket frog), *Bufo melanosticus* (the common toad), *Rana tigrina* (the bull frog) etc. This also needs detailed assessment study and could form part of BR programme in the future.

Fish fauna: The Ken river and its other tributaries are home for the fish fauna of various kinds. Ken river is a perennial river, Therefore various type of fishes are found in sufficient density in fresh water, which provides food supply to the other reptiles and birds of the area. As per information provided by fisheries department, a total of 14 species of fishes are found in the area. These are given in Table-6.7. Amongst them Catla, Rohu, Mrigal, Channa, Sonrh, Chainga, Magur, Kalbasu are common fishes. The species like *Mystus tengara, Wallago attu, Tor tor, Mistris singhala, Hilsa ilisha* come under threatened category. The species like *Wallago attu, Tor tor, Mistris singhala* are rare for the area.

Table 6.8: List of fishes found in Panna BR

S No	Local Name	Common Name	Scientific Name	Category
1.	Bam	Bam	*Mastacembelus armatus*	Common
2.	Catla	Catla	*Catla catla*	Common
3.	Mrigal	Mrigal	*Cirrhinus mrigala*	Common
4.	Chhanna	Channa	*Amlasis nama*	Common
5.	Chainga	Chainga	*Channa gachna*	Common
6.	Magur	Magur	*Clarius betracus*	Common
7.	Singhar	Tengara	*Mystus tengara*	Endangered
8.	Sonrh	Sonrh	*Officio cephalis*	Common
9.	Padan/Padhin	Catfish	*Wallago attu*	Rare
10.	Kalbasu	Kalbasu	*Labeo calbasu*	Common

11.	Mahaseer	Mahseer	*Tor tor*	Rare/End.
12.	Katai	Katai	*Mistris singhala*	Rare
13.	Hilsa	Hilsa	*Hilsa ilisha*	Endangered
14.	Rohu	Rohu	*Labeo rohita*	Common

Mahseer: A threatened species

Mahseer is one among world-renowned prized game and food fishes. It is widely distributed and is available in India, Nepal, Bangladesh, Pakistan and Ceylon. It is represented by six species in various rivers and streams of India, under varied ecosystems ranging from cols Sub-Himalayan at 6^0C to the plains where the temperature in summer goes beyond 35^0C.

Despite their abundance at one time, Mahseer a local migratory fish is reported to decline both in number and size in different rivers of India. In the state of Madhya Pradesh, Mahseer is found in all the river systems but it constitutes the most prominent species (*Tor tor*) in Ken, where it contributed about 40% among the carps land. In recent year, Mahseer catch has declined considerably. The reasons for the decline are due to anthropogenic factors such as want on destruction of brood fishes as well as juveniles, use of destructive methods of fishing viz. dynamiting, electrocution, etc., as well as biological factors such as demersal nature of eggs, long incubation period followed by a long semi quiescent stage during which they fall easy prey to predators. The fecundity of Mahseer is also very low compared to major carps. During high turbid waters, silt and peris eggs settle down at the bottom, smother the demersal.

6.5.3 Diversity of Vertebrates

The invertebrate fauna of the area has not been studied in detail. The butterfly diversity is very rich in the area. Around 25 species have been reported in the area. A list of butterfly diversity has been enclosed as Annex- 6: VIII.

Other invertebrates that have been studied are disease causing. The most visible insect attack in this forest is on the principal species i.e. teak. The teak skeletonnizer, *Hyblea pureo* – is active all over teak belt. Other disease causing organisms includes anthrax, liver fluke, mosquitoes, termites etc. Apart from this many parasitic organisms are also found in the area. These include nematodes, trematodes, *Hialomma kumari* on tigers.

CHAPTER – 7

SETTLEMENTS

7.1 GENERAL

Geographical area of Panna Biosphere Reserve is distributed among six blocks of Panna and Chhatarpur districts. Out of these, parts of three blocks viz., Ajaigarh, Panna and Gunnor fall in Panna district, and the parts of remaining three blocks *viz*. Bijawar, Rajnagar and Laundi fall in Chhatarpur district.

A total of 306village/urban agglomerations fall in proposed Panna Biosphere Reserve. Out of this, there are 03 urban agglomerations and 303 villages. Panna, Khajuraho and Ajaygarh are the urban agglomeration. Of the total 209 villages/ urban agglomerations are located within Panna district and the remaining 97 villages/ urban agglomerations are located in Chhatarpur. The blockwise analysis reveals that maximum numbers of settlements are located in Panna block, followed by Ajaygarh, Rajnagar, Bijawar, Gunnor and least in Laundi.

In core zone there is no urban agglomeration. Only 06 villages (1.96% of villages) are located in core zone. Out of this 03 each are located in Panna and Chhatarpur district, respectively. Out of total 4 are located within Panna NP and remaining 2 are located within North Panna Forest Division. A total of 159 urban agglomeration/ villages are located in buffer zone (51.96 % of total village/ urban agglomeration). Out of these, 120 Nos. are located in Panna district and the remaining 39 in Chhatarpur district. Only one urban agglomeration viz., Ajaygarh is located in this zone.

In transition zone there are 141 (46.08% of total BR) villages/ urban agglomerations. Amongst these Panna and Khajuraho are the urban agglomerations while remaining 139 are villages. Of the total village/ urban agglomeration, 86 are located in Panna and remaining 55 in Chhatarpur district.

On the whole the area is said to be basically rural setting. The number of villages/urban agglomerations covered under various blocks is given in Table- 7.1. The distribution of main urban agglomeration/ villages is shown in Map- 7.1. The detailed list of villages/urban agglomeration is given at Annex- 7: I.

7.2 HOUSEHOLD SETTLEMENTS

In the proposed BR total number of houses occupied is 78,379 (census 2001). 80.35% of these are occupied in the rural areas and 19.65% at urban area (Table 7.2). District-

wise analysis indicates that 68.30% is located in Panna district and remaining 31.70% in Chhatarpur district. Maximum number of houses (37.90%) is located at Panna block & minimum 0.65% at Laundi block.

Table- 7.1: Distribution of villages/ urban agglomeration under various zones of proposed Panna BR

District / block	Village/ urban agglomerations									Total
	Core zone			Buffer zone			Transition zone			
	Vill.	UA	Sub-total	Village	UA	Sub-total	Village	UA	Sub-total	
Panna										
Ajaigarh	-	-	-	41	01	42	25	-	25	**67**
Panna	03	-	03	74	-	74	38	01	39	**116**
Gunnor	-	-	-	04	-	04	22	-	22	**26**
Sub-total	03	-	03	119	01	120	85	01	86	**209**
Chhatarpur										
Bijawar	03	-	03	13	-	13	17	-	17	**33**
Rajnagar	-	-	-	26	-	26	35	01	36	**62**
Laundi	-	-	-	-	-	-	02	-	02	**02**
Sub-total	03	-	03	39	-	39	54	01	55	**97**
Total	**06**	**-**	**06**	**158**	**01**	**159**	**139**	**02**	**141**	**306**

Note : These villages/urban areas have been identified on the basis of toposheets, tehsil/ blocks maps & census figures of the Govt. of India.

Map- 7.1: Distribution of main settlements of Panna potential BR

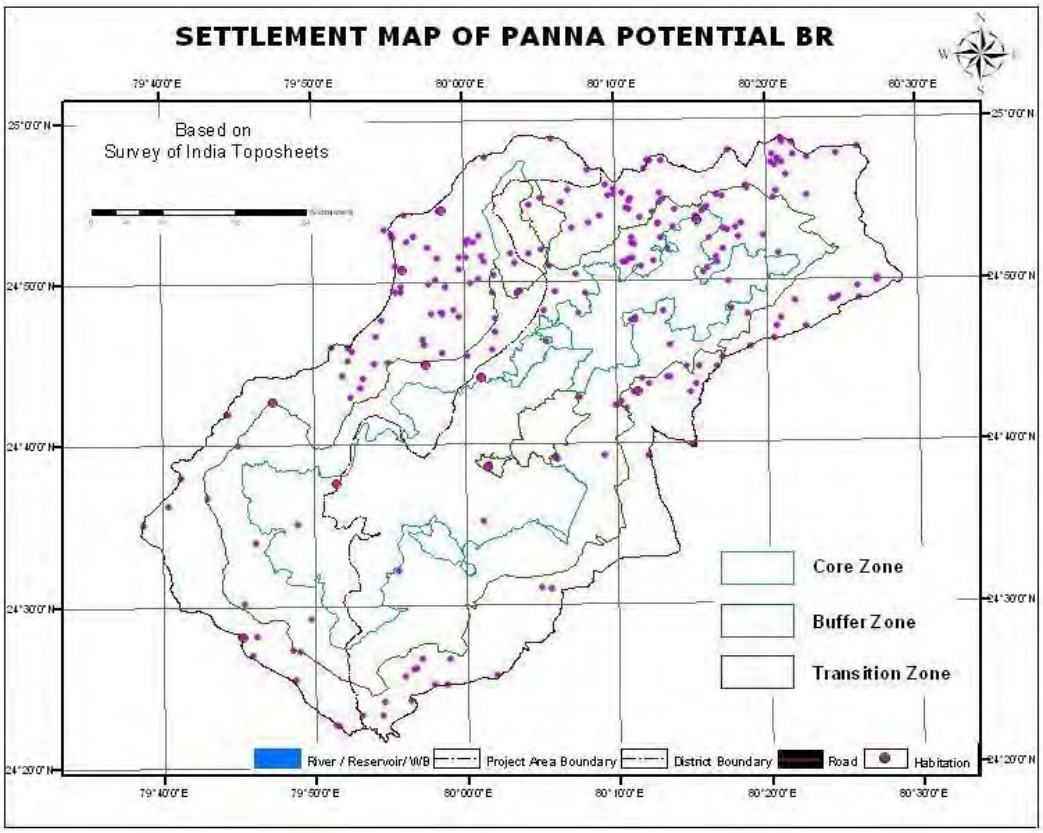
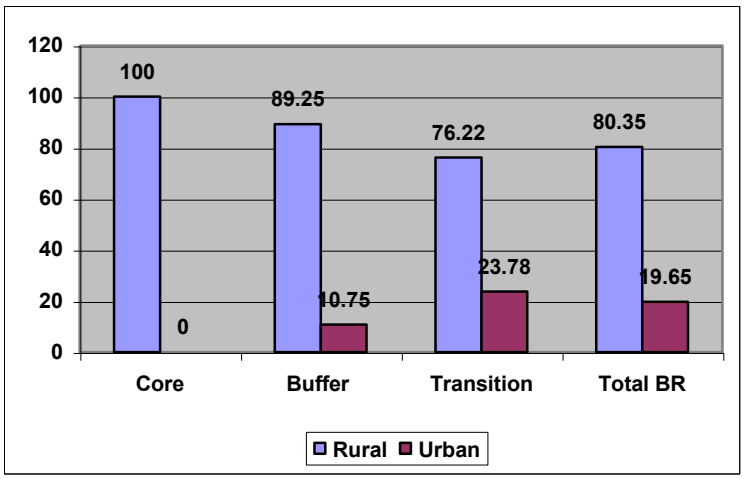

SETTLEMENT MAP OF PANNA POTENTIAL BR
Based on
Survey of India Toposheets
Core Zone
Buffer Zone
Transition Zone
River / Reservoir/ WB
Project Area Boundary
District Boundary
Road
Habitation
79°40'0"E
79°50'0"E
80°00'0"E
80°10'0"E
80°20'0"E
80°30'0"E
25°00'0"N
24°50'0"N
24°40'0"N
24°30'0"N
24°20'0"N

Table- 7.2: Number of households occupied in the BR area (Census, 2001)

District Block/ Tehsil	No. of Households		
	Rural area	Urban area	Total
Panna			
Ajaygarh	13696	2522	16218
Panna	22325	9584	31909
Gunnor	5195	-	5195
Sub-total	41216	12106	53322
Chhatarpur			
Bijawar	3972	-	3972
Rajnagar	17148	3297	20445
Laundi	640	-	640
Sub-total	21760	3297	25057
Grand total	**62976**	**15403**	**78379**

The zone wise rural and urban settlements are shown in Annex- 7: II and their percentage are given in Fig 7.1. There are 752 households in core zone; 23,466 in buffer zone and maximum (54,161) in transition zone. In core zone, 100% of household falls in rural area followed by buffer (89.25%) and transition (76.22%).

Fig-7.1: Household settlement (%) in various zones of Panna BR



7.3 HOUSEHOLD DENSITY

The total person per household of Panna BR is 5.44%. The maximum of 6.02% persons per household have been recorded in Tehsil Laundi and the lowest 5.04 % persons per household in Gunnor tehsil. In Panna BR the total household per km^2 is 30.99%. The Ajaigarh tehsil accounts maximum (50.20%)

households per km² and the minimum (7.78%) household per km² is recorded in Bijawar tehsil of Panna BR.

The total household density per village of the Panna BR is 256.14 out of which, block Rajnagar recorded the maximum household density/ village (329.76 per village). The Tehsil Laundi is next to Rajnagar in occupying maximum household density per village (320.00). The overall household per km² for BR is higher (191.80) in urban area as compared to rural (25.72) areas.

Table -7.3 Average of persons per household, per sq km household & density per village (Based on Census, 2001)

District Block/ Tehsil	Rural area of Panna BR			Urban area of Panna BR			Total of Panna BR		
	Persons / H. hold	House holds nos/ km²	Density of H. hold/ Villages	Persons / H. hold	House holds no. / km²	Density of H. hold / Wards	Persons/ H. hold	House holds nos,/ km²	Density of H. hold/ Villages
Panna									
Ajaygarh	5.46	43.31	207.52	5.55	370.34	168.13	5.47	50.20	242.06
Panna	5.29	28.83	194.13	5.43	699.56	354.96	5.34	40.49	275.08
Gunnor	5.04	23.52	199.81	-	-	-	5.04	23.52	199.81
Total	5.32	31.43	199.11	5.46	590.25	288.24	5.35	40.04	255.13
Chhatarpur									
Bijawar	5.36	7.78	120.36	-	-	-	5.36	7.78	120.36
Rajnagar	5.65	28.39	281.12	5.85	55.13	219.80	5.69	30.80	329.76
Laundi	6.02	27.89	320.00	-	-	-	6.02	27.89	320.00
Total	5.61	19.14	226.67	5.85	55.13	219.80	5.64	20.94	258.32
Grand total	**5.42**	**25.72**	**207.84**	**5.45**	**191.80**	**270.23**	**5.44**	**30.99**	**256.14**

The details of number of person/household, number of household per km² and household density per village is given in Table-7.3 while there percentage in various zones are given Annex-7: III. The same is graphically represented through Fig- 7.2, 7.3 and 7.4.

Fig- 7.2: Number of person per household of Panna BR

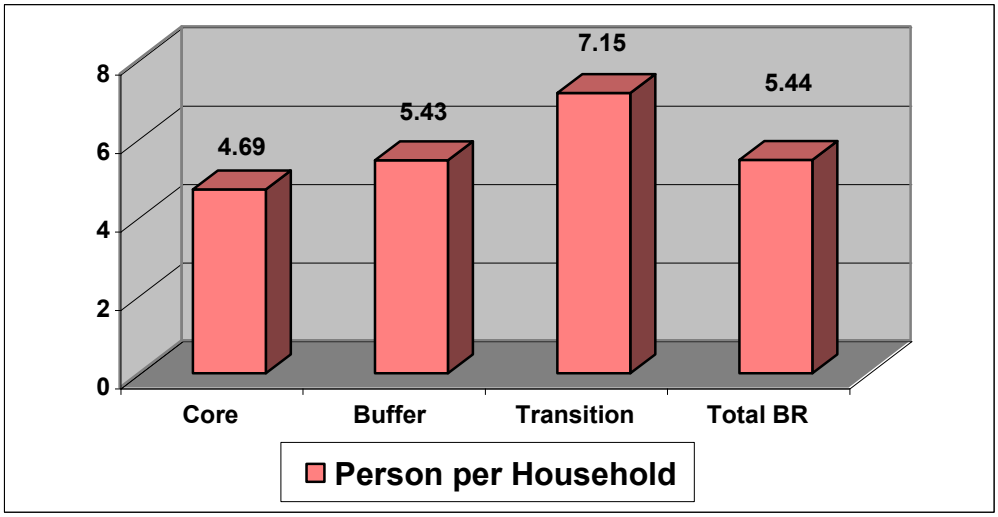


Fig. 7.3: Number of household per sq km of Panna BR

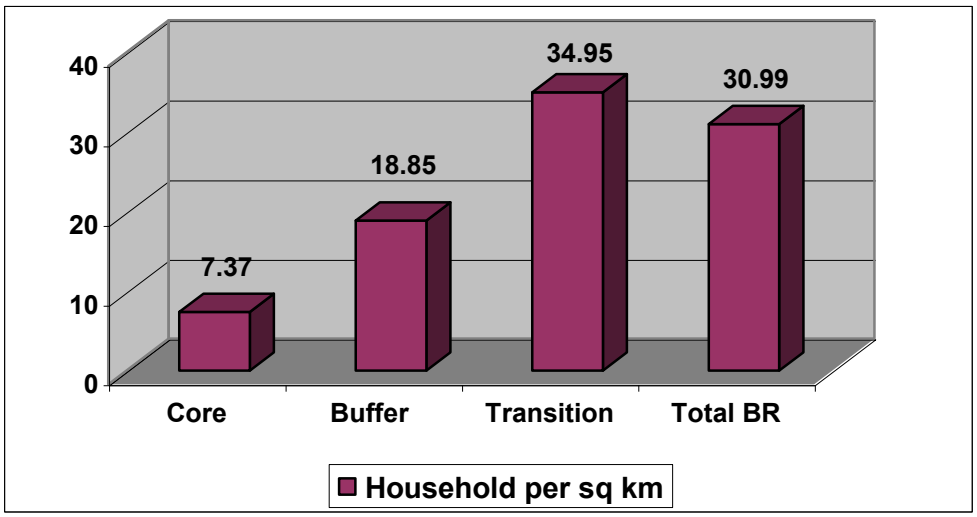
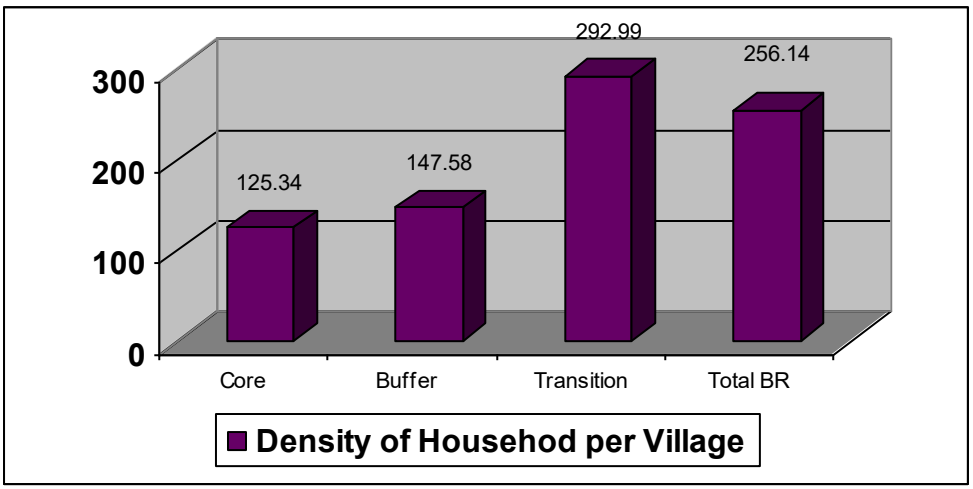


Fig. 7.4: Number of household per village of Panna BR



The number per household for Panna BR is 5.44, while that of household per km² is 30.99. Similarly the household per village is 256.14. The number of person/ household is lower (4.69) in core zone as compared to buffer (5.43) and transition zone (7.15). The number of household per km² is minimum (7.37) in core zone and maximum in transition zone (34.95). Similarly the number of household per village is minimum in core zone (125.34) as compared to buffer (147.58) and transition zone (292.99)

7.4 POPULATION DISTRIBUTION & DENSITY

The total population of proposed Panna Biosphere Reserve as per 2001 census is 4, 26,498. Of this 2, 85,131 (66.85%) is confined in Panna district and the remaining 141367 (33.15%) is in Chhatarpur. Rajnagar block have relatively more population (116226 persons) in district Chhatarpur, while Panna block (1, 70,211 persons) has registered highest population in Panna district. Laundi block show the lowest population of 3855 persons (Table 7.4). The rural

population of the proposed BR accounts for 79.99% and the urban population account for (20.01%).

The percentage of districtwise total population, zonewise and district wise distribution for rural and urban area are shown in Fig 7.5. A total of 66.85% of population resides in Panna district while the rest in Chhatarpur district. It is also evident that only small fraction (0.8%) resides in core zone, 29.90% resides in buffer zone and maximum (69.30%) population in transition zone. Majority of population of rural and urban resides in Panna district. The zonewise population distribution in urban and rural areas along with density per sq km is given in Annex-7.IV.

The density of total population along with the zonewise density of population of (per sq km) of Panna BR is given in Fig- 7.6. The density of total population per sq km for Panna BR is 168.65. The rural population density is 139.33 per sq km while that of urban is 1062.63 per sq km. The zonewise analysis reveals that, it is least (34.6%) in core zone compared to buffer (102.4) and transition zone (250.00).

Table- 7.4: Population Distribution and density (per sq km) of Panna BR

District Block/ Tehsil	Rural population		Urban population		Total population	
	Tot. Pop.	Density	Tot. Pop.	Density	Tot. Pop.	Density
Panna						
Ajaygarh	74734	236.31	13997	2055.36	88731	274.65
Panna	118154	152.60	52057	3799.78	170211	216.01
Gunnor	26189	118.59	-	-	26189	118.59
Sub-total	219077	167.06	66054	3220.58	285131	214.08
Chhatarpur						
Bijawar	21286	41.72	-	-	21286	41.72
Rajnagar	96940	160.51	19286	322.51	116226	175.11
Laundi	3855	167.97	-	-	3855	
Sub-total	122081	107.36	19286	322.51	141367	118.11
Grand total	**341158**	**139.33**	**85340**	**1062.63**	**426498**	**168.65**

7.5 POPULATION DISTRIBUTION BY SEX

In Panna BR the male population (53.03) is slightly higher as compared to the female (46.97). There is almost no difference in the male and female percentage of rural and urban population. The sex ratio (female population/ 1000 male) is 866. The blockwise analysis reveals that it is maximum (915) in Gunnor block and minimum (847) in

Laundi block. The percentage distribution of population in rural & urban area is given in Table- 7.5. The zonewise analysis is given in Fig- 7.7. From this it is evident that the sex ratio (female/1000 male) is maximum (890) in transition zone compared to buffer (876) and core (882) zones. The details are given in Annex-7: V.

Fig- 7.5: Population Distribution of Panna Biosphere Reserve

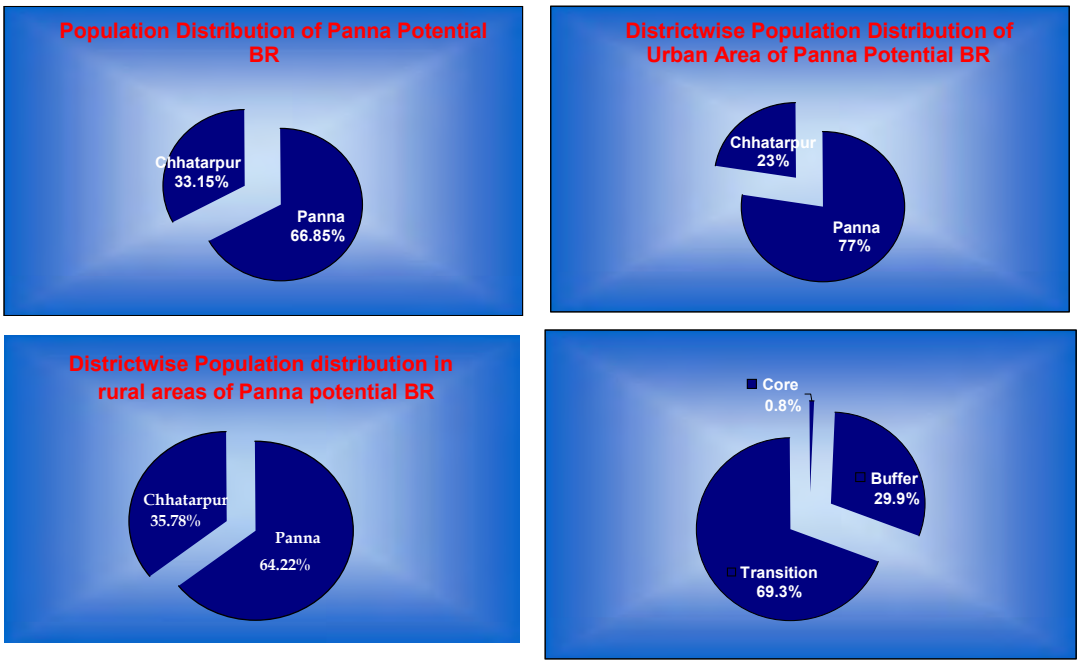


Fig-7.6: Population Density per sq km in Panna Potential BR

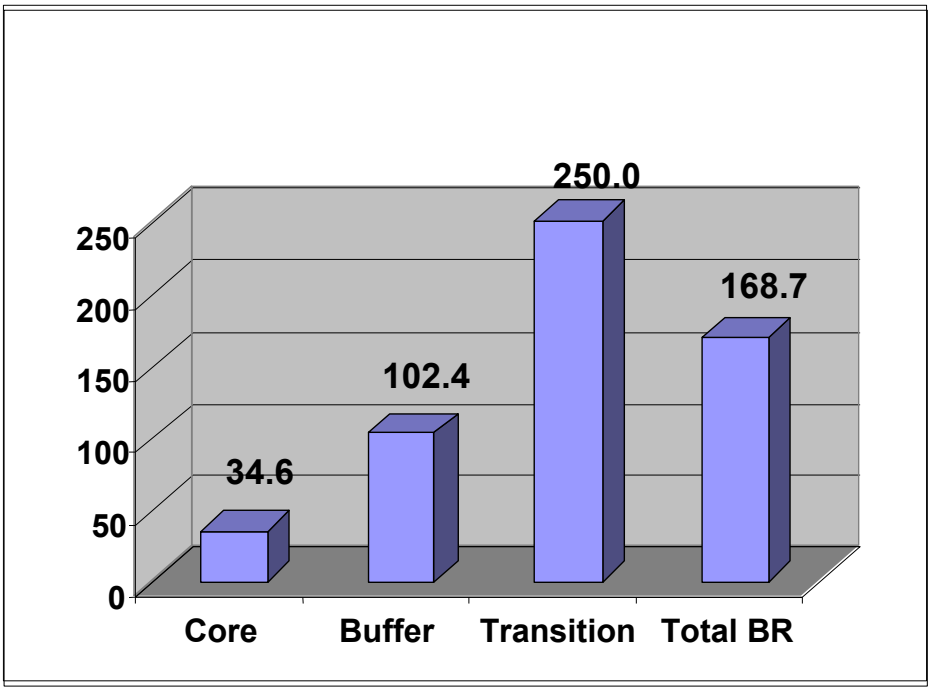
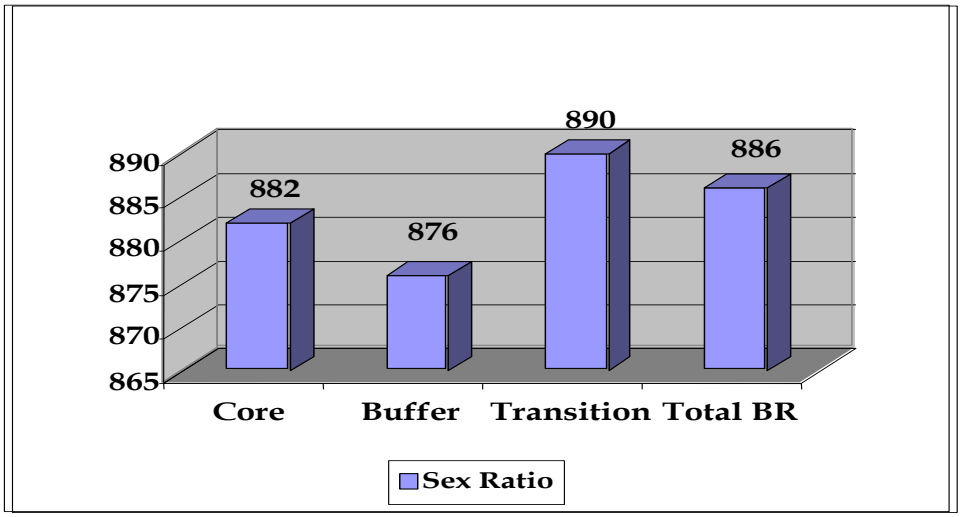


Table-7.5: Percentage distribution of population by sex

District Block/ Tehsil	Rural population (%)			Urban population (%)			Total population (%)		
	Male	Female	Female Pop./ 1000 Male	Male	Female	Female Pop./ 1000 Male	Male	Female	Female Pop./ 1000 Male
Panna									
Ajaygarh	53.75	46.25	860	53.24	46.76	878	53.67	46.33	863
Panna	52.77	47.23	895	52.79	47.21	894	52.78	47.22	895
Gunnor	52.21	47.79	915	-	-	-	52.21	47.79	915
Sub-total	53.04	46.96	885	52.89	47.11	891	53.00	47.00	887
Chhatarpur									
Bijwar	53.26	46.74	878	-	-	-	53.26	46.74	878
Rajnagar	53.17	46.83	881	52.33	47.67	911	53.03	46.97	886
Laundi	54.14	45.86	847	-	-	-	54.14	45.86	847
Sub-total	53.22	46.78	879	52.33	47.67	911	53.10	46.90	883
Grand total	**53.10**	**46.90**	**883**	**52.76**	**47.24**	**895**	**53.03**	**46.97**	**886**

Fig-7.7: Sex Ratio (Female Population/ 1000Male) within Panna Potential BR Area



7.6 DISTRIBUTION OF SC AND ST POPULATION

The total scheduled tribe (ST) population in the Panna BR area is 56,041. This accounts 13.14% of the total population (Census, 2001) while scheduled caste (SC) population is 70,373 (16.50%). Thus SC & ST population together account 29.64% of the total population. The concentration of SC population is maximum (21.28%) in Ajaigarh block and minimum in Panna block (11.92%). Higher concentration of ST is found in Bijawar (33.15%) followed by Gunnor blocks (Table- 7.6). Higher concentration of SC (17.37%) is found in rural area compared to urban area (13.03%). Similarly the ST population is almost three times (15.63%) in rural area as compared to urban area (3.18).

The zonewise analysis of ST rural and urban population indicates that the entire population (11.57%) of core zone is within rural area. In buffer zone SC population is almost same in rural & urban area, while in transition zone SC population is slightly higher in rural area as compared to urban area. In core zone the entire ST population (36.98%) lies in rural area. In buffer zone ST population (24.37%) is more than 3 times in rural area as compared to urban area. Similarly in transition zone it is almost five-

times. From this it is evident that maximum rural ST population is found in core zone followed by buffer zone and least in transition zone. The zonewise rural and urban SC & ST population is given in Figs.-7.8 and 7.9, respectively while the details of SC and ST population is given in Annex- 7: VI.

Table-7.6: Percentage distribution of SC & ST to w.r.t. to corresponding total population in Panna Biosphere Reserve

District Block/ Tehsil	Rural SC & ST distribution		Urban SC & ST distribution		Total SC & ST distribution	
	Total SC	Total ST	Total SC	Total ST	Total SC	Total ST
Panna						
Ajaygarh	22.37	13.90	15.49	07.54	21.28	12.90
Panna	12.45	18.75	10.70	02.79	11.92	13.87
Gunnor	20.70	24.13	-	-	20.70	24.13
Sub-total	16.82	17.74	11.71	03.80	15.63	14.51
Chhatarpur						
Bijwar	15.34	33.15	-	-	15.34	33.15
Rajnagar	19.16	07.48	17.52	01.04	18.89	06.39
Laundi	14.55	04.95	-	-	14.55	04.95
Sub-total	18.35	11.85	17.52	01.04	18.24	10.38
Grand total	**17.37**	**15.63**	**13.03**	**03.18**	**16.50**	**13.14**

Fig.7.8: SC population (%) within Panna potential BR

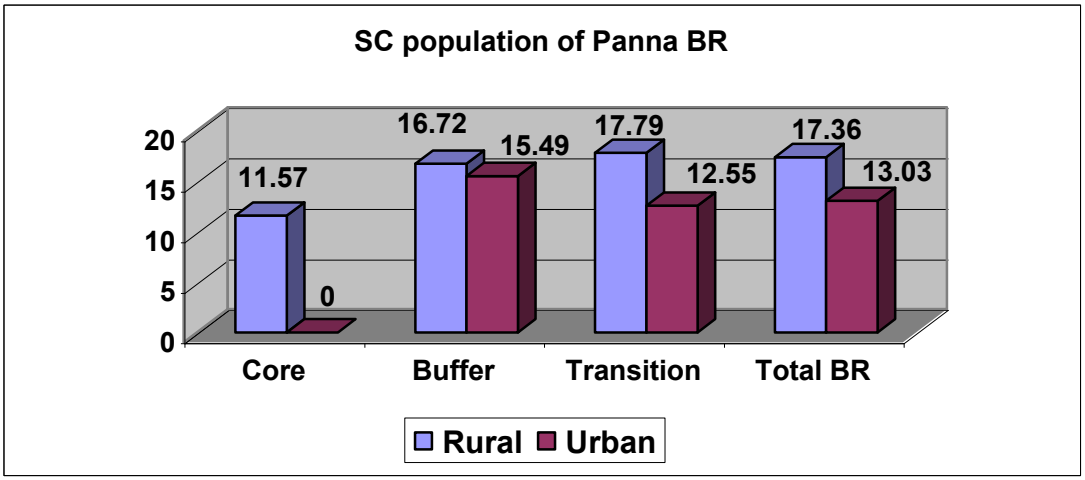
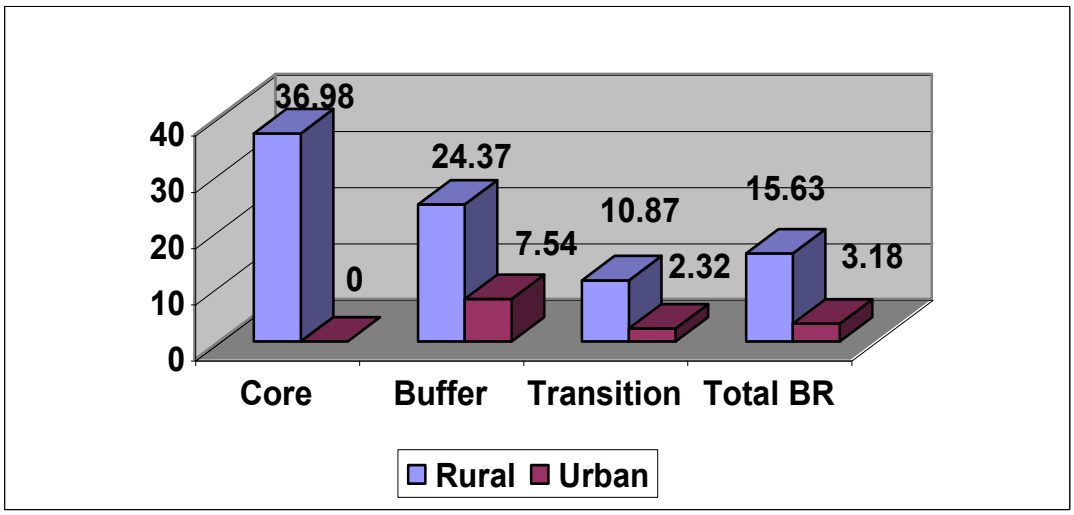
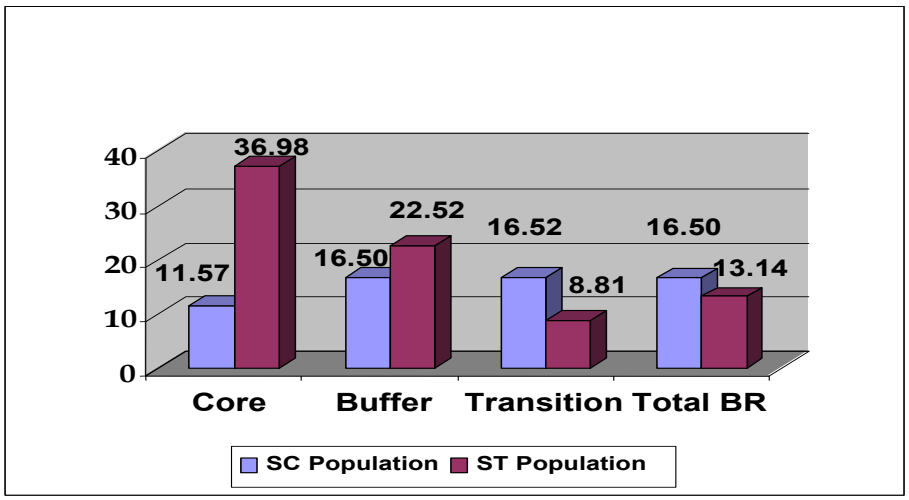


Fig.-7.9: ST population (%) within Panna potential BR



The zonewise SC & ST population is given in Fig 7.10. It reveals that the percentage of SC population is lesser (11.57%) in core zone compared to buffer (16.50%) and transition zones (16.52), while the ST population is highest in core zone (36.98%) followed by buffer zone (22.52%) and least in transition zone (8.81%).

Fig.7.10: SC & ST Population Distribution (%) in Panna Potential



7.7 LITERACY

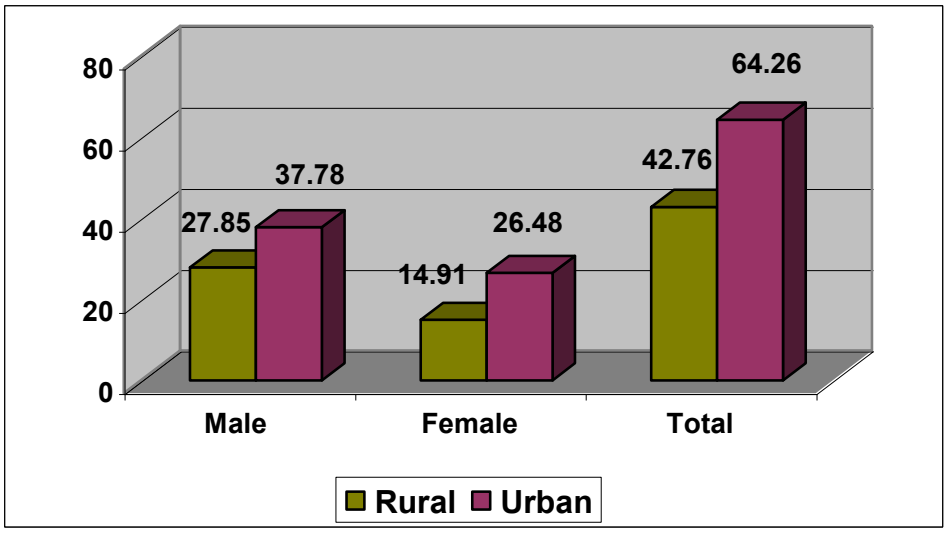
As per census (2001), the literacy of proposed Panna BR area is 47.06 % only (Table-7.7). This is 17.05% below than national literacy rate of 64.11%. The rural literacy rate is 42.76% while urban accounts 64.26%. The literacy rate of both male and female is higher in urban areas as compared to rural area (Fig- 7.11). The male literacy is 29.84% and the female literacy is 17.22%.

The rural literacy rate of Tehsil Laundi is 28.95% only. Out of this, the female literacy rate is 07.78% only. The low literacy rate seems due to involvement of lower number of villages of this block within BR. The literacy rate of Panna district (including rural and urban) is recorded 51.25% with female literacy rate of 19.40%, which is comparatively higher than Chhatarpur district. In Panna BR, the highest literacy rate (58.57%) was recorded in Panna block. Apart from this, the female literacy rate is also recorded high (23.58%) in Panna block compared to other blocks of Panna BR.

Table-7.7: Percentage of literates to total population in Panna BR

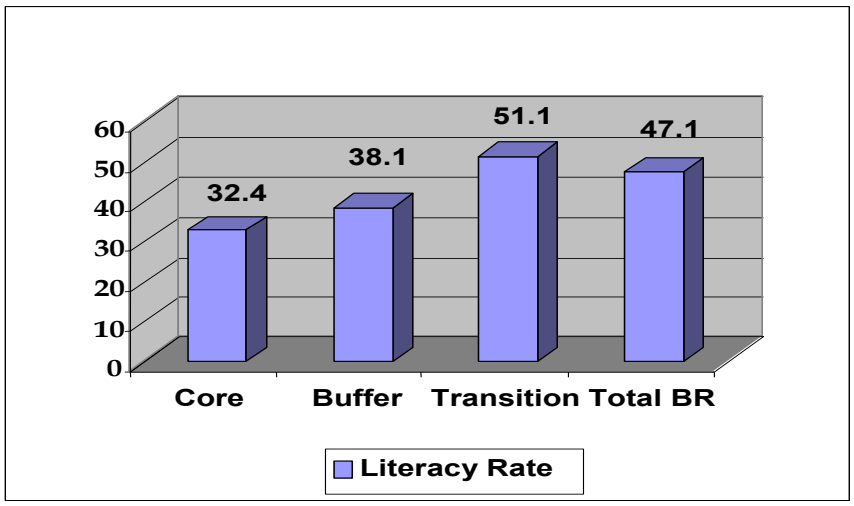
District Block/ Tehsil	Rural Literacy Rate (%)			Urban Literacy Rate (%)			Total Literacy Rate (%)		
	Person	Male	Female	Person	Male	Female	Person	Male	Female
Panna									
Ajaygarh	38.00	26.22	11.78	57.18	34.76	22.42	41.03	27.57	13.46
Panna	53.12	32.46	20.67	70.94	40.75	30.20	58.57	34.99	23.58
Gunnor	38.33	25.88	12.44	-	-	-	38.33	25.88	12.44
Sub-total	46.20	29.55	16.65	68.03	39.48	28.55	51.25	31.85	19.41
Chhatarpur									
Bijawar	32.02	21.95	10.07	-	-	-	32.02	21.95	10.07
Rajnagar	37.89	25.58	12.31	51.37	31.95	19.42	40.13	26.64	13.49
Laundi	28.95	21.17	07.78	-	-	-	28.95	21.17	07.78
Sub-total	36.59	24.81	11.78	51.37	31.95	19.42	38.60	25.78	12.82
Grand total	**42.76**	**27.85**	**14.91**	**64.26**	**37.78**	**26.48**	**47.06**	**29.84**	**17.22**

Fig 7.11: Male/ Female literacy (%) in rural & urban areas of Panna BR



The zonewise analysis reveals that the literacy rate is highest (51.1%) in transition zone followed by buffer zone (38.1%) and least in core zone (32.4%). The same is shown in graphical form (Fig 7.12). The details of literates of male, female their total is given in Annex-7: VII.

Fig 7.12: Zonewise literacy rate (%) in Panna Potential BR



7.8 PARTICIPATION RATE

Participation rate is calculated on the basis of the total number of people engaged in economic activities of the region. They are categorized as agricultural labourers,

household industry workers, cultivators, other worker & marginal workers. In Panna BR, the % of total participation of workers involved in various economic activities is only 37.62%, as compared to non- workers (62.38%).

The districtwise analysis indicates almost the same trend. Of the total worker, 25.12 % resides in Panna district and the remaining (12.50%) resides in Chhatarpur district (Table 7.8). The maximum % of participation was recorded in Rajnagar block, which is almost 10% and the least (0.43%) in Laundi block. The details of rural, urban and total participation are given in Annex-7: VIII (A).

Table- 7.8: Participation of workers (%) to total population

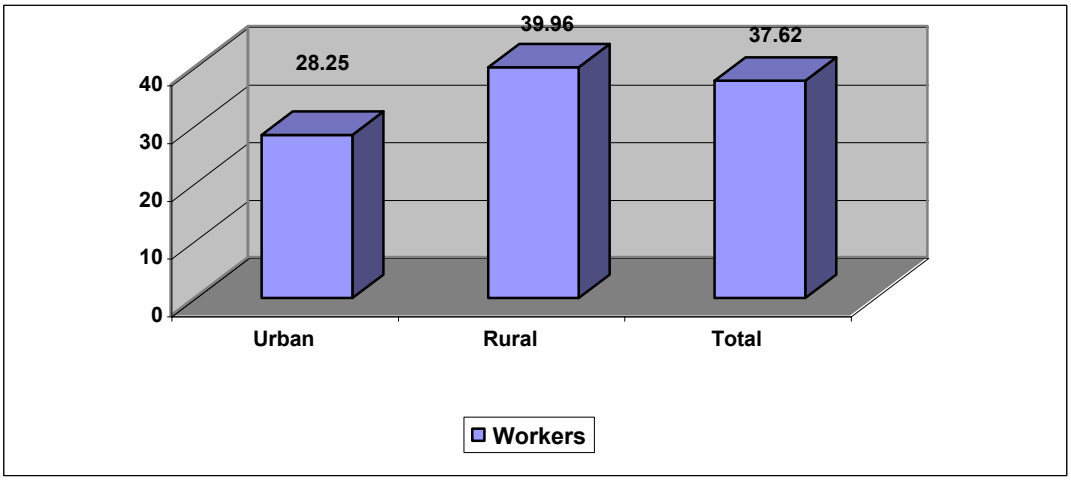
District Block/ Tehsil	Total worker	Culti.	Agri. lab.	H. ind.	Other worker	Marg. worker	Non-worker	Total Pop.
PANNA								
Ajaygarh	43.05	19.43	4.33	0.93	5.78	12.59	56.95	20.8
Panna	33.16	4.85	3.04	1.19	18.28	5.81	66.84	39.9
Gunnor	47.71	17.52	14.21	0.81	5.22	9.95	52.29	6.1
Total	**37.57**	**10.55**	**4.46**	**1.07**	**13.19**	**8.30**	**62.43**	**66.9**
CHHATARPUR								
Bijawar	42.54	14.57	7.80	1.52	6.94	11.71	57.46	5.0
Rajnagar	36.50	15.16	3.60	0.96	9.17	7.64	63.50	27.3
Laundi	47.89	39.40	0.88	0.00	1.45	6.15	52.11	0.9
Total	**37.72**	**15.73**	**4.16**	**1.02**	**8.62**	**8.21**	**62.28**	**33.1**
Grand total	**37.62**	**12.27**	**4.36**	**1.05**	**11.68**	**8.27**	**62.38**	**100.0**

As mentioned earlier, the areas of Ajaygarh, Panna and Rajnagar are urban areas. The participation rate of total workers is 28.25% of total urban population, which is only 5.65% of the total population (Table 7.9 and Fig 7.13). Of the different types of workers, the participation rate of other workers was reported maximum (19.65%) while the agricultural labours accounts only (0.69%) of the total urban population of Panna BR. Of the total participation of the urban population, the block Panna recorded the maximum participation rate of total workers viz., 17% while the Rajnagar block recorded lowest participation rate (6.53%).

Table- 7.9: Participation of workers (%) in urban area

District Block/ Tehsil	Total worker	Culti	Agri. lab.	H. ind.	Other worker	Marg. worker	Non-worker	Total Pop.
PANNA								
Ajaygarh	28.31	2.22	0.87	0.96	14.66	9.59	71.69	16.4
Panna	28.00	0.72	0.46	1.43	22.43	2.97	72.00	61.0
Total	**28.07**	**1.04**	**0.55**	**1.33**	**20.78**	**4.37**	**71.93**	**77.4**
CHHATARPUR								
Rajnagar	28.91	7.19	1.21	0.76	15.81	4.08	71.09	22.6
Total	**28.91**	**7.19**	**1.21**	**0.76**	**15.81**	**4.08**	**71.09**	**22.6**
Grand total	**28.26**	**2.43**	**0.70**	**1.20**	**19.66**	**4.31**	**71.74**	**100.0**

Fig 7.13: Rural & Urban participation (%) of Workers of Proposed Panna BR



In Panna BR, the rural population involved in various economic activities is 39.96%, which is comparatively lower than the population of non- workers (60.03%). The same is shown in Table- 7.10. Of the total participation of the rural population, the block Rajnagar recorded the maximum participation rate of total workers, which is 10.80% while the Bijawar block Laundi recorded lowest participation rate (0.54%).

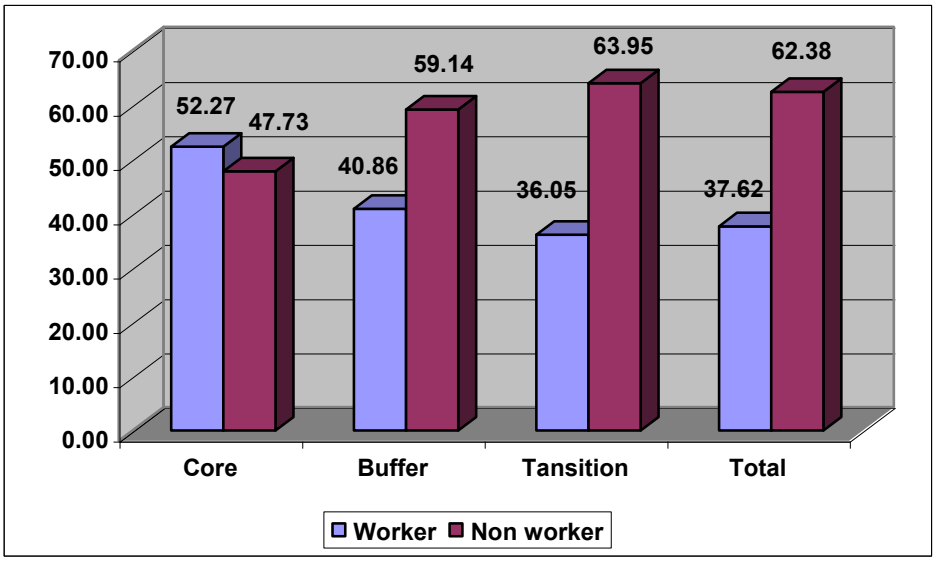
Table- 7.10: Participation of workers (%) in rural area

District Block/ Tehsil	Total worker	Culti.	Agri. lab.	H. ind.	Other worker	Marg. worker	Non-worker	Total Pop.
Panna								
Ajaygarh	45.81	22.65	4.97	0.92	4.12	13.15	54.19	21.9
Panna	35.43	6.68	4.17	1.08	16.45	7.06	64.57	34.6

Gunnor	47.71	17.52	14.21	0.81	5.22	9.95	52.29	7.7
Total	**40.44**	**13.42**	**5.65**	**0.99**	**10.90**	**9.48**	**59.56**	**64.2**
Chhatarpur								
Bijawar	42.54	14.57	7.80	1.52	6.94	11.71	57.46	6.2
Rajnagar	38.02	16.74	4.08	1.00	7.85	8.35	61.98	28.4
Laundi	47.89	39.40	0.88	0.00	1.45	6.15	52.11	1.1
Total	**39.12**	**17.08**	**4.63**	**1.06**	**7.49**	**8.87**	**60.88**	**35.8**
Grand Total	39.97	14.73	5.28	1.02	9.68	9.26	60.03	100.0

The details of zonewise participation of workers and non-workers are given in Annex-7: VIII (B) and the same is graphically presented in Fig 7.14. This shows that the participation of workers is maximum (52.27%) in core zone followed by buffer zone (40.86%) and minimum in transition zone (36.05%). Similarly the non-workers are minimum in core and maximum in transition zone.

Fig 7.14: Participation of workers & Non workers (%) to total Pop of Panna BR



7.9 SCHOOL FACILITIES

There is about one school in every village in the region. The number of middle and high schools are less than primary schools. The town based or urban-based blocks have greater number of public schools. Accessibility and availability of school facility is higher in the urban areas. This further indicates that blocks with greater ratio of schools have higher literacy rate.

This is the one of the main reasons why the literacy rate is lower. However, the literacy rate has increased in spite of almost same number of primary schools. This indicates that the school going children have increased. The trend is changing in the light of "Anganwadis" and the role of NGO"s in making the people aware of the importance of education.

7.10 ECONOMY

Agriculture: Major occupations in villages are agriculture and cattle-rearing including dairy. Except for minor craft based on bamboo, being carried out by tribe in the area, there is no other craft worth the name. Since there is abundant grass and other vegetation, the agriculturists also keep few cattle or goats. The number of goats has declined considerably, but now the agriculturists are preferring buffaloes. The number of livestock per family differs from village to village**.**

Majority of the villages being situated on dry plateaus have rain fed agriculture. People belong to following occupational structure:

- Unspecialized agriculturists
- Unspecialized cattle breeders, and
- Unspecialized labour.

Cattle Rearing: Cattle rearing are equally an important occupation. Every cultivator of the villages is a cattle herder or even a landless labour has few heads of cattle. It is not strange since the areas around the village have big grasslands. These grasslands are to be found especially on the top of the tableland and also on the banks of rivulet and the river Ken.

Milk Yield: Villagers have too many cows and buffaloes but the milk yield is small. The reason is apparent that the cattle are not scientifically reared. The milky animals are traditionally moved in the nearby jungle where they feed and then they come back in the evening. Small amount of milk is obtained from these cattle. The people are poor but the number of milky animal is large.

7.11 NATURAL RESOURCES EXPLOITATION

Tendu Patta has always been a source of seasonal income to all communities. The other forest produce that supplements the villager's income is a MFP like Aonla, Chironji, and Mahua. Except for *Tendu Patta*, collection of other MFPs within the forest limits is banned w.e.f. 1995, but in the outside forest these have been major attractions. However, the villagers do not get the return of

their efforts immediately, and most of the time not in cash. Ever since the state stopped the practice of auctioning of MFP units (in the 1980's), the established contractors and big merchants have started approaching the villagers for MFP collection through their middlemen. In return, the villagers get a little cash or some food grains in advance while the balance is paid subsequently. Actual benefits are hardly substantial.

Among the non-forest component base of natural resources, mining of building stone (Vindhyan sandstone) is the most popular occupation. A few more villages send their laborers for such mines spread all over the district of Panna. Mining operation continues for about 8-9 months in a year while 3-4 months of the rainy season are slack season due to flooding of mining pits and to some extent inapproachability of trucks etc., for transport. Some of the villagers also go for buying yearly *Patta* in diamond (surface) mining areas, but this number is very limited as this is more labour intensive and expensive gamble.

7.12 OTHER FACILITIES

Clean and safe drinking water facilities are a far cry. The most easily available source of potable water is through open wells, followed by rivers, tanks, hand pumps and canals. More than 50% of potable water sources are hand pumps and wells in the region. These are the major source of potable water in both districts followed by river and tank water. In Rajnagar the canal water is the second major source.

7.13 TRIBES AND OTHER CASTES

All the villages have subsistence economy – based mostly on agriculture, and cattle rearing. Major ethnic groups are **Gond (Rajgond, Nandgond and Saurgond)** and **Khairuas** among the tribes; **Yadavas (Dauvas)** and a few scheduled castes. Except for a couple of villages that are nearly purely tribals, all have mixed populations including upper castes.

Among Gonds, **Rajgonds** are thought to have descended from the 'ruling' Gond clan and are taken superiority to Nandgonds and Saurgonds, who have been the ruled class.

Yadavas are basically the people who pursue cattle rearing and depend on selling of milk and milk products. The main pressure on forests comes from this caste as many of them have no lands with them but still possess herds of cattle – both cows and buffaloes, which feed solely on forests for grazing.

'Basors' – a group of Scheduled castes, who work with bamboo, make articles out of it and sell them in villages/weekly markets of towns. Tendency of illicit bamboo cutting is common among Basors as they always prefer green bamboo, which is easy to split and work with.

The **Kushwahas** and **Dhimars** often indulge in fishing. They are the people who often work for big fish- contractors – catching fish both in tanks leased out for fishing and in other water bodies, including those inside the park.

A few **Sonars** also lived in Chhatarpur area of the national park.

CHAPTER – 8

ARCHAEOLOGICAL AND TOURIST PLACES

8.1 GENERAL

In recent times, tourism, all over the world has come as major economic enterprises. Probably it is the only business that helps in reaching better understanding among human cultures and takes the people to the wondrous attributes of the only living celestial body in the universe. It thus has significant potential for working in favour of the cause for running into the dangers of impactive pressures from too many or irresponsible/ill-informed visitors.

To address such vexed contradictions, scientists and managers have evolved the concept of" Ecotourism", which is an amalgam of environmental, economic and social areas of tourism interests. Since India's cultural diversity and the greater repository of its wondrous wild creatures, plants and wild lands, have bestowed on her the distinctive mystique, irresistible to tourists worldwide, there cannot be any stronger reason for adopting the tenets of ecotourism. The country has 566 PAs to conserve its wilderness treasure– we need ideas and initiatives to address the challenge.

Madhya Pradesh, the very heart of India, abounds in wild life, thick forests, and pristine scenic places. Panna-Chhatarpur complex possesses some of the best forests of Bundelkhand – one of the six geographic-cultural regions of the M.P.

8.2 PANNA

Steeped in the splendor of the royal legacies of its past, Panna is infectious, reverentially mysterious, enveloping and holy. It nestles peacefully in its magnificent mementoes of a glorious past and marvels of ancient and medieval architecture. Pervading mythology and folklore, an aura of consummate harmony and quietitude haloes it, setting it apart from the bustle of everyday life.

For Panna spiritual legacy stretches back to legendary ages: it is these deep forests that Rama and Sita passed through in their post-Chitrakoot south-wards journey. And it is here that they met the sage Agastya and his pupil Sutiksna and gave Darshan to Vrihaspati. The Pandavas stayed here during

their exile. Panna is the most sacrosanct pilgrimage for the followers of the Pranami sect world over.

8.3 Vrihaspati Kund

It is important from archaeological point of view. In the face of a hill, on the bank of river Bagen, it is a deep river gorge (about 800 feet deep) with a horse-shoe shaped waterfall at one end. The beauty of the view is breathtaking. On descending about 50 feet, there is a very long path along the cliff wall under an overhang. Under the lip of the waterfall, is a gallery like cave about 150 m long, containing many prehistoric painted rock-shelters, belonging to the Mesolithic age. The figures are executed mostly in red ochre, and are hence called "Rakat ki Putariyan" by the local folk.

As is evident from its name, the place has enormous religious importance too. It is believed that, after leaving Chitrakoot, Lord Rama came to this area and at this place gave Darshana to Vrihspati, the guru of the 'Devtas'. This area also houses one cave temple of the Chandela period and one also sees some interesting stone sculptures scattered around. During the monsoons, it is a magnificent and awesome sight and after the monsoons it is a beautiful picnic spot.

8.4 Barachh

It is one of the important sites from archaeological aspect. On the Akola Nalla, near Barachh village, one finds rock paintings which describe the life of pre-historic cave-dwellers, in vivid, panoramic detail. Executed mainly in red-ochre, with themes taken from the everyday events, the scenes usually depict hunting, battle and festivals. Some wild animals also have been depicted; quite akin to the manner in which they have recently been found in the Neolithic age rock shelters of Bhimbetka.

Both, Vrihaspati Kund and Barachh are archaeological treasures, invaluable chronicles in the history of man, and present an eloquent testimony of Panna being a heritage of great civilizations.

8.5 Ajaigarh Fort

Ajaigarh fort has rich rewards for the traveler unafraid of distance, difficulty and danger. Reached at least deep in rough and rugged country, the challenge is not yet ended: its uneven rampart is an aching 800 foot climb from the plain and nearly three miles round enclosing a triangular projection. It is situated 33 km north of Panna at a height of 1744 feet above sea level, on a lofty flat-

topped spur of the Vindhyan hills. The lower part of the hill, which consists of reddish sandstone, is very abrupt and quite inaccessible.

The foundation of Ajaigarh is referred to an unknown Raja, Ajai Pal. But the name Ajaigarh is not found in any of the inscriptions, the name being invariably given as Jaipur-Durg. There are reasons to believe that Kalinger and Ajaigarh forts are contemporary in origin. Kalinger is mentioned in the Vedas, the Ramayana, the Mahabharata and the Puranas. Cunningham opines that Kalinger fort was built in the first century. Same should be the case with Ajaigarh fort; although, historical certainty in this regard would remain elusive.

It is astonishing that this fort has not been promoted for purposes of tourism. Its security angle, in consonance with the needs of its times is fairly interesting. With its great bastions and four large water caverns, Ajaigarh was a self-contained forest hill fort, meant to withstand long sieges and able to shelter the whole region's population within its walls. Its archaeological value is beyond words. The craftsman of Ajaigarh worshipped the rising sun as the mystic world, the lotus, carving its petals on pillars, arches and soaring Shikhars.

Panels and friezes of voluptuous nymphs and celestial Apsaras in a variety of sensuous attitudes recall the romantic and heroic sagas of the Chandella court bards, about the many loves of Parmadi, about the valour of his two Banaphar Rajput warriors Allha and Udal.

8.6 KHAJURAHO- A WORLD HERITAGE SITE

The temples of Khajuraho located on outer fringe of transition zone of the proposed BR are India's unique gift to the world, representing, as they do, a paean to life, to love, to joy, perfect in execution and sublime in expression. Life in every form and mood has been captured in stone, testifying not only to the craftsman's artistry but also the extraordinary breadth of vision of the Chandela Rajputs under whose rules the temples were conceived and constructed. It is one of the world heritage sites.

The name Khajuraho evolved from the ancient word "Kharjuravahaka", which is derived from the Sanskrit word Kharjur meaning date palm. The Khajuraho temples were built in the short span of a hundred years, from 950-1050 AD in a truly inspired burst of creativity. Of the 85 original temples, 22 have survived till today to constitute one of the world's great artistic wonders.

The temples of Khajuraho are architecturally unique, being different from other temple prototype of their period. Each stands on a high masonry platform with a marked upward direction in the structures, further enhanced by vertical projection to create the effect of grace and lightness. Each of the chief compartments is mounted by its own roof, grouped so that the

highest is in the center, the lowest over the portico; a highly imaginative recreation of the rising peak of the Himalaya, abode of the gods.

The three main compartments are the entrance (Ardhamandapa), assembly hall (Mandapa) & sanctum (Garbha Griha), with further additions in the more developed temples. The entire temples have been classified into three geographical divisions viz., - western, eastern and southern.

The Western group of temples: It includes Kandariya Mahadeo, Chaunsath Yogini, Chitragupta Temple, Vishwanath Temple, Lakshmana Temple and Matangeswara.

The Eastern group of temples: It includes Parsvanath Temple, Ghantai Temple & Adhinath Temple. Beside this three Hindu temples of the group are the Brahma and the Javari.

The Southern group of temples: It includes Duladeo Temple & Chaturbhuj Temple.

Sound & Light Show: This fascinating Son-et-lumiere spectacle evokes the life and times of the great Chandela Kings and traces the story of the unique temples from the 10th Century to the present day. Mounted at the complex of the Western Group of temples, the 50 minute show runs in Hindi and English every evening. Amitabh Bachchan, Indian film superstar, narrates the story of Khajuraho in his mesmerizing voice.

State Museum of Tribal and Folk Arts: A fine collection of masterpieces of tribal and folk arts and artifacts from all over Madhya Pradesh is on display at the Chandela Cultural Complex. The State Museum has more than 500 representative items of Terracottas, metal craft, woodcraft, tribal and folk painting, tattoos, jwellery and masks. The museum is open on all days except Monday and government holidays from 12:00 noon to 8:00 P.M.

New Temples Excavated: In recent excavations at Bija Mandal, located 3 km south-east of the western group of temples, remains of several temples even older than the originally known 85 have been found.

8.7 PANNA ARCHAEOLOGICAL MUSEUM

The museum set up in 1988 in Hindupat Palace, is rich in antiquities including sculptures and relieves. The exhibits, interesting artistically and iconographically have been fetched from Nand Chand, Nachna, Mohendra, Pawai, Patha Batasa, Collector's residence, circuit house etc. They include Vaishnava, Shaiva, Jain and Goddess images along with certain secular ones. The painted rock shelters of Vrhihaspati Kund are also here. Panna's archaeological importance is underlined through the images etc., displayed here, presenting a continuous unbroken chain from the Gupta's to the Chandela's.

8.8 OTHER PLACES OF INTEREST

Pandav Fall: A waterfall, which attracts one and all, Pandav Fall is one such place. It is around 30 m high. The beauty of the water fall is enhanced by a large pool at its base and ancient caves overlooking the pool. Further more, it is among the few perennial falls in the region, though it is at its best in monsoon. Pandav Fall is named after the legendary Pandavs, who according to a local belief spent some time in the caves here. Pandav Fall is easily accessible; it is located just off the Panna-Chhatarpur, highway 12 km from Panna towards Chhatarpur 7 km from Madla gate of the Tiger Reserve towards Panna. Pandav Fall is open to visitors round the year.

Kamasan Fall: This fall is located close to the boundary of Panna Tiger Reserve (PTR) and is only two km away from Hinouta gate of PTR. The fall provides very good scenery during the monsoon.

Dhundhawa Fall: This fall is about 5 km inside the TR from the Hinouta gate and is about 75 m deep and drains in Ken river. The place provides very good scenery particularly during monsoon. The fall is a water source for wild animals during the summer. This place is frequently visited by tiger and sloth bear.

Bhauradeh : This place is 12 km away from the Madla gate on the Ken river. The place is full of big rocks in the course of Ken river. Tourists visit this place and enjoy the beauty of the Ken river sitting on the rocks.

Lakhanpur Seha: Located about 12 km from Panna, it is a scenic perennial waterfall. On the way to this fall, one passes through the area where the private diamond mining is done. The place is an excellent visit during monsoon.

Khajri Korar: Located about 9 km from Panna on the Ajaigarh road, it is a deep gorge at the end of which an ancient Shiva temple is located. It is a beautiful scenic spot and on a clear day one can see the Ken river and Khajuraho with the help of binoculars from this place.

Bhadar and Badgadi: Bhadar is located 10 km away from the Hinouta gate, while Badgadi is 20 km away. Both places are abandoned village sites and provide a very good habitat for wildlife.

Gehrighat and Ken River Gorge: Both these places are deep inside the Panna NP, 35 km away from Hinouta gate. These places present a visitor with pleasant stops during his visit. The Ken river gorge, inside the deep forests and overlooking the mighty plateaus, is at its best during the wet season. The Gehrighat where the river Ken enters the gorge after a short flat stretch is a place where nature has found exquisite expression in a myriad enchanting way. Its tranquil beauty defies the limitations of descriptive language to the extent that one comes face to face with the Vedantic truth: "He who sees

cannot say, and he who says has not seen".

Ken Boating Site: The boating site in Ken river is located about 7 km away from Madla gate of the TR. Boating provides unique scenery on both sides of the Ken river. One may also see a number of crocodiles in the river particularly during the winter.

Madla: Located 25 km away from Panna town towards Chhatarpur on the NH -75, it is the entrance of the TR. The place is visited by a large number of tourists including a number of foreign tourists. The interpretation centre on the bank of the Ken river will further improve the tourist value of the place.

Rajgarh Palace: This palace is 3 km from the NH-75 and is in very good condition. Government of Madhya Pradesh is converting it into a heritage hotel.

Cave Paintings: There are a number of caves in the proposed BR and there are wall paintings in them. These are like Bhimbaithaka paintings found near Bhopal.

Ken-Gharial Sanctuary: This sanctuary is one of the very limited number of sanctuaries in India that is sincerely dedicated to breeding programs and proper housing of Gharials, a cousin of the mighty crocodiles. They are sometimes referred to as 'Indian Gharials' or 'Gavials'. They are characterized by their exceedingly elongated and unbelievably slender snouts that invariably demarcate them from their evolutionary contemporaries, the crocodiles. The sanctuary is positioned at the rendezvous point of the twin rivers, namely, Ken and Khudar. Being positioned inside the premises of the Chhatarpur district approximately 24 km away from Khajuraho, the Ken-Gharial sanctuary is a popular destination that is frequently visited by animal enthusiasts.

The Gharials, chief attraction of this **Sanctuary,** is a rare breed of reptiles. Although they share a common line of evolutionary descent with the crocodiles, they are deficient in the robust jaw power and sheer skull strength that is vested to the crocodiles. But on the other hand the Gharials are proficient in trapping down wee fishes and supple body movements that is rarely seen in crocodiles.

The Gharials of the Ken-Gharial sanctuary in Madhya Pradesh are recorded to have grown to an astounding length of 6 m. Although the myths about the 'killer Gharial' is obviously not true as their fragile jaws are virtually incompetent in consuming human beings but it is advisable to keep your safe distance from these creatures.

Raneh Fall: This is a water fall in the Ken river which provides a rare scenic beauty and nature's art in the river. This is visited by about 35,000 tourists annually including more than 10,000 foreign tourists.

Mohareghat : This place is located about 5 km from Raneh Fall in the Ken river. One may easily sight gharial at this place. Boating facility is also available to the tourists. During boating, the visitors may enjoy the narrow

rocky banks of the river.

Trekking Route: A trekking route from Raneh Fall to Chhapara and Ajaygarh via Piparaghat has been identified for the tourists. The trekking route is full of nature's treasure.

Dharamsagar Lake: There are four main lakes in Panna Lokpalsagar, Benisagar, Nripatsagar and Dharamsagar. However, the only lake worth a visit is Dharamsagar. Inside the lake stands a small beautiful Shiva temple with its pristine simplicity. From the circuit house the view of the lake is unparallel and the best time for it is sunrise and sunset when the lake below mirrors the changing hues of the morning and evening sky. It also offers a panoramic view of town.

Lakshmipur: Built in Paladian style by Maharaja Rudra Pratap Singh as his hunting lodge, it was recently converted into an open jail. It is presently unoccupied and in a state of decay. Stripped of its former glory, this magnificent building testifies to the refined aesthetic qualities of the Bundelas.

Ken River Lodge and Tree House: The Ken river lodge is owned and operated by a Major Chandrakant while the 'Tree House' owner is a swiss, Mr. Gielle. Both these places are situated next to each other on the banks of the Ken river at a fairly picturesque spot. The tree house is a good place to have outdoor dinners in a romantic locale. Ken river lodge offers boating, fishing and snorkeling on the river; along with lodging and boarding facilities. It is a good place to have a lunch stop, a pleasurable time on the river and to savour the taste of exotic rural environment for a short while.

Gangau Weir: A stop dam has been constructed at Ken river near Gangau village. It has been constructed during British period and a canal has been created for utilizing water for irrigation. The adjoining hill top around will create magnificence scenic view. Due to its unique design and location it provides excellent site for picnic. The area can be further developed for attracting tourists.

CHAPTER – 9

DEVELOPMENT PROJECTS & THEIR LIKELY IMPACTS

9.1 MINING

The diamond mines are located in a belt of 80 km across the district. The belt starts from Paharikhera north-east to Majhgawan south-west with breadth around 30 km. The government owned National Mineral Development

Corporation (NMDC), a Diamond mine, located at Majhgawan is just outside the Panna Tiger Reserve of the Hinouta range and encroaches on part II of Gangau sanctuary. It is about 20 km away from Panna and is approachable by all metal roads from Panna. The nearest airport is Khajuraho, which is about 60 km from Majhgawan, while the nearest railhead is Satna, which is about 92 km. away.

The main impact due to mining activity mainly Majhgawan may be as follows-

- The Panna Tiger Reserve (Panna National Park and the Gangau WLS) are in close proximity to each other and have affected by diamond mining.
- Mountains of solid waste material from the opencast mine, pre- and post-treatment are dumped on the surrounding forestland, encroaching on both Panna National Park and Gangau sanctuary.
- Slurry from the mine also feeds into the river and its tributaries carrying the sludge to the tiger reserve.
- There is also biotic pressure on the area for firewood and fodder from about workers residing in the colony of NMDC.
- The residual earth after extraction of diamonds (called „Reha") had been dumped indiscriminately on the border of the Panna NP and in the Panna Reserved Forests and had seriously impacted the ecology including that of the Ken river, which is the lifeline of entire area.

However, the mining activities at Majhgawan are not being carried out at present. Hon'ble Supreme Court has already granted permission for mining activity. Further process for initiation of mining activities is under process and the mining operation may start in due course of time. Thus there would be adverse impact on the wildlife and forest quality of the adjoining forest area.

There is also some private opencast diamond mining workout in small scale in Panna. Illegal mining of Diaspore and Pirophilite stone, which is known as Bundelkhand Granite, is being carried just outside of the Ken-Gharial sanctuary. Sandstone mines is also being carried out in the region. Besides, stone mining is also carried out at some places.

9.2 SATNA - KHAJURAHO RAILWAY LINE

There is a proposal of Satna-Khajuraho railway line passing through Panna Tiger Reserve especially through Gangau sanctuary. As per proposal presented by deputy chief engineer (construction), Central West Railway, Bhopal on 29/11/2006, the total length of the railway line would be 123.9 km which is a part of Lalitpur-Singarauli railways line.

It includes 9 km passing through Panna Tiger Reserve. Two tunnels will also be constructed inside the PTR and 74 m broad forest area is also proposed for diversion. It means that 9 km long and 74 m broad i.e. 66.60-ha areas will be needed for diversion. The likely main environmental impact may be as follows-

- Proposed railway line is not appropriate in view of wildlife management. According to article 29, Wildlife (Conservation) Act 1972, habitat destruction of wildlife can only be permitted, if there is some better option of wildlife management.
- In the Panna TR area dry deciduous teak and mixed forests are found. This area along with other nearby forest areas are important habitat for tigers and other wildlife species. They would be adversely affected.
- Although 66.60 ha of area is proposed for diversion but a total of 18 sq km area of Gangau sanctuary will lose its natural status and will become inappropriate for the wild animals. Thus wildlife habitat area may be affected due to this.

As per information provided by office of Field Director, Panna Tiger Reserve there are other two alternative proposal for the railway line. However no final decision has been taken for passing of the route for the proposed railway line.

9.3 KEN-BETWA RIVER LINK PROJECT

9.3.1 General: The National Water Policy, adopted by the Government of India in 1987, emphasized the need for inter basin transfer of water. It states "water should be made available to water short areas by transfer from other areas including transfers from one river basin to another, based on a national perspective, after taking into account the requirements of the areas/ basins". In this connection, it has been proposed to divert the surplus waters of river Ken at Daudhan village) through Ken-Betwa link canal to river Betwa in the proposed biosphere area for meeting water requirements in the water deficit Betwa basin.

Ken-Betwa Link Project (KBLP) is one of the links among 30 river links proposed by the Government of India"s National Water Development Agency (NWDA), involving MP and UP in Bundelkhand region. The proposal is still under consideration at State and Central level.

Proposed K-B link project comprises a storage reservoir about 73.8 m high Greater Gangau Dam (GGD) to be created on Ken river at Daudhan village, about 2.5 km upstream of the existing Gangau weir and about 19 km from NH-75 (Chhatarpur-Panna road), a side channel concrete spillway, two power houses, and a 231.45 km long link canal to transfer surplus waters from Ken to Betwa river.

9.3.2 Main Features of Project: The key features of the project are as follows-

- The reservoir will irrigate an area of 3.70 lakh ha by the direct irrigation and provide water to drought prone areas of upper Betwa sub-basin by way of substitution to 1.27 lakh ha annually. Besides this, the project will provide 850 Mcum of water to U.P. to utilize in the downstream areas of the Ken Multi-Purpose Project (KMPP). The ultimate benefits going to be accrued from the project will go to the states of M.P. and U.P.
- The total installed capacities of the powerhouses proposed under the project are 72 MW.
- It will also provide about 12 Mm^3 of water for drinking purpose to the en-route areas of the link canal.

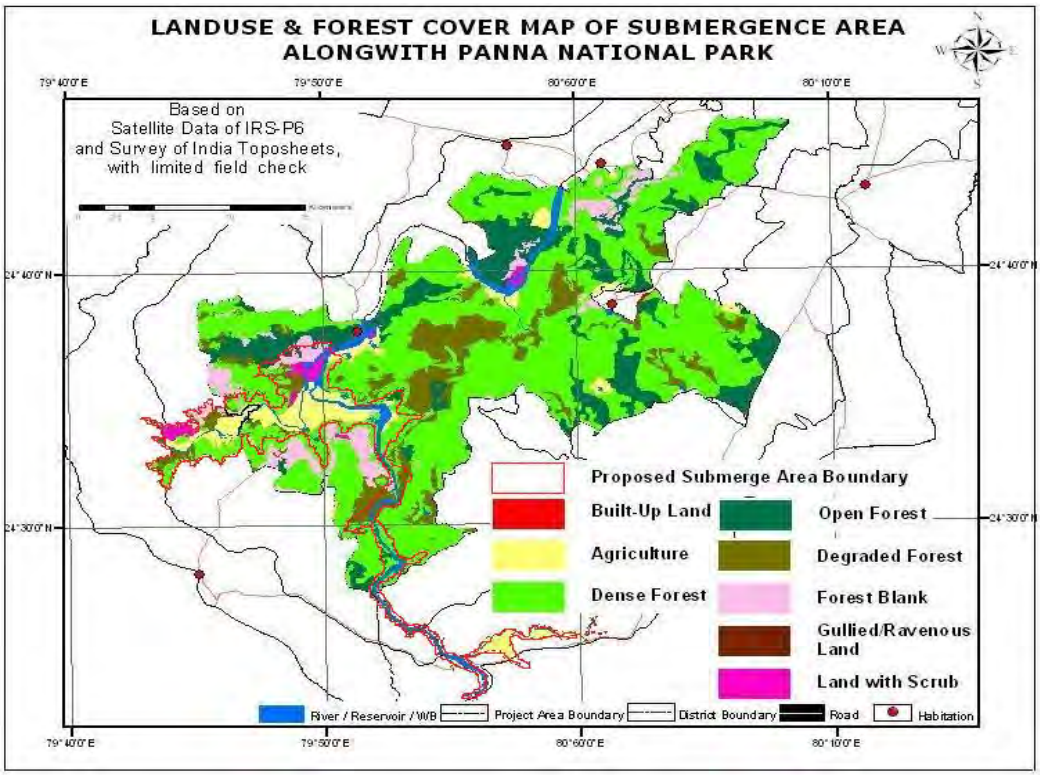
9.3.3 Environmental & Ecological Impact

The major environmental and ecological aspects of K-B link canal project mainly pertain to the areas of the submergence. Relevant aspects on environment and ecology of K-B link canal project and the possible impacts have been discussed in the following paragraphs:

Submergence Area: The total area of submergence of Greater Gangau reservoir (Daudhan dam) of Ken-Betwa River link project at FRL 287 m of the reservoir is 86.50 sq. km. However, the area based on satellite imaginary is 87.34 sq km. A total of 10 villages are fully coming under submergence and about 900 families having a total population of about 8550 will be displaced. The population density of the area is about 70 people per sq km.

The entire area of the submergence comes under Proposed Panna BR. The maximum area comes under Chhatarpur district toward western side of the Ken river. Out of the total submergence area 57.21 sq. km lies within Panna National Park. This comes 65.50 % of the total submergence. The submergence with reference to Panna N P area location along with area of Panna National Park is given in Map- 9.1.

Map- 9.1



Landuse of Total Submergence Area: The details of landuse of the total submergence area are given in Annex- 9.1 and the same in spatial form is given in Map- 9.2. The percentage of the areas for various uses is given in Fig– 9.1. It reveals that 49.09% of the area is covered under forest. The land cover under agriculture is 28.69% while that of the water bodies constitute 16.92%. The wasteland is about 5.29%. The agriculture is basically confined on either side of the tributaries of the Ken river. The Water bodies lies along the Ken River and its tributary. The dense type of forest cover is 29.00 % while open type of forest is very few (2.83%). The dense forest is basically found in central part of the submergence area in northern and also most part of the southern sides in Chhatarpur district and also toward eastern side of the Ken River in Panna district. Beside this major patch is also found toward southern side. The open forest is found only in small patches. The degraded and forest blank cover is 11.24% and 6.02%, respectively. The scrub land is basically found in northern side in Chhatarpur district in patches. Adjoining to this also lies forest land. On the whole quality of the forest can be said to be average.

Landuse of Submergence Area Falling in Panna NP: Of the total submergence area of Greater Gangau Dam, 57.21 sq km fall within Panna NP. The landuse analysis of this area is given in Table- 9.1. Within submergence area, the forest account for 54.78 % followed by agriculture land (24.03%), water bodies (16.82%), and wasteland (4.36%). The dense forest accounts 33.86% w.r.t. the total geographical area of submergence with in Panna NP.

Map- 9.2

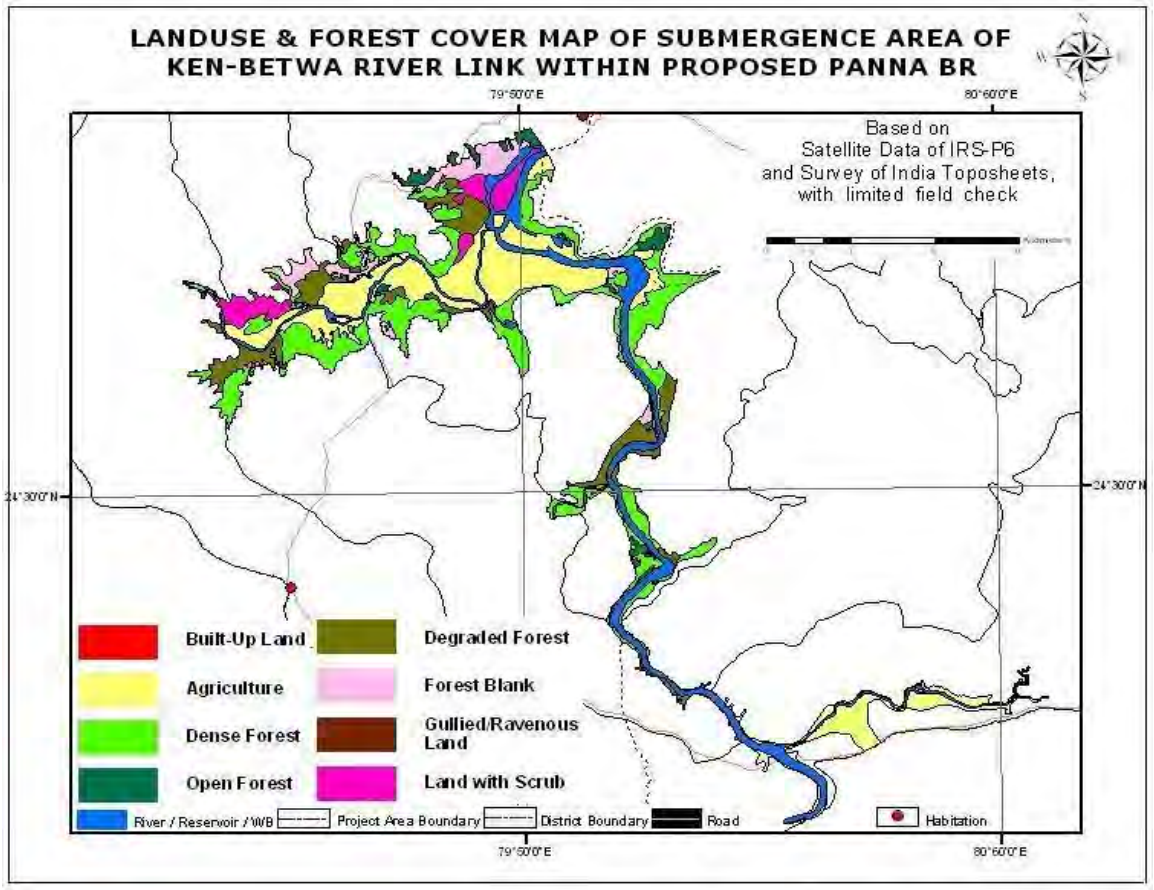


Table – 9.1: Landuse of submergence area falling within Panna NP

S. No.	Category of Landuse	Area (sq. km)	Area (%)
1.	Agricultural land	13.75	24.03
2.	Built up land		
3.	Forest		
	Dense	19.37	33.86
	Open	2.36	4.13
	Degraded	5.9	10.31

	Forest Blank	3.71	6.48
4.	Wastelands	2.50	4.36
5.	Water bodies	9.62	16.82
	Total	57.21	100.00

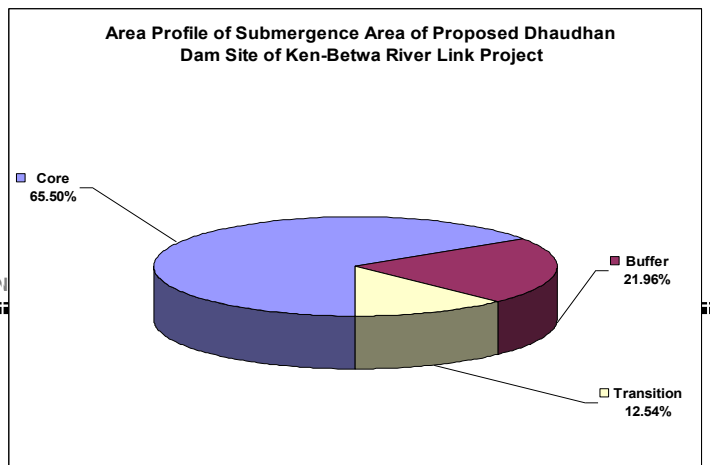
Landuse of Panna NP before and after exclusion of Submergence area**: After submergence of the area due to proposed Greater Gangau reservoir, the total area of the Panna National Park is reduced from 561.22 sq km to 504.01 sq km. Of the reduced area, 61.62% is dense forest against the 58.79% before the submergence of the area. The agriculture land is now 2.07% against the 4.31% before the submergence. Similarly the area under water bodies is 1.71% against 3.25% before the submergence. In fact, the quality of the National park area excluding submergence is would be comparatively better than the previous. The comparative landuse of Panna National Park before and after exclusion of submergence is given in Table- 9.2.**

Table – 9.2: Comparative Landuse of Panna National Park before and after exclusion of submergence

S. No.	Category	Breakup of total area before submergence		Breakup of total area excluding submergence	
		Area (sq. km)	Area (%)	Area (sq. km)	Area (%)
3.	Agricultural land	24.23	4.31	10.48	2.07
4.	Built up land	0.28	0.04	0.28	0.06
3.	Forest				
	Dense	329.95	58.79	310.58	61.62
	Open	87.30	15.56	84.94	16.85
	Degraded	-	-	59.31	11.77
	Scrub	65.21	11.62	-	-
	Forest Blank	31.82	5.67	28.11	5.58
4.	Wastelands	4.17	0.74	1.67	0.33
5.	Water bodies	18.26	3.25	8.64	1.71
	Total	**561.22**	**100**	**504.01**	**100.00**

Zonewise Submergence Area of Greater Gangau Dam: As mentioned earlier, the total submergence area on account of proposed Greater Gangau reservoir for Ken- Betwa link project is 87.34 sq km. The details are given in Annex-9: I. Of this 65.50% lies in core zone, 21.96 % in Buffer zone and the remaining area of 12.54 % in transition zone. The same is shown in Fig- 9.2. Thus, the loss of area on account of submergence would be greater in the core zone.

Fig- 9.2



Impact on Flooding: As the FRL of the proposed Greater Gangau reservoir has been fixed at 287.0 m, which is about 52.0 m above the present FRL of the existing Gangau weir. It is therefore, seen that the storage of Greater Gangau dam will definitely contribute its own role in mitigating floods in the downstream portion of Ken basin to a greater extent.

Impact on Fisheries: Creation of the Greater Gangau dam shall-definitely increases the production rate of all the varieties of fishes found in the area. In addition to this some other improved varieties of fishes like Catla, common carp, Kariyat, Mrigal etc., can be cultured very easily. However, this will be against rule of Wildlife Protection Act, 1972.

Impact due to construction of Colony: An area of about 25 ha is to be cleared for the construction of the project staff colony near the existing Gangau weir. No additional area for the construction of road is to be cleared, as almost all the locations are accessible by the motorable dry weather roads.

Living conditions of the affected tribal: Out of the total population submerged, the schedule castes and schedule tribes constitute about 15.5% and 34.4% respectively. The literacy rate is about 9.7%, which indicates that the available educational facilities are inadequate. About two-third of the population constitutes the labour force and their main occupation is agriculture.

Impact on wildlife: Due to submergence, the northern part of the Panna National Park falling in Chhatarpur district is almost separated from the southern part of the Panna National Park. This may affect the movement of the wild life. Besides, due to increase in water spread area along the tail end of the Ken River there may be difficulty in the movement of the wild animals within the Park area especially from Chhatarpur district area to Panna district area.

The impact of the submergence on the wild life will be negative. The wildlife would lost its own natural characteristic of moving from the interior forest areas adjacent to the areas of submergence. Similarly, there would be overall adverse impact on flora and other faunal diversities.

As mentioned above 49.08% of the total submergence area comes under the forest & about 29.00 % of the total geographical areas have dense type of forest, the loss to the flora and forest will be very high. The entire wood log, minor forest produce & biodiversity of the submergence area would get lost forever.

Public health aspects of the population: The proposed dam and its surrounding areas are well known for endemic malaria. Due to submergence, incidence of malaria and related diseases would increase. The villagers along the periphery of the reservoir will face the problem of wastewater disposal, as the existing drains will become inefficient due to the impoundment of water in the reservoir in their vicinity.

Impact on medium and small scale industries: At present there is no industrial unit has been set up in the area. Due to coming of such a multipurpose project in the area, setting up of some medium and small industrial units in and around the project area in near future can't be ruled out. This will be helpful for the overall development of the area economically. However, possible pollutions due to industrial unites have to be studied and adequate mitigative measures have to be adopted, while sanctioning the units.

Water logging and salinity aspects: The water holding capacity of the soils of the command area is low to medium and the water table levels in the command area on an average is well below the ground surface, there is no need to take any special efforts to lower down the sub-soil water table in the areas under normal conditions. Ground water found in these areas is free from salinity problems.

The ground water table is expected to rise, due to the reservoir impoundment in the submerged area. The ground water regime in the canal alignment would generally remain unaffected as the canal is proposed to be wholly lined with cement concrete.

Landslides on the periphery of the reservoir: Ground level may rise gently on the left bank and little steeper in the right bank of the reservoir. There is very little possibility of landslide on the periphery of the reservoir, since the area mainly consists of pink granite rock free from faults etc, as per the available geological reports.

Siltation due to sediment load: Due to the water spread area of the reservoir, the long hill streams joining to the river will get shortened, which may result in widening of the channels close to the periphery of the reservoir. The widening will cause more silt deposit at the reservoir site. The rate of siltation at the rate of 357cum/sqkm/year has been considered for this project.

CHAPTER - 10

ADMINISTRATION

10.1 GENERAL ADMINISTRATION

The proposed Panna Biosphere Reserve comes under Panna and Chhatarpur districts. The administrative pattern of both the District is the same as prevalent in other districts of Madhya Pradesh. The District is the basic unit of administration. The District Magistrate/Collector is the administrator of the District. The most important work of the DM is to maintain law and order, various rules and implementation of Government orders. The collector is the link between the State Government and the people of the District; the custodian of law and authority, the pivot on which the local administration turns. Being the Chief Executive Officer of the District, The Collector exercises general supervision over the District level officers of various departments in their non-technical work. Co-ordination of the activities of various departments at district level, control over local- self government bodies, if necessary contact with the public in committees or during interviews with

visitors, execution of government schemes and miscellaneous functions such as Panchayats, census, elections and relief measures in times of emergencies like floods, epidemics etc, also come within his purviews.

To maintain the general administration of the district there are Additional District Magistrate for the assistance. Apart from this, there are one City Magistrate for district and Sub Divisional Magistrate (SDM) for Tehsils. Also there is Additional City Magistrate in both the district.

District magistrate is also concerned with well-planned development of the district. For planning purpose district is divided into Blocks. As mentioned earlier that parts of six blocks falls under the BR area. Ajaigarh, Panna and Gunnor are covered under Panna district while Bijawar, Rajnagar and Laundi are covered under Chhatarpur district.

10.2 JILLA PANCHAYAT AND JANPAD PANCHAYAT

For coordination and implementation of rural development works, there is a chief executive officer under Jilla Panchayat. The elected member is chairman of Jilla Panchayat. A senior office is posed as Chef Executive Officer at Jilla Panchayat level. He is responsible for implantation of all rural developmental works of the district. Similarly at block, level there is chairman, who is also elected representative and is called chairman of the Janpad Panchayat. Under them there is chief executive officer. At village level (or group of villages), there are elected Sarpanch/ Upsarpanch.

10.3 DISTRICT LEVEL DEPARTMENTS ORGANISATIONS

The district level officers of various departments/ organisations specially related to developmental works for Panna and Chhatarpur are represented generally by Class I & II officers. Amongst them the main departments related to various developmental works are as follows-

1. Divisional Forest Officer, Forests
2. Chief Medical Officer/ Health Officers
3. Executive Engineer, Water Resources
4. Executive Engineer, Rural Engg. Services
5. Executive Engineer, PWD
6. District Education Officer, School Education
7. Executive Engineer, Public Health
8 Dy Director, Farmer Welfare & Agri. Dev.
9 Asstt. Director, Horticulture
10 Asstt. Director, Fisheries
11. Dy Director, Veterinary Services
12. Regional Tourism Officer
13. Astt. Director, Schedule Caste Welfare

14 Dy Director, Health & Family welfare
15. Astt. Director, Tribal Welfare
16 District Planning Officer

The organizational setup and their main functions of some important departments like Public Works, Agriculture, Animal Husbandry, Forest, Horticulture etc., follows as under :

Forest department: For administrative purpose the forest department of district Panna is divided in two divisions i.e. North Forest Division and South Forest Division. However, in the case of Chhatarpur there is only one forest division. Forest area of Panna Tiger Reserve is administered by forest officers of the rank of chief conservator forest supported by Dy Director and Asstt Director, forests. The Divisional Forest Officer (DFO) is the head of the division and responsible for protection of forest. He is responsible for Implementing all the prescriptions as prescribed under various working plans and micro plans, empowering both Joint Forest Management Committees (JFMCs) and staff of the forest department for holistic development of forestry sector, application of modern advanced electronic media for efficient management of forestry affairs. For assistance there is one Sub Divisional Officer (SDO) of forest, and forest ranger, deputy forest ranger, forests assistant, and forest guard are posted at field.

Public Works Departments (PWD): PWD is responsible for the maintenance and repair work of government buildings, roads, bridges and construction of small bridges (Pulias) etc. For his help, there are assistant engineers block wise and junior engineer are posted.

Department of Farmer Welfare & Agriculture Development: Dy Director, Agriculture at district level is responsible for monitoring all the agriculture activities and development works in the area. For his assistance there is an Agriculture Officer, One Additional Agriculture Officer, Sub Divisional Agriculture Extension Officers, Assistant Development Officer (agriculture), Assistant Agriculture Inspector and several Kamdars are there. This department also monitors the work of the plant protection. For the help there is a plant protection supervisor at block level.

Animal Husbandry: Deputy Director, Animal Husbandry is the responsible for the work to organize and implementation of various programmes related to animal husbandry. At both the district there is Chief Veterinary Officer and several Veterinary Doctors are posted. Their main work is to improving the breed of animals and production. For animals there are veterinary hospital, mobile veterinary office and artificial invigilation center. Apart from this several dispensaries and Pashu Seva Kendra also established in the area.

Horticulture: The department is responsible for increasing horticulture and its area. It is also responsible for extension of horticultural crops, production and

distribution of high variety plants, distribution of developed seeds of vegetables and condiments and development of aromatic & medicinal plants. Asstt. Director is the head in his office. Senior horticulture inspector, horticulture inspector is also there for assisting him.

Fisheries: Asstt Director is the head at district level and responsible to develop rivers & ponds for fish culture, research & development in the field of fisheries, improvement of fishing techniques & marketing, regulation of fish catch, stocking of all the water bodies with genetically improved seeds using village ponds for seed rearing, fish seed farms and rearing ponds owned by the departments will now be leased to unemployed graduates, fisherman and cooperative societies for seed production, encouraging fish seed production & introducing prawn culture in private sector.

Tourism Development Corporation: The proposed Panna Biosphere area offers a variety of tourist attractions ranging from sculpture to wild life and hence it is comparable to any top tourist region of the country. As an industry, tourism has a great potentiality for earning foreign exchange and also creates employment opportunities.

The Madhya Pradesh State Tourism Development Corporation (MPSTDC) has set up the regional office in Khajuraho with the objective to provide lodging, catering, transport facilities to the domestic as well as international tourists. The corporation is expected to provide information regarding tourism and organizes adventure programmes for the tourists. Regional Tourism Officer is the head & responsible authority of MPSTDC.

CHAPTER – 11

PROTECTION MECHANISM

11.1 GENERAL

Biosphere reserves are mainly a management concept. As mentioned below in subsequent paras no new legislation is required to implement the objectives of Biosphere in the proposed Panna Biosphere Reserve.

11.2 FLORA AND FAUNA CONSERVATION

The conservation of fauna and flora in National Park and both the Sanctuaries is fully protected legally through the Wildlife Protection Act, 1972, its subsequent amendments (1991 & 2002), and the rules made there under.

11.3 FOREST CONSERVATION

The conservation and management of Reserved and Protected forests is provided under the Indian Forest Act, 1927, and its subsequent amendments. The Reserved Forests are free of rights but Protected Forests do have some

burden of right of use, which has to be taken care of in schemes of management of these forests. Protection of forests, prosecution of offenders against violations of forest laws etc., are all provided in this Act.

11.4 MINOR FOREST PRODUCE EXPLOITATION

Utilization of forest produce, harvesting of major and minor produce etc., is regulated under the Madhya Pradesh Van Upaj Vyapar Viniyaman Adhiniyam 1969. Transport of forest produce also controlled through this Adhiniyam as well as the Indian Forest Act, 1927. Grazing is controlled through MP Grazing Rules 1986 under the Indian Forest Act, 1927. The laws make no provision for conservation.

11.5 DIVERSION OF FOREST LANDS

The conversion of forest land for non-forest activities, restriction on felling of trees of forest areas, and any activities, which may be detrimental to forests, can be easily controlled by Forest Conservation Act, (1980).

11.6 LAND IN VILLAGES MP LAND REVENUE CODE

The management of government land in villages outside Reserved and Protected forests is done through the Madhya Pradesh Land Revenue Code, which provides for protection of trees etc., on public lands as well as privately owned lands.

11.7 CONSERVATION OF BIODIVERSITY

Protection of biodiversity and the illegal trade & exploitation of biological resources of biodiversity can be controlled through Biodiversity Act, 2006.

11.8 AIR/ WATER POLLUTION/ENVIRONMENTAL PROTECTION

The air and water pollution activities and any activity leading to degradation of environment in the proposed Biosphere Reserve area can easily be controlled by the Air (Prevention and Control of Pollution) Act, 1981, the Water (Prevention and control of Pollution) Act, 1974, and Environmental (Protection) Act, 1986.

11.9 PRIVATE / COMMON LANDS: BHUMI SUDHAR

Conservation activities on privately owned or common lands can be carried out through the powers vested in the Government by the Madhya Pradesh Bhumi Sudhar Yojana Adhiniyam 1967. Section 7 of this Act empowers Government to prepare land improvement schemes involving the following matters:

- Prevention of erosion soil
- Preservation and improvement of soil

- Introduction of dry farming methods
- Improvement of methods of cultivation and extension of cultivation
- Provision and improvement of water supply
- Control and maintenance of tree growth
- Prohibition or control of grazing or reservation of land for pasture
- Regulation or prohibition of firing of vegetation
- Cultivation of waste or fallow land
- Reclamation of waste, saline or waterlogged land
- Eradication of Kans or any other kind of weed or vegetation which is likely to adversely affect or interfere with cultivation
- Soil and water use management
- Any other matter which may be prescribed

This list is exhaustive and covers most items on which control may have to be imposed under the Biosphere Reserve programme. The act prescribes the detailed procedure which in brief involves constitution of a District Committee under Chairmanship of the District Collector. The committee may appoint an officer to prepare a scheme for a specified area. The draft scheme is then published, objections from people involved and affected are heard and considered and the District Committee then sanctions the scheme in which respect it enjoys full powers, only if less than 33% involved people object to the scheme or any part of it. The superior body to the committee is the State Land Improvement Board chaired by the Minister for Agriculture in the State, which has full powers to decide on the scheme. Implementation is through an Executive Officer.

One apparent weakness seems to be in the sphere of pesticide and fertilizer use regulation. As matters stand to day, the State Government have no powers to stop or ban the use for agricultural purposes, any pesticide or fertilizer, that may not fit in with the Biosphere concepts. The Environment protection Act, 1986 of Government of India may be invoked with suitable mechanism designed for operation in BR.

11.10 CONTROL OF LIVE STOCK

Control and management of livestock population in Madhya Pradesh is done through the acts mentioned below:

The Central Provinces Cattle Diseases Act, 1934: The act empowers Government to control routes of movement of cattle imported into the state, the season of movement, establishes quarantine stations, vaccinate against contagious diseases, prescribe fees for vaccination etc.

The Madhya Pradesh Livestock Improvement Act 1950 (Amended by MP

Extension of Law Act of 1958): This act empowers Government to mark bulls which only could be kept for procreation of future herds. Bulls that are not approved are not to be retained without castration.

The Madhya Pradesh Agricultural Cattle Preservation Act, 1959: This act prohibits slaughter of agricultural cattle, prohibits transport for slaughter and sale or purchase for slaughter. This act in a way blocks the full operation of the earlier mentioned Act (ii).

The Madhya Pradesh Pashu Niyantran Adhiniyam, 1976: Through this act the State Government derives power to regulate the keeping, maintaining or movement of cattle in places or areas specified in the order, regulate 'Gwala' colonies, dairies and cattle pens and prohibit or regulate import of cattle in the specified area.

11.11 DEPARTMENT OF ENVIRONMENT

Madhya Pradesh State is specially aware and committed to the cause of conservation. It was the first State to establish a Department of Environment, vide notification No. 8431/CR-79-1(I) DATED 11th December, 1975.

11.12 ENVIRONMENTAL PLANNING & COORDINATION ORGANISATION

The Environmental Planning & Coordination Organisation (EPCO) is a registered society under the Madhya Pradesh Registration of Societies Act, 1973. It is an advisory body to the State Government for all matters related to environment. It has its Governing Council having members from various disciplines including a member from the Department of Forest, Department of Finance for Govt. of MP, Universities of the State, NEERI, Nagpur; and the MoEF, Govt. of India. It is equipped with adequate funds and qualified manpower and vested with the responsibility and matching authority to ensure that development proceeds in consonance with the State Environmental Policy and Conservation Strategy. The organization has already taken-up schemes for up gradation of the environment in the state.

Mostly, Principal Secretary, Housing and Environment, Govt. of MP, is the ex-officio as, Director General of EPCO and Chairman of Governing Council. However, senior officer at level of Principal Secretary may be fulltime Director General of EPCO. Similarly a senior officer at level of Secretary is ex-officer Executive Director of EPCO. This is followed by Divisional head at technical level. The State of MP is thus statewide, conceptually and administratively well tuned to coordination related to conservation and management aspects.

CHAPTER – 12

MANAGEMENT ASPECTS

12.1 GENERAL

The thrust of the Biosphere programme will be in the following directions:

- To improve the status of the ecosystem as a whole.
- To create employment opportunities, since it is believed that poverty leads to actions deleterious to the ecosystem.
- To improve production and utilization of raw materials for energy needs of man and his domesticates, and for providing employment.
- To reduce anthropogenic pressures on conservation managed areas.
- To analyze, appreciate and evaluate traditional agricultural and husbandry practices, life styles and occupations to avail of the gems of traditional wisdom resultant of thousands of years of experience.
- To conserve and preserve local varieties of food grains, fruits, fibers, wild roots, tubers, yarns, medicinal herb.
- To preserve and propagate the gene pools that has evolved through thousands of years of natural selection.

12.2 MODEL SUGGESTIONS

The thrusts of the Project are sought to be implemented through a model that would have an ecosystem approach. The organic linkages of the human-use-sub-system will be the basis of eco-development, utilizing the biophysical and cultural resources of the ecosystem and using the technological packages available with development departments with proper modifications in light of the Biosphere conservation concepts. Local participation in resource creation and utilization, and a complementary role for non-governmental organizations in the eco-development process will be a cornerstone of the proposed model. Management suggestions are given in brief here under for each sub-system of the ecosystem.

12.3 CULTIVATION SUB SYSTEM

This sub-system comprises both the well-to-do and the medium and marginal farmers. The agro-ecosystem is generally poor in organic matter, water and nutrients, due to long spells of continuous cultivation and poor marginal soils in hilly tracts. Almost all the biomass produced in the fields is taken out, for food, fodder and fuel requirements, thus impoverishing the soil year by year. The cultivation sub system may need to be reorganized in the following ways:

- Culturing crops and forages ecologically adaptable to soil, water, climate

and biota of the site.

- Optimizing the use of biological, chemical/physical resources of the sub-system i.e. effective use of biological pest control, green manuring, cover crops, rotations and use of agricultural wastes and other resources available at site supporting soil conservation in agricultural practices aiming at zero erosion levels.
- Application of strategies which include minimal changes in the ecosystem; to protect the environment, and avoid use of market based energies and other requirements in manipulating the agricultural sub-system; promoting diversion and diversion cum storage type micro/minor irrigation.
- Cultural village wastelands should be set aside for grazing/fodder production, or for small timber production for local use, by planting suitable species, including people from the stage of project planning itself. If possible, cultivation of food base for Kosa/silk worms, rope fibers e.g. sisal, Baib grass (Sabai), etc. may be practiced.
- At individual level, the level the villagers should be motivated for farm forestry, for production of seasonal fruits, firewood's, forage etc. so that they need not depend upon the forest for these articles, and his energies could be utilized for other economic activities. Farm forestry, while reducing pressure on forests, will help in greening the countryside, reduce reflectivity of the earth in the area, prevent soil erosion and ameliorate climate conditions, apart from yielding economic gains. The planning and implementation, however, has to be on a village by village basis, and would need much administrative support. Detailed management plans prepared under specialist guidance will ensure continuity of management policies.
- Improvement of village Chulhas, use of wood gasifiers, or methane gas using anaerobic digesters could be promoted to make fuller use of available biomass.
- Improvement of financial returns to agriculturists by improving marketing strategies.
- Support to raise disappearing cultivars/cultigens of food crops.
- Integrated pest control methods to be popularized, to avoid chemical controls which are deleterious to human health as well as the environment in many ways.

12.4 CATTLE, GOAT, POULTRY REARING SUB-SYSTEM

The suggestions for these are as follows:

- This sub-system is economically a supplement to most households in the area and is almost universal in its coverage. In parts e.g. the wheat lands,

cattle are reared on agricultural by products but in the vicinity of forested tracts they are left for foraging in forests. The present state of this sub system is highly negative in terms of environmental parameters. The large cattle biomass grazing in forests is beyond the capabilities of the forests in terms of fodder and forage production and if the cattle were not stall fed partially in the lean months, they would die of starvation. The system has developed due to the lack of a reasonable premium on forest grazing and the comparatively little energy requirement of humans in the maintenance. This is not to say that the energy needs of the cattle are also less. The energy needed to move to and from the pasturage is more than what the pasturage offers, hence the leaning of the cattle in the summer months.

- Gradual reduction of scrub cattle, eugenic improvement of local cattle breeds, without foreign blood lines, to obtain better yields from less biomass consumptions, help for disposal of surplus cattle by marketing aids and organization of dairy product processing and marketing to help local economy, and not merely boost milk scheme profits will be needed.

- Goat keeping must be discouraged, or if tolerated these must be stall fed only. Much energy is wasted on fencing of fields, gardens, orchards, plantation etc. to protect against free ranging goats. These generate income at the cost of environment. Their use as human consumption is in big towns and cities and not at the village level.

- Encouraging keeping of local bantam poultry as a supplementary source of income is much more eco-friendly. Farm grown local breeds are much more palatable than factory grown broilers etc. removal of bottle necks against sustained production and improvement of marketing organization seems to be the action needed.

12.5 FORESTRY SUB SYSTEM

The suggestion for these are as follows

- The forestry sub-system is already a managed one, in fact it has been under management for over a century and a quarter. The objectives of management have changed with the concept of the position of forests, vis-à-vis agriculture. The current national policy, one adopted in 1988 acknowledges their role as 'maintenance of environmental stability.

- The forests of the proposed Biosphere Reserve area are under a number of grades of management. The Sanctuary area is a conservation area, where even tourism is treated as a necessary evil, to be kept under strict control on environmental grounds. The area thus has its own system of conservation. The management plan for the National Park area has already been prepared.

- In case of the sanctuary there is possibility of management of the forest cover when necessary for propagating the interest of wildlife. Revised management plan is now necessary for proper and concerted management of the sanctuary in view of the amendment in 1991 in Wildlife protection Act, 1972.

- The multiple use forests, i.e. the reserved and the protected forest (RF/PF) areas are managed under working plans of the forest divisions concerned. However, sometimes some prescriptions are misinterpreted or mis-applied. The forestry management practices will have to be reviewed in light of the biosphere precepts and necessary modifications could be incorporated in the plans, or the plans modified in respect of the areas included in the BR. The enjoyed facility of removal for one's own use will be allowed to continue. Fuel wood should be supplied by Forest Department at depots established in rural areas away from forests to meet the needs of the people, at a cheap rate. Similarly, agriculturist's need for timber, poles, implements etc. should be available from Nistar depots and the system in vogue for a long time should be revitalized. No one should need to go to the forests with his axe for his needs. Similarly, the exploitation of minor forest produce, like fruits, Mahul leaves, gums, honey, Phuljhadu, medicinal plants, roots tubers, yarns etc., which are taken today without any consideration for their perpetuation, need to be studied in detail for their productivity and utilization limits. This could be taken up under the Biosphere project research component.

- Management of forest grazing will again be one of the most important management modifications. The present system along with the policy of the Government. Whereby the cow family is free to graze in the forest of practically little control has to be done away with. A full scale grazing settlement must be done and grazing control by units established either only for the Biosphere Reserve, or, preferably for the entire forest divisions involved, and indeed for the whole State in due course. But the action is immediately needed in respect of the Biosphere reserve areas. Restrictions of grazing on certain areas, rotational grazing, irrigated fodder farms, etc., should hand in hand with reduction of scrub cattle and collection of grazing fees from all grazing cattle owners. Free and unlimited grazing has been one of the main causes of pasture impoverishment and increase of scrub cattle at cost of better breeds, encouraging unproductive cattle as an ever deteriorating resource.

- The operational management for the Biosphere Reserve forests could be better done if the areas are constituted into distinct ranges, under the Territorial Divisional Forest Office, so that there is a distinction in the management aspect. No additional staff seems to be called for at the present stage for the forestry works as most of the works are already being carried out with different objectives.

- The degraded waste lands are at present no-body's concern. These are either barren or overgrown with weed species useful to no one. The wasteland concept will be on a different plan. Our objective is to create a resource on every bit of land which is today nobody's property. The resource would have to be one which is most needed by the local people, and by their consent, cooperation and initiative, and also their protection – in other words their total involvement in the project. Even agricultural field bunds, walkways cattle paths (Goyas), village roads, grave yards, cremation grounds, river banks, canal banks and similar linear stretches could be used to produce useful trees, hedges, herbs and shrubs under intensive management.

12.6 AQUATIC SUB SYSTEM

The proposed Biosphere area includes a sizeable extent of water-body in the various reservoirs and its back waters. The water area is at present used for fish harvesting. This may continue as long as the conservation rules are not violated. This is necessary to help obtain proper species mix in the aquatic fauna, as well as ideal size mix in the fish catches. It will also help in conservation of other aquatic creatures e.g. otters, crocodile, Gharial, turtles, water monitors, water snakes etc., each of which has a role to play in nature's scheme of things will also be of management objective. The management of the protected waters could be prescribed in the management plans of the Biosphere Reserve and would be binding on the Fisheries Department.

12.7 TOURIST SUB SYSEM

There are two world heritage sites viz. 'Ajaigarh Fort' and 'Temples of Khajuraho' falling in proposed Biosphere area. The proposed area includes four township /urban area *viz.* Ajaigarh, Kakrehti, Panna, and Khajuraho.

This tourist traffic could be base material for dissemination of the Biosphere concept and the extension activities wil1 have to take advantage of this resource. The maladies that affect our environment and the methodologies of repair or amelioration can best be appreciated if they are on display within easy reach of tourist visitors.

12.8 CORE SUB SYSEM

As mentioned in Chapter 5, the Core zone would consist of a part of entire area of Panna National Park, part I, III & IV of Gangau sanctuary and the RF & PF area of North Panna Forest Division. The area- falling under the N P consists of reserved forests. Thus no legal rights are involved. In the proposed core zone only six villages are involved. Thus there would be no problems by declaring the area as core zone. The core zone would have a visitor area for tourists and also a "wilderness zone", which will be closed to all except the serious minded researcher working on a project that calls for entry into the

"Wilderness" area. Apart from the managing authorities of the park and sanctuary, this area is to be closed completely. No cattle grazing are allowed in NP area. However, it would be strictly regulated in part of Sanctuary area and RF/ PF of North Panna Division area falling in core zone. Fire protection will be absolute and thus will be a major function of the Park management. The core zone will have a good bit of research work going on and will need research stations etc. Care will have to be taken that these do not become obtrusive, detracting from the aesthetics of the core zone. No construction will be permissible in the "Wilderness" zone.

The larger animal and plant species of the area have been inventoried. However, new species may continue to be discovered and attempts will be made to conserve them *in situ* and propagate them ex-situ. In no case should the wilderness zone be used for such *ex-situ* attempts at conservation. Even in the core zone outside the wilderness only such propagation may be attempted as does not call for manipulation of the habitat or creation of engineering structures.

12.9 BUFFER SUB SYSEM

The remaining parts (II part) of Gangau sanctuary and Ken-Gharial sanctuary forms part of the buffer zone (a). The total area of this proposed zone (a) works out to be approx 106.77 sq km. The other area may form buffer zone (b). The outside area beyond the sanctuary consists of reserve and protected forests. The legal rights are restricted in this area. The reserved forest areas under multiple use management, while protected in other ways i.e. forest working, grazing etc. can yet be used for wild species propagation and culture, which has been prohibited in the core zone. These areas physically form a buffer between the multiple use forests and the totally protected area of the core zone. The rules prescribed for sanctuaries & RF/PF provides the required protection. The buffer zone would also consist of other areas like revenue land, village settlements, water bodies etc. These would be managed by respective laws applicable to them.

12.10 THE RESTORATION SUB SYSEM

This will be the degraded or wastelands within the Biosphere Reserve Area. These are spread over many patches, many too small for mapping. It is not possible to identify and mark them all on the map sheets. Aerial 'photos and remote sensed imagery provides some idea, but local information and knowledge is sufficient to locate and manage them. Social Forestry areas will be part of this zone.

12.11 THE PROSPECTIVE MANAGEMENT PLANS

Detailed Prospective management plan embodying the management proposal for each eco sub-system will have to be prepared for continuity of

management and time bound implementation, as also estimation of financial, organizational and managerial responsibilities and budgeting from year to year. The practice is well entrenched in the forestry sector where forest management plans are prepared for 15 year periods and followed in the field. Presently management plans in most of the biosphere reserves are prepared on annual basis. There is need to develop a long term strategy for preparing 5 years prospective plan for biosphere reserve incorporating the existing plans already prepared by various departments/ organizations working in the area and also keeping in the concept of biosphere reserve , so that it may serve as guideline for preparing annual management plan of BR. This would help in prioritization of activities under BR. Besides, this would also helps in advance of duplications of works.

CHAPTER – 13

RESETTLEMENT AND REHABILITATION

13.1 GENERAL

Indiscriminate destruction of wildlife habitat, shrinkage in the forest and over hunting of wild animals in the past decades has posed a great threat of extinction of wild animals.

In past forest dwellers used to live as "indigenous" people, as there was no dearth of wilderness in and around the habitation. Plenty of forest growth with ample source of water were available undisturbed for the use of wildlife. Only a limited area was used by man and livestock for their Nistar and other uses. Now the situation has changed, the human and livestock population has multiplied whereas the forest growth have shrunken to pitiable level due to ruthless and merciless over exploitation of the wilderness resulting in manifold pressures on remaining forests.

Existence and sustainability of a protected area can be prolonged when there is least biotic disturbances. A permanent human settlement along with their livestock in any protected area is not only detrimental for the growth of flora and fauna, but also for human population who have to face a lot of day-to-day problems. The various problems faced by the human beings and their livestock include the followings.
Problems faced by the human beings:

- Recurring threat of mauling and attack by the carnivores.
- Frequent cattle-depredation by the leopards and tigers.
- Crop-raiding by the ungulates causing severe economic losses.

Similarly, the human beings always pose a threat on the existence and growth of the flora and fauna of the protected area by their following activities. Disturbance caused to wild animals:

- Setting of the fire resulting in the irreparable losses to the habitats

- Intentional water hole poisoning.
- Deliberate poisoning of the tiger or leopard's kill to take revenge of the death of their cattle.

- Unrestricted grazing causes a severe competition of for fodder and grasses.
- Frequent trespassing of the cattle of different areas causes dispersal of seeds of various weeds and suppression of the palatable grass species.

In the present situation, it is now an immediate managerial requirement to keep the protected area free from adverse biotic interference so that the damaged habitat may resurrect in due course of time. Resettlement of human habitations along with their livestock to a convenient place is one of the most important operations. After their evacuation, the agricultural fields would transform into beautiful meadows and other habitation sites into a good habitat in favour of various wild animals.

13.2 ENCLAVED VILLAGES

The core zone (Panna National Park area) of proposed Panna Biosphere Reserve has been inhabited by man since long. There are some villages within the limits of protected area known as enclave villages while other which are adjacent to the Protected Area are called fringe villages.

Even before the notification of the Panna National Park or the Gangau wildlife sanctuary, this section of forest harboured a good number of human populations. The communities living in the dense forest survived by practicing simple form of cultivation and rearing the cattle. These forest people lived in small villages. Occasionally the villages were abandoned and at the new site the new villages established. This was neither a frequent nor a regular practice.

Once an area of this dense forest was notified as protected one, it is found that there were 15 numbers of inhabited villages and uninvited or abounded villages. The Panna National Park had 8 populated and 2 deserted villages in the limits of Panna district and 5 populated villages within the limits of districts Chhatarpur (Table 13.1 & 13.2). The total population as per 1991 Census was 3601. The cultivated land was 1984 ha.

Table 13.1: Cultivable Land and the Population of enclave villages

S. No.	District	Cultivable Land (ha)	Population
1.	Panna	598.468	1533
2.	Chhatarpur	1385.328	2068
	Total	1983.796	3601

Source: as per Census, 1991.

Table 13.2: Range wise Distribution of Enclave Villages

Range	Enclave Villages	
	Inhabited villages	**Abandoned villages**
Panna District		
Panna	1. Talgaon	
Mandla	2. Budhrod	
	3. Pipartola	
	4. Surajpura	
	5. Gangau	
Hinouta	6. Kharrya	
	7. Badgadi	
	8. Khamariya	
	9. Kaneri	
	10. Jhatar	
		11. Sakra
Chhatarpur district		
	12. Raipura-chanari	
	13. Mota - chokan	
	14. Palkohan	
	15. Kharyani	
	16. Dhodhan	

Out of them 12 villages have been rehabilitated upto 2008-09 out of Panna Tiger Reserve area. Thus only 4 villages have to be rehabilitated.

13.3 RESETTLEMENT OF THE ENCLAVE VILLAGES

As per the provisions contained in Wildlife Protection Act (1972), it is legally necessity to rehabilitate all the villages of PA to a suitable site out side the PA, to restore tranquility and to resurrect the health of the ecosystem and having the least biotic interference.

As a policy matter all the enclave villages of the NP have to be evacuated. However, conservationists and the supports of Human Rights have differences on seen rehabilitation.

CHAPTER - 14

SOCIAL FORESTRY

14.1 GENERAL

Social forestry program is not new in India. 'Van Mahotsava' program was come into existence in 1950 to promote afforestation among villagers. The objective of Van Mahotsava is to provide information to villagers about importance of forests and process of planting various types of trees, so that farmers get proper promotion for plantation. Unfortunately, it is celebrated as function and has not secured desired success. Although the regional forestry program was taken care in second and third five year planning but desired success was not achieved. In 1974, MP State government felt the need of social forestry programs and appointed a forest officer to give suggestions on that matter. The report submitted by the forest officer suggested afforestation on large scale on community land for the requirement of fuel, fodder and other woods for villagers. Later in year 1978, a new social forestry scheme came into existence with the help of 'Ford Foundation Scheme' and in 1987 social forestry forest division was established but due to financial constraints, the desired progress could not be made. In year 1981-82, USAID approved 50% of financial help for reestablishment and improvement of deforested areas of western Madhya Pradesh. Rest 50% finance was provided by the state government. Along with this 20% provision of the funds from Govt. of India grant to state governments was made for social forestry afforestation. After USAID scheme, MP State government has formed separate social forestry, forest divisions in whole state.

14.2 OBJECTIVES

From the ancient times, the objective of forest management is public welfare. The objective of social forestry is also welfare of society. The main objectives of the social forestry program are as following:

- To fulfill the requirement of fodder and fuel for villagers so that biological pressure on forests is minimized and their conservation should take place.
- To protect and improve environment by afforestation on deforested and barren land.
- Conservation of land and water by best possible use of land.
- To ensure employment and develop small scale industries.
- Effective use of forest produce, use of non wood material instead of

wood and use of alternate sources of energy and their promotion.

- Multi-dimension development of villages by different projects, maintaining ecological stability and balance.

14.3 PROGRAMME SCHEDULE

Following areas and programs is generally included in social forestry:

- **Regional Forestry:** To plant trees in line at boundaries of fields and around houses, wells, ponds etc., and' to form wind shield
- **Extension Forestry:** Mixed forestry in which plantation of those species is done on governmental and non-governmental land which produce fuel, fodder etc., plantation of those species near roads, railway lines and canals which are fast growing and with the education of extension forestry, promotion to use of non-wood material and use of other sources of energy.
- Improvement of deteriorated forests
- Afforestation to improve environment and establish new tourist spots.

14.4 EXTENSION PROCESSES

There is need of public awareness and direct participation for social forestry and forest extension programs. For this following extension processes should be followed:

- To aware villagers at home, field and work place by personal meeting about benefits of the program.
- To promote programs through lectures, presentations, movies, discussions etc in various groups e.g. Panchayat, worker's union, schools, colleges etc.
- To promote programs of social forestry through various communication medium like television, radio, news papers, magazines and exhibitions.
- To distribute various pamphlets, posters, literatures related to social forestry programs.
- To aware public about the benefits of social forestry programs through exhibition of successful plantations and afforested areas.
- To aware public about the Governmental promotional plans. Following promotional programs has been promulgated:
    a) Establishment of departmental, private, school, students and women plantation centers.
    b) Distribution of plants and seeds.
    c) Establishment of rural forests
    d) Grants on private plantations
    e) Promotion to plant trees near community water sources.
    f) Promotion for the establishment of rural Nikunj centers.
    g) Generation of fuel-efficient burners.

h) Establishment of modern/electric crematory

i) Organization of various prize-distributing events. Volunteer and Government organization should be affiliated for forest extension and forest protection. Attempts should be made to form such organizations where these are not established yet.

- Rural forest committees and forest protection committees should be established and their active participation should be ensured. Direct people participation should be taken with the help of village Panchayat where there are no such committees.

14.5 SPECIES SELECTION IN AFFORESTION

The selection of proper technique for plantation and species are very important for the success of social forestry program. Plantation technique mainly depends on status of land and available financial resources. Species selection for plantation mainly depends on status of land, economic and social needs of local people, effect of the particular species on environment and should be useful to local people in many ways. Chief Forest Conservator has also given instructions for the species selection for social forestry.

14.6 SELECTION OF ENERGY SAVING DEVICES

Various models have to be used to fulfill the rural energy needs. But this is clear that dependence on fuel wood should be minimized as soon as possible. It should be kept in mind while seeking for alternative sources of energy that the other sources should work in all seasons, should be easily available and should have positive social environmental effect. An integrated rural energy project should be created for overall development of villagers. For this it is necessary that effective use of various energy sources viz., conventional and non- conventional also commercial and non-commercial should be done so that there is efficiency in per person energy requirement.

14.7 NON-CONVENTIONAL ENERGY SOURCES

Following non-conventional energy sources can be proposed to lessen load on fuel wood viz., Biogas Plant, Smokeless Chulha, Biomass Gasifier, Wind Mills/Aero-generator, Solar Cooker, Solar Water heating system, Solar Drier, Solar Still, Solar refrigeration and Power Plant, Solar Photovoltaic system, Energy Afforestation

14.8 EXTENSION EDUCATION

Since the Social Forestry Program is a Governmental Program, public is not assured about it fully. There is lack of knowledge in officers and other staff of forest department. Proper training should be imparted to the staff and other dedicated officers and staff should be attached to the programs.

14.9 SOCIAL FORESTRY IN CHHATARPUR

General: The social forestry, Forest Division was constituted in Chhatarpur district on 1st April 1987 with the notification no. F 26-2-87-10-3 of MP State Government. Chhatarpur and Tikamgarh districts were included in this forest division with headquarters at Chhatarpur. As Social forestry department was not fully developed initially, actual pace of work came into existence from 1988.

The main objective of Social forestry, forest division Chhatarpur district was to commence afforestation in forest land also on community, private and barren lands along with awareness and promotion of afforestation and conservation of forests in local people. With the help of social forestry following grant schemes were carried out These includes Demonstration field, Gram Nikunj, Bund plantation, Agriculture forestry, Tree forestry, Decentralized nursery, Promotion for the use of alternative energy sources

The promotion and awareness about above mentioned schemes in Chhatarpur district by Forest Division was done in 1988-89. Along with this afforestation was done with the finances from District Collector's Grant.

Forest Extension: The afforestation in Chhatarpur district was not done in foundation year 1987 due to lack of man power. Afforestation program was started in year 1988-89.

Grant Schemes: Under grant schemes bund plantation, agriculture forestry and tree agriculture projects are included. In this farmers get grant aid in installments for afforestation.

Establishment of Gram Nikunj:

- Plantation can be done on minimum 1 ha to maximum 2 ha.
- Rural people will do plantation on community land.
- 624 plants per hectare should be planted.
- Considering land & climate following species can be grown in project area by permission of Gram Panchayat : Mango, Jamun, Kathal, Amla, Ber, Peepal, Bargad, Kanji, Neem.

Decentralized Nursery: To provide employment to rural public farmer category and to promote plantation, Government of India had started a policy to grow plants in private nurseries. According to this, each nursery has to prepare 10 thousand plants. To form nursery, department provides polythene bags, manure, seeds at 15 paisa per plant as first installment. After the plant attains the age of 2 months, second installment at 15 paisa per plant polythene bag is provided for security, irrigation and maintenance and at the end of months June-July when plant attains age of 5 to 6 months, forest department purchase fully developed and successful plants at the rate of 70 paisa per

plant. After subtracting the advance payment, rest amount is paid as third installment. The purchased plants will be used by forest department in various plantation areas as per need. Rest plants will sell on rules as follows:

- To other governmental departments and educational institutions on their requirement, free of cost.
- To other governmental departments and to public at the rate of 20 paisa per plant for 1000 plants and 30 paisa per plant for more than 1000 plants. For local unemployed person for each sell of plant taken from department will get 10 paisa per plant as commission. This scheme is now abandoned.

Forest extension programs under social forestry, forest division are not fully successful.

Now Social forest is not exist and entire works related t social forestry works related to Chhatarpur district is being carried out under research and extension programme of the forest department.

14.10 SOCIAL FORESTRY IN PANNA

In the past few decades when the necessity of fuel and fodder were not that acute, villagers have not to go out of villages for their day to day consumptions, as the nearby areas of villages and grazing grounds in villages etc were available for community use. But due to gradually increasing human population and cattle population, all these areas became insufficient and overloaded and this acute deficiency created pressure on Governmental forests. Also, villagers have to cover long distances to avail resources. With the result, two decades ago, social forestry program under the 'Panchvan Yojana' came into existence. The main aim of this program is to grow such species on community land that are useful for the villagers as fuel, fodder and other woods so that pressure on the forest get minimized and resources be easily available to villagers. Also, the aim of this program is to create awareness and promotion in villagers about private land and barren land. To give real form and accelerate the pace of development of social forestry programs, Social Forestry, Forest Division, Panna was established. Under the Social Forestry, Forest Division, Panna, during the plan period 1995 to 2001, under many plans the afforestation program was resorted on 3737 ha land.

Social forestry program were only partly successful in achieving its real objectives. An appraisal of this program indicate that social forestry program was run on the same pattern as other Governmental programs rather than giving due importance to its real objectives that is involvement of local people. Due to this although year by year plantation was done but proper care, security and maintenance was not done for long period, therefore these areas has not been well established and developed. Though the target of afforestation program was achieved but the real objectives of the program i.e. local participation has not been taken care of. Thus, social forestry program

became target oriented rather than result oriented. Since the due importance has not been given to local bodies and rural institution, this created adverse effect on success of these programs.

Now Social forest is not exist and entire works related t social forestry works related to Panna district is being carried out under research and extension programme of the forest department.

CHAPTER – 15

EXTENSION, EDUCATION & TRAINING

15.1 EXTENSION

The Biosphere programme is about a concept that is not established in the minds of even the more enlightened people. To the rural population actually involved in the programme, the concept is incomprehensible. The success of the programme is totally dependent upon local understanding and co-operation. That the programme is aiming at a better quality of life for the very people involved while trying to assimilate their own traditional methods and lifestyles to the extent possible in light of to day's knowledge has to be brought home and towards this end a strong extension thrust will be necessary. The actions proposed will first have to be explained and got appreciated by the people and then pressed along in practice. Extension and public relations will therefore be a major activity in the immediate future. If the programs are accepted by people these extension activities would not be needed after the initial few years. Public relations activity will probably replace extension as more and more people will want to know about the programme, if it achieves the aims that it sets out to achieve.

Extension Programme should be carried out by concerned Field Departments/ Organisations as a component of their existing centers in the area.

15.2 EDUCATION

Success of the Biosphere programme will depend on education at many levels. The local population will be covered in the extension programme but the custodians of the Biosphere Reserve, the managers and the planners, also need to be educated about the aims and objects of the programme. The Biosphere Reserve will be a permanent place for environmental education, demonstrating the value and benefits of protected areas and ecologically sound biosphere utilization practices to human survival and quality of life. The programme will extend to university students, school boys and nature groups/ NGOs also. The educational materials will have a compendium of all information, audio visual presentations" models, posters, photographs and documentation of research findings.

15.3 TRAINING

It is important that both the professionals and the managers in the Biosphere Reserve are properly initiated into the functioning of the Biosphere programme and the benefits accruing to the country. They will need training in education as well as communication of the conservation message to the people, the visitors and the Biosphere residents that they interact with. The training will be inter-disciplinary, skill-oriented and field conducted as far as possible.

Projects will have to be developed to demonstrate application of the existing knowledge to a particular environmental problem. Eco-development camps for rural areas of the Biosphere Reserve and nearby population need to be organized. Voluntary organizations in the area, if any, must be utilized whenever possible. They may organize the camp themselves with support from governmental agencies in various spheres.

As staff turnover, rather quick, is a standing phenomenon in the current pattern of administration, the training programme too will have to be carried regularly.

CHAPTER – 16

RESEARCH & MONITORING

16.1 GENERAL

Biosphere reserves as centres of conservation provide excellent location for benchmark studies on natural ecosystems vis-à-vis man modified ecosystems. Man made lakes, managed forest and forestry, cattle husbandry, farming systems et al would be under scrutiny. Three distinct levels- of total conservation, of sustainable development, and of unbridled development - would be available in close proximity, in the Biosphere reserve and outside it. This would provide opportunity for field oriented research, which is very essential and surely lacking in the country today.

16.2 THE APPROACH

The approach to this programme will keep in view that permanent salaried staff living under stressful conditions do not always achieve what is desired of them. It is recommended that the Biosphere project provide the basic requirements of research, viz. sustenance fellowship, field residential facilities, laboratory and equipment with maintenance personnel, and have co-operative agreement with Government and non-Government organisations, universities, individual researchers and in-service research personnel of various disciplines and departments.

The biosphere management will have a research advisory committee which would foster and coordinate the research, specifying research needs and priorities, helping with information, methodology, and guidance if needed but leaving the actual design and content and methodology to experts in the relevant discipline - the professionals, scientists. Each project will be prepared in such details as to enable continuation of research even if there be a turnover of personnel or research scholar.

The assessment of the progress of the research work under each item would be made by a special research monitoring comprising of scientists of the discipline, Biosphere Reserve representatives and representatives of the financiers i.e. Government of India or State Government, CSIR, UGC, or even NGOs, if involved in any special project.

In any case, research within the Biosphere Reserve will not be open to all and sundry. The work will only be undertaken if relevant to the objectives of the Biosphere Reserve. The research could be pure or applied but pure research without visible links with the MAB programme is not recommended in the Biosphere area.
Monitoring of the environmental functions and achievements arising from the conservation and sustainable development programmes and procedures is essential to quantitatively determine the effectiveness of each programme. The water flow regime inside and outside, the water quality, the water table depth, the ground water recharge efficiency, soil build-up or erosion, silt loads of streams, mineral cycling in natural, manmade and multiple use forests, cultures, socio economic status, bio-diversity including plants, animals, micro organism, population dynamics of wildlife including key insect pollinators, bird pollinators and insectivores, energy and material flow in traditional and improved agricultural and pastoral systems, human utilisation and availability of wild plants for food, fodder or medicines, will be prime' objects of continuous or frequent monitoring over a period of years.

Monitoring is different from research in that no new knowledge is gained immediately. The process is also a continuous and prolonged one. This part of the work therefore needs a different set up from that of research. Here the job would have to be tackled by scientist of the special discipline, but on a salaried basis. In some cases it may be easier for the work programme to be taken up by the concerned department directly, the progress and efficiency of the works being monitored by the Biosphere Research Committee.

The funding pattern for these programmes have to have an assurance of long time provision, which in the present procedures of budgeting are almost impossible to achieve. Some mechanism needs to be developed to ensure steady flow of funds over a long period.

16.3 INFRASTRUCTURE

In view of the approach stated above the following infrastructure is suggested that the researchers should interact with Field Director of Panna Tiger Reserve and other Field agencies located in the area. The guest house and rest houses may be made available to the researchers freely or with nominal payments. The existing infrastructure facilities like field camps within forest areas may be made available to the researchers.

16.4 SUGGESTED RESEARCH INSTITUTIONS

Some of the organisations likely to be interested in the research and monitoring programmes and some of the topics of their interest are indicated below. These are only very broad indications and surely many other issues would also be taken up by them when the programme gets going.

(a) State Forest Research Institute (SFRI), Jabalpur, MP

- Studies on plant ecology and succession.
- Plant and animal community structure and composition.
- Basic bio geographic sketch of the Biosphere Reserve.
- Taxonomic studies on flora.
- Management of man-impacted resources

(b) Forest Research Institute, Regional Research Centre, Jabalpur MP

- Studies on pest-predator relationships of forest insects.
- Mycological studies on nature and extent of mycological infestations in natural biomes.
- Ecology of fungal biomes in natural sal forests.
- Soil nutrient status and recycling in forest and grassland biomes under various intensities of grazing.

(c) The Wildlife Institute of India (WII), Dehra Dun

- Bio geographical studies.
- Structure and composition of animal communities.
- Habitat suitability index studies and modelling.
- Predator-prey relationship studies.

(d) The Zoological Survey of India, Calcutta

- Inventories of reptilian and amphibian fauna of Panna BR and existing Sanctuaries.

- Inventories of Insects, Arachnids and other Arthropods in natural sal and mixed forests.
- Avifauna of Panna BR vis-à-vis that of managed forests and cultivated lands of the area.
- Comparative studies of occurrence of insectivorous birds in protected environs and open cultivation and their effect on crop pest control.

(e) Central Circle, Botanical Survey of India (BSI), Allahabad (UP)

- Floristic studies, plant collection and identification.
- Identification of special micro communities developing in protected niches and their effect on soil and micro or macro flora and fauna.
- Ecology and biology of plant resources, and genetic diversity.
- Analysis of plant community structure and composition.

(f) Regional Research Centre, Anthropological Survey of India (ASI) Sagar, and Indian Council of Social Science & Research.

- Studies on sociological changes consequent on introduction of developmental processes.
- Effects of current forestry management practices on tribal society, customs and economics, and modifications.
- Sociological response to forest, nature and wildlife conservation in local tribal societies, Economic structure of local tribal communities and needs for their improvement.

(g) The Bombay Natural History Society, Mumbai

- Checklist of avifauna
- Studies on bird-community structure and composition in Biosphere areas and Sanctuaries vis-à-vis unprotected environment in nearby areas.
- Controlling effect of insectivorous birds on crops pests around National Park and Sanctuaries.

(h) The National Environmental Engineering and Research Institute (NEERI), Nagpur

- Studies on water quality status, foliar interception soil stability, ground water recharge efficiency of totally protected forest ecosystems.

(i) Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur / Dr. Hari Singh

Gour University, Sagar (MP)

- Micro-climatic effects of irrigated cultivation viz dry land farming, and pest response to change of cropping patterns.
- Identification of wild and disappearing cultivars of domestic crops.
- Study of genetic diversity levels of local food crops.
- Studies on land-use patterns, their effects, & methods of improvement.
- Soil nutrient studies in crop fields adjacent to forest ecosystem.
- Effect of pest controlling birds on pests of agricultural crops, efficiency of natural biological control systems & their applicability to other areas.
- Studies on methods pf restoration of man-impacted degraded lands.
- Bio-fertilizer efficiency vs. chemical fertilizers, and feasibility for large scale, long time use.

(j) The Veterinary Institute, Jabalpur

- Prophylaxis and treatment of contagious diseases of wild bovines.
- Serological identification of animal tissues through specific anti-serum tests. Preparation of anti-sera of important species for forensic identification, and evidence.
- Studies on comparative efficacy of artificial insemination vs. zygote transplant methods in improving cattle breeds in Biosphere area.
- Improving methods of farming of indigenous poultry breeds and improving marketing organisation.
- Improving husbandry practices for non-conventional live-stock, pigs, etc.

The organisations like **Mahatma Gandhi Gramodaya University, Chitrakut**; **Rani Durgavati University, Jabalpur**; **Awadesh Pratap Singh University, Rewa**; **Madhya Pradesh Council of Science and Technology (MPCOST), Bhopal**; **Environmental Planning & Coordination Organisation (EPCO), Bhopal**; **Indian Institute of Forest Management (IIFM), Bhopal**; **Salim Ali Centre for Ornithology and Natural History, Kalampalnyam, Coimbatore**; **World Wildlife Fund for Nature (WWF), India**; **NGOs**; Individual and Group researchers may take up these and many other items of research depending on their field of excellence and relevance of the study to Biosphere objectives. All encouragement will be given to the scientists of these and other organisations.

16.5 MONITORING

Monitoring and Evaluation are the two important elements of research as they indicate the extent of achievement of the objectives and goals of the project and also determine the additional inputs needed to improve the project. While monitoring is an ongoing process of assessment, evaluation is an assessment of whether the various goals have been achieved at the end of specified phase and at the end of Project.

Biodiversity conservation is a multidisciplinary subject, requires entirely new systems and approach of monitoring and evaluation. It will require services of various subject experts. The matters of department policy are of multi-sectoral nature and need high degree of inter-departmental coordination and synergy.

Monitoring may be done by any of the Research Organisation mentioned earlier. Besides, monitoring may be carried out by Environmental Planning & Coordination Organisation from time to time. Some of the items to be monitored are indicated below, but others will also come up as per research needs and pointers.

Continuous or / Frequent

- Climatic and hydrological variables.
- Watershed studies, soil erosion
- Pollutant levels in air and water

Periodical

- Soil characteristics, nutrient status
- Plant and animal community composition and structure
- Changes in land use patterns, human settlements, pasturage and pastoral methods.
- Changes in the quality of life due to Biosphere Reserve programmes,
- Forestry practices find their effects, on environment, economy, employment and the difference caused by BR programmes.

CHAPTER – 17

BIOSPHERE RESERVE 'GOVERNANCE'

17.1 PROPOSED COORDINATING MECHANISMS

From the suggestions made earlier in the chapter of management, it will be evident that the management of the Biosphere would be a multi disciplinary exercise, involving disciplines that are handled by different departments of government, under numerous projects and schemes. Unfortunately these schemes are spread so thinly over the population/area that they often fail to impress by their impact.

In the Biosphere Reserve Project the idea is to bring maximum number of developmental schemes and projects less than one umbrella through coordination so that they all operate to saturation in the area thus the Biosphere Project becoming a showpiece of proper development compatible with conservation and perpetual utilization of the outputs of the ecosystem. However, the integration of all these functions is not an easy exercise.

The administrative structure in such a multi-disciplinary effort as managing a Biosphere Reserve could be complicated. It is surmised that creation of a large technical work frame of diverse and specialized disciplines under the single line authority of Director may not be suitable, simply because no Director will have the technical capability or time to supervise and guide all these activities.

In case of Pachmarhi and Achanakmar-Amarkantak (M.P. Part) the Housing and Environment Department is the nodal department on behalf of State Government. The State Government has also identified Environmental Planning and Coordination Organisation (EPCO) has Nodal Agency for coordination and its implementation.

For management of Pachmarhi and Achanakmar-Amarkantak (M.P. Part) Biosphere Reserves, federal structures have been adopted. The proposals are identified and prepared by the line departments/ Organisation/ NGOs etc., working in the field at district. These are approved by respective district level committee constituted under the Chairmanship of respective Collectors as per their departmental norm and sent to EPCO for its compilation. After compilation the proposals are placed before State Level Steering Committee constituted under the Chairmanship of Chief Secretary. After its due approval the proposals, these are sent to the Ministry of Environment and Forests, Government of India for its sanction. The funds are directly made available to EPCO for its distribution to concern field agencies. Presently the Management Action Plan is being prepared on annual basis. However emphasis is being given to prepare prospective plan for five years. 100% grant is provided by Ministry of Environment and Forest, Government of India for approved items of Management Action Plans for its implementation. Looking to the experience of Pachmarhi & Achanakmar-Amarkantak BR it is proposed to have such federal structure in case of Panna BR. Therefore no additional staff is proposed in the BR, the existing officers/ staff at field level can coordinate and implement the BR projects. They would work as ex-officio officers/ staff for BR project.

17.2 THE MANAGEMENT COMMITTEE

For management of the Pachmarhi and Achanakmar-Amarkantak (M.P. Part) Biosphere Reserves there are two management committees as mentioned above. These are State Level Steering Committee (SLCC) and District Level Field Coordination Committees.

17.2.1 STATE LEVEL STEERING COMMITTEE

The State Level Steering Committee have already been constituted by State Government at the state level under the Chairmanship of Chief Secretary to deal with matters of coordination between different departments, to see that the proper orientation of programmers related to implementation of the Management action Plan of Pachmarhi and Achanakmar-Amarkantak (M.P. Part) Biosphere Reserves. The same committee can also oversee the coordination and management aspects of Proposed Panna Biosphere Reserve also. The compositions of the committee are as follows:

1	Chief Secretary	Chairman
2	Principal Secretary, Housing & Environment	Member
3	Principal Secretary, Forests	,,
4	Principal Secretary, Biodiversity & Biotechnology	,,
5	Principal Secretary, Health	,,
6	Principal Secretary, Veterinary services	,,
7	Principal Secretary, Scheduled Caste & Scheduled Tribes	,,
8	Principal Secretary/ Secretary, Agriculture	,,
9	Principal Secretary, Tourism	,,
10	Principal Secretary, Panchayat & Rural Development	,,
11.	Station Commander, Pachmarhi	,,
12	Principal Chief Conservator of Forest, Wildlife Division, Deptt. of Forests, Govt. of MP	,,
13	Nominee of Ministry of Environment & Forests, Govt. of India	,,
14	Executive Director, EPCO	Mem. Secretary

The committee would be responsible for coordination and monitoring at State level and resolve the problems, if any, for development & conservation may evolve its own rules of business in the initial meetings after they have acquainted themselves with the task on hand. The committee is empowered to invite specialists and representatives from other organizations for suggestions and assistance.

17.2.2 District Level Field Coordination Committee (DLFCC)

The district level field coordination committees for Hoshangabad, Chhindwara and Betul districts have already been constituted by the state government for Pachmarhi Biosphere Reserve. Similarly the DLFCC for Dindori and Anuppur districts have also been constituted by the state government for Achanakmar-Amarkantak (M.P. Part) Biosphere Reserve.

In line with these committees, it is also proposed to constitute district level

field coordination committee separately for Chhatarpur and Panna districts for Proposed Panna BR. The committee may comprise of the following officials:

The District Level Field Coordination Committee (DLFCC) for Panna

❑ Collector, Panna	Chairman
❑ Chief Executive Officer, Jilla Panchayat, Panna	Member
❑ Dy. Director, Panna Tiger Reserve, Panna	"
❑ Divisional Forest Officer (North) Panna	"
❑ Divisional Forest Officer (South) Panna	"
❑ Project Director B R, EPCO, Bhopal	Mem. Secretary
❑ Dy. Director, Agriculture, Panna	
❑ Dy. Director, Panchayat and Rural Dev., Panna	"
❑ Dy Director, Veterinary Services, Panna	"
❑ CMO/ Health Officer, Panna	"
❑ Executive Engineer, Rural Engg. Services, Panna	"
❑ Distt Education Officer, Panna	"
❑ Asstt. Director, Fisheries, Panna	"
❑ District Planning Officer, Panna	"
❑ Asstt. Director, Horticulture, Panna	"
❑ Asstt. Director, Tribal Welfare, Panna	"
❑ District Manager, MP Agro. Dev. Corp. Panna	
❑ Asstt. Director, Scheduled Caste, Panna	
❑ Nominee of Mem. Sec., State Biodiversity Board, Bhopal	"
❑ Nominee of MP Tourism Dev. Corp., Bhopal	

The District Level Field Coordination Committee (DLFCC) for Chhatarpur

❑ Collector, Chhatarpur	Chairman
❑ Chief Executive Officer, Jilla Panchayat, Chhatarpur	Member
❑ Divisional Forest Officer (General) Chhatarpur	"
❑ Project Director B R, EPCO, Bhopal	Mem. Secretary
❑ Dy. Director, Agriculture, Chhatarpur	Member
❑ Dy Director, Veterinary Services, Chhatarpur	"
❑ Dy. Director, Panchayat and Rural Dev., Chhatarpur	"
❑ CMO/ Health Officer, Chhatarpur	"
❑ Executive Engineer, Rural Engg. Services, Chhatarpur	"
❑ Dy. Director/Asstt. Director, Fisheries, Chhatarpur	"
❑ Asstt. Director, Tribal Welfare, Chhatarpur	"
❑ District Planning Officer, Chhatarpur	"
❑ Distt Education Officer, Chhatarpur	"
❑ Asstt. Director, Horticulture, Chhatarpur	"
❑ District Manager, M.P. Agro. Dev. Corp., Chhatarpur	"
❑ Nominee of Mem. Sec., State Biodiversity Board, Bhopal	"
❑ Nominee of M.P. Tourism Dev. Corp., Bhopal	"

- Nominee of Archaeology Deptt., Khajuraho "

The functions and Power of the Committees are as follows:

- To invite subject specialists/ NGOs/ other institution for help & suggestion as per needs
- To be responsible for implementation of schemes. The line field Deptts. / Org. / NGOs shall identify problem areas & prepare schemes.
- After due approval of committee schemes to be sent to ED, EPCO/ Project Director, BR for getting approved by SLSC
- A minimum of 3 meetings to be held in one year, Additional meetings may be arranged as per need
- Committee may constitute local committees for preparation of sectoral schemes.
- To be responsible for implementation & completion of schemes
- To be responsible for monitoring of the schemes

17.3 The Chief Executive

It is suggested that Executive Director, EPCO should works as ex -officio Chief Executive Officer or Director, Biosphere Reserve.

17.4 The Project Director, Biosphere Programme, EPCO

It is suggested that the Officer –in- charge, BR in EPCO shall act as Project Director BR. He should have adequate qualifications and experience in biological sciences or environmental sciences. EPCO is already handling Pachmarhi and Achanakmar- Amarkantak (MP part) Biosphere Reserves in the State and their management and coordination is a very challenging technical task apart from the administrative aspects. EPCO will not be able to handle the Biosphere Programme without a whole time technical officer on the job, along with supporting staff to be funded by the Ministry.

17.5 Biosphere Reserve Advisory Committee

This could be an Advisory Committee of specialists in various disciplines from NGOs, Universities, and retired technocrats etc., who are knowledgeable in the matters of environmental/ biodiversity research and conservation/ management of biodiversity. This Committee could be a purely advisory body giving its opinion on the research & management thrusts and strategies to be applied to the area. The exact composition can be decided at a later stage. This will meet once in a year or as needed.Annex – 3: I

Month wise maximum & minimum temperature (^{0}C) of Panna from 1980 to 2007

Month												Max & Min in Year
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
4	27.2	31.5	39.4	42.2	35.6	29.9	29.1	30.8	32.3	28.7	23.6	**42.2**
3	12.5	17.5	23.7	29.2	26.5	24.4	23.8	23.5	21.1	15.0	10.9	**10.3**
1	NA	30.8	NA	39.6	NA	30.5	30.6	31.3	31.5	26.9	23.1	**39.6**
1	NA	17.8	NA	26.9	NA	24.5	24.3	23.8	19.2	13.1	8.9	**8.9**
2	23.6	28.8	36.4	38.4	37.7	34.8	NA	NA	NA	NA	NA	**38.4**
7	12.4	15.2	22.1	25.1	27.1	26.5	NA	NA	NA	NA	NA	**11.7**
1	24.2	31.7	34.2	39.3	39.2	32.3	30.8	30.7	29.3	26.2	24.1	**39.3**
9	11.1	16.7	20.9	26.0	27.9	25.3	24.7	24.0	18.7	10.9	10.2	**8.9**
0	23.7	33.2	38.1	42.3	37.5	32.5	29.3	30.4	31.5	27.5	25.4	**42.3**
3	10.7	17.0	23.3	27.9	27.2	24.4	23.5	22.1	18.9	11.1	9.3	**9.3**
4	27.0	34.7	38.1	42.5	39.1	32.1	30.4	30.7	30.0	28.5	25.7	**42.5**
4	7.4	14.5	19.6	25.7	26.3	24.3	23.7	23.0	18.7	12.6	11.1	**7.4**
9	25.0	31.6	NA	39.8	38.4	31.5	31.3	33.1	33.2	30.5	23.3	**39.8**
3	11.7	16.3	NA	24.4	25.8	23.3	22.8	21.9	17.9	13.4	9.5	**9.5**
4	28.0	32.3	38.8	40.6	41.9	35.8	33.4	30.4	32.4	28.5	24.8	**41.9**
3	11.7	16.2	22.6	24.8	27.1	23.6	23.3	21.4	18.2	11.8	7.1	**7.1**
9	28.5	33.2	39.3	42.6	38.4	31.8	NA	33.0	32.1	28.7	25.7	**42.6**
3	10.6	16.5	22.5	26.8	24.7	22.4	NA	21.8	16.4	11.2	8.0	**7.3**
4	27.0	31.9	38.2	42.0	37.0	37.2	31.7	31.5	32.5	29.3	23.2	**42.0**
4	8.8	14.0	19.0	25.1	23.4	21.9	21.3	20.6	16.1	11.3	7.1	**5.4**
3	24.0	28.2	26.9	38.2	35.4	29.6	29.9	29.0	28.9	26.9	23.3	**38.2**
4	9.9	13.0	19.7	24.3	24.0	20.8	21.0	19.9	16.7	10.9	7.2	**7.2**
1	26.7	30.8	35.2	42.1	38.2	34.3	27.9	30.0	28.9	25.0	21.3	**42.1**
	10.4	14.7	18.6	24.6	23.7	22.1	20.0	19.2	14.2	9.5	6.7	**5.1**
7	23.2	31.5	36.0	40.3	41.2	35.5	30.7	30.6	30.8	27.7	NA	**41.2**
3	6.8	13.7	19.3	22.5	24.5	21.5	19.8	18.0	14.5	10.5	NA	**5.6**
3	27.2	30.1	37.1	42.2	39.5	33.6	32.4	26.5	29.5	27.0	21.4	**42.2**
4	11.1	17.0	22.7	27.9	27.7	26.0	24.7	23.5	20.4	15.0	9.8	**5.4**
4	23.1	31.5	34.5	40.2	37.0	29.1	28.3	29.3	28.8	25.4	22.2	**40.2**

	12.5	18.7	22.9	28.3	27.4	24.5	24.0	22.2	18.8	16.3	15.5	**12.3**
	23.4	28.5	34.2	39.4	40.6	32.7	29.3	30.2	31.0	26.6	23.0	**40.6**
	6.7	14.0	19.6	23.9	24.9	21.5	20.2	19.1	16.2	10.3	6.3	**6.3**
	24.9	32.6	36.0	NA	37.3	NA	NA	29.7	NA	NA	23.7	**37.3**
	7.7	15.6	17.9	NA	27.3	NA	NA	22.9	NA	NA	NA	**6.9**
	25.4	NA	NA	NA	NA	NA	NA	30.6	NA	27.2	NA	**NA**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**
	24.3	34.1	40.3	45.6	47.4	34.5	34.4	34.3	34.7	32.4	27.1	**47.4**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**
	31.7	36.7	43.3	44.4	40.5	37.5	32.4	32.0	32.5	24.7	26.7	**44.4**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**
	27.3	34.2	42.1	41.4	36.4	33.0	33.0	32.9	36.0	31.9	27.1	**42.1**
	8.7	13.6	22.2	28.2	26.9	26.2	25.7	23.5	19.1	13.4	7.9	**7.7**
	29.6	31.5	39.3	42.1	36.5	31.2	33.3	33.7	34.3	31.1	26.9	**42.1**
	10.0	15.5	20.4	27.5	26.7	25.5	25.7	23.9	20.3	13.2	8.8	**7.1**
	28.4	35.2	41.4	43.9	41.0	31.1	29.1	33.2	33.4	27.7	27.1	**43.9**
	11.3	15.4	21.7	27.3	27.7	25.2	22.8	23.4	15.2	11.8	10.2	**8.0**
	26.9	34.0	41.4	42.2	41.5	33.8	32.2	39.7	32.2	30.6	24.9	**42.2**
	12.7	15.4	22.4	25.5	28.5	25.6	24.5	23.4	18.9	13.6	10.0	**6.6**
	37.5	41.4	42.7	41.4	37.7	34.7	31.7	34.9	31.7	30.5	25.7	**42.7**
	16.4	24.2	27.9	27.3	26.3	24.9	24.4	23.5	19.4	13.0	9.9	**9.5**
	25.5	33.7	38.8	40.4	38.4	31.8	29.8	32.6	31.9	27.5	22.8	**40.4**
	10.3	16.9	22.3	27.5	29.6	25.7	23.9	21.7	19.5	12.6	10.2	**8.5**
	27.5	31.8	39.9	42.2	38.9	31.6	30.	30.2	29.3	26.1	22.4	**42.2**
	12.9	15.6	22.5	28.9	27.6	25.2	24.1	23.2	18.6	11.9	9.5	**9.5**
	24.5	33.2	36.8	41.5	41.6	32.9	30.5	29.8	30.1	27.	23.5	**41.6**
	10.4	17.9	23.5	27.2	26.9	26.7	23.9	22.9	20.4	11.8	8.4	**6.5**
	32.35	**39.58**	**39.16**	**42.46**	**41.61**	**35.65**	**32.0**	**33.02**	**32.96**	**30.61**	**27.17**	**42.46**
	10.59	**16.08**	**21.45**	**26.14**	**26.28**	**24.00**	**23.15**	**22.12**	**17.94**	**12.39**	**9.17**	**8.18**

Annex - 3: II

Mean Wind Velocity (km/hr) and Predominant Wind Direction at Satna and Nowgon

Months	Wind Velocity (km/hr)		Wind direction - Morning		Wind direction - Evening	
	Satna	Nowgon	Satna	Nowgon	Satna	Nowgon
Jan	3.7	2.7	C/WSW	C/SSW	NNW	NNE
Feb	4.5	4.0	C/WSW	SSW	WNW	NNW
Mar	5.5	4.2	C/WSW	SSW	WNW	WNW
Apr	6.2	4.7	WSW	SW	WNW	WNW
May	7.4	6.0	WSW	WSW	WNW	WNW
Jun	9.2	8.2	WSW	WSW	WNW	WSW
Jul	7.6	7.1	WSW	SW	WSW	WSW
Aug	6.6	5.9	WSW	SW	WSW	WSW
Sep	5.3	4.4	WSW	WSW	WNW	WSW
Oct	3.3	2.9	C/WNW	SW	NNW	C/NNE
Nov	2.7	2.1	C/WSW	SSW	NNW	C/NNE
Dec	2.9	2.1	C/WSW	C/SSW	NWW	NNE
Average	**5.4**	**4.5**				

Land use and forest cover of Gangau Sanctuary of proposed Panna BR

S. No.	Category	Area in sq km					Area in %
		I	II	III	IV	Total	
1	**Agricultural land**	0.26	4.39	--	0.67	5.32	6.20
2.	**Built-up**	--	4.82	--	---	4.82	5.62
3	**Forest**						
	Dense	8.17	26.44	0.12	7.59	42.32	49.30
	Open	0.94	3.93	1.67	4.46	11.0	12.81
	Scrub	10.78	5.19	0.05	3.40	19.42	22.62
	Forest Blank	1.09	0.23		0.35	1.67	1.95
4	**Wastelands**	0.13	--	--	--	0.13	0.15
5	**Water bodies**	--	0.88	--	0.28	1.16	1.35
	Total	**21.37**	**45.88**	**1.84**	**16.75**	**85.84**	**100**

Land use and forest cover of Panna Tiger Reserve

S. No.	Category	Area in sq km					Area in %
		Gangau sanctuary			Panna NP	Total	
		I	III	IV			
1	Agricultural land	0.26	--	0.67	24.23	25.16	4.19
2.	Built-up	--	--	---	0.28	0.28	0.05
3	Forest						
	Dense	8.17	0.12	7.59	329.95	345.83	57.53
	Open	0.94	1.67	4.46	87.30	94.37	15.70
	Scrub	10.78	0.05	3.40	65.21	79.44	13.21
	Forest Blank	1.09		0.35	31.82	33.26	5.53
4	Wastelands	0.13	--	--	4.17	4.3	0.72
5	Water bodies	--	--	0.28	18.26	18.54	3.08
	Total	**21.37**	**1.84**	**16.75**	**561.22**	**601.18**	**100**

Land use and forest cover of Ken-Gharial sanctuary

S No	Category	Area in sq km	Area in %
1	**Agricultural land**	**16.97**	27.87
2	**Forest**		
	Dense	4.05	6.67
	Open	20.71	34.03
	Scrub	9.72	16.00
	Forest Blank	--	
3	**Wastelands**	**0.1**	0.16
4	**Water bodies**	**9.30**	15.27
	Total	**60.89**	**100**

Annex –6: I

The list of plant species of various divisions recorded in proposed Panna BR

THALLOPHYTA

1) Algae

S No	Algal Species	Sub-aquatic condition	Ecological Distribution
A.	**Bacillariophyceae**		
1.	*Cymbella aspera*		Planktonic
2.	*Cymbella tumida*		Planktonic
3.	*Cymbella tumida f. ventricosa*		Planktonic
4.	*Fragillaria species*		Planktonic
5.	*Gomphonema intricatum*		Planktonic
6.	*Gomphonema subapicatum*		Planktonic
7.	*Gyrosigma attenuatum*		Planktonic
8.	*Melosira granulate*		Free floating
9.	*Navicula cryptocephale*		Planktonic
10.	*Navicula virudula*		Planktonic
11.	*Nitszchia palea*		Planktonic
12.	*Pinnularia acrosphaerica*		Planktonic
13.	*Rhopalodia gibba*		Planktonic
14.	*Surirella secies*		Planktonic
15.	*Synedra capitata*		Planktonic
16.	*Synedra tabulate*		Planktonic
17.	*Synedra ulna*		Planktonic
B.	**Chlorophyceae**		
18.	*Ankistrodesmus falcatus*		Planktonic
19.	*Arthrodesmus convergens*		Free floating
20.	*Bulbochaete varians*		Epiphytic
21.	*Chaetophora attenuate*		Epiphytic

22.	*Chaetophora elegans*	Epiphytic
23.	*Chara zeylanica*	Attached
24.	*Characium ambiguum*	Epiphytic
25.	*Characium angustum*	Epiphytic
26.	*Characium arissicum*	Epiphytic
27.	*Chlamydomonas polypyrenoideum*	Planktonic
28.	*Chlamydomonas snowii*	Planktonic
29.	*Chlorella vulgaris*	Planktonic
30.	*Chloroccum humicola*	Planktonic
31.	*Cladophora callicoma*	Epizoic
32.	*Cladophora glomerata*	Epizoic
33.	*Closterium eherenbergii*	Planktonic
34.	*Closterium kuetzingi*	Planktonic
35.	*Closterium lanceolatum*	Planktonic
36.	*Closterium moniliferum*	Planktonic
37.	*Closterium nematodes*	Planktonic
38.	*Coelastrum microporum*	Planktonic
39.	*Coleochaete nitellarum*	Epiphytic
40.	*Cosmarium auriculatum*	Planktonic
41.	*Cosmarium granatum*	Planktonic
42.	*Cosmarium javanicum*	Planktonic
43.	*Cosmarium lundelli*	Planktonic
44.	*Cosmarium margaritatum*	Planktonic
45.	*Cosmarium obsoletum*	Planktonic
46.	*Cosmarium regnelli*	Planktonic
47.	*Cosmarium subtumidum*	Planktonic
48.	*Dictyosphaerium pulchellum*	Planktonic
49.	*Dimorphococcus lunatus*	Planktonic
50.	*Drapernaldiopsis indica*	Free floating
51.	*Euastrum bidentatum*	Planktonic
52.	*Euastrum denticulatum*	Planktonic
53.	*Euastrum irregulare*	Planktonic
54.	*Euastrum spinulosum*	Planktonic
55.	*Euastrum subtellatum*	Planktonic
56.	*Eudorina elegans*	Planktonic

57.	*Genicularia elegans*		Planktonic
58.	*Gloeotaenium loitlesbergerianum*		Planktonic
59.	*Gonatozygon aculeatum*		Planktonic
60.	*Hydrodictyon reticulatum*		Free floating
61.	*Kirchneriella lunaris*		Planktonic
62.	*Korshikoviella limnetica*		Planktonic
63.	*Micrasterias pinnatifida*		Planktonic
64.	*Microspora quadrata*		Epiphytic
65.	*Mougeotia drouetii*		Free floating
66.	*Mougeotia elegantula*		Free floating
67.	*Mougeotia gelatinosa*		Free floating
68.	*Mougeotia indica*		Free floating
69.	*Mougeotia jogensis*		Free floating
70.	*Mougeotia nummuloides*		Free floating
71.	*Mougeotia ovalispora*		Free floating
72.	*Mougeotia radians*		Planktonic
73.	*Mougeotia scalaris*		Free floating
74.	*Mougeotia sphaerocarpa*		Free floating
75.	*Mougeotia transeaui*		Free floating
76.	*Nephrocytium lunatum*		Planktonic
77.	*Netrium digitus*		Planktonic
78.	*Nitella hyaline*		Attached
79.	*Oedocladium tiffanyanum*	Moist soil	
80.	*Oedogonium undulatum*	Moist soil	
81.	*Oedogonium borisianum*		Epiphytic
82.	*Oedogonium curvum*		Epiphytic
83.	*Oedogonium nodulosum*		Epiphytic
84.	*Oedogonium randhawae*	Moist soil	
85.	*Onychonema leave*		Planktonic
86.	*Oocytis elliptica*		Planktonic
87.	*Pediastrum duplex*		Planktonic
88.	*Pediastrum duplex* var. *reticulatum*		Planktonic
89.	*Pediastrum ovatum*		Planktonic
90.	*Pediastrum simplex*		Planktonic
91.	*Pediastrum tetras*		Planktonic

92.	*Pithophora polymorpha*	Free floating
93.	*Pleurotaenium eherenbergii*	Planktonic
94.	*Pleurotaenium trabecula*	Planktonic
95.	*Rhizoclonium hookerii*	Free floating
96.	*Scenedesmus arcuatus*	Planktonic
97.	*Scenedesmus dimorphus*	Planktonic
98.	*Scenedesmus obliguus*	Planktonic
99.	*Scenedesmus quadricauda var. minus*	Planktonic
100.	*Scenedesmus quadricauda* var. *westii*	Planktonic
101.	*Selenastrum gracile*	Planktonic
102.	*Selenastrum westii*	Planktonic
103.	*Spirogyra bichromatophora*	Free floating
104.	*Spirogyra brunnea*	Free floating
105.	*Spirogyra columbiana*	Free floating
106.	*Spirogyra cylindrical*	Free floating
107.	*Spirogyra deadalea*	Free floating
108.	*Spirogyra flavescens*	Free floating
109.	*Spirogyra fuellebornei*	Free floating
110.	*Spirogyra hylina*	Free floating
111.	*Spirogyra lamellate*	Free floating
112.	*Spirogyra margaritata*	Free floating
113.	*Spirogyra microspora*	Free floating
114.	*Spirogyra neglecta*	Free floating
115.	*Spirogyra nitida*	Free floating
116.	*Spirogyra oblate*	Free floating
117.	*Spirogyra paludosa*	Free floating
118.	*Spirogyra parvula*	Free floating
119.	*Spirogyra pseudoneglecta*	Free floating
120.	*Spirogyra setiformis*	Free floating
121.	*Spirogyra silvicola*	Free floating
122.	*Spirogyra subsala*	Free floating
123.	*Staurastrum dickiei*	Planktonic
124.	*Staurastrum pinnatum*	Planktonic
125.	*Staurastrum tohopekaligense*	Planktonic
126.	*Stigeoclonium nannum*	Epiphytic

127.	*Tetraedon trigonium*	Planktonic
128.	*Ulothriz fimbriata*	Epiphytic
129.	*Ulothriz zonata*	Epiphytic
130.	*Uronema gigas*	Epiphytic
131.	*Volvox globator*	Planktonic
132.	*Zygnema chalybeospermum*	Free floating
133.	*Zygnema cyanosporum*	Free floating
134.	*Zygnema cylindrosporum*	Free floating
135.	*Zygnema czurdae*	Free floating
136.	*Zygnema majus*	Free floating
137.	*Zygnema mucigenum*	Free floating
138.	*Zygnema normani*	Free floating
139.	*Zygnema sphaericum*	Free floating
140.	*Zygnema stellinum*	Free floating
141.	*Zygnemopsis gracilis*	Free floating
142.	*Zygnemopsis indica*	Free floating
143.	*Zygnemopsis lamellate*	Free floating
144.	*Zygnemopsis stephensiae*	Free floating
C. Cyanophyceae		
145.	*Anabaena circinalis*	Free floating
146.	*Anabaena fertilissima*	Free floating
147.	*Anabaena iyengarii*	Free floating
148.	*Anabaena sphaerica*	Free floating
149.	*Anabaena sphaerica* var. *attenuata*	Free floating
150.	*Anabaena spiroides*	Free floating
151.	*Anabaena torulosa*	Free floating
152.	*Anabaena vaginicola*	Free floating
153.	*Anabaena volzii*	Free floating
154.	*Anabaenopsis circularis*	Free floating
155.	*Anabaenopsis tanganyikae*	On rocks
156.	*Aphanocapsa koordersi*	Planktonic
157.	*Aphanocapsa littoralis*	Planktonic
158.	*Aphanocapsa pulchera*	Planktonic
159.	*Aphanothece stagnina*	Free floating
160.	*Arthrospira jenneri*	

161.	*Arthrospira khannae*		
162.	*Arthrospira platensis*		
163.	*Calothrix braunii*		Free floating
164.	*Chroococcus minor*	Moist soil	
165.	*Chroococcus minutes*	Moist soil	
166.	*Chroococcus tenax*	Moist soil	
167.	*Chroococcus turgidius*	Moist soil	
168.	*Cylindrospermum gorakhpurense*		Free floating
169.	*Cylindrospermum musicola*	Moist soil &	Free floating
170.	*Dactylococcopsis fascicularis*		Free floating
171.	*Gloeocapsa decorticans*	Moist soil	
172.	*Gloeotheca rupestris*	Moist soil	
173.	*Gloeotheca samoensis*	Moist soil	
174.	*Gloeotrichia ghosei*		Free floating
175.	*Gloeotrichia intermedia*		Free floating
176.	*Gloeotrichia natans*		Free floating
177.	*Gloeotrichia raciborskii*		Free floating
178.	*Lyngbya confervoides*		Free floating
179.	*Lyngbya hieronymusii*		
180.	*Lyngbya kashyapii*		Attached
181.	*Lyngbya limnetica*	Moist soil	
182.	*Lyngbya maj scula*		Attached
183.	*Lyngbya major*		Free floating
184.	*Lyngbya rubida*		Free floating
185.	*Lyngbya spiralis*		With other alga
186.	*Merismopedia elegans*		Free floating
187.	*Merismopedia glauca*		Free floating
188.	*Merismopedia marssonii*		Free floating
189.	*Merismopedia tenuissima*		Free floating
190.	*Microcoleus chthonoplastes*		With other algae
191.	*Microsystis flos-aquae*		Planktonic
192.	*Microsystis protocystis*		Planktonic
193.	*Microsystis robusta*		
194.	*Nodularia spumigena*		With other alga
195.	*Nostoc carneum*	Moist soil	

196.	*Nostoc commune*	Moist soil	
197.	*Nostoc linckia*	Moist soil	
198.	*Nostoc paludosum*	Moist soil	
199.	*Nostochopsis lobatus*		Atta./FF
200.	*Oscillatoria amphibia*		
201.	*Oscillatoria annae*		Attached
202.	*Oscillatoria calcuttensis*		
203.	*Oscillatoria chalybea*		
204.	*Oscillatoria formosa*		Attached
205.	*Oscillatoria limosa*		
206.	*Oscillatoria princeps*		
207.	*Oscillatoria proboscidea*		Attached
208.	*Oscillatoria pseudogeminata*		Attached
209.	*Oscillatoria salina*	Moist soil	
210.	*Oscillatoria salina f major*	Moist soil	
211.	*Oscillatoria sancta*		
212.	*Oscillatoria subbrevis*		
213.	*Oscillatoria tenuis*		Attached
214.	*Phormidium ambiguum*		Attached
215.	*Phormidium autumnale*		Attached
216.	*Phormidium favosum*		Free floating
217.	*Phormidium fragile*	Moist soil	
218.	*Phormidium incrustatum*		Attached
219.	*Phormidium retzii*		Attached
220.	*Phormidium subfuscum*		Free floating
221.	*Phormidium uncinatum*		Attached
222.	*Rivularia aquatica*		Attached
223.	*Scytonema bohneri*	Moist soil	
224.	*Scytonema myochrous*	Moist soil	
225.	*Scytonema pascheri*	Moist soil	
226.	*Scytonema schmidtii*	Moist soil	
227.	*Spirulina gigantea*		
228.	*Spirulina laxissima*		
229.	*Spirulina princeps*		

D. Euglenophyceae

230.	*Euglena elastica*	Planktonic
231.	*Euglena oxyuris*	Planktonic
232.	*Euglena spirogyra*	Planktonic
233.	*Euglena tripteris*	Planktonic
234.	*Euglena acus*	Planktonic
235.	*Phacus curvicauda*	Planktonic
236.	*Phacus orbicularis*	Planktonic
237.	*Phacus platalea*	Planktonic
238.	*Phacus meson*	Planktonic
239.	*Trachelmonas hispida*	Planktonic
E. Rhodophyceae		
240.	*Batrachospermum moniliformae*	Lithophytic
241.	*Compsopogon aeruginosus*	Free floating

2) Lichens

S No	Lichens species	Family
1.	*Bacidia submedialis* (Nyl.) Zahlbr	Bacidiaceae
2.	*Lecanora perplexa* Brodo	Lecanoraceae
3.	*Lecanora pulicaris* (Pers.) Ach.	Lecanoraceae
4.	*Phylliscum tinctorium* (Nyl.)Hale.	Lichinaceae
5.	*Phylliscum indicum* Upreti	Lichinaceae
6.	*Petulla obscurans* (Nyl.)Gyel.	Peltulaceae
7.	*Petulla euploca* (Ach.) Poelt in Pisut	Peltulaceae
8.	*Buellia disjecta* Zahlbr.	Phsciacae
9.	*Dinnaria consimilis* (stirton)D.Awasthi	Phsciacae
10.	*Dinnaria aegialita* (Afz. In Ach.) Moore	Phsciacae
11.	*Pyxine petricola* Nyl.	Phsciacae
12.	*Pyxine cocoes* (swartz) Nyl.	Phsciacae
13.	*Endocarpon rosettum* A. Singh & Upreti	Verrucariaceae
14.	*Endocarpon nannum* A. Singh & Upreti	Verrucariaceae

BRYOPHYTA

S	Name of Species	Family	Thallus size	Distribution

No			(mm)	
1.	*Anthoceros crispulus* Mont	Anthocerotaceae	Upto 5mm	**Rare**
2.	*Notothylas indica* Kashyap	Anthocerotaceae	Upto 0	Frequent
3.	*Asterella angusta* St	Aytoniaceae	Upto 15	Frequent
4.	*Plagiochasma appendiculatum* L et L	Aytoniaceae	Upto 5	Less Frequent
5.	*Plagiochasma intermedium* L et L	Aytoniaceae	Upto 5	Less Frequent
6.	*Riccia billardieri*, Mont et N	Ricciaceae	Upto 0	Frequent
7.	*Riccia cruciate,* Kashyap	Ricciaceae	Upto 4-5	Less Frequent
8.	*Riccia grollei,* Udar Nom	Ricciaceae	Upto 5	Frequent
9.	*Riccia discolor* L et L	Ricciaceae	Upto 8-12	Less Frequent
10.	*Cyathodium cavernarum* Kunze	Targioniaceae	Upto 5	Less Frequent

PTERIDOPHYTES

S No	Name of Species	Family	Habit	Distribution
1.	*Marsilea quadrifolia*	Marsileaceae	Aquatic	Less Frequent
2.	*Lygodium flexuosum* (L.)	Lygodiaceae	Climbing	Less Frequent
3.	*Cheilsathes tenuifolia* (Burm.)	Cheilanthaceae	Lithophytic	Less Frequent
4.	*Equisetum ramossissimum* Desf.	Equisetaceae	Terrestrial	Less Frequent

GYMNOSPERMS

S No	Name of Species	Family	Ecological Categories
1.	*Araucaria* spp.	Araucariaceae	
2.	*Thuja orientalis*	Cupressusaceae	
3.	*Cedrus deodara*	Pinaceae	
4.	*Cycas* spp.	Pinaceae	

ANGIOSPERMS

1. Dicoyledons

S No	Family	Botanical name	Ecological Categories

1.	Acanthaceae	*Adhatoda zeylanica*	
2.		*Andrographis ovata*	
3.		*Andrographis paniculata*	
4.		*Barleria cristata*	
5.		*Barleria prionitis*	
6.		*Blephatic maderaspatenris*	
7.		*Dicliptera verticillata*	
8.		*Dipteraeanthus prostrates*	
9.		*Elytraria acaulis*	
10.		*Eranthemum nervosum*	
11.		*Eranthemum purpurascens*	
12.		*Gendarusa vulgaris*	
13.		*Hemigraphis latebrosa*	
14.		*Hygrophila auriculata*	
15.		*Hygrophila polysperma*	
16.		*Indoneesiella echioides*	
17.		*Justicia diffusa*	
18.		*Lepidagathis trinervis*	
19.		*Nelsonia canescens*	
20.		*Peristrophe paniculata*	
21.		*Rungia pectinata*	
22.		*Rungia repeus*	
23.		*Justicia quinqueangularis*	
24.		*J. simplex*	
25.		*Thundergia erecta*	
26.	Aizoaceae	*Trianthema portulacastrum*	
27.	Alangiaceae	**Alangium salvifolium**	Rare
28.	Amaranthaeae	*Achyranthes aspera*	
29.		*Aerva lauata*	
30.		*Aerva sanguinolenta*	
31.		*Alternanthera paronychioides*	
32.		*Alternanthera pungens*	
33.		*Alternanthera sessilis*	
34.		*Amaranthus caudatua*	
35.		*Amaranthus hybridus*	

36.		*Amaranthus spinosus*
37.		*Amaranthus tenuifolius*
38.		*Amaranthus tricolor*
39.		*Amaranthus viridis*
40.		*Celosia argentea*
41.		*Digera muricata*
42.		*Gomphrena celosioides*
43.		*Gomphrena globosa*
44.		*Pupalia lappacea*
45.	Anacardiaceae	*Buchanania lanzan*
46.		*Lannea coromandelica*
47.		*Mangnifera indica*
48.		*Semicarpus anacardium*
49.		*Spondia pinnata*
50.	Annonaceae	*Annona sqamosa*
51.		*Moliusa velutina*
52.		*Moliusa tomentosa*
53.		*Polyalthia longifolia*
54.	Apiaceae	*Anethum graveoleus*
55.		*Centella asiatica*
56.		*Coriandrum sativum*
57.		*Daueos careta*
58.		*Foeniculum vulgare*
59.		*Trachyspermum ammi*
60.	Apocynaceae	*Alstonia scholaris*
61.		*Carissa carandas*
62.		*Carissa spinarum*
63.		*Catharanthus pusillus*
64.		*Catharanthus roseus*
65.		*Holarrhena antidysenterica*
66.		*Ichnocarpus frutescens*
67.		*Nerium indicum*
68.		*Plumeria rubra forma acutifolia*
69.		*Tabernacemontana divaricata*
70.		*Thevetia peruviana*

71.		*Wrightia tinetoria*
72.	Aristolochiaceae	*Aristolochia indica*
73.	Asclepiacelaceae	*Calotropis gigantean*
74.		*Calotropis procera*
75.		*Cryptolepix buchanani*
76.		*Cryptostegia grandiflora*
77.		*Gymnema sylvestre*
78.		*Hemidesmus indicus*
79.		*Marsdenia tenacissima*
80.		*Oxystelma esculentum*
81.		*Pergularia daemia*
82.		*Telosma pallid*
83.	Asteraceae	*Acanthospermum hispidum*
84.		*Aelenostemma lanenia*
85.		*Ageratum conyzoides*
86.		*Ageratum houstonianum*
87.		*Bidens biternata*
88.		*Blainrillea aemella*
89.		*Blumea bifolia*
90.		*Blumea eriantha*
91.		*Blumea lacera*
92.		*Blumea lanceolaria*
93.		*Blumea membrancea*
94.		*Blumea mollis*
95.		*Blumea obligna*
96.		*Blumea oxyodonta*
97.		*Blumea virens*
98.		*Breea arvensis*
99.		*Caesulia axillaries*
100.		*Calendula arvensis*
101.		*Carthamus oxycantha*
102.		*Centipeda minima*
103.		*Cochorium intybus*
104.		*Cosmos bipinnatus*
105.		*Cosmos sulphurens*

106.		*Cyathocline purpurea*	
107.		*Echinops echinatus*	
108.		*Eclipta prostorta*	
109.		*Elephantopus scabeo*	
110.		*Emilia sonchifolia*	
111.		*Eupatorium odoratum*	Rare
112.		*Glossocardia bosvalllea*	
113.		*Glossogyne bidens*	Rare
114.		*Gnaptiatium affine*	
115.		*Gnaptiatium pensylvanicum*	
116.		*Gnaptiatium polycavlon*	
117.		*Gnaptiatium pulvinatum*	
118.		*Goniacaulon indicum*	
119.		*Grangea maderaspatana*	
120.		*Helianthus annuus*	
121.		*Lagascea mollis*	
122.		*Launaea procumbens*	
123.		*Oligochaeta ramose*	
124.		*Parthenium hysterophorus*	
125.		*Pentanema indica*	
126.		*Pulicaria angustifolia*	
127.		*Pulicaria foliolosa*	
128.		*Sclerocarpus africanus*	Rare
129.		*Sonchus oleraceus*	
130.		*Sonchus wightianus*	
131.		*Sphaeranthus indicus*	
132.		*Spilanthus paniculata*	
133.		*Tagetes erecta*	
134.		*Tagetes patula*	
135.		*Tridax procumbens*	
136.		*Vernonia cinerea*	
137.		*Vernonia divergens*	
138.		*Xanthium indicum*	
139.		*Zinnia elegans*	
140.	Balanitaceae	*Balanites roxburghii*	

141.	Balsaminaceae	*Impatiens balsamina*
142.	Basellaceae	*Basella alba*
143.	Bignoniaceae	*Dolichandrous falcate*
144.		*Jaaranda mimosifolia*
145.		*Kigelia Africana*
146.		*Millingtonia hortensis*
147.		*Oroxylum indicum*
148.		*Pyrostegia venusta*
149.		*Spathodea campanulata*
150.		*Sterospermum chelonoides*
151.		*Tecoma stans*
152.	Bombaceae	*Bambax ceiba*
153.	Boraginaceae	*Bothriospermum tenellum*
154.		*Colelensia procumbens*
155.		*Corelia dichotoma*
156.		*Corelia macleodii*
157.		*Ehretia laevis*
158.		*Heliotropium ovalifolium*
159.		*Heliotropium strigosum*
160.		*Heliotropium supinum*
161.		*Rotula aquatica*
162.		*Trichodesma zeylanicum*
163.	Brassicaceae	*Alyssum maritimum*
164.		*Brassica compestris*
165.		*Brassica juncea*
166.		*Brassica oleracea var capstata*
167.		*Brassica oleracea var gongylodes*
168.		*Brassica rapa*
169.		*Brassica. oleracea var botrytix*
170.		*Cochlearia cochlearioides*
171.		*Coronopus didymus*
172.		*Eruca sativa*
173.		*Raphanus sativa*
174.		*Rorippa indica*
175.	Buddlejaceae	*Buddleja asiatica*

176.	Burseraceae	*Boswellia serrata*	
177.		*Bursera serrata*	
178.		*Garuga pinnata*	
179.	Caesalpiniaceae	*Bauhinia malabarica*	
180.		*Bauhinia purpurea*	
181.		*Bauhinia racemosa*	
182.		*Bauhinia vahlii*	
183.		*Bauhinia variegate*	
184.		*Caesalpinia bondue*	
185.		*Caesalpinia decapetala*	
186.		*Caesalpinia pulcherrima*	
187.		*Cassia fistula*	
188.		*Cassia obsus*	
189.		*Cassia obtusifolia*	
190.		*Cassia occidentalis*	
191.		*Cassia pumila*	
192.		*Cassia siamea*	
193.		*Cassia sophera*	
194.		*Cassia tora*	
195.		*Delonix regia*	
196.		*Parkinsonia aculeate*	
197.		*Peltophorum pterocarpum*	
198.		*Tamarindus indica*	
199.	Cactaceae	*Cereus pterogonus*	
200.		*Opuntia elatior*	
201.	Campanulaceae	*Campanula beuthamii*	
202.		*Wahlenbergia marginata*	
203.	Cannabaceae	**Cannabis sativa**	
204.	Capparidaceae	*Capparis sepiaria*	
205.		*Capparis zeylanica*	
206.		*Cleome gynandra*	
207.		*Cleome viscose*	Rare
208.		*Crataera magna*	
209.	Caricaceae	*Carica papaya*	
210.	Caryophyllaceae	**Dianthus caryophyllus**	

211.		*Dianthus chinensix*
212.		*Polycarpon prostratum*
213.		*Spergula arvensis*
214.		*Spergula follax*
215.		*Spergula rubra*
216.		*Stellaria media*
217.		*Vaccaria pyramidata*
218.	Casurinaceae	*Casuarina equisetifolia*
219.	Celastraceae	**Cassine glauea**
220.		**Gymnosporia montana**
221.		*Maytenus emarginatus*
222.		*Maytenus senegalensis*
223.	Ceratophyllaceae	*Ceratophyllum demersum*
224.	Chenopodiaceae	*Beta vulgaris*
225.		*Chenopodium ambrosiodes*
226.		*Chenopodium murale*
227.		*Chenopodium album*
228.		*Kochia trichophylla*
229.		*Spinacia oleracea*
230.	Cochlospermaceae	*Cochlospermum religiosum*
231.	Combrectaceae	*Anogeissus latifolia*
232.		*Anogeissus pendula*
233.		*Combretum albielum*
234.		*Combretum roxburghii*
235.		*Quisqnalst indica*
236.		*Terminalia alata*
237.		*Terminalia arjuna*
238.		*Terminalia bellirica*
239.		*Terminalia chebula*
240.	Convolvulaceae	*Argyreia kleiniana*
241.		*Argyreia sericea*
242.		*Convolvulus prostrates*
243.		*Convolvulus arvensis*
244.		*Cuscuta hyaline*
245.		*Cuscuta reflexa*

246.		*E. nummularius*
247.		**Evolvulus alsinoides**
248.		*Ipomea aquatica*
249.		*Ipomea batatus*
250.		*Ipomea cairica*
251.		*Ipomea carnea*
252.		*Ipomea eriocarpa*
253.		*Ipomea hederifolia*
254.		*Ipomea nil*
255.		*Ipomea obscura*
256.		*Ipomea pes-tigridis*
257.		*Ipomea quamobelit*
258.		*Ipomea sinensis*
259.		*Ipomea turbinate*
260.		*Jacqnemontia paniculata*
261.		*Merremia emarginata*
262.		*Merremia tridentate*
263.		*Operculina turpethum*
264.		*Porana paniculata*
265.		*Rivea hypocrateriformis*
266.	Crassulaceae	*Kalanchoe pinnata*
267.	Cucurbitaceae	*Benincasa hispida*
268.		*Blastansia garcinsi*
269.		*Citrullus lanatus*
270.		*Coccinia grandis*
271.		*Cucumis melo*
272.		*Cucumis sativus*
273.		*Cucurmita maxima*
274.		*Diplocyclos palmatus*
275.		*Lagenaria siceraria*
276.		*Luffa acutangula*
277.		*Luffa cylindrical*
278.		*Melothria maderaspatana*
279.		*Momordica charantia*
280.		*Momordica dioica*

281.		*Trichosanthes anguina*	
282.		*Trichosanthes cucumerina*	
283.	Ebenaceae	*Diospyros cordifolia*	
284.		*Diospyros malabarica*	
285.		*Diospyros melanoxylon*	
286.	Elatinaceae	*Bergia ammannioides*	
287.		*Bergia capensix*	Rare
288.	Euphorbiaceae	*Acalypha ciliate*	
289.		*Acalypha indica*	
290.		*Acalypha malabarica*	
291.		*Antidesma acidum*	
292.		*Antidesma ghaesembilla*	
293.		*Baliosperum moutanum*	
294.		*Breynia retusa*	
295.		*Bridelia retusa*	
296.		*Chrozophora prostrate*	
297.		*Chrozophora rottleri*	
298.		*Codiaeum variegatum*	
299.		*Croton bonplandianum*	
300.		*Drypetes roxburghii*	
301.		*Euphorbia cristata*	
302.		*Euphorbia heterophylla*	
303.		*Euphorbia heyneana*	
304.		*Euphorbia hirta*	
305.		*Euphorbia hypercifolia*	
306.		*Euphorbia milii*	
307.		*Euphorbia neriifolia*	
308.		*Euphorbia perbracteata*	
309.		*Euphorbia prostrate*	
310.		*Euphorbia pulcherrima*	
311.		*Euphorbia serpens*	
312.		**Euphorbia thymifolia**	
313.		*Euphorbia tirucalli*	
314.		*Jatropha curacas*	
315.		*Jatropha gossypifolia*	

316.		*Jatropha integerrima*
317.		*Mallotus philippensis*
318.		*Manihot esculeuta*
319.		*Pedilanthus tothymaloides*
320.		*Phyllanthus amarus*
321.		*Phyllanthus embica*
322.		*Phyllanthus maderaspatensis*
323.		*Phyllanthus reticulatus*
324.		*Phyllanthus urinaria*
325.		*Phyllanthus virgatus*
326.		*Ricinus communis*
327.		*Securinega virosa*
328.		*Trewia polycarpa*
329.	Flacourtiaceae	*Casearia grareoleus*
330.		*Casearia elliptica*
331.		*Flacourtia indica*
332.	Fumariaceae	*Fumaria indica*
333.	Gentianaceae	*Canscora decurrens*
334.		*Centaurium meyeri*
335.		*Enicostema axillare*
336.		*Exacum pedunculatum*
337.		*Hoppea dichotoma*
338.	Gesneriaceae	*Didymocarpus pygmaea*
339.	Hydrophyllaceae	*Hydrola zeylanica*
340.	Lamiaceae	*Acrocephalus hispidus*
341.		*Anisochilus carnosus*
342.		*Anisomeles indica*
343.		*Colebrooka oppositifolia*
344.		*Coleus amboinicus*
345.		*Hyptis suaveoleus*
346.		*Lavandula bipinnata*
347.		*Leonatis nepetifolia*
348.		*Leucas aspera*
349.		*Leucas cephalotes*
350.		*Leucas nutans*

351.		*Leucas clarkei*
352.		*Leucas biflora*
353.		*Leucas lanata*
354.		*Leucas Montana*
355.		*Leucas mollissima*
356.		*Mentha spicata*
357.		*Nepeta hindostana*
358.		*Ocimum basilicum*
359.		*Ocimum canum*
360.		*Ocimum tenuiflorum*
361.		*Ocimum grantissimum*
362.		*Orthosiphon pallidus*
363.		*Pogostemon benghalense*
364.		*Salvia coccinuia*
365.		*Salvia plebeian*
366.	Lauraceae	*Cassytha filiformis*
367.	Lecythidaceae	*Careya arborea*
368.	Leeaceae	*Leea asiatica*
369.	Leguminaceae (Fabaceae)	*Abrus precatorious*
370.		*Aeschynomene indica*
371.		*Alysicarpus bupleurifolium*
372.		*Alysicarpus hamosus*
373.		*Alysicarpus longifolium*
374.		*Alysicarpus monitifer*
375.		*Alysicarpus tetragonolobus*
376.		*Alysicarpus vaginalis*
377.		*Atylosla scarabaecoides*
378.		*Butea monosperma*
379.		*Butea superba*
380.		*Cajanus cajan*
381.		*Canavalia gladiata*
382.		*Canavalia virosa*
383.		*Cicer arietinum*
384.		*Clitoria biflora*
385.		*Clitoria ternatea*

386.	*Crotalaria albida*	
387.	*Crotalaria hirsute*	
388.	*Crotalaria hirta/C. medicaginea*	
389.	*Crotalaria juncea*	
390.	*Crotalaria linifolia*	
391.	*Crotalaria orixensis*	Rare
392.	*Crotalaria prostrate*	
393.	*Crotalaria spectabilix*	
394.	*Cymopsix tetragonoloba*	
395.	*Dalbergia lanceolaria*	
396.	*Dalbergia latifolia*	
397.	*Dalbergia paniculata*	
398.	*Dalbergia sissoo*	
399.	*Desmodium gangeticum*	
400.	*Desmodium heterocarpon*	
401.	*Desmodium laxiflorum*	
402.	*Desmodium pulchellum*	
403.	*Desmodium relutinum*	
404.	*Desmodium triflorum*	
405.	*Erythrina suberosa*	Rare
406.	*Flemingia macrophylla*	
407.	*Flemingia nana*	Rare
408.	*Galactia tenuiflora*	
409.	*Glycine max*	
410.	*Goniogyna hiota*	
411.	*Indigofera astragatina*	
412.	*Indigofera cassioides*	
413.	*Indigofera cordifolia*	
414.	*Indigofera glabra*	
415.	*Indigofera glanetulosa*	
416.	*Indigofera linifolia*	
417.	*Indigofera linnaei*	
418.	*Indigofera nummulariifolia*	
419.	*Indigofera tinctoria*	
420.	*Indigofera trifoliate*	

421.	*Indigofera trita*	
422.	*Lablab purpureus*	
423.	*Lathyrus aphaca*	
424.	*Lathyrus sativus*	
425.	*Lens culinaris*	
426.	*Medicago polymorpha*	
427.	*Melilotus alba*	
428.	*Melilotus racemosa*	Rare
429.	*Mueuna pruriens*	
430.	*Ongeinia oojeinensis*	Rare
431.	*Phaseolus vulgaris*	
432.	*Pisum sativum*	
433.	*Pongamia pinnata*	
434.	*Pterocarpus marsupium*	
435.	*Rhynchosia minsma*	
436.	*Sesbania bispinosa*	
437.	*Sesbania grandiflora*	
438.	*Sesbania sesban*	
439.	*Smithia conferta*	
440.	*Tephrosia pumila*	
441.	*Tephrosia purpurea*	
442.	*Tephrosia strigosa*	
443.	*Tephrosia villosa*	
444.	*Teramnus labialis*	
445.	*Trifolium alexandrinum*	
446.	*Trifolium nesupinatum*	
447.	*Trifolium repens*	
448.	*Trigonella corniculata*	
449.	*Trigonella foenum graecum*	
450.	**Uraria picta**	Rare
451.	*Vicia faba*	
452.	*Vicia hirsute*	
453.	*Vicia sativa*	
454.	*Vigna mungo*	
455.	*Vigna radiate*	

456.		*Vigna trilobata*	
457.		*Vigna umbellate*	
458.		*Zornia gibbosa*	
459.	Lentibulariaceae	*Utricularia aurea*	
460.		*Utricularia exoleta*	
461.	Linaceae	*Linum usitatissimum*	
462.	Loganiaceae	*Mitreola petiolata*	
463.	Loranthaceae	*Dendrophthoe falcate*	
464.		*Viscum articulatum*	
465.	Lythraceae	*Ammannia baccifera*	
466.		*Ammannia multiflora*	
467.		*Lagerstroemia parviflora*	
468.		*Lagerstroemia reginae*	
469.		*Lawsonia inermis*	
470.		*Rotala demiflora*	
471.		*Rotala serpylliflora*	Rare
472.		*Rotala indica*	
473.		*Rotala mexicana*	Rare
474.		*Woodfordia fructicosa*	
475.	Magnoliaceae	*Michelia champaca*	
476.	Malpighiaceae	*Galphimia gracilis*	
477.	Malvaceae	*Abelmoschus esculentus*	
478.		*Abelmoschus manihot*	
479.		*Abelmoschus. moschatus*	
480.		*Abutilon hirtum*	
481.		*Abutilon indicum*	
482.		*Alcea rosea*	
483.		*Gossypium hirsutum*	
484.		*Hibiscus cannatrinus*	
485.		*Hibiscus lobatus*	
486.		*Hibiscus ovalifolius*	
487.		*Hibiscus panduraeformis*	
488.		*Hibiscus rosa-sinensis*	
489.		*Hibiscus schizopetalus*	
490.		*Hibiscus ritilolius*	

491.		*Kydia calycina*	
492.		*Malva sylvestris*	
493.		*Malva vericillata*	
494.		*Malvastrum coromandelianum*	
495.		*Pavonia repanda*	
496.		*Sida acuta/ S. cordata/S. cordifolia*	Rare
497.		*Sida rhombifolia/S. spinosa*	
498.		*Thespesia lampas*	
499.		*Thespesia populnea*	
500.		*Urena lobata*	
501.	Meliaceae	*Azadirachta indica*	
502.		*Cipadessa baccifera*	
503.		*Melia azedarach*	
504.		*Soymida febrifuga*	
505.		*Toona ciliate*	
506.	Menispermaceae	*Cissampelos pareira*	
507.		*Cocculus hirsutus*	
508.		*Tinospora cordifolia*	
509.	Menyanthaceae	*Nymphoides hydrophylla*	
510.		*Nymphoides indica*	
511.	Mimosaceae	*Acacia auriculiformis*	
512.		*Acacia lencophilis*	
513.		*Acacia donateli*	
514.		*Acacia nilotica*	
515.		*Acacia torta*	
516.		*Acacia farnesiana*	
517.		*Acacia catechu*	
518.		*Acacia pennata*	
519.		*Albizia lebbeck*	
520.		*Albizia odoratisimum*	
521.		*Albizia procera*	
522.		*Dichrostachys cinerea*	
523.		*Leucaena leucocephala*	
524.		*Mimosa himalayana*	
525.		*Pithecellobium dulce*	

526.		*Prosopis juliflora*
527.		*Potentilla supine*
528.	Molluginaceae	*Glinus lotoides*
529.		*Glinus oppositifolius*
530.		*Mollugo nudicaulie*
531.		*Mollugo peutaphylla*
532.	Moraceae	*Artocarpus heterophyllus*
533.		*Artocarpus lakoocha*
534.		*Ficus benghalensis*
535.		*Ficus religiosa*
536.		*Ficus mollis*
537.		*Ficus microcarpa*
538.		*Ficus hispida*
539.		*Ficus racemosa*
540.		*Ficus palmate*
541.		*Ficus tinctoria*
542.		*Ficus virens*
543.		*Morus alba*
544.		*Morus australis*
545.		*Streblus asper*
546.	Moringaceae	*Moringa oleifera*
547.	Myrtaceae	*Callistermon citrinus*
548.		*Euealyptus umbellate*
549.		*Psiclium quajara*
550.		*Syzygium cumini*
551.		*Syzygium heyneanum*
552.	Nelumbonaceae	*Nelumbo nucifera*
553.	Nyctaginaceae	*Boerhavia diffusa*
554.		*Bougainvillea spectabilis*
555.		*Mirabilis jalapa*
556.	Nymphaeaceae	*Nymphaea pubescens*
557.		*Nymphaea nauchali*
558.	Oleaceae	*Jasminum flexile*
559.		*Jasminum graneliflorum*
560.		*Jasminum multiflorum*

561.		*Nyetanthes arbor- tristix*	
562.	Onagraceae	*Ludwigia adscendens*	
563.		*Ludwigia hyssopifolia*	
564.		*Ludwigia octovalvis.*	
565.		*Ludwigia perennis*	
566.	Orobanchaceae	*Orobanche aegyptiaca*	
567.	Oxalidaceae	*Biophytum reinwardtii*	
568.		*Biophytum sensitivum*	
569.		*Oxalis corniculata*	
570.		*Oxalis richarcdiana*	
571.	Papaveraceae	*Argemone mexicana*	
572.		*Argemone ochroleuca*	Rare
573.		*Papaver rhoeas*	
574.	Passifloraceae	*Passiflora edulis*	
575.	Pedaliaceae	*Martynia annua*	
576.		*Sesamum indicum*	
577.	Phytoloccaceae	*Rivina humilis*	
578.	Plumbaginaceae	*Plumbago zeylanica*	
579.	Polygolaceae	*Polygola arvensis*	Rare
580.		*Polygola elongate*	
581.		*Polygola erioptern*	
582.		*Antigonum leptopus*	
583.		*Polygonum barbatum*	
584.		*Polygonum glabrum*	
585.		*Polygonum plebeium*	
586.		*Rumex dentatus*	
587.	Portulacaceae	*Portulaca oleracea*	
588.		*Portulaca pilosa/ P. quadrifida*	
589.	Primulaceae	*Anagallis arvenros*	
590.		*Primula umbellata*	
591.	Proteaceae	*Grevillea robusta*	
592.	Punicaceae	*Punica granatum*	
593.	Ranunculaceae	*Delphinium ajacis*	
594.		*Nigella sativa*	
595.		*R. sceleratus*	

596.	Rhamnaceae	*Ventilago elenticulata*	
597.		*Ziziphus mauritiana*	
598.		*Ziziphus nummularia*	
599.		*Ziziphus oenoplia*	
600.		*Ziziphus rugosa*	Rare
601.		*Ziziphus xylopyrus*	
602.	Rosaceae	*Rosa indica*	
603.	Rubiaceae	*Anthocephalus chinensis*	
604.		*Catunaregam spinosa*	
605.		*Catunaregam nilotica*	
606.		*Gardenia jasminoides*	
607.		*Gardenia latifolia*	
608.		*Haldinia cordifolia*	
609.		*Hamelia patens*	
610.		*Hymenodictyon orixense*	Rare
611.		*Ixora coccinea*	
612.		*Ixora paretta*	
613.		*Mitragyna parvifolia*	
614.		*Morinda pubescens*	
615.		*Neanotis calycina*	
616.		*Oldenlandia affinis*	
617.		*Oldenlandia corymbosa*	
618.		*Pavetta tomentosa*	
619.		*Spermacoce hispida*	
620.		*Spermacoce pusilla*	
621.		*Spermadictyon suaveolens*	
622.		*Wendlandia heynei*	Rare
623.	Rutaceae	*Aegle marmelos*	
624.		*Citrus limon*	
625.		*Feronia limonia*	
626.		*Murraya koenigii*	
627.		*Murraya paniculata*	
628.		*Naringi crenulata*	Rare
629.	Salicaceae	*Salix tetrasperma*	
630.	Sapindaceae	*Cardiospermum haticacabum*	

631.		*Dodonaea angustifolia*	
632.		*Sapinetus emarginatus*	
633.		*Schleichera oleosa*	Rare
634.	Sapotaceae	*Madhuca longifolia*	
635.		*Manikara hexandra*	
636.		*Mimusops elengi*	
637.	Scrophulariaceae	*Autirrhinum orontium*	
638.		*Centranthera nepoleuris*	
639.		*Dopatrium junceum*	
640.		*Gloseostigma diandra*	
641.		*Kickxia ramosissima*	
642.		*Limnophila aromatica*	
643.		*Limnophila rugosa*	
644.		*Limnophila indica*	
645.		*Lindenbergia indica*	
646.		*Lindernia procumbeus*	
647.		*Lindernia crustaceae*	
648.		*Lindernia ciliate*	
649.		*Mazus pumilus*	
650.		*Scoparia duicis*	
651.		*Stiga angustifolia*	
652.		*Sutera dissecta*	
653.		*Verbascum chinense*	
654.		*Verbascum thapsus*	
655.		*Veronica anagallis- aquatica*	
656.	Simaroubaceae	*Acianthus excelsa*	
657.	Solanaceae	*Capsicum annuum*	
658.		*Capsicum frutescens*	
659.		*Cestrum nocturnum*	
660.		*Datura metel*	
661.		*Datura innoxia*	
662.		*Lycopersicon esculentum*	
663.		*Nicotiana rustica*	
664.		*Nicotiana plumbaginifolia*	
665.		*Nicotiana tabaenum*	

666.		*Petunia hybrida*	
667.		*Physalis minima*	
668.		*Solanum nigrum*	
669.		*Solanum virginianum*	
670.		*Solanum incanum*	
671.		*Solanum melongena*	
672.		*Withania somnifera*	
673.	Sphenocleaceae	*Sphenoclea zevlanica*	
674.	Sterculiaceae	*Eriolancea candollei*	Rare
675.		*Firmiana colorata*	
676.		*Helicteres isora*	
677.		*Melochia corchorifolia*	
678.		*Pterospermum acerifolium*	
679.		*Sterculia foetida*	Rare
680.		*Sterculia urens*	
681.		*Sterculia villosa*	Rare
682.		*Waltheria indica*	
683.	Tamaricaceae	*Tamarix ericodes*	
684.	Tiliaceae	*Corchorus aestuans*	
685.		*Corchorus capsularis*	
686.		*Corchorus fascicularis*	Rare
687.		*Corchorus olitorius*	
688.		*Corchorus tridens*	
689.		*Grewia damine*	
690.		*Grewia helicterifolia*	
691.		*Grewia hirsute*	
692.		*Grewia rotnii*	
693.		*Grewia subinaequalis*	
694.		*Grewia tillifolia*	
695.		*Triumfetta pentandra*	
696.		*Triumfetta rhomboidea*	
697.		*Triumfetta rotundifolia*	
698.	Trapaceae	*Trapa natans*	
699.	Turneraceae	*Ternera ulmifolia*	
700.	Ulmaceae	*Holoptelea intergrifolia*	

701.		*Trema orientalis*
702.	Urticaceae	*Pilea microphylla*
703.		*Pouzolzia pentandra*
704.	Verbenaceae	*Clerodendrum indicum*
705.		*Clerodendrum inerma*
706.		*Clerodendrum multiflorum*
707.		*Clerodendrum serratum*
708.		*Clerodendrum viscosum*
709.		*Clerodendrum venosum*
710.		*Duranta repens*
711.		*Gmelina arborea*
712.		*Lantana camara*
713.		*Lantana indica*
714.		*Phyla hodiflora*
715.		*Stachytarpheta jamaicensis*
716.		*Tectona grandis*
717.		*Verbena bipinnatifida*
718.		*Vitex negundo*
719.	Violaceae	*Hybanthus enneaspermus*
720.	Vitaceae	*Ampelocissus latifolia*
721.		*Ampelocissus tomentosa*
722.		*Cayratia auriculata*
723.		*Cayratia trifolia*
724.		*Cissus quadrangularis*
725.		*Cissus repanda*
726.		*Vitis vinifera*
727.	Zygophyllaceae	*Tribulus terrestris*

2. Monoctyledons

S No	Family	Botanical name	Ecological Categories
728.	Agavaceae	**Agave angustofolia**	
729.	Alismataceae	*Sagittaria guayanemis*	
730.		*Sagittaria trifolia*	
731.	Amaryllidaceae	*Crinum defixum*	

732.		*Crinum latifolium*	
733.		*Pancratium verecundum*	
734.		*Zephyranthes flava*	
735.	Aponogetonaceae	*Aponogeton natans*	Rare
736.	Araceae	*Acorus calamus*	Rare, grow in marshy places
737.		*Amorphophallus bulbifer*	
738.		*Colocasia esculenta*	
739.		*Cryptocoryne retrospiralis*	
740.		*Pistia stratioles*	
741.	Arecaceae	*Borassus flavellifer*	Rare
742.		*Caryota ureus*	Rare
743.		*Livistonia chinensis*	Rare
744.		*Phoenix acaulis*	
745.		*Phoenix sylvestris*	
746.	Butomaceae	*Butomopsis latifolia*	
747.	Cannaceae	*Canna indica*	
748.	Commelinaceae	*Commelina suffriticosa*	Rare
749.		*Commelina benghaleusis*	
750.		*Commelina diffusa*	
751.		*Commelina hasskarlii*	
752.		*Commelina longifolia*	
753.		*Commelina. paludosa*	
754.		*Cyanotis arachnoidea*	Rare
755.		*Cyanotis cristata*	
756.		*Murdannia nudiflora*	
757.		*Tonningia axillaries*	
758.	Costaceae	*Costus speciosus*	
759.	Cyperaceae	*Bulbostylis barbata*	
760.		*Bulbostylis densa*	
761.		*Cyperus alulatus*	
762.		*Cyperus brevifolius*	
763.		*Cyperus compressus*	
764.		*Cyperus cyperoides*	
765.		*Cyperus difformis*	
766.		*Cyperus distans*	

767.	*Cyperus exaltatus*	
768.	*Cyperus halpan*	
769.	*Cyperus iria*	
770.	*Cyperus nutans*	
771.	*Cyperus pangorei*	
772.	*Cyperus pseudokyllingiodies*	
773.	*Cyperus pumilus*	
774.	*Cyperus pygmaeus*	
775.	*Cyperus rotundus*	
776.	*Cyperus squarrosus*	
777.	*Cyperus tenuispica*	
778.	*Cyperus triceps*	
779.	*Eleochoris geniculata*	Rare
780.	*Eleochoris atropurpurea*	
781.	*Eleochoris duleis*	Rare
782.	*Fimbristylis aestivalis*	
783.	*Fimbristylis alboviridis*	
784.	*Fimbristylis bisumbellata*	
785.	*Fimbristylis dichotoma*	
786.	*Fimbristylis dipsacea*	Rare
787.	*Fimbristylis falcate*	
788.	*Fimbristylis fusca*	Rare
789.	*Fimbristylis littoralis*	
790.	*Fimbristylis miiaceae*	
791.	*Fimbristylis ovata*	
792.	*Fimbristylis schoenoides*	
793.	*Fimbristylis tetragona*	
794.	*Fuirena ciliaris*	
795.	*Rhynchospora longisetis*	
796.	*Scirpus articulatus*	
797.	*Scirpus brachyceras*	Rare
798.	*Scirpus juncoides*	Rare
799.	*Scirpus litoralis*	
800.	*Scirpus maritimus*	
801.	*Scirpus microcephalus*	

802.		*Scirpus roylei*	
803.		*Scirpus squarrosus*	
804.	Dioscoreaceae	*Dioscorea belophylla*	
805.		*Dioscorea hispida*	
806.		*Dioscorea bulbifera*	
807.		*Dioscorea pentaphylla*	
808.	Eriocaulceae	*Eriocaulon civereum*	
809.		*Eriocaulon heterolepis*	Rare
810.		*Eriocaulon longicuspis*	Rare
811.		*Eriocaulon parviflorum*	Endemic
812.		*Eriocaulon quinquangulare*	
813.	Hydrocharitaceae	*Blyxa aubertix*	
814.		*Hydrilla verticillata*	
815.		*Lagarosiphon alternifolia*	
816.		*Ottelia alismoides*	
817.		*Vallisneria natus*	
818.	Hydrophyllaceae	*Hydrola zeylanica*	
819.	Hypoxidaceae	*Curculigo orchioides*	
820.	Iridaceae	*Gladiolus trostis*	
821.	Juncaceae	*Juncus bufonius*	
822.	Lemnaceae	*Lemna perpusilla*	
823.	Liliaceae	*Allium cepa*	
824.		*Allium sativum*	
825.		*Aloe vera*	
826.		*Asparagus gracilis*	Rare
827.		*Asparagus racemosus*	
828.		*Asphodelus tenuifolius*	
829.		*Chlorophytum tuberosum*	Rare
830.		*Gloriosa superba*	Rare
831.		*Iphigenia indica*	
832.		*Urginea indica*	
833.	Musaceae	*Musa paradisiacal*	
834.	Najadaceae	*Najas indica*	Rare
835.		*M. minor*	Rare
836.	Orchidaceae	*Habenaria marginata*	

837.		*Vanda tessellate*	
838.	Poaceae	*Alloteropsis eimicina*	
839.		*Apluda mutica*	
840.		*Aristida adscensiouis*	
841.		*Aristida funiculate*	
842.		*Aristida setacea*	
843.		*Arthraxou lancifolius*	
844.		*Arundinella pumila*	Rare
845.		*Arundinella setosa*	
846.		*Arundo donox*	
847.		*Avena sativa*	
848.		*Bambusa arundinacea*	
849.		*Bothriochloa kuntzeana*	
850.		*Bothriochloa pertusa*	
851.		*Brachiaria eruciformis*	
852.		*Brachiaria ramose*	
853.		*Brachiaria reptans*	
854.		*Capillipedium assimile*	Rare
855.		*Cenchrus biflorus*	
856.		*Chloris barbata*	
857.		*Chloris dolichostaechya*	
858.		*Chloris montana*	Rare
859.		*Chloris virgata*	
860.		*Chrysopogan aeiculatus*	
861.		*Chrysopogan fulvus*	
862.		*Coix aquatica*	
863.		*Coix lacryma*	
864.		*Crypsis schoenoides*	Rare
865.		*Cymbopogan jwarancusa*	Rare
866.		*Cymbopogan martini*	
867.		*Cynodon arcuatus*	
868.		*Cynodon dactylon*	
869.		*Dactyloctenium aegyptium*	
870.		*Dendrocalamus strictus*	Vulnerable
871.		*Desmostachya bipinnata*	

872.	*Dicanthium annulatum*	
873.	*Dicanthium caricosum*	
874.	*Digitaria abindens*	
875.	*Digitaria bicornis*	
876.	*Digitaria ciliaris*	
877.	*Digitaria longiflora*	
878.	*Digitaria setigera*	
879.	*Digitaria stricta*	
880.	*Digitaria ternata*	Rare
881.	*Dinebra retroflexa*	
882.	*Displaehue fusca*	
883.	*Echinochloa frumentacea*	
884.	*Echinochloa stagnina*	
885.	*Eleusine indica*	
886.	*Eragrostiella bifaria*	
887.	*Eragrostiella brachyphylla*	
888.	*Eragrostiella nardoides*	
889.	*Eragrostis aspera*	
890.	*Eragrostis atrovirens*	
891.	*Eragrostis cilianensis*	
892.	*Eragrostis diarrhena*	
893.	*Eragrostis gangetica*	
894.	*Eragrostis japonica*	
895.	*Eragrostis nutans*	
896.	*Eragrostis pilosa*	
897.	*Eragrostis poaeoides*	
898.	*Eragrostis riparia*	
899.	*Eragrostis tenella*	
900.	*Eragrostis teniufolia*	
901.	*Eragrostis tremula*	
902.	*Eragrostis unioloides*	
903.	*Eragrostis viscosa*	Rare
904.	*Eremopogon foveolatus*	
905.	*Eriochloa procera*	Rare
906.	*Eulaliopsis binata*	Rare

907.	*Haekelochloa granularis*	
908.	*Hemarthria compressa*	
909.	*Heteropogon contortus*	
910.	*Hordeum vulgare*	
911.	*Hygroryza aristata*	
912.	*Imperata cylindrica*	
913.	*Isachne globosa*	
914.	*Ischaemum indicum*	
915.	*Ischaemum rugosum*	
916.	*Iseilema laxum*	
917.	*Iseilema prostratum*	
918.	*Leptochloa panacea*	
919.	*Lolium temuleutum*	Rare
920.	*Melanocenchris jacquemontii*	
921.	*Mnesithea laevis*	Rare
922.	*Ophiura exaltatus*	
923.	*Oplismenus burmannii*	
924.	*Oropetium roxburghianum*	Rare, endemic in India
925.	*Oropetium thomaeum*	Rare
926.	*Oryza rufiopogon*	
927.	*Oryza sativa*	
928.	*Panicum maximum*	Rare
929.	*Panicum paludosum*	
930.	*Panicum psilopodium*	
931.	*Panicum sumatreuse*	
932.	*Panicum walense*	
933.	*Paspalidium flavidum*	
934.	*Paspalidium punctatum*	
935.	*Paspalum scrobiculatum*	
936.	*Paspalum vaginatum*	Rare
937.	*Pennisetum pedicellatum*	
938.	*Pennisetum typhoides*	
939.	*Perotis indica*	
940.	*Phalaris minor*	
941.	*Phragmites karka*	

942.		*Pogonatherum paniceum*	
943.		*Polypogan monspeliensis*	
944.		*Pseudopogonatherum contortum*	
945.		*Pseudopogonatherum brunoniana*	Rare
946.		*P. spinescens*	Rare
947.		*Rottboellia exaltata*	Rare
948.		*Saccharum bengaleme*	
949.		*Saccharum officinarum*	
950.		*Saccharum spontoneum*	
951.		*Sacciolepix indica*	
952.		*Sacciolepix interrupta*	
953.		*Setaria intermedia*	
954.		*Setaria italica*	
955.		*Setaria pumila*	
956.		*Setaria verticillata*	
957.		*Sorghum cernuum*	
958.		*Sorghum halepense*	
959.		*Sorghum miliaceum*	
960.		*Sorghum nitidum*	Rare
961.		*Sporobolus diander*	
962.		*Sporobolus tenuissimus*	
963.		*Themeda laxa*	Rare, Endemic to India
964.		*Themeda quadrivalvis*	
965.		*Themeda triandra*	
966.		*Thysanolaena maxima*	
967.		*Tragus roxburghii*	
968.		*Triticum aestivum*	
969.		*Urochloa panicoides*	
970.		*Vetiveria zizanioides*	
971.		*Zea mays*	
972.	Pontederiaceae	*Eichhornia crassipes*	
973.		*Monochoria vaginalis*	
974.	Potamogetonaceae	*Potamogeton crispus*	
975.		*Portulaca nodosus*	

976.	Smilacaceae	*Smilax zeylanica*	Rare
977.	Taccaceae	*Tacca leontopetaloides*	
978.	Typhaceae	*Typha angustifolia*	
979.	Zannichelliaceae	*Zannichella palustris*	
980.	Zingiberaceae	*Curcuma aromatica*	
981.		*Zingiber capitatum*	
982.		*Zingiber officinale*	

Family wise numbers of genera and species in angiosperms of Panna BR

S No	Family	No of Genera	No of Species
A. Dicotyledons			
1.	Acanthaceae	19	25
2.	Aizoaceae	1	1
3.	Alangiaceae	1	1
4.	Amaranthaceae	8	17
5.	Anacardiaceae	5	5
6.	Annonaceae	3	4
7.	Apiaceae	6	6
8.	Apocynaceae	10	12
9.	Aristolochiaceae	1	1
10.	Asclepiadaceae	9	10
11.	Asteraceae	39	57
12.	Balanitaceae	1	1
13.	Balsaminaceae	1	1
14.	Basellaceae	1	1
15.	Bignoniaceae	9	9
16.	Bombaceae	1	1
17.	Boraginaceae	7	10
18.	Brassicaceae	7	12
19.	Buddlejaceae	1	1
20.	Burseraceae	3	3
21.	Cactaceae	2	2
22.	Caesalpinaceae	7	20
23.	Campanulaceae	2	2
24.	Cannabaceae	1	1
25.	Capparidaceae	3	5
26.	Caricaceae	1	1
27.	Caryophyllaceae	5	8
28.	Casuarinaceae	1	1
29.	Celasteraceae	3	4
30.	Ceratophyllaceae	1	1
31.	Chenopodiaceae	4	6
32.	Cochlospermaceae	1	1
33.	Combretaceae	4	9
34.	Convolvulaceae	10	26
35.	Crassulaceae	1	1
36.	Cucurbitaceae	12	16
37.	Ebenaceae	1	3
38.	Elatinaceae	1	2
39.	Euphorbiaceae	18	41
40.	Leguminaceae (Fabaceae)	41	90
41.	Flacourtiaceae	2	3
42.	Fumeriaceae	1	1

43.	Gentianaceae	5	5
44.	Gesneriaceae	1	1
45.	Hydrophyllaceae	1	1
46.	Lamiaceae	15	26
47.	Lauraceae	1	1
48.	Lecythidaceae	1	1
49.	Leeaceae	1	1
50.	Lentibulariaceae	1	2
51.	Linaceae	1	1
52.	Loganiaceae	1	1
53.	Loranthaceae	2	2
54.	Lythraceae	5	10
55.	Magnoliaceae	1	1
56.	Malphighiaceae	1	1
57.	Malvaceae	12	24
58.	Meliaceae	5	5
59.	Menispermaceae	3	3
60.	Menyanthaceae	1	2
61.	Mimosaceae	8	17
62.	Molluginaceae	2	4
63.	Moraceae	4	14
64.	Moringaceae	1	1
65.	Myrtaceae	4	5
66.	Nelumbonaceae	1	1
67.	Nyctaginaceae	3	3
68.	Nymphaeceae	1	2
69.	Oleaceae	2	4
70.	Onagraceae	1	4
71.	Orobanchaceae	1	1
72.	Oxalidaceae	2	4
73.	Papaveraceae	2	3
74.	Passifloraceae	1	1
75.	Pedaliaceae	2	2
76.	Phytolocaceae	1	1
77.	Plumbaginaceae	1	1
78.	Polygonaceae	4	8
79.	Portulaceae	1	2
80.	Primulaceae	2	2
81.	Proteaceae	1	1
82.	Punicaceae	1	1
83.	Ranunculaceae	3	3
84.	Rhamnaceae	2	6
85.	Rosaceae	1	1
86.	Rubiaceae	15	20
87.	Rutaceae	5	6
88.	Salicaceae	1	1
89.	Sapindaceae	4	4
90.	Sapotaceae	3	3

91.	Scrophulariaceae	14	19
92.	Simaroubaceae	1	1
93.	Solanaceae	9	16
94.	Sphenocleaceae	1	1
95.	Sterculiaceae	7	9
96.	Tamaricaceae	1	1
97.	Tiliaceae	3	14
98.	Trapaceae	1	1
99.	Turneraceae	1	1
100.	Ulmaceae	2	2
101.	Urticaceae	2	2
102.	Verbanaceae	10	15
103.	Violaceae	1	1
104.	Vitaceae	4	7
105.	Zygophyllaceae	1	1
Sub-total		**451**	**727**
B. Monocotyledons			
1.	Agavaceae	1	1
2.	Alismataceae	1	2
3.	Amaryllidaceae	3	4
4.	Aponogetonaceae	1	1
5.	Araceae	5	5
6.	Arecaceae	5	6
7.	Butomaceae	1	1
8.	Cannaceae	1	1
9.	Commelinaceae	4	10
10.	Costaceae	1	1
11.	Cyperaceae	7	45
12.	Dioscoreaceae	1	4
13.	Eriocaulaceae	1	5
14.	Hydrocharitaceae	5	5
15.	Hydrophyllaceae	1	1
16.	Hypoxidaceae	1	1
17.	Iridaceae	1	1
18.	Juncaceae	1	1
19.	Lemnaceae	1	1
20.	Liliaceae	8	10
21.	Musaceae	1	1
22.	Najadaceae	1	2
23.	Orchidaceae	2	2
24.	Poaceae	72	134
25.	Pontederiaceae	2	2
26.	Potamogetonaceae	2	2
27.	Smilacaceae	1	1
28.	Taccaceae	1	1
29.	Tnypnaceae	1	1
30.	Zannichelliaceae	1	1
31.	Zingiberaceae	2	3

Sub-total	**31**	**136**	**255**
Grand total	**136**	**587**	**982**

Annex– 6: III

List of Rare Plant Species found at Panna BR

S No	Botanical Name	Family
1.	*Acorus calamus*	Araceae
2.	*Alangium salvifolium*	Alangiaceae
3.	*Aponogeton natans*	Aponogetonaceae
4.	**Argemone ochroleuca**	Papaveraceae
5.	*Arundinella pumila*	Poaceae
6.	**Asparagus gracilis**	Liliaceae
7.	**Bergia capensis**	Elatinaceae
8.	**Borassus flabellifer**	Arecaceae
9.	*Capillipedium assimile*	Poaceae
10.	**Caryota urens**	Arecaceae
11.	*Chlorophytum tuberosum*	Liliaceae
12.	**Cleome viscosa**	Capparidaceae
13.	*Cloris Montana*	Poaceae
14.	*Commelina suffruticosa*	Commelinaceae
15.	**Corchorus fascicularis**	Tiliaceae
16.	*Crotalaria orixensis*	Fabaceae
17.	*Crypsis schoenoides*	Poaceae
18.	*Cyanotis arachnoidea*	Commelinaceae
19.	*Cymbopogan jwarancusa*	Poaceae
20.	**Dendrocalamus strictus**	Poaceae
21.	**Eleocharis dulcis**	Cyperaceae
22.	*Eleocharis geniculata*	Cyperaceae
23.	**Eragrostis viscosa**	Poaceae
24.	*Eriocaulon heterolepis*	Eriocaulceae
25.	*Eriocaulon longicuspis*	Eriocaulceae
26.	*Eriocaulon parviflorum*	Eriocaulceae
27.	*Eriochloa procera*	Poaceae
28.	*Eriolaena candollei*	Sterculiaceae
29.	*Erythrina suberosa*	Fabaceae
30.	**Eulatsopsis binata**	Poaceae
31.	*Eupatorium odoratum*	Asteraceae

32.	*Fimbristylis dipsacea*	Cyperaceae
33.	*Fimbristylis fusca*	Cyperaceae
34.	*Flemingia nana*	Fabaceae
35.	*Gloriosa superba*	Liliaceae
36.	*Glossogyne bidens*	Asteraceae
37.	**Hymenodictyon orixense**	Alangiaceae
38.	*Livistonia chinensis*	Arecaceae
39.	*Lolium temuleutum*	Poaceae
40.	*Millettia racemosa*	Fabaceae
41.	**Mnesithea laevis**	Poaceae
42.	*Najas indica*	Najadaceae
43.	*Najas minor*	Najadaceae
44.	**Naringi crenulata**	Rutaceae
45.	*Oropetium thomaeum*	Poaceae
46.	*Oropetum roxburghianum*	Poaceae
47.	**Ougeinia oojeinensis**	Fabaceae
48.	*Panicum maximum*	Poaceae
49.	*Paspalum vaginatum*	Poaceae
50.	**Polygala elongata**	Polygolaceae
51.	*Pseudoraphis brunoniana*	Poaceae
52.	*Pseudoraphis spinescens*	Poaceae
53.	*Rotala mexicana*	Lythraceae
54.	*Rotala serpyllifolia*	Lythraceae
55.	*Rottboellia exaltata*	Poaceae
56.	*Schleichera oleosa*	Sapindaceae
57.	*Scirpus brachyceras*	Cyperaceae
58.	*Scirpus juncoides*	Cyperaceae
59.	*Sclerocarpus africanus*	Asteraceae
60.	*Sida cordifolia*	Malvaceae
61.	*Smilax zeylanica*	Smilacaceae
62.	*Sorghum nitidum*	Poaceae
63.	**Sterculia foetida**	Sterculiaceae
64.	*Sterculia villosa*	Sterculiaceae
65.	**Themeda laxa**	Poaceae
66.	*Tragus roxburghii*	Poaceae

67.	*Uraria picta*	Fabaceae
68.	*Wendlandia nexen*	Alangiaceae
69.	*Ziziphus rugosa*	Rhamnaceae

Annex– 6: IV

List of important medicinal plants found in proposed Panna BR

S. No	Scientific name	Common name/ local name	Status
1.	*Abrus precatorius*	Gunja	NT
2.	*Abutilon indicum*	Kanghi	NT
3.	*Achyranthes aspera*	Latjira	NT
4.	*Acorus calamus**	Bach	Rare
5.	*Adathoda vasica**	Adusa	NT
6.	*Aegle marmelos**	Bel	NT
7.	*Alangium salvifolium*	Ankol	Rare
8.	*Aloe vera**	Guarpatha	NT
9.	*Ampelocissus latifolia*	Katti bel	NT
10.	*Andrographis paniculata**	Kalmegh	VU
11.	*Anogeissus Latifolia**	Dhawra	NT
12.	*Aponogeton natans*	Haiti	Rare
13.	*Argemone maxicana*	Satyanasi	NT
14.	*Argemone ochroleuca*	Kateri	Rare
15.	*Aristolochia indica*	Hooka-bel	NT
16.	*Asparagus racemosus**	Satawari	NT
17.	*Azadirachta indica*	Neem	NT
18.	*Balanites roxburghii*	Hinganbet	NT
19.	*Bergia capensis*		Rare
20.	*Barleria pronititis*	Vajradanti	NT
21.	*Biophytum reinwardtii*	Mothi lajwanti	NT
22.	*Borassus flabellifer*	Talavruksha	Rare
23.	*Boswellia serrata**	Shallaki Guggal	NT
24.	*Buchanania lanzan*	Chironji	NT
25.	*Calotropis procera**	Aak	NT
26.	*Cannabis sativa**	Bhaang	NT
27.	*Careya arborea*	Kumbhi	VU
28.	*Caryota urens*	Kumbhi	Rare
29.	*Cassia fistula**	Amaltas	NT
30.	*Cassia tora*	Chirota	NT
31.	*Cayratia trifolia*	Amalbel	NT
32.	*Centella asiatica**	Mandukparni	EN
33.	*Chlorophytum tuberosum**	Safed Musli	Rare
34.	*Cipadessa baccifera*	Nagalinga	NT
35.	*Cissus quadrangularis*	Hadjot	NT

36.	*Citrus limon**	Jambiri nimbu	NT
37.	*Cleome gynandra*	Hurthur	NT
38.	*Cleome viscosa*	Kateri	Rare
39.	*Clerodendrum indicum*	Bharangi	NT
40.	*Corchorus fascicularis*	Bahuphalli	Rare
41.	*Costus speciosus**	Keokand	NT
42.	*Curculigo orchiodes**	Kali Musli	Rare
43.	*Curcuma aromatica**	Jangli Haldi	VU
44.	*Dendrocalamus strictus*	Lathi Bans	Rare
45.	*Desmodium gangeticum*	Shalaparni	NT
46.	*Didymocapus pignae*	Patthar chata	NT
47.	*Dioscorea bulbifera**	Varahi	NT
48.	*Eleocharis dulcis*	Chinese water chestnut	Rare
49.	*Embelica oficinalis**	Amla	NT
50.	*Eragrostis viscosa*	Sticky love grass	Rare
51.	*Erythrina suberosa*	Madar	Rare
52.	*Evolvulus alsinoides*	Vishnukrantha	NT
53.	*Feronia limonia*	Kaitha	NT
54.	*Ficus benghalensis*	Bargad	NT
55.	*Ficus religiosa*	Pipal	NT
56.	*Garuga pinnata*	kharpat	NT
57.	*Gloriosa superba**	Kalhari	Rare
58.	*Glossogyne bidens*	Kamraj	Rare
59.	*Gymnema sylvestre**	Gurmar	NT
60.	*Gymnosporia Montana**	Mal-Kangani	NT
61.	*Helicteres isora**	Marorphalli	NT
62.	*Hemidesmus indicus**	Anantamula	NT
63.	*Hygrophila auriculata*	Kokilaksha	NT
64.	*Hymenodictyon orixense*	kala bachnag	Rare
65.	*Impatiens balsamina*	Gulmendi	NT
66.	*Lannea coromandelica*	Mohin	NT
67.	*Linum usitatissimum**	Alasi	NT
68.	*Malva sylvestris*	Gul-khair	NT
69.	*Marsdenia tenacissima*	Dudhia bela	VU
70.	*Mnesithea laevis*	Kurki	Rare
71.	*Morus alba**	Shahtoot	NT
72.	*Murraya koenigii*	Kurry patta	NT
73.	*Naringi crenulata*	Kawath	Rare
74.	*Ocimum basilicum**	Ramtulsi	NT
75.	*Oxalis corniculata*	Puliyarila	NT
76.	*Oxystelma esculentum*	Dudhialata	NT
77.	*Ougeinia oojeinensis*	Bandhan	Rare
78.	*Panicum maximum*	Guinea grass	Rare
79.	*Pergularia daemaia*	Utrana jutuka	NT
80.	*Phaseolus vulgaris*	Rajma	NT

81.	*Phyllanthus amarus**	Bhuiaonla	NT
82.	*Plumbago zeylanica**	Chitrak	NT
83.	*Polygala elongata*	Narrow-Leaved Milkwort	Rare
84.	*Pterocarpus marsupium**	Bija sal	NT
85.	*Ricinus communis*	Arandi	NT
86.	*Rotula aquatica*	Pashanabhed	NT
87.	*Schleichera oleosa*	Kusum	Rare
88.	*Sesbania bispinosa*	Dhaincha	NT
89.	*Sida cordifolia*	Bala	Rare
90.	*Smilax zeylanica*	Chobchini	Rare
91.	*Solanum nigrum**	Makoy	NT
92.	Soymida febrifuga	Rohan	NT
93.	Sterculia foetida	Jangli badam or Pinari	Rare
94.	Sterculia villosa	Udal	Rare
95.	Syzygium cumini*	Jamun	NT
96.	Terminalia arjun*	Arjun	NT
97.	Terminalia bellirica*	Behada	NT
98.	Terminalia chebula*	Bahera	NT
99.	Thespesia lampas	Ban kapas	NT
100.	Tinospora cordifolia*	Giloy	NT
101.	Toona ciliata	Mahogany	NT
102.	Tribulus terrestris*	Gokhru	NT
103.	Uraria picta	Dabra, Pitvan	NT
104.	Urginea indica	Jangali piaz	NT
105.	Vitex negundo*	Nirgundi	NT
106.	Vitis vinifera	Draksha	NT
107.	Withania somnifera*	Ashwagandha	NT
108.	Zingiber officinale*	Adarak	NT

*Commercially important medicinal plant

R:	Rare	28
EN:	Endangered	02
Vul:	Vulnerable	03
NT:	Not Threatene d	75

The estimation of animal population in Panna NP from 1988 to 2004

S No	Year	Animal						
		Tiger	Leopard	Nilgai	Chinkara	Chital	Sambar	Chousingha
1	**1988**	37	31	2325	1790	522	860	546
2	**1989**	30	31	1019	573	333	385	98
3	**1990**	30	17	1075	780	385	430	125
4	**1991**	28	16	1030	793	353	463	150
5	**1992**	25	14	1076	784	354	456	137
6	**1993**	25	13	1001	654	475	542	113
7	**1994**	23	13	985	650	467	544	106
8	**1995**	22-27	25-27	1314	400	410	892	101
9	**1996**	23-28	28-30	1507	651	522	962	139
10	**1997**	22-24	31	1925	831	842	892	144
11	**1998**	21	32	1961	751	669	1084	147
12	**1999**	25	39	2006	767	929	1215	118
13	**2000**	28	32	1982	594	747	902	130
14	**2001**	31	32	9462	3994	5534	8062	849
15	**2002**	33	30	10635	4173	8720	7677	873
16	**2003**	33	29	9500-10000	3500-4000	6500-7000	7500-8000	800-1000
17	**2004**	34	40	9232	3761	5585	6563	688

Commonly seen mammals of proposed Panna BR

S No	Family	Zoological name	Local name	English name
I.	**PRIMATES**			
1	Colobidae	*Presbytia entellus*	Langoor	Common Langoor
2	Circophtecidae	*Macaca mulatta*	Bandar	Rhesus macaque
II.	**INSECTIVORA**			
1.	Erinacedae	*Hemiechinus auritus collaries*	-	Hedgehog
2.	Tupaiidae	*Suncus murinus*	Chachundar	Musk shrew
III.	**CHIROPTERA**			
1.	Pteropodidae	*Cynopterus sphinx*	Chamgadar	Short nosed fruit bat
2.	Pteropodidae	*Pteropus ginganteus*	Udati laumdi	Flying Fox
IV.	**PHOLIDOTA**			
1.	Manidae	*Manis crassicandata*	Silu, Bajra kit	Indian pangolin, Scaly anteater
V.	**CARNIVORA**			
1.	Ursidae	*Melursus ursinus*	Bhalu, Reech	Sloth Bear
2.	Felidae	*Panthera tigris*	Sher, Nahar, Bagh	Tiger
3.	Felidae	*Panthera pardus*	Gulbagh, Tendua	Panther, Leopard
4..	Felidae	*Felis chaus*	Jangli Billi	Common wild cat
5.	Felidae	*Felis caracal*		Lesser cat
6.	Hyaenidae	*Hyaena*	Lakarbagga	Striped Hyaena
7.	Herpestidae	*Herpestes edwardsi*	Newla	common Mongoose
8.	Mustelidae	*Melivora capensis*	Bijju	Indian Ratel or Honey Badger
9.	Canidae	*Canis aureus*	Siyar	Jackal
10.	Canidae	*Vulpes bengalensis*	Lomri	Indian Fox
11	Canidae	*Cuon alpinus*	Sonkutta, Van kutta	Wild dog
VI.	**RODENTIA**			

1.	Sciuridae	*Funambulus pennanti*	Gilhari	Common five striped squirrel
2.	Muridae	*Bandicota bengalensis*	Chuha	Field rat
3.	Muridae	*Neosocia bandicota*	Chunse	Bandicoot
4.	Muridae	*Rattus rattus- refescena*	Chuha	Common house rat
5.	Muridae	*Golund ellioti*	Chuha	The Indian bush rat
6.	Hystricidae	*Hystrix indica*	Sahi	Common Indian Porcupine
7.	Leporidae	*Lepus nigricollis*	Kargosh	Common Indian hare
VII.	**UNGULATA**			
1.	Suidae	*Sus scrofa*	Suar	Indian Wild Boar
2.	Tragulidae	*Tragu;us meminna*	Pisora	Mouse Deer
3.	Antilopinae	*Antilope cervicapra*	Krishna Mrig	Black buck
4.	Antilopinae	*Gazella gazella bennetti*	Chinkara	Indian Gazelle
5.	Antilopinae	*Boselaphus tragocamelus*	Neelgai	Blue bull
6.	Antilopinae	*Tetracerus quadricornis*	Chausingha	Four horned antelope
7.	Cervidae	*Muntiacus muntjak*	Kotki Bhendki	Indian Barking Deer
8.	Cervidae	*Cervus unicolor*	Sambhar	Sambhar
9.	Cervidae	*Axis axis*	Cheetal	Spotted Deer

Birds of the proposed Panna Biosphere Reserve

S No	Common name	Scientific name	Ecological distribution
	I. Phasianidae		
1.	Painted Francolin	*Francolinus pictus*	W
2	Grey Francolin	*Francolinus pondicerianus*	W
3	Rain Quail	*Coturnix coromandelica*	W
4	Jungle Bush-Quail	*Perdicula asiatica*	WU
5	Rock Bush-Quail	*Perdicula argoondah*	WU
6	Painted Spurfowl	*Galloperdix lunulata*	W
7	Red Spurfowl	*Galloperdix spadicea*	W
8	Indian Peafowl	*Pavo cristatus*	W
	II. Anatinae		
9	Greylag Goose	*Anser anser*	WWV
10	Bar-headed Goose	*Anser indicus*	WWV & L
11	Cotton Pygmy-Goose	*Nettapus coromandelianus*	W
12	Lesser Whistling-Duck	*Dendrocygna javanica*	W
13	Ruddy Shelduck	*Tadorna ferruginea*	WWV & L
14	Common Shelduck	*Tadorna tadorna*	WWV
15	Comb Duck	*Sarkidiornis melanotos*	W
16	Gadwall	*Anas strepera*	WWV
17	Eurasian Wigeon	*Anas penelope*	WWV
18	Spot-billed Duck	*Anas poecilorhyncha*	W
19	Common Teal	*Anas crecca*	WWV
20	Garganey	*Anas querquedula*	WWV
21	Northern Pintail	*Anas acuta*	WWV
22	Northern Shoveler	*Anas clypeata*	WWV
23	Red-crested Pochard	*Netta rufina*	WWV
24	Common Pochard	*Aythya ferina*	WWV
25	Tufted Duck	*Aythya fuligula*	WWV
	III. Turnicidae		
26	Small Buttonquail	*Turnix sylvatica*	W
27	Yellow-legged Buttonquail	*Turnix tanki*	W
28	Barred Buttonquail	*Turnix suscitator*	W

	IV. Picidae		
29	Eurasian Wryneck	*Jynx torquilla*	L & WWV
30	Brown-capped Woodpecker	*Dendrocopos nanus*	W
31	Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	W
32	Black-rumped Flameback	*Dinopium benghalense*	W
33	Blue-throated Barbet	*Megalaima asiatica*	W
34	White-naped Woodpecker	*Chrysocolaptes festivus*	W
	V. Megalaimidae		
35	Brown-headed Barbet	*Megalaima zeylanica*	W
36	Coppersmith Barbet	*Megalaima haemacephala*	W
	VI. Bucerotidae		
37	Indian Grey-Hornbill	*Ocyceros birostris*	W
	VII. Upupidae		
38	Eurasian Hoopoe	*Upupa epops*	WWV
	VIII. Coraciidae		
39	Indian Roller	*Coracias benghalensis*	W
40	Common Kingfisher	*Alcedo atthis*	W
41	White-throated Kingfisher	*Halcyon smyrnensis*	W
42	Black-capped kingfishe	*Halcyon pileata*	W
43	Pied Kingfisher	*Ceryle rudis*	W
44	Stork-billed Kingfisher	*Pelargopsis capensis*	W
45	Little Green Bee-eater	*Merops orientalis*	W
46	Blue-tailed Bee-eater	*Merops philippinus*	W
	IX. Cuculidae		
47	Pied Cuckoo	*Oxylophus jacobinus*	W
48	Common Hawk-Cuckoo	*Cuculus varius*	W
49	Indian Cuckoo	*Cuculus micropterus*	W
50	Banded Bay Cuckoo	*Cacomantis sonneratii*	L
51	Grey-bellied Cuckoo	*Cacomantis passerinus*	W
52	Plaintive Cuckoo	*Cacomantis merulinus*	L
53	Drongo Cuckoo	*Surniculus lugubris*	L
54	Asian Koel	*Eudynamys scolopacea*	W
55	Sirkeer Malkoha	*Phaenicophaeus leschenaultii*	W
	X. Centropodidae		

56	Greater Coucal	*Centropus sinensis*	W
	XI. Psittacidae		
57	Alexandrine Parakeet	*Psittacula eupatria*	W
58	Rose-ringed Parakeet	*Psittacula krameri*	W
59	Plum-headed Parakeet	*Psittacula cyanocephala*	W
	XII. Apodidae		
60	House Swift	*Apus nipalensis*	W
61	Alpine Swift	*Tachymarptis melba*	W
	XIII. Hemipronidae		
62	Crested Treeswift	*Hemiprocne coronata*	WS
	XIV. Strigidae		
63	Collared Scops-Owl	*Otus bakkamoena*	W
64	Eurasian Eagle-Owl	*Bubo bubo*	L
65	Brown Fish-Owl	*Ketupa zeylonensis*	W
66	Brown Hawk-Owl	*Ninox scutulata*	W
67	Mottled Wood-Owl	*Strix ocellata*	W
68	Jungle Owlet	*Glaucidium radiatum*	W
69	Spotted Owlet	*Athene brama*	W
70	Barn Owl	*Tyto alba*	W
	XV. Caprimulgidae		
71	Grey Nightjar	*Caprimulgus indicus*	W
72	Large-tailed Nightjar	*Caprimulgus macrurus*	W
73	Indian Nightjar	*Caprimulgus asiaticus*	W
74	Savanna Nightjar	*Caprimulgus affinis*	W
	XVI. Columbidae		
75	Rock Pigeon	*Columba livia*	WC
76	Oriental Turtle-Dove	*Streptopelia orientalis*	WWV
77	Laughing Dove	*Streptopelia senegalensis*	W
78	Spotted Dove	*Streptopelia chinensis*	W
79	Red Collared-Dove	*Streptopelia tranquebarica*	W
80	Eurasian Collared-Dove	*Streptopelia decaocto*	WC
81	Yellow-footed Green-Pigeon	*Treron phoenicoptera*	W
	XVII. Rallidae		
82	Brown Crake	*Amaurornis akool*	C

83	Ruddy-breasted Crake	*Porzana fusca*	C
84	Slaty-breasted Rail	*Gallirallus striatus*	C
85	White-breasted Waterhen	*Amaurornis phoenicurus*	C
86	Common Moorhen	*Gallinula chloropus*	C
87	Purple Swamphen	*Porphyrio porphyrio*	C
88	Common Coot	*Fulica atra*	CWV
XVIII.	**Pteroclidae**		
89	Painted Sandgrouse	*Pterocles indicus*	W
XIX.	**Scolopacidae**		
90	Common Snipe	*Gallinago gallinago*	WWV & L
91	Spotted Redshank	*Tringa erythropus*	WWV
92	Common Redshank	*Tringa totanus*	WWV
93	Marsh Sandpiper	*Tringa stagnatilis*	WWV
94	Common Greenshank	*Tringa nebularia*	WWV
95	Green Sandpiper	*Tringa ochropus*	WWV
96	Wood Sandpiper	*Tringa glareola*	WWV
97	Common Sandpiper	*Tringa hypoleucos*	WWV
98	Little Stint	*Calidris minuta*	WWV
99	Temminck's Stint	*Calidris temminckii*	WWV
XX.	**Jacanidae**		
100	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	W
101	Bronze-winged Jacana	*Metopidius indicus*	W
XXI.	**Burhinidae**		
102	Eurasian Thick-knee	*Burhinus oedicnemus*	W
103	Great Thick-knee	*Burhinus recurvirostris*	W
XXII.	**Charadriidae**		
104	Black-winged Stilt	*Himantopus himantopus*	WC
105	Yellow-wattled Lapwing	*Vanellus malabaricus*	W
106	Red-wattled Lapwing	*Vanellus indicus*	WC
107	River Lapwing	*Vanellus duvaucelii*	W
XXIII.	**Glareolidae**		
	Indian Courser	*Cursorius coromandelicus*	W
XXIV.	**Laridae**		

108	Brown-headed Gull	*Larus brunnicephalus*	WWV
109	Common Black-headed Gull	*Larus ridibundus*	WWV & L
110	Great Black-headed Gull	*Larus ichthyaetus*	WWV
111	River Tern	*Sterna aurantia*	WC
112	Little Tern	*Sterna albifrons*	W
113	Black-bellied Tern	*Sterna acuticauda*	W
114	Small Pratincole	*Glareola lactea*	W
XXV.	**Accipitridae**		
115	Black-winged Kite	*Elanus caeruleus*	W
116	Black Kite	*Milvus migrans*	W
117	Osprey	*Pandion haliaetus*	WWV & L
118	Pallas's Sea-Eagle	*Haliaeetus leucoryphus*	W
119	Grey-headed Fish-Eagle	*Ichthyophaga ichthyaetus*	W
120	Tawny Eagle	*Aquila rapax*	W
121	Booted Eagle	*Hieraaetus pennatus*	WWV & L
123	Cinereous Vulture	*Aegypius monachus*	WU
124	Himalayan griffon vulture	*Gyps himalayensis*	WU
125	White-rumped Vulture	*Gyps bengalensis*	C
126	Long-billed Vulture	*Gyps indicus*	C
127	Indian Griffon Vulture	*Gyps fulvus*	WU
128	Red-headed Vulture	*Sarcogyps calvus*	C
129	Egyptian Vulture	*Neophron percnopterus*	C
130	King vulture	*Sarcoramphus papa*	WU
131	Short-toed Snake-Eagle	*Circaetus gallicus*	W
132	Crested Serpent-Eagle	*Spilornis cheela*	W
133	Black Eagle	*Ictinaetus malayensis*	W
134	White-tailed Eagle	*Haliaeetus albicilla*	SWV
135	Western Marsh Harrier	*Circus aeruginosus*	WWV
136	Pied Harrier	*Circus melanoleucos*	WWV
137	Northern Harrier	*Circus cyaneus*	WWV
138	Shikra	*Accipiter badius*	W
139	Eurasian Sparrowhawk	*Accipiter nisus*	WWV & resident
140	Besra	*Accipiter virgatus*	W
141	Crested Goshawk	*Accipiter trivirgatus*	W

142	Oriental Honey-buzzard	*Pernis ptilorhyncus*	WWV & resident
143	White-eyed Buzzard	*Butastur teesa*	W
144	Bonelli's Eagle	*Hieraaetus fasciatus*	W
145	Brahminy Kite	*Haliastur indus*	W
146	Changeable Hawk-Eagle	*Spizaetus cirrhatus*	W
XXVI.	**Falconidae**		
147	Common Kestre	*Falco tinnunculus*	WWV & resident
148	Lesser Kestrel	*Falco naumanni*	W Winter migrant
149	Eurasian Hobby	*Falco subbuteo*	WWV & L
150	Peregrine Falcon	*Falco peregrinus*	WWV & resident
XXVII.	**Podicipedidae**		
151	Little Grebe	*Tachybaptus ruficollis*	WC
152	Great Crested Grebe	*Podiceps cristatus*	SWV & L
XXVIII.	**Anhingidae**		
153	Oriental Darter	*Anhinga melanogaster*	W
XXIX.	**Phalacrocoracidae**		
154	Little Cormorant	*Phalacrocorax niger*	W
155	Indian Cormorant	*Phalacrocorax fuscicollis*	W
156	Great Cormorant	*Phalacrocorax carbo*	WWV & resident
XXX.	**Ardeidae**		
157	Little Egret	*Egretta garzetta*	W
158	Grey Heron	*Ardea cinerea*	WWV & resident
159	Purple Heron	*Ardea purpurea*	WWV & resident
160	Great Egret	*Casmerodius albus*	W & SWV
161	Intermediate Egret	*Mesophoyx intermedia*	W
162	Cattle Egret	*Bubulcus ibis*	W
163	Indian Pond-Heron	*Ardeola grayii*	W
164	Striated Heron	*Butorides striatus*	W

165	Black-crowned Night-Heron	*Nycticorax nycticorax*	W
166	Black Bittern	*Ixobrychus flavicollis*	W
167	Cinnamon Bittern	*Ixobrychus cinnamomeus*	W
XXXI.	**Threskiornithidae**		
168	Black-headed Ibis	*Threskiornis melanocephalus*	W
169	Red-naped Ibis	*Pseudibis papillosa*	W
170	Eurasian Spoonbill	*Platalea leucorodia*	WWV & resident
XXXII.	**Ciconiidae**		
171	Painted Stork	*Mycteria leucocephala*	W
172	Asian Openbill	*Anastomus oscitans*	W
173	Woolly-necked Stork	*Ciconia episcopus*	W
174	Black Stork	*Ciconia nigra*	WWV
175	Black-necked Stork	*Ephippiorhynchus asiaticus*	W
176	Lesser Adjutant	*Leptoptilos javanicus*	W
XXXIII.	**Pittidae**		
177	Indian Pitta	*Pitta brachyura*	W
XXXIV.	**Laniidae**		
178	Bay-backed Shrike	*Lanius vittatus*	W
179	Long-tailed Shrike	*Lanius schach*	W
180	Southern Grey Shrike	*Lanius meridionalis*	L
181	Brown Shrike	*Lanius cristatus*	WWV
XXXV.	**Corvidae**		
182	Rufous Treepie	*Dendrocitta vagabunda*	W
183	House Crow	*Corvus splendens*	W
184	Large-billed Crow	*Corvus macrorhynchos*	L
185	Eurasian Golden-Oriole	*Oriolus oriolus*	W
186	Black-hooded Oriole	*Oriolus xanthornus*	W
187	Large Cuckoo-shrike	*Coracina macei*	W
188	Black-headed Cuckoo-shrike	*Coracina melanoptera*	W
189	Black-winged Cuckoo-shrike	*Coracina melaschistos*	W
190	Small Minivet	*Pericrocotus cinnamomeus*	W
191	White-browed Fantail	*Rhipidura aureola*	W
192	Ashy Drongo	*Dicrurus leucophaeus*	W

193	Black Drongo	*Dicrurus macrocercus*	W
194	White-bellied Drongo	*Dicrurus caerulescens*	W
195	Asian Paradise-Flycatcher	*Terpsiphone paradisi*	W
196	Common Iora	*Aegithina tiphia*	W
197	Common Woodshrike	*Tephrodornis pondicerianus*	W
XXXVI.	**Irenidae**		
198	Blue-winged Leafbird	*Chloropsis cochinchinensis*	W
XXXVII.	**Muscicapidae**		
199	Scaly Thrush	*Zoothera dauma*	W
200	Blue Rock-Thrush	*Monticola solitarius*	L & WWV
201	Orange-headed Thrush	*Zoothera citrina*	W
202	Red-breasted Flycatcher	*Ficedula parva*	WWV
203	Ultramarine Flycatcher	*Ficedula superciliaris*	L
204	Verditer Flycatcher	*Eumyias thalassina*	L
205	Tickell's Blue-Flycatcher	*Cyornis tickelliae*	W
206	Grey-headed Canary flycatcher	*Culicicapa ceylonensis*	L
207	Asian Brown Flycatcher	*Muscicapa dauurica*	L & WWV
208	Oriental Magpie-Robin	*Copsychus saularis*	W
209	Indian Robin	*Saxicoloides fulicata*	W
210	Black Redstart	*Phoenicurus ochruros*	L & WWV
211	Indian Chat	*Cercomela fusca*	W
212	Pied Bushchat	*Saxicola caprata*	W
213	Common Stonechat	*Saxicola torquata*	W
XXXVIII.	**Sturnidae**		
214	Chestnut-tailed Starling	*Sturnus malabaricus*	W
215	Brahminy Starling	*Sturnus pagodarum*	W
216	Rosy Starling	*Sturnus roseus*	WWV & migrant
217	Asian Pied Starling	*Sturnus contra*	W
218	Common Myna	*Acridotheres tristis*	W
219	Bank Myna	*Acridotheres ginginianus*	W
XXXIX.	**Sittidae**		
220	Chestnut-bellied Nuthatch	*Sitta castanea*	W
XL.	**Certhiidae**		

221	Spotted creeper	*Salpornis spilonotus*	W
XLI.	**Paridae**		
222	Great Tit	*Parus major*	W
XLII.	**Hirundinidae**		
223	Dusky Crag-Martin	*Hirundo concolor*	W
224	Barn Swallow	*Hirundo rustica*	WWV
225	Wire-tailed Swallow	*Hirundo smithii*	W
226	Red-rumped Swallow	*Hirundo daurica*	WWV
227	Streak-throated Swallow	*Hirundo fluvicola*	W
XLIII.	**Pycnonotidae**		
228	Red-vented Bulbul	*Pycnonotus cafer*	W
XLIV.	**Cisticolidae**		
229	Grey breasted Prinia	*Prinia hodgsonii*	W
230	Hill Prinia	*Prinia atrogularis*	L
231	Jungal Prinia	*Prinia sylvatica*	W
232	Plain Prinia	*Prinia inornata*	W
233	Ashy Prinia	*Prinia socialis*	W
234	Zitting Cisticola	*Cisticola juncidis*	W
235	Striated Grassbird	*Megalurus palustris*	W
XLV.	**Zosteropidae**		
236	Oriental White-eye	*Zosterops palpebrosus*	W
XLVI.	**Sylviidae**		
237	Common Tailorbird	*Orthotomus sutorius*	W
238	Lesser Whitethroat	*Sylvia curruca*	WWV
239	Paddyfield Warbler	*Acrocephalus agricola*	WWV
240	Blyth's Reed-Warbler	*Acrocephalus dumetorum*	WWV
241	Hume's Warbler	*Phylloscopus humei*	WWV
242	Sulphur-bellied Warbler	*Phylloscopus griseolus*	L & WWV
243	Greenish Warbler	*Phylloscopus trochiloides*	L & WWV
244	Indian Scimitar-Babbler	*Pomatorhinus horsfieldii*	WWV
245	Tawny-bellied Babbler	*Dumetia hyperythra*	WWV
246	Yellow-eyed Babbler	*Chrysomma sinense*	WWV
247	Common Babbler	*Turdoides caudatus*	WWV

248	Jungle Babbler	*Turdoides striatus*	WWV
249	Large Grey Babbler	*Turdoides malcolmi*	WWV
250	Blue throat	*Luscinia svecica*	WWV
XLVII.	**Alaudidae**		
251	Indian Lark	*Mirafra erythroptera*	W
252	Ashy-crowned sparrow Lark	*Eremopterix grisea*	W
253	Rufous tailed Lark	*Ammomanes phoenicurus*	W
254	Oriental skylark	*Alauda gulgula*	W
XLVIII.	**Nectarinidae**		
255	Thick-billed Flowerpecker	*Dicaeum agile*	W
256	Purple Sunbird	*Nectarinia asiatica*	W
XLIX.	**Passeridae**		
257	House Sparrow	*Passer domesticus*	W
258	Chestnut-shouldered Petronia	*Petronia xanthocollis*	W
259	White Wagtail	*Motacilla alba*	L & WWV
260	White-browed Wagtail	*Motacilla maderaspatensis*	W
261	Yellow Wagtail	*Motacilla flava*	WWV
262	Grey Wagtail	*Motacilla cinerea*	L & WWV
263	Tawny Pipit	*Anthus campestris*	WWV
264	Blyth's Pipit	*Anthus godlewskii*	WWV
265	Long-billed Pipit	*Anthus similis*	W
266	Paddyfield Pipit	*Anthus rufulus*	W
267	Tree Pipit	*Anthus trivialis*	L & WWV
268	Olive-backed Pipit	*Anthus hodgsoni*	WWV
269	Richard's Pipit	*Anthus richardi*	WWV
270	Baya Weaver	*Ploceus philippinus*	W
271	Red Avadavat	*Amandava amandava*	W
272	Indian Silverbill (White throated)	*Lonchura malabarica*	W
273	White-rumped Munia	*Lonchura striata*	W
274	Scaly-breasted Munia	*Lonchura punctulata*	W
275	Black-headed Munia	*Lonchura malacca*	W
L.	**Fringillidae**		
276	Common Rosefinch	*Carpodacus erythrinus*	L & WWV
277	Crested Bunting	*Melophus lathami*	W

278	Red-headed Bunting	*Emberiza bruniceps*	WWV
279	Grey-necked Bunting	*Emberiza buchanani*	SWV
280	Chestnut-breasted Bunting	*Emberiza stewarti*	L & WWV
281	Yellow-breasted Bunting	*Emberiza aureola*	WWV

Common	**C**
Local Resident	**L**
Widespread	**W**
Widespread Uncommon	**WU**
Widespread Scares Resident	**WS**
Widespread Common	**WC**
Common Winter Visitors	**CWV**
Sparse Winter Visitors	**SWV**
Widespread Winter Migrants	**WWM**
Widespread Winter Visitors	**WWV**
Wild & Sparse Winter Visitors	**W & SWV**
Local & Widespread Winter Visitors	**L & WWV**
Sparse Winter Visitors & Local Resident	**SWV & L**
Widespread Winter Visitors & Local Resident	**WWV & L**
Widespread Winter Visitors & Migrant	**WWV & M**
Widespread Winter Visitors & Resident	**WWV & R**

Butterfly diversity of proposed Panna BR

S.No.	Common Name	Scientific Name	Status
Family: Papilionidae (Swallowtails – The Papilios)			
1.	Crimson Rose	*Pachliopta hector*	Occasional
2	Lime Butterfly	*Papilio demoleus*	Common
3	Mormon	*Papilio polytes romulus*	Occasional
4	Blue Bottle	*Graphium sarpedon*	Common
5	Spot Sword Tail	*Pathysa nomius nomius*	Common
Family : Pieridae (White- Yellow- The Pierids)			
6.	Cabbage White	*Pieris canidia indica*	Common
7	Jezebel	*Delias eucharis*	Common
8	Pioneer	*Anapheis aurota aurota*	Common
9	Yellow Orange Tip	*Ixias pyrene sesia*	Occasional
10	Wanderer	*Valeria valeria hippa*	Common
11	Lemon Emigrant	*Catopsilia Pomona*	Occasional
12	Grass Yellow	*Terias hecabe simulata*	Common
13	Mottled Emigrant	*Catopsilia pyranthe*	Common
14	Gull	*Cepora nerissa phryne*	Common
Family : Lycaenidae (Blues – The Lycaenids)			
15	Pierrot	*Castalius rosimon rosimon*	Common
16	Silverline	*Spindasis vulcanus vulcanus*	Common
17	Striped Pierrot	*Tarucus naru*	Common
18	Zebra blue	*Syntarucus plinius*	Occasional
19	Pale Grass Blue	*Zizeeria maha ossa*	Common
20	Gram Blue	*Euchrysops cnejus*	Common
21	Pea Blue	*Lampides boeticus*	Common
22	Cerulean	*Jenides celeno aelianus*	Common
23	Angled Sunbeam	*Curetis dentata dentata*	Occasional
24	Palm darts	*Telicota ancilla*	Common
25	Red Flash	*Rapala iarbus iarbus*	Common

List of villages/ urban agglomerations falling under of proposed Panna BR

Core zone

S No	Village/ Urban Agglomeration	S No	Village/ Urban Agglomeration
DISTRICT – PANNA			
Block& Tehsil - Ajaygarh			
1	Nil		
Block& Tehsil - Panna			
1	Chhapar (North Panna Division)	2	Patha (North Panna Division)
3	Talgaon (Panna National Park)		
Block& Tehsil - Gunnor			
1	Nil		
Sub Total		**03 nos (Villages – 03; UA – Nil)**	
DISTRICT – CHHATARPUR			
Block& Tehsil – Bijawar			
1	Dhodhan(Panna National Park)	2	Kharyani (Panna National Park)
3	Palkohan (Panna National Park)		
Block& Tehsil – Rajnagar			
1	Nil		
Block& Tehsil – Laundi			
1	Nil		
Sub Total		**03 nos (Villages – 03; UA - nil)**	
Total (Panna & Chhatarpur)		**06 nos (Villages – 06; UA - nil)**	

Buffer zone

DISTRICT – PANNA			
Block& Tehsil - Ajaygarh			
1	Ajaygarh - UA	2	Aramganj
3	Bahadurganj	4	Banhari Kalan
5	Banhari Khurd	6	Baryarpur Bhumiyan
7	Baryarpur Kurmiyan	8	Baveru
9	Bhairaha	10	Bhapatpur Kurmiyan
11	Bhasuda	12	Bhujwai

13	Bilahi	14	Bimtaha
15	Chataini	16	Chunaha
17	Deogaon	18	Dhawari
19	Dugaraho	20	Gadarpur
21	Gumanganj	22	Hanumatpur
23	Hirapur	24	Jhinna
25	Kalyanpur	26	Kishunpur
27	Kudai	28	Kunwarpur
29	Majhgawan (Kodai)	30	Mohari
31	Padraha	32	Partappur
33	Patha (Rajapurkolan)	34	Raipur
35	Rampur	36	Sabduwa
37	Salaiya	38	Salaiyan
39	Simra Kalan	40	Singhpur
41	Taroni	42	Vishramganj
Block& Tehsil - Panna			
1	Akla	2	Amdar
3	Amjhiriya	4	Babupur Rajapur
5	Badagaon	6	Badgadi Kalan
7	Bador	8	Bagonha
9	Bakchur	10	Bandhi Khurd
11	Bangla	12	Basariya
13	Bhadar Kushmani	14	Dahlan Chauki
15	Darera	16	Dondi
17	Gahdara	18	Gangau
19	Gudaha	20	Gujar
21	Harsa	22	Hinota
23	Imaliya	24	Itwan Khas
25	Jamunhai	26	Jardhoba (Indragarh)
27	Jaruwapur	28	Jhalai
29	Jhalar Khamariya	30	Jhirata
31	Kachha	32	Kaimasan
33	Kandawaha	34	Karri
35	Kathari Bilhata	36	Katriya

37	Khajuri	38	Kharguwan
39	Khauchi Upka	40	Kheiriya
41	Kohni	42	Kota Muhli
43	Kotwalipur	44	Kudan
45	Kudar	46	Kudari
47	Kudraiya	48	Lalar
49	Madaiya	50	Madla
51	Majhgawan Charkhari	52	Majhgawan Panna
53	Majholi	54	Manjha
55	Manki	56	Manor
57	Mathli	58	Mihguwan
59	Nahri	60	Pali
61	Palthara	62	Pipartola
63	Rahuniya	64	Rakseha
65	Ranipur	66	Sakra
67	Sarkoha	68	Simra
69	Sukhwaha kalan	70	Sunara
71	Surajpura	72	Tilguwan
73	Umar Jhala	74	Umrawan
Block& Tehsil - Gunnor			
1	Kachnari	2	Khamri
3	Marha	4	Rampur
Sub Total		**120 nos (Villages – 119; UA – 01)**	
Block& Tehsil – Bijawar			
1	Bhorkhuwa	2	Biharvara
3	Dugriya	4	Ghori
5	Kadwara	6	Kakra
7	Magrela	8	Majhguwan Kalan
9	Mankora	10	Neguwa
11	Pathapur	12	Patori
13	Sukwaha		
Block& Tehsil – Rajnagar			
1	Akona	2	Baharpura
3	Bansarai	4	Barbaspura

5	Bardwaha	6	Basata
7	Bhota chokan	8	Bhusor
9	Chandranagar	10	Dhoguwan
11	Jhamtuli	12	Karodiya
13	Kharkhurai	14	Majhgawan
15	Pahadi Bawan	16	Patan
17	Raipura	18	Rajgarh
19	Rajpur	20	Ranguwa
21	Salaiya	22	Sapoha
23	Seja	24	Silon
25	Toriya	26	Vikrampur
Block& Tehsil – Laundi			
1	Nil		
Sub Total		**39 nos (Villages – 39; UA - nil)**	
Total (Panna & Chhatarpur)		**159 nos (Villages – 158; UA – 01)**	

Transition zone

DISTRICT – PANNA			
Block& Tehsil - Ajaygarh			
1	Badirugh	2	Bahirwara
3	Baradandeka	4	Bara Kagreka
5	Barkola khurd	6	Biharpurwa (Barhapurwa)
7	Biladi	8	Champatpur
9	Dewra Bhapatpur	10	Hardi
11	Imlahat	12	Jaitupur
13	Khoram Jhapariya	14	Majgaon (Bara Majgaon)
15	Makhanpur	16	Mohacha
17	Nandanpur	18	Nawasta
19	Nayagaon	20	Pista
21	Shahpura	22	Sidhpur
23	Simarda	24	Simra Khurd
25	Sinhai		
Block& Tehsil - Panna			
1	Akola	2	Amhai
3	Bahera (Mela)	4	Bandhi Kalan

5	Barachh	6	Bhamka
7	Bijwara	8	Bilha (Bilkhura)
9	Bilkhura	10	Dhangarh
11	Dharmpura	12	Gahra
13	Harduwa (Bilha)	14	Itwan Kalan
15	Janakpur	16	Jharkhuwa (Tara)
17	Kalyanpur	18	Karola
19	Khimariya	20	Khirwa
21	Krishna Kalyanpur	22	Kunwarpur
23	Laxmipur	24	Maira
25	Makrand Ganj	26	Murachh
27	Paharuwa	28	Panna - UA
29	Pati (Bajariya)	30	Purushottampur
31	Pathariya	32	Raipani
33	Ramkhiria	34	Sarangpur
35	Simariya	36	Singhpur
37	Sirswaha	38	Tara
39	Udki		
Block& Tehsil - Gunnor			
1	Balgaha	2	Baraunha
3	Bhadar	4	Duroha
5	Dwari	6	Gadokhar
7	Hinouti	8	Jaitpura
9	Jaswantpura	10	Jijgaon
11	Kalyanpura	12	Kanchaura
13	Mahuwa Dando	14	Majhgawa Shekh
15	Mehguwan Khurd	16	Piparwah
17	Rajpura	18	Ratanpura
19	Singhaura	20	Siri
21	Tamgarh	22	Vikarmpur (Pathar)
Sub Total		**86 nos (Villages – 85; UA - 01)**	
Block& Tehsil – Bijawar			
1	Amroniya	2	Basudha
3	Bhaiskhar	4	Dewra

5	Furtal	6	Garda
7	Ghughari	8	Jaitpur
9	Jharkuwa	10	Karri
11	Kishangarh	12	Maharkhuwa
13	Motigarh	14	Patna
15	Purwa	16	Raipura
17	Salaiya		
Block& Tehsil – Rajnagar			
1	Bamari	2	Bamitha
3	Bamnora	4	Bandargarh
5	Beniganj	6	Barakheda
7	Bhilguwan	8	Beharkhera
9	Bhiyatal	10	Bhulera
11	Chitrai	12	Chokakodan
13	Dhabad	14	Dhamna
15	Diviya purwa	16	Dugaria
17	Gangwaha	18	Ghura
19	Hakimpura	20	Imalha
21	Kabar	22	Khajuraho (UA)
23	Kishorganj	24	Kurela
25	Mahilwar	26	Mau Masania
27	Nahdora	28	Pahara purwa
29	Paniyar	30	Patharguwan
31	Pipariya	32	Pira
33	Pratappura	34	Shivrajpur
35	Singro	36	Tikuri
Block& Tehsil – Laundi			
1	Bilhari	2	Pancham Nagar
Sub Total		**55 nos. (Villages – 54; UA - 01)**	
Total (Panna & Chhatarpur)		**141 nos. (Villages – 140; UA - 01)**	

Zonewise number of household in villages/ urban agglomerations (UA) of Panna BR

Core zone

District Block/ Tehsil	Number of Households		Total households
	Rural	Urban	
Panna			
Ajaygarh	-	-	-
Panna	194	-	194
Gunnor	-	-	-
Sub-total	194	-	194
Chhatarpur			
Bijawar	558	-	558
Rajnagar	-	-	-
Laundi	-	-	-
Sub-total	558	-	558
Total	**752**	**Nil**	**752**

Buffer zone

Panna			
Ajaygarh	7816	2522	10338
Panna	6501	-	6501
Gunnor	483	-	483
Sub-total	14800	2522	17322
Chhatarpur			
Bijawar	889	-	889
Rajnagar	5255	-	5255
Laundi	-	-	-
Sub-total	6144	-	6144
Grand total	**20944**	**2522**	**23466**

Transition zone

Panna			
Ajaygarh	5880	-	5880
Panna	15630	9584	25214
Gunnor	4712	-	4712
Sub-total	26222	9584	35806
Chhatarpur			
Bijawar	2525	-	2525
Rajnagar	11893	3297	15190
Laundi	640	-	640
Sub-total	15058	3297	18355
Grand total	**41280**	**12881**	**54161**

Annex- 7: III

Zonewise no of persons per household, household per sq km & density of household per village of Panna BR

Core zone

District Block/ Tehsil	Rural area			Urban area			Total		
	Persons/ H. hold	House holds/ km²	Density of H. hold/ Villages	Persons/ H. hold	House holds / km²	Density of H. hold/ Wards	Persons/ H. hold	House holds/ km²	Density of H. hold/ Villages
Panna									
Ajaygarh	-	-	-	-	-	-	-	-	-
Panna	4.67	6.07	64.67	-	-	-	4.67	6.07	64.67
Gunnor	-	-	-	-	-	-	-	-	-
Sub-total	4.67	6.07	64.67	-	-	-	4.67	6.07	64.67
Chhatarpur									
Bijawar	4.70	7.97	186.00	-	-	-	4.70	7.97	186.00
Rajnagar	-	-	-	-	-	-	-	-	-
Laundi	-	-	-	-	-	-	-	-	-
Sub-total	4.70	7.97	186.00	-	-	-	4.70	7.97	186.00
Grand total	**4.69**	**7.37**	**125.34**	**Nil**	**Nil**	**Nil**	**4.69**	**7.37**	**125.34**

Buffer zone

Panna									
Ajaygarh	5.45	47.08	190.63	5.55	370.34	168.14	5.48	59.81	246.14
Panna	5.23	13.09	87.85	-	-	-	5.23	13.09	87.85
Gunnor	4.92	6.83	120.75	-	-	-	4.92	6.83	120.75
Sub-total	5.34	20.18	124.37	5.55	370.34	168.14	5.37	23.40	144.35
Chhatarpur									
Bijawar	6.03	4.26	68.38	-	-	-	6.03	4.26	68.38
Rajnagar	5.55	17.77	202.12	-	-	-	5.55	17.77	202.12
Laundi	-	-	-	-	-	-	-	-	-
Sub-total	5.62	12.18	157.54	-	-	-	5.62	12.18	157.54
Grand total	**5.45**	**16.92**	**132.56**	**5.55**	**370.34**	**168.14**	**5.43**	**18.85**	**147.58**

Transition zone

Panna									
Ajaygarh	5.46	39.14	235.20	-	-	-	5.46	39.14	235.20
Panna	5.33	63.66	411.32	5.43	699.56	354.96	8.64	60.42	401.59
Gunnor	5.05	31.39	214.18	-	-	-	5.05	31.39	214.18
Sub-total	5.30	48.04	308.49	5.43	699.56	354.96	7.28	46.92	305.28
Chhatarpur									
Bijawar	5.26	10.90	148.53	-	-	-	5.26	10.90	148.53
Rajnagar	5.70	38.59	339.80	5.85	55.13	219.80	7.32	32.32	330.36
Laundi	6.02	27.89	320.00	-	-	-	6.02	27.89	320.00
Sub-total	5.64	26.76	278.85	5.85	55.13	219.80	6.92	24.19	273.78
Grand total	**5.43**	**37.24**	**296.98**	**5.54**	**175.25**	**306.69**	**7.15**	**34.95**	**292.99**

Zonewise rural and urban population distribution and density (per sq km) of Panna BR

Core zone

District / Block/ Tehsil	Rural population		Urban population		Total population	
	Tot. Pop.	Density	Tot. Pop.	Density	Tot. Pop.	Density
Panna						
Ajaygarh	-	-	-	-	-	-
Panna	906	28.36	-	-	906	28.36
Gunnor	-	-	-	-	-	-
Sub-total	906	28.36	-	-	906	28.36
Chhatarpur						
Bijawar	2620	37.41	-	-	2620	37.41
Rajnagar	-	-	-	-	-	-
Laundi	-	-	-	-	-	-
Sub-total	2620	37.41	-	-	2620	37.41
Grand total	**3526**	**34.57**	**Nil**	**Nil**	**3526**	**34.57**

Buffer zone

Panna						
Ajaygarh	42626	256.74	13997	2055.36	56623	327.60
Panna	34009	68.45	-	-	34009	68.45
Gunnor	2374	33.56	-	-	2374	33.56
Sub-total	79009	107.70	13997	2055.36	93006	125.62
Chhatarpur						
Bijawar	5364	25.71	-	-	5364	25.71
Rajnagar	29143	98.54	-	-	29143	98.54
Laundi	-	-	-	-	-	-
Sub-total	34507	68.41	-	-	34507	68.41
Grand total	**113516**	**91.70**	**13997**	2055.36	**127513**	**102.44**

Transition zone

Panna						
Ajaygarh	32108	213.73	-	-	32108	213.73
Panna	83239	339.01	52057	3799.78	135296	521.89
Gunnor	23815	158.66	-	-	23815	158.66
Sub-total	139162	254.94	52057	3799.78	191219	341.72
Chhatarpur						
Bijawar	13302	57.44	-	-	13302	57.44
Rajnagar	67797	219.99	19286	322.51	87083	236.65
Laundi	3855	167.97	-	-	3855	167.97
Sub-total	84954	150.97	19286	322.51	104240	167.45
Grand total	**224116**	**202.16**	**71343**	**113.74**	**295459**	**249.95**

Zonewise distribution of male & female pop. & No of female pop./ 1000 male of Panna BR

Core zone

District Block/Tehsil	Rural population			Total population		
	Male	Female	Female Pop./ 1000 Male	Male	Female	Female Pop./ 1000 Male
Panna						
Ajaygarh	-	-		-	-	
Panna	472	434	919	472	434	919
Gunnor	-	-		-	-	
Sub-total	472	434	919	472	434	919
Chhatarpur						
Bijawar	1402	1218		1402	1218	
Rajnagar	-	-	869	-	-	869
Laundi	-	-		-	-	
Sub-total	1402	1218	869	1402	1218	869
Grand total	**1874**	**1652**	**882**	**1874**	**1652**	**882**

Buffer zone

District Block/ Tehsil	Rural population			Urban population			Total population		
	Male	Female	Female Pop./ 1000 Male	Male	Female	Female Pop./ 1000Male	Male	Female	Female Pop./ 1000Male
Panna									
Ajaygarh	22871	19755	864	7452	6545	878	30323	26300	867
Panna	17997	16012	890			-	17997	16012	890
Gunnor	1232	1142	927			-	1232	1142	927
Sub-total	42100	36909	877	7452	6545	878	49552	43454	877
Chhatarpur									
Bijawar	2809	2555	910			-	2809	2555	910
Rajnagar	15612	13531	867			-	15612	13531	867
Laundi	-	-	-			-	-	-	-
Sub-total	18421	16086	873			-	18421	16086	873
Grand total	**60521**	**52995**	**876**	7452	6545	**878**	**67973**	**59540**	**876**

Transition zone

Panna									
Ajaygarh	17302	14806	856			-	17302	14806	856
Panna	43880	39359	897	27482	24575	894	71362	63934	896
Gunnor	12442	11373	914			-	12442	11373	914
Sub-total	73624	65538	890			894	73624	65538	891
Chhatarpur									
Bijawar	7126	6176	867			-	7126	6176	867
Rajnagar	35930	31867	887	10093	9193	911	46023	41060	892
Laundi	2087	1768	847			-	2087	1768	847
Sub-total	45143	39811	882			911	45143	39811	887
Grand total	**118767**	**105349**	**887**	**37575**	**33768**	**899**	**156342**	**105349**	**890**

Total

District Block/ Tehsil	Rural population			Urban population			Total population		
	Male	Female	Female Pop./ 1000 Male	Male	Female	Female Pop./ 1000Male	Male	Female	Female Pop./ 1000Male
Panna									
Ajaygarh	40173	34561	1720	7452	6545	878	47625	41106	1723
Panna	62349	55805	2706	27482	24575	894	89831	80380	2705
Gunnor	13674	12515	1841	-	-	-	13674	12515	1841
Sub-total	**116196**	**102881**	**2686**	**7452**	**6545**	**1772**	**123648**	**109426**	**2687**
Chhatarpur									
Bijawar	11337	9949	1777	1402	1218		9935	8731	1777
Rajnagar	51542	45398	2623	10093	9193	1780	61635	54591	1759
Laundi	2087	1768	847				2087	1768	847
Sub-total	**64966**	**57115**	**2624**	**1402**	**1218**	**911**	**63564**	**55897**	**1760**
Grand total	**181162**	**159996**	**2645**	**45027**	**40313**	**1777**	**226189**	**166541**	**2648**

Annex-7: VI

Population distribution of SC & ST to total population of Panna BR

Core zone

District Block/ Tehsil	Rural SC & ST distribution		Urban SC & ST distribution		Total SC & ST distribution	
	Total SC	Total ST	Total SC	Total ST	Total SC	Total ST
Panna						
Ajaygarh	-	-	-	-	-	-
Panna	11	586	-	-	11	586
Gunnor	-	-	-	-	-	-
Sub-total	11	586	-	-	11	586
Chhatarpur						
Bijawar	397	718	-	-	397	718
Rajnagar	-	-	-	-	-	-
Laundi	-	-	-	-	-	-
Sub-total	397	718	-	-	397	718
Grand total	**408**	**1304**	Nil	Nil	**408**	**1304**

Buffer zone

Panna						
Ajaygarh	9509	7823	2168	1056	11677	8879
Panna	3647	12565	-	-	3647	12565
Gunnor	96	1331	-	-	96	1331
Sub-total	13252	21719	2168	1056	15420	22775
Chhatarpur						
Bijawar	713	3092	-	-	713	3092
Rajnagar	5011	2852	-	-	5011	2852
Laundi	-	-	-	-	-	-

Sub-total	5724	5944	-	-	5724	5944
Grand total	**18976**	**27663**	2168	1056	**21144**	**28719**

Transition zone

Panna						
Ajaygarh	7207	2564	-	-	7207	2564
Panna	11057	9004	5571	1454	16628	10458
Gunnor	5325	4988	-	-	5325	4988
Sub-total	23589	16556	5571	1454	5571	1454
Chhatarpur						
Bijawar	2156	3247	-	-	2156	3247
Rajnagar	13565	4370	3379	200		
Laundi	561	191	-	-	561	191
Sub-total	16282	7808	3379	200	19661	8008
Grand total	**39871**	**24364**	**8950**	**1654**	**48821**	**26018**

Total

Panna						
Ajaygarh	16716	10387	2168	1056	18884	11443
Panna	14715	22155	5571	1454	20286	23609
Gunnor	5421	6319			5421	6319
Sub-total	**36852**	**38861**	**7739**	**2510**	**21002**	**24815**
Chhatarpur						
Bijawar	3266	7057			3266	7057
Rajnagar	18576	7222	3379	200	5011	2852
Laundi	561	191			561	191
Sub-total	**22403**	**14470**	**3379**	**200**	**25782**	**14670**
Grand Total	**59255**	**53331**	**11118**	**2710**	**70373**	**56041**

Annex-7: VII

Zonewise along with rural and urban literates of Panna BR

Core zone

District	**Rural Literates**			**Urban Literates**			**Total Literates**		
Block/ Tehsil	**Person**	**Male**	**Female**	**Person**	**Male**	**Female**	**Person**	**Male**	**Female**
Distt. Panna									
Ajaygarh	-	-	-				-	-	-
Panna	319	237	82	-	-	-	319	237	82
Gunnor	-	-	-	-	-	-	-	-	-
Sub-total	**319**	**237**	**82**	**-**	**-**	**-**	**319**	**237**	**82**
Distt. Chhatarpur									
Bijawar	824	563	261	-	-	-	824	563	261
Rajnagar	-	-	-	-	-	-	-	-	-
Laundi	-	-	-	-	-	-	-	-	-
Sub-total	824	563	261	-	-	-	824	563	261
Grand total	**1143**	**800**	**343**	**Nil**	**Nil**	**Nil**	**1143**	**800**	**343**

Buffer zone

Distt. Panna									
Ajaygarh	14755	10368	4387	8003	4865	3138	22758	15233	7525
Panna	13567	8941	4626	-	-	-	13567	8941	4626
Gunnor	904	643	261	-	-	-	904	643	261
Sub-total	**29226**	**19952**	**9274**	**8003**	**4865**	**3138**	**37229**	**24817**	**12412**
Distt. Chhatarpur									
Bijawar	1130	814	316	-	-	-	1130	814	316
Rajnagar	10269	7138	3131	-	-	-	10269	7138	3131
Laundi	-	-	-	-	-	-	-	-	-
Sub-total	11399	7952	3447	-	-	-	11399	7952	3447
Grand total	**40625**	**27904**	**12721**	**8003**	**4865**	**3138**	**48628**	**32769**	**15859**

Transition zone

Distt. Panna									
Ajaygarh	13646	9230	4416	-	-	-	13646	9230	4416
Panna	48882	29173	19709	36931	21212	15719	85813	50385	35428
Gunnor	9133	6135	2998	-	-	-	9133	6135	2998
Sub-total	**71661**	**44538**	**27123**	**36931**	**21212**	**15719**	**108592**	**65750**	**42842**
Distt. Chhatarpur									
Bijawar	4861	3295	1566	-	-	-	4861	3295	1566
Rajnagar	26465	17658	8807	9907	6162	3745	36372	23820	12552
Laundi	1116	816	300	-	-	-	1116	816	300
Sub-total	32442	21769	10673	9907	6162	3745	42349	27931	14418
Grand total	**104103**	**66307**	**37796**	**46838**	**27374**	**19464**	**150941**	**93681**	**57260**

Total

Distt. Panna									
Ajaygarh	28401	19598	8803	8003	4865	3138	36404	24463	11941
Panna	62768	38351	24417	36931	21212	15719	99699	59563	40136
Gunnor	10037	6778	3259	-	-	-	10037	6778	3259
Sub-total	**101206**	**64727**	**36479**	**44934**	**26077**	**18857**	**146140**	**90804**	**55336**
Distt. Chhatarpur									
Bijawar	6815	4672	2143	-	-	-	6815	4672	2143
Rajnagar	36734	24796	11938	9907	6162	3745	46641	30958	15683
Laundi	1116	816	300	-	-	-	1116	816	300
Sub-total	**44665**	**30284**	**14381**	**9907**	**6162**	**3745**	**54572**	**36446**	**18126**
Grand total	**145871**	**95011**	**50860**	**54841**	**32239**	**22602**	**200712**	**127250**	**73462**

Participation of workers in prposed Panna BR

Rural area

District Block/ Tehsil	Total worker	Culti.	Agri. lab.	H. ind.	Other worker	Marg. worker	Non-worker	Total Pop.
PANNA								
Ajaygarh	34236	16927	3717	687	3081	9824	40498	74734
Panna	41863	7889	4929	1274	19434	8337	76291	118154
Gunnor	12495	4588	3721	213	1367	2606	13694	26189
Total	88594	29404	12367	2174	23882	20767	130483	219077
CHHATARPUR								
Bijawar	9056	3102	1660	323	1478	2493	12230	21286
Rajnagar	36853	16231	3953	967	7609	8093	60087	96940
Laundi	1846	1519	34	0	56	237	2009	3855
Total	47755	20852	5647	1290	9143	10823	74326	122081
Grand total	**136349**	**50256**	**18014**	**3464**	**33025**	**31590**	**204809**	**341158**

Urban area

PANNA								
Ajaygarh	3962	311	122	134	2052	1343	10035	13997
Panna	14578	374	238	745	11675	1546	37479	52057
Total	18540	685	360	879	13727	2889	47514	66054
CHHATARPUR								
Rajnagar	5575	1386	234	146	3049	786	13711	19286
Total	5575	1386	234	146	3049	786	13711	19286
Grand total	**24115**	**2071**	**594**	**1025**	**16776**	**3675**	**61225**	**85340**

Total

PANNA								
Ajaygarh	38198	17238	3839	821	5133	11167	50533	88731
Panna	56441	8263	5167	2019	31109	9883	113770	170211
Gunnor	12495	4588	3721	213	1367	2606	13694	26189
Total	107134	30089	12727	3053	37609	23656	177997	285131
CHHATARPUR								
Bijawar	9056	3102	1660	323	1478	2493	12230	21286
Rajnagar	42428	17617	4187	1113	10658	8879	73798	116226
Laundi	1846	1519	34	0	56	237	2009	3855
Total	53330	22238	5881	1436	12192	11609	88037	141367
Grand total	**160464**	**52327**	**18608**	**4489**	**49801**	**35265**	**266034**	**426498**

Zonewise participation of workers to total population of Panna BR

Core zone

District Block/ Tehsil	Total worker	Culti.	Agri. lab.	H.Hold . ind..	Other worker	Marg. worker	Non worker	Total pop.
PANNA								
Ajaygarh	-	-	-	-	-	-	-	-
Panna	556	135	19	2	155	245	350	906
Gunnor	-	-	-	-	-	-	-	-
Total	556	135	19	2	155	245	350	906
CHHATARPUR								
Bijawar	1287	508	160	85	110	424	1333	2620
Rajnagar	-	-	-	-	-	-	-	-
Laundi	-	-	-	-	-	-	-	-
Total	1287	508	160	85	110	424	1333	2620
Grand total	**1843**	**643**	**179**	**87**	**265**	**669**	**1683**	**3526**

Buffer zone

PANNA								
Ajaygarh	22899	9578	1759	619	4162	6781	33724	42626
Panna	13531	3262	1901	261	4692	3415	20478	34009
Gunnor	1125	256	238	21	185	425	1249	2374
Total	37555	13096	3898	901	9039	10621	55451	93009
CHHATARPUR								
Bijawar	2551	850	592	55	280	774	2813	5364
Rajnagar	11998	5342	1343	391	2020	2902	17145	29143
Laundi	-	-	-	-	-	-	-	-
Total	14549	6192	1935	446	2300	3676	19958	34507
Grand total	**52104**	**19288**	**5833**	**1347**	**11339**	**14297**	**75409**	**127513**

Transition zone

PANNA								
Ajaygarh	15299	7660	2080	202	971	4386	16809	32108
Panna	42354	4866	3247	1756	26262	6223	92942	135296
Gunnor	11370	4332	3483	192	1182	2181	12445	23815
Total	69023	16858	8810	2150	28415	12790	122196	191219
CHHATARPUR								
Bijawar	5218	1744	908	183	1088	1295	8084	13302
Rajnagar	30430	12275	2844	722	8638	5977	56653	87083
Laundi	1846	1519	34	0	56	237	2009	3855
Total	37494	15538	3786	905	9782	7509	66746	104240
Grand total	**106517**	**32396**	**12596**	**3055**	**38197**	**20299**	**188942**	**295459**

Statistics of submergence area of proposed Greater Gangau Dam (Dhudhan Dam) related to Ken-Betwa Link Project

S. No.	Category	Area in sq km			Total	Area in %
		Core	Buffer	Transition		
1.	**Agricultural land**	**13.75**	**5.41**	**5.90**	**25.06**	**28.69**
2.	**Forest**					
	Dense	19.37	5.27	0.69	25.33	29.00
	Open	2.36	0.08	0.03	2.47	2.83
	Degraded	5.9	2.91	1.01	9.82	11.24
	Forest Blank	3.71	1.55	--	5.26	6.02
3.	**Wastelands**	**2.50**	**1.72**	**0.40**	**4.62**	**5.29**
4.	**Water bodies**	**9.62**	**2.24**	**2.92**	**14.78**	**16.92**
	Total	**57.21**	**19.18**	**10.95**	**87.34**	**100.00**