

**STUDIES ON PROSPECTS AND POTENTIALS OF
ECOTOURISM IN CHHATTISGARH WITH SPECIAL
REFERENCE TO BIODIVERSITY CONSERVATION
OF PROTECTED AREAS**

M. Sc. (Forestry) THESIS

by

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RAIPUR (C.G.)**

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THESIS

Submitted to the

INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

by

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**IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE
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CERTIFICATE – I

This is to certify that the thesis entitled “ **STUDIES ON PROSPECTS AND POTENTIALS OF ECOTOURISM IN CHHATTISGARH WITH SPECIAL REFERENCE TO BIODIVERSITY CONSERVATION OF PROTECTED AREAS**” submitted in partial fulfilment of the requirements for the degree of “**MASTER OF SCIENCE IN FORESTRY**” of the Indira Gandhi Krishi Vishwavidyalaya, Raipur is a record of the bonafide research work carried out by **BHARATI SINGH** under my guidance and supervision. The subject of the thesis has been approved by Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma (certificate, awarded etc.) or has been published / published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by her.

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CERTIFICATE - II

This is to certify that the thesis entitled “**STUDIES ON PROSPECTS AND POTENTIALS OF ECOTOURISM IN CHHATTISGARH WITH SPECIAL REFERENCE TO BIODIVERSITY CONSERVATION OF PROTECTED AREAS**” submitted by **BHARATI SINGH** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in partial fulfilment of the requirements for the degree of “**MASTER OF SCIENCE IN FORESTRY**” in the **DEPARTMENT OF FORESTRY** has been approved by the external examiner and Student's Advisory Committee after an oral examination.

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Date:

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LIST OF ABBREVIATIONS

Abbreviations	Description
%	Per cent
⁰ C	Degree Celsius
&	And
=	Equal to
>	More than
<	Less than
m	Metre
mm	Milimetre
cm	Centimetre
T	Tree
Sh	Shrub
H	Herb
Cl	Climber
Gr	Grass
<i>et al.</i>	And others/ co-workers
etc.	So on
Fig.	Figure
ha	Hectare
ha ⁻¹	Per hectare
i.e.	That is
MAB	Man And Biosphere
IVI	Importance Value Index
No.	Number
<i>viz.</i>	Namely
MoEF	Ministry of Environment and Forest
WTO	World Tourism Organization
FSI	Forest Survey of India
CBE	Community Based Ecotourism
e.g.	For example
NTFP	Non-Timber Forest Products

CHAPTER – I

INTRODUCTION

Ecotourism is considered the fastest growing market in the tourism industry, according to the World Tourism Organization with an annual growth rate of 5 % worldwide. This represents 6 per cent of the world gross domestic product and 11.4 % of consumer spending-not a market to be taken lightly. The concept of ecotourism has gained importance only recently. During 1990, tourism received increasing attention in developing countries. In India, for instance, there has been a large increase in international tourism in the last few years. In the year 2002, there has been a 14.6 % increase in international tourist arrivals along with 22.4 % growth in foreign exchange and most of this increase is due to India's protected areas made for *in situ* conservation of biodiversity declared by Central and State Government categorized as Biosphere reserves, National parks and Wild life Sanctuary. Nature-based tourism a sub-sector of tourism can be an important channel for redistributing resources from countries who demand higher nature based vacation to developing countries, which comprise mega-diversity regions and protected parks (Gossling, 1999). Thus tourism could be a means of redistributing economic resources, mitigating the socio-economic situation both at local and national scale contributing to biodiversity conservation. The term ecotourism was coined by Hector Ceballos-Lascurain in 1983, and was

initially used to describe nature-based travel to relatively undisturbed areas with an emphasis on education. The concept has, however, developed to a scientifically based approach to planning, management and development of sustainable tourism products and activities. Basically ecotourism means- “ tourism involving travel to areas of natural or ecological interest, typically under the guidance of a naturalist, for the purpose of observing wildlife and promotion of understanding and conservation of the environment.”

Historical, biological and cultural conservation, preservation, sustainable development etc. are some of the fields closely related to ecotourism. Generally speaking eco-tourism focuses on local cultures, wilderness, adventures, volunteering, personal growth and learning new ways to live on the vulnerable planet; typically involving travel to destinations where the flora, fauna, and cultural heritage are the primary attractions. In addition to evaluating environmental and cultural factors, an integral part of eco-tourism is in the promotion of recycling, energy efficiency, water conservation, and creation of economic opportunities for the local communities. The ecotourism is defined by the World Tourism Organization (WTO) as, “ Tourism that involves traveling to relatively undisturbed natural areas with the specified object of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspects (both of the past or the present) found in these areas”. The key elements of ecotourism include a natural environment with environment friendly visitors, not having any serious impact on the eco-system and positively involved local community. Through ecotourism travelers come to better understand the unique natural and cultural environments round the globe. Many international

organizations and agencies support ecotourism as a favorable tool for sustainable development.

The World Conservation Union (IUCN) describes ecotourism as, “responsible travel to natural areas that conserves the environment and improves the well-being of local people.” However for tourism to be called ecotourism, it should be fully compatible with the conservation goals of the country, while at the same time pose minimum threat to the continuation of local culture and society. Moreover, it should contribute by means of income and education to the contribution of ecosystems (Brown 1997). Ecotourism can be of different forms such as losing oneself in a beautiful natural forest, watching animals, birds and trees in a forest, corals and marine life in sea, engaging in boating or wandering amongst sand dunes.

About the impacts of ecotourism the optimistic view is that tourists are an economic force that can promote the conservation of the natural attractions. Here revenues from tourists, in the form of entrance fees, domestic air fares, accommodation and food, hiring charges of the guide, sale of local goods such as handicrafts and souvenirs and tax revenues levied on the above, are distributed among the population that is most likely to exploit the natural areas. Such a transfer of revenue establishes a direct link between conservation and personal income. For example, hotels, restaurants, and bars hire local workers, pay rents to locals, and purchase local fruits and vegetables, fish, meat etc. For many countries, ecotourism is not simply a marginal activity to finance protection of the environment but as a major industry of the national economy. For example, in places such as Costa Rica, Ecuador, Nepal, Kenya, Madagascar, and Antarctica, ecotourism represents a

significant portion of the gross domestic product and economic activity (Isaacs, 2000; Eadington and Smith, 1992). Currently there are various moves to create national and International ecotourism accreditation programs. India is one of the twelve-mega diversity countries of the World, and a country with a rich and renowned cultural heritage. Yet, the potential of ecotourism to help conserve these resources and assist in economic development remains largely untapped both in terms of the domestic and international market.

India has a rich heritage of wild flora and fauna. With a population of 1000 million people is home to 16 percent of the world's population, 18 percent of the world's numbering 470 million and occupies only 2.5 percent of the world's geographical area covering 3.29 million square kilometers (MoEF, 2001). Being a mega diversity country, it supports two bio-diversity hot spots as well as sixteen diverse forest types from the subtropical and mangroves to tropical evergreen forests as well as temperate and alpine forests in high Himalayan ranges. Even though recorded forest area in the country is 7, 65,210 km² (2.42% of the land area), satellite data indicates forest cover of 6, 75, 538 km² (20.55 % of the total land area). However, 12.68% of the total forest area has crown cover of over 40 % and the rest is open forest. About 0.48 million ha are mangrove forests (FSI, 2000).

The Botanical Survey of India has assessed that the country has 45,000 identified plant species including 15,000 flowering plants (nearly 7% of world's flora) out of which 5,154 are found only in India. Recent rapid surveys using revised IUCN guidelines (Sacan, 2000) indicated that in India 76 bird species, 98 amphibians, 198 reptiles and 178 mammal species are endangered or vulnerable. Similarly around 1,500 endemic plant species are

facing varying degrees of threat. India's rich and unique biological resources are economically important both globally and nationally. At least 166 species of crop plants and 320 species of wild relatives of cultivated plants originated from the Indian sub-continent. About 90% of all medicines used in India come from plant species. Medicinal plants and various non-wood forest products as well as fuel wood, fodder and grazing for domestic animals serve an important source for subsistence as well as of income and livelihood for nearly 147 million villages. The forest areas yield various non-wood forest products for local consumption and economic gain. Of the 15.69million ha area under 592 protected areas network, more than 50% of these have human population in and around (MoEF, 2000). Large human and livestock and human populations depend on fuel wood, fodder, grazing, non-wood forest products, they have been prohibited from using these resources in the forest areas declared as National Park or Sanctuary. Thus there is need of alternative arrangements for their sustenance.

Chhattisgarh the 26th state of Indian union was carved out of Madhya Pradesh on 1st November 2000. The newly formed state shares borders with six states. The state is endowed with rich cultural heritage and natural diversity. The Indian government has recognized Chhattisgarh as a "maximum tourist potential" state and will help its endeavors in establishing itself as 'a center of ECOTOURISM'. Chhattisgarh the 9th largest state in India rarely comes up in the vocabulary of a tourist guide. The lack of publicity has protected it's yet to be explored natural beauty and cultural heritage from the prying eyes of a seasoned traveler. Chhattisgarh is one of the greenest states of India with over 44% of its total area under lush forest. It

is home to 3 National Parks, 11 Wildlife Sanctuaries and 1 Biosphere Reserve. The forests are known not only for their flora and fauna but also contain about 88 species of medicinal plants. Chhattisgarh has identified some regions with a very high potentiality for ecotourism with a lot of initiatives. Chhattisgarh is destined to become the most favorite ecotourism destinations in India and few among best in the world. The infrastructure like motels, huts, hostels, restaurants, guides, adventure sports, tracking and other facilities are necessary to popularise and attracts to the tourist to visit and enjoy the nature based ecotourism. To study the potentials of ecotourism at one large unit of protected area i.e. Biosphere reserve and smaller unit wild life sanctuary has been selected to undertake the research in Chhattisgarh the present study was conducted. The study was based on following objectives:

1. To study the ecotourism activities in Achanakmar-Amarkantak biosphere reserve (particularly in Chhattisgarh region) and Udanti wildlife sanctuary.
2. Documentation of important flora and fauna having commercial, aesthetic and medicinal value.
3. To know the impacts of ecotourism on sustainable livelihood of local people.

CHAPTER - II

REVIEW OF LITERATURE

In this chapter an attempt has been made to review the work done on ecotourism in India and abroad. However due to paucity of literature on few aspects, the similar types of studies carried in other aspects of ecotourism are also cited. The literature is reviewed under the following objectives:

1. Studies on ecotourism in India and abroad.
2. Documentation of important flora and fauna having commercial, aesthetic and medicinal value.
3. To know the impacts of ecotourism on sustainable livelihood of local people.

2.1 Studies on ecotourism in India and abroad.

Bhattacharya *et. al.* (2006) performed a study for the assessment of the awareness about implementation of the rules, regulations and guidelines with respect to the impact of ecotourism in the park. The study assessed the impacts of implementation of the operational guidelines and suggests measures for better visitor's management in the park.

Cristian (2002), reported about development of ecotourism in Chile. It was noted that, since 1990s the development of various ecotourism projects have resulted in 350 thousand visitors, generating an annual 800 million dollars for the national economy.

Davenport *et. al.* (2002) reported on management tools that aid in planning and promoting ecotourism within parks. Some of the tools that have been discussed include, visitor's impact management, increasing domestic tourism, optimizing user fee structure, revenue sharing, integrated conservation and development projects based on ecotourism; and investment in tourism infrastructure and interpretation.

Duim and Philipen (2002), through study at Costa Rica examined the contribution of eco-tourism in nature conservation taking example of a private reserve (Monteverde) and a national park (Manuel Antonio) and found contradictory results. On one side it provides financial assistance for maintenance; on the other tourism development activities in the immediate vicinity has led to negative impacts on nature and environment. They also found that the local people were not benefited properly.

Gossling (1999) reported that ecotourism can contribute to safeguard biodiversity and ecosystem functions. A cost-benefit analysis of those ecosystems richest in species diversity, i.e. tropical rain forests, leads to the conclusion that tourism and its direct use value can play an important role as an incentive for protection. Visiting in sensitive areas needs to be limited; education, management and control measures have to be integrated and money captured from tourists has to be increased. Tourism needs to go substantial changes in the long run.

Kumar and Rangaswamy (2002) studied about ecotourism in Karnataka and found that there is great potential of ecotourism. There is need for a separate Ecotourism policy for its better promotion.

Lindberg *et. al.* (1996) evaluated ecotourism potential of Cockscomb Basin Wildlife Sanctuary. The result indicated that tourism achieves the objectives of ecotourism as conservation, development and local economic benefits and support but it should be implemented of a modest user fee.

Mukerji (2006) revised various measures for conservation and management of the biodiversity of Indian forests as provided in the Indian Forest Act, since 1856 to 2003 aiming ecodevelopment around the protected areas. Supporting the ecodevelopment strategy around the protected areas and he concluded that people's participation is the best approach for it.

Obua (1997) reported the ecological impacts of ecotourism in a national park of Uganda. It was observed that development of campsites involve removal of vegetation which accounts for loss of woody species and reduces species composition in protected areas. Some recommendations have been made to prevent such vegetation loss.

Rawat and Sharma (2003), studied on development of stakeholder based ecotourism in Uttarakhand, India. Ecotourism holds a great potential for conservation of fragile mountain ecology. The study revealed that the stakeholder participation can considerably increase the infrastructure for ecotourism sharing government's burden.

Salam *et al.* (2000), suggested that nature-oriented tourism can be one means to help achieve sustainability in the reserve forest as well as protecting the important world heritage site. Well-planned tourism could provide economic and political incentives for proper management and conservation and could bring additional benefit to local communities and regional economies.

Sayed and Langawi (2003) concluded that the flora and fauna are the live resources which require the habitat characters to be preserved for their conservation. The paper discusses the application of ecotourism techniques that ensures biodiversity conservation and elaborates their effectiveness under the socio-climatic and socio-cultural condition of Kuwait. The result provides a systematic plan to identify the steps of Ecotourism development and the cost of biodiversity.

Serrano (1997) gave some principles for achieving sustainable tourism development. These principles can be adopted to avoid many of the negative impacts of tourism development, such as increased crime, economic inequality and negative impacts on local cultures.

Stem *et al* (2003) performed a comparative case study. The research findings indicated that eco-tourism is an effective conservation strategy and community development tool. They illuminated legal restrictions as a control over deforestation and hunting but tour operators were insignificant in

increasing environmental awareness. There were also indications of ecotourism dominating local economies and offered suggestions to improve ecotourism's potential.

Tisdell (1997), the study illustrated a number of consequences of ecotourism development in Sunderbans. The problems involved in developing tourism include highly seasonal tourism, no local people involved in the tourism industry- so very few employment benefits to locals, permits are required for entry both in Bangladesh and India which often causes delays which can frustrate tourists; and wild animals, especially tigers, are elusive.

Weaver (2002) studied the concept of ecotourism and its potential impacts. The positive impacts include its incentive effect for protecting natural habitats, its provision of funds and volunteer activity. Negative effects tend to be negligent, includes introduction of exotic species, wildlife stress.

2.2 Documentation of important flora having commercial, aesthetic and medicinal value.

Bist (2000) carried out a systematic study and showed the impact of changes in the forest cover in Nanada Devi Biosphere Reserve of India. The analysis showed that in the Reserve area, the forest cover has increased showed a positive trend, which needs to be maintained.

Khushwah and Kumar (2000) studied the biodiversity indices for flora in Madhav National Park, Satpuda National Park, Indrāvati National Park,

and Bandhavgarh National Park. The values of Shannon- Wiener indices as computed were found to be 2.508, 2.226, 1.842 and 1.815 respectively. They have calculated that Bandhavgarh, Indravati and Satpuda national park need to be given more attention for protection and conservation of biodiversity. According to them there is need to strictly follow the rules with legal and other provisions in order to minimize the biotic pressures.

Maliya (2007) studied the rare species of Katrniyaghat Wildlife Sanctuary. The survey enlisted 41 rare species including plants from trees, small and medium sized trees, shrubs, herbs and climbers, out of which 23 had a wide range of Ayurvedic and Ethnomedicinal uses. Remaining 18 species were economically valuable.

Reddy *et. al.* (2006) studied the vegetation and floristic diversity of a national park at Orissa which represents different vegetation in different habitats. Total 372 species were identified belongs to 262 genera under 100 families.

Shrivastava and Choudhary (2007) studied floristic diversity in the various regions of Itanagar Wildlife Sanctuary. The study also provides phenological details of the various plant species along with their local uses.

Singh (2004) studied the biodiversity of Ratanmahals Wildlife Sanctuary in Gujarat state and its surrounding area in Gujarat and Madhya Pradesh which is the last large block of surviving forests (515km²) in Malwa

region for conservation in priority under a regional planning has been highlighted in his work. Majority of the forest is under dense forest and Ratanmahals, a small sanctuary, is an integral part of forest demarcated for conservation of biodiversity. This study reflects an overview on floral and faunal diversity and conservation need of the Malwa plateau in the two states.

Singh (2007) has given a general account of the vegetation pattern of Valmiki National Park. The author has enlisted the available plant species along with their utilization as economic, medicinal importance as well plants being locally utilized for many purposes. About 700 species spread over 459 genera and 117 families are reported.

Subramani *et. al.* (2007) studied the floristic diversity and life forms of the plant species available and prepared biological spectrum out of it. The species documented included medicinal, aromatics, exotics. Ecological characterization of the vegetation has been made according to life forms. The biological spectrum revealed theronanophanerophytic vegetation in the study area which was partly due to vegetation disturbance.

Sundriyal and Sundriyal (2003) studied small representative types and habitats in the Eastern Himalayas. Thus the total vegetation was identified and evaluated for evaluating the status of the vegetation. Of the total 215 species recorded at all the sites, 26% have fodder value, 16% fuel, 10% timber, 10% wild edibles, 5% medicinal and another and 13% of miscellaneous uses. Thus 80% of the flora has some kind of economic use.

2.3 To know the impacts of ecotourism on sustainable livelihood of local people.

Bhattacharya *et. al.* (2003) studied and explored the community-based ecotourism (CBE) in the Kerwa forest area (near Van Vihar National Park), Madhya Pradesh, India. A tourism potential survey was conducted to determine the tourism resource of the area and to assess the potential stakeholders' interest in combining efforts to develop sustainable CBE in the location. It was concluded that the Kerwa area has adequate potential for small-scale ecotourism development and, with appropriate and organized planning and implementation, conservation and economic development in the area is possible.

Bradley (2004), introduced a model of sustainable community-based ecotourism (CBET) implemented in Cambodia, by the NGO Mlup Baitong. CBET is a form of nature tourism managed by the community of the destination, with direct benefit to itself while offering the visitor a unique experience. The Cambodia Community-Based Ecotourism Network (CCBEN) is then introduced, and the closer cooperation between the various sectors working in tourism was proposed.

Card and Vogelsong (1995) studied how ecotourism meets the sustainable development goal. It was argued that the inclusion of local labor and business is supreme to future development. It was concluded that while

supporting conservation efforts, ecotourism emphasizes reciprocal social contact with communities and creates economic opportunity.

Chakravarty (2003) reported resident's attitude towards the potential impacts of ecotourism. The analysis is based on data from 738 completed interview schedules. The case study indicates the critical role played by the local communities for their effective participation and aroused concern for their rights to use the zone. Also suggestions had been outlined for the proposed park, for the tourists and for the residents.

Corcoran (1996) found that some individuals are generating supplemental income from ecotourism and are optimistic about its future. Rural communities are developing tourism as a source of new jobs and income. Two models have been highlighted that provide a framework for community-based ecotourism strategies.

Getzner (2002) reported the potential contribution of the Gesause National Park in the development of Austria. Using a regional multiplier model showed that employment could be increased significantly. About 50-100 additional full-time jobs could be created; the unemployment rate which is 11% could be reduced by 10-25%.

Koch (1997) presented a political economy of nature tourism in South Africa. It has been argued that tourism can be used as a tool to reconstruct rural economy if obstacles that inhibit community participation are taken into

consideration. Other sections discuss conservation reform, tourism based development initiatives, involvement of tribal authorities, importance of utilizing local knowledge in park management.

Lindberg (1998) identified three economic aspects of ecotourism. Through tourism, the natural areas can be added values, user fees and revenue to support natural area protection and ecotourism and economic development.

Maikhuri *et. al.* (2000), reported the history of expeditions and the impact on the local economy, identification of ecotrekking/ expedition routs and potential sites, and designing appropriate strategies/ action plans for sustainable ecotourism. This will not only help to resolve the local people-policy conflicts and improve the local economy but will also help to achieve the biodiversity conservation goals.

Nelson (2004) reviewed how community-based ecotourism has evolved and how it contributes to both conservation and rural development. The rural communities are signing commercial agreements with private operators to develop ecotourism ventures on their land which offers them new economic opportunities.

Schoemann (2003) studied the socio-political aspects of establishing ecotourism in Qwa-Qwa National Park, South Africa. The study aimed to investigate the lack and problems of tourism development with emphasis on ecotourism. The disputes related to land tenure ship, inability of government

to provide proper policies and directions for development of ecotourism, inefficient funding operations are some of the problems in park development which prevent the local community to share the ecotourism benefits.

Schulze (1998) conducted a study through community-based ecotourism development in Malaysia aimed to analyze link between socioeconomic systems with local natural resource base; social structure and village institutions; impact of gazettement of the Wildlife Sanctuary on the village economy and different approaches towards ecotourism development. The promotion of village based ecotourism development requires formal training and early involvement in planning avoids unnecessary conflict between local population and tourism development agency.

Stem, *et. al.* (2003) studied the community participation in ecotourism benefits and examined the ecotourism's effectiveness as a conservation strategy. The research conducted reveals that ecotourism is effective as a conservation strategy as well as for employment generation.

CHAPTER – III

MATERIALS AND METHODS

The present investigation entitled “*Studies on prospects and potentials of ecotourism in Chhattisgarh with special reference to biodiversity conservation of protected area.*” was carried out at Achanakmar-Amarkantak Biosphere Reserve, Bilaspur Forest division, Bilaspur district and Udanti Wildlife Sanctuary of Gariaband Forest Division, Raipur district of Chhattisgarh during the year 2007-2008. The details of the study site, climate, geology, soil, forest flora, fauna and other features of land along with the methodologies adopted are described below:

3.1 Study sites:

The study was conducted in Jugad and Koeba ranges of Udanti Wildlife Sanctuary of Gariaband Forest Division, Raipur district and Achanakmar, Game and Lamni range of Achanakmar- Amarkantak Biosphere Reserve, Bilaspur Forest division, Bilaspur district. The geographical location, physiographic and other features of study area are given below.

3.1.1 Achanakmar-Amarkantak Biosphere Reserve

3.1.1.1 General:

The Achanakmar-Amarkantak Biosphere reserve was built in March 2005. The Achanakmar-Amarkantak Biosphere Reserve spreads in the lap of Maikal hills of Satpuda mountain ranges. The biosphere reserve gives rise to three rivers- Narmada, Sone and Amanalla (the supporting river of Arpa/ Mahanadi River). The reserve lies at a distance of 60 km. from Bilaspur

district. The sal forests of Achanakmar are countable as one of the best Sal Forests of the country. The natural glory of the forest is a rare experience in its own.

3.1.1.2 Location and extent:

The Achanakmar-Amarkantak Biosphere Reserve lies between 22°15'' to 22°58'' North latitude and 81°25'' to 82°5'' East longitude, having an area of 3835.51 sq. km, partly falling in Madhya Pradesh and partly falling in Chhattisgarh State. The state-wise distribution of the area shows that 1224.98 sq. km area comes under Madhya Pradesh and remaining 2610.53 sq. km. area in Chhattisgarh. It comprises parts of Bilaspur district of Chhattisgarh and Dindori and Anuppur districts of Madhya Pradesh falling in agro-climatic zone The Central Plateau and Hill Region. Out of the total area, 68.1% lies in Bilaspur district followed by Anuppur (16.2%) and Dindori (15.7%). It includes one Protected Area (PA) viz., Achanakmar Sanctuary lying in Bilaspur district with a total geographical area of 551.15 sq. km. which forms the core zone of the Biosphere Reserve. Fig. 3.1 (a) shows the location map and 3.1 (b) shows the detail map of Achanakmar-Amarkantak Biosphere Reserve.

3.1.1.3 Zonation:

Presently the Achanakmar-Amarkantak Biosphere Reserve has been divided into core and buffer zone area only. However, the buffer zone area has to be further divided into buffer and restoration zone with the consent of both states Governments.

3.1.1.3.1 Core zone:

The Achanakmar-Amarkantak Biosphere Reserve has a core zone of 551.15 sq. km constituted by Achanakmar sanctuary .The entire core zone area falls in Chhattisgarh State.

3.1.1.3.2 Buffer zone:

Of the total area an area of 3283.96 sq. km serves as buffer zone of the Biosphere Reserve. Out of this an area of 1224.98 sq km falls in Madhya Pradesh and the rest of the area of 2058.98 sq. km. falls in Chhattisgarh.

3.1.1.4 Topography and geology:

The topography is very varied form the rice fields below in Bilaspur and Anuppur and wheat fields in Dindori to the hills of Maikal range of Sartpura, culminating in the Amarkantak plateau of bauxite rocks. Steep escarpments are seen surrounding the Plateau. Numerous streams and Nallas, many of which are perennial, cut up the whole area. The biosphere reserve area is one of major watershed of peninsular India separating rivers draining into Arabian Sea and Bay of Bengal. Its uniqueness lies in the fact that it is the source of three major river systems namely Narmada, Johilla and Sone (Ganga basin) and Ama Nallah stream that join Arpa river (Mahanadi basin).

The biosphere reserve area includes Maikal hill ranges, the junction of Vindhyan and Satpura hill ranges forming a triangular shape. The geology of the area is varied.

3.1.1.5 Climate:

The biosphere area has a typical monsoon climate, with three distinct seasons-summer form March-June, rainy from July-October and winter form

November-February. Generally, May and June are the hottest month whereas December and January are the coolest month of the year. Clouds prevail during the southwestern monsoon season i.e. from June-September. The relative humidity of the region is fairly high due to thick vegetation of Sal forest at higher elevation and frequent showers of rain throughout the year. The humidity remains very high during July-September. Fig. 3.2 shows the meteorological observations of Bilaspur district during the study year.

3.1.1.6 Rainfall:

The average annual rainfall of the area is about 1624.3 mm distributed over an average annual rainy days of 92 (range 71-118 days). The average monthly rainfall indicates that a few showers of rain occur throughout the year in this area but 85.42% of average annual rainfall is received during the monsoon months extending from June to September. The rainfall increases and reaches maximum of 460.58 mm in the month of August, after which it decreases to the lowest is 12.98mm in the month of December.

3.1.1.7 Soil:

The soils of the area are generally lateritic, alluvial and black cotton type, derived from granite, gneisses and basalts. Black cotton soil is occurring in Dindori-Pendra Road and also along the Narmada River. In part of Amarkantak, laterite occurs mainly as capping above the Deccan trap. Red soil is also found on hilltops, which is murramy or loosely packed and gritty, generally shallow and incapable of supporting good forest growth. Alluvial soils cover on the plateau generally varies between 1 to 5m thickness is also observed at some places. It is probably in such areas that marshy condition develops due to poor seepage.

3.1.1.8 Land use pattern:

The land use analysis indicates that forests constitute 66.31% of the area (2423.54 sq. km.), while agricultural lands constitute 34.03% (1305 sq. km.) and wastelands are about 1.36% covering 52.22 sq. km. only. The rest of area is built up land (0.11%), totaling 1.42% of the total area. Under the forest category, maximum area is covered by closed forest with 55.35%, followed by open forest (4.53%), degraded forests (2.45%) and use is available in the area except an industrial state and there is thus vast opportunity for introducing sustainable, environment friendly technologies to various land uses under Biosphere Reserve programme.

3.1.1.9 Forest and flora:

The forest area of the Achanakmar-Amarkantak Biosphere Reserve represents tropical deciduous vegetation and can be classified into Northern Tropical Moist Deciduous and Southern Dry Mixed Deciduous forests (Champion and Seth, 1968). The entire area of sanctuary is hilly in which good grades of sal, mixed and bamboo forests are situated. The major species of the forest are *Shorea robusta*, *Terminala tomentosa*, *Anogeissus latifolia*, *Adina cordifolia*, *Gmelina rborea*, *Dalbergia paniculata*, *Ougeinia oojeinensis*, *Lagerstroemia parviflora*.

3.1.1.10 Fauna:

In this Biosphere Reserve which is covered with forests we can find tiger, panther other than these carnivores gaur, sambhar, spotted deer, chausinga, langur, wild boar, bear, flying squirrel etc. are in plenty. Among

birds peacock, maina, cuckoo, parrot, vulture, robin, kingfisher, seven sisters, nightjar etc. are found.

3.1.1.11 Forest villages:

There are 22 forest villages inside the sanctuary comes under Biosphere Reserve, a part where study was carried out in Chhattisgarh area. The total population is 5796 out of which 90% are Baiga, Gond and Oraon (scheduled tribes) and rest 10% are harijans (scheduled casts) and other groups.

3.1.2 Udanti Wildlife Sanctuary:

3.1.2.1 General:

Udanti Wildlife Sanctuary was established in the year 1983. The sanctuary lies in a total area of 237.28 sq km. The sanctuary situated on Raipur-Deobhog state highway of Chhattisgarh-Orissa border at a distance of 162 km away from Raipur. Udanti wildlife sanctuary derives its name from the river flowing from west to east throughout the sanctuary. The river divides the sanctuary into almost equal halves of a well forested area of South-Eastern Raipur district. The forest types of the area represent tropical deciduous forest. The sanctuary was notified as Wildlife Sanctuary in the year 1985. More than 80% of the area is covered by different forest types.

3.1.2.2 Geographical location and physiography:

The study was conducted in Udanti Wildlife Sanctuary situated in Raipur district, Chhattisgarh. It is located in Central India in between the longitude 82° 03' E to 82° 84' 18" E and latitude 20° 0' N and 20° 10' 53" N. The sanctuary is famous for its wilderness value. It directly benefits the cause of conservation since tourists are exposed to the process of conservation

education and nature interpretation through wildlife tourism. The undulating terrain of Udanti is covered with well stocked forests. The ground is covered with patches of grasses, plants bushes and saplings. The sal forest glazitters in the majority of North-Western half of the sanctuary. Fig. 3.3 (a) shows the location map and Fig. 3.3 (b) shows the detail map of Udanti Wildlife Sanctuary.

3.1.2.3 Objectives:

To strengthen the cause of conservation of the sanctuary through conservation oriented tourism and become a centre of nature education in this region through following objectives:

1. Informed wilderness experience will be provided to the visitors. Tourist guide will be trained and interpretation centre will be created.
2. To visitors to view a cross section of the sanctuary values. Tourism zone will be created covering dense forest, waterfalls.

3.1.2.4 Climate:

The climate of study area is tropical. Total annual rainfall is 1402 mm. More than 80% of the rainfall occurs during monsoon season from mid June to September. Number of rainy days varies from 80-90 with an occasional rainfall during October to February. Mean monthly minimum and maximum temperature varies from 11.5⁰C and 41.1⁰C. The maximum temperature goes beyond 45⁰C in May and minimum below 10⁰C in December. Relative humidity is generally higher (82%) in July and August where as minimum below 10⁰C in December .Relative humidity is generally higher (82%) in July and August where as minimum (29%) in May. Fig. 3.4 shows the meteorological observations of Raipur district during the study year.

3.1.2.5 Geology:

The main composition of the study area has Dolestic sand stone, lime stone and conglomerates Granite type. In some place near the village Payelikhand valuable diamond mineral deposit is also reported.

3.1.2.6 Soil:

Soil is mostly sandy loan, which is deep at valley and shallow on slope. Murram soil is also found only in patches in plain areas of the sanctuary. Soil erosion and gully formation is usually common. The soil colour varies from black grey to reddish. On the other hand, this soil having good water holding capacity and supporting rich vegetation. Some of these lands are utilized for cultivation of Agricultural crops.

3.1.2.7 Water resources:

The channels are more or less filled during the monsoon season. The majority of bigger channels flow from South-West hill terrain of study area form South-West direction to North-East direction. The hill terrain of study area forms few important catchments. The water from different catchments collects in the Udanti River from which ultimately joints in Mahanadi River. Many village-made ponds and natural ponds do exist.

3.1.2.8 Forest types and flora:

Different types of forest vegetation occur in the study area. Champion and Seth (1968) have classified the forest vegetation of the area into two major forest types *viz.*,

1. Dry peninsular Sal forest (5 B/c Ic(iv))
2. Northern Dry mixed deciduous forest (5 b/c 2 (ii))

The predominant woody flora found in these forests are *Shorea robusta*, *Terminala tomentosa*, *Anogeissus latifolia*, *Cleistanthus collinus*, *Tectona grandis*, *Boswellia serrata*, *Buchanania lanzan*, *Dalbergia paniculata*, *Diospyros melanoxylon*, *Emblica officinalis*, *Bauhinia vahlii*, etc. In understory *Woodfordia fruticosa*, *Zizyphus sp.s*, *Phoenix acaulis*, *Nyctanthes arboristis* are commonly found. Among *Poaceae* many important grasses of 26 types are present. Forest mainly contains 85 tree species, 28 species of climbers, 28 species of shrubs and herbs, 26 grasses and bamboos. Several ferns, bryophytes and algae have also been observed in the area.

3.1.2.9 Fauna:

Udanti boasts of more than 120 species of birds including several migratory ones. Different species of mammals, birds, reptiles along with other organisms are found in the study area. The important fauna are Indian wild buffalo, tiger, gaur, spotted deer, sambhar, barking deer, chausinga, nilgai, monkey, hare and large number of birds and reptiles are commonly seen and most common among them are peacock, jungle fowl, bulbul etc. A specific reason for the creation of the sanctuary is the presence of the endangered species- Wild Buffalo (*Bubalus bubalis*) which is state animal of Chhattisgarh and found in Assam and Chhattisgarh. Udanti is one of the rare wildernesses where the biggest animals, Wild buffalo and Bison can be seen together.

3.1.2.10 Other land use practices:

3.1.2.10.1 Agricultural land crops:

There are around 12 villages inside and at the periphery of Udanti. The inhabitants are poor simple people. Principal agricultural crops cultivated

in the study area are paddy and *Lathyrus*. Gram is also sown in few patches; besides gram other pulses like arhar, green gram and mung are also cultivated in marginal lands and paddy field bunds. Among vegetables the prominent crops grown in this area are brinjal, raddish, beans, tomatoes, etc.

3.1.2.10.2 Grasslands:

Grasslands are also found in patches in open areas; occasionally occur as under-storey in mixed deciduous forests and also in hill plateaus. Biotic interferences coupled with edaphic factors helped in the perpetuation of grasslands are also found with *Phoenix* sp. in the forest.

3.1.2.11 Tourist Zones:

An exclusive tourist zone is created to enable visitors to view a cross section of Sanctuary values and enriching wilderness recreation by visiting following areas-

1. Waterfalls.
2. Interpretation centre.
3. Trekking on high hills.
4. Nature trail from nallahs.

Selection of zone is done such that waterfalls, Udanti river and dense forest area is covered in a small compact area.

3.1.2.12 Interpretation centre:

A building for interpretation centre at Koeba has been constructed. Interpretation material on wild buffaloes and other wild animals has been displayed. The plan envisages interpreting ecology of wild buffaloes, ecology of Sal forest, animal and birds in the sanctuary. Basic amenities for toilet,

drinking water have been developed. At tourist visiting places soothing floristic diversity have been created to appeal tourists.

3.1.2.13 Ecotourism:

Ecofriendly tourism has been supported and developed. This will link local people for conservation and also create a source of income to them. This will benefit both sanctuary people and tourists. Local people who are of FPC (Forest Protection Committee) have been involved.

3.1.3 Local tribes of the study area:

3.1.3.1 Kamar:

Kamar is a very primitive tribe who principally inhabit Bindranawagarh region and Dhamtari, Mahasamund and Raipur district and also adjoining areas of Orissa. The Kamars inhabit 219 villages (134 in Gariaband tehsil of Raipur district and 69 in Dhamtari district). The Kamars are basically shifting cultivators but after settlement they are not interested in settled cultivation therefore, they started bamboo work, craft and NTFP collection for their livelihood. The tribe is arbitrarily divided into two groups known as Paharpatiya and Bundharajya depending on whether they inhabit hilly terrain or plain areas. The dialect of the Kamars is known as Kamari. The Kamars are mainly of medium stature, bodies are well built. Constant use of axe, bow and arrows in the forest gives a good shape to their muscles. The Kamar is individualist by nature. He wanders alone in the jungle with his bows and arrows. Another notable trait of Kamar character is his sense of dignity. There are a number of complex rules and regulations governing the interaction and intercourse of the Kamars with other tribes and casts, especially prohibiting them from eating food cooked by outsiders. The fruits

of some of the trees like Tendu (*Diospyros melanoxylon*), Char (*Buchanania lanzan*) and Mahua (*Madhuca latifolia*) are used by the Kamars to supplement their diet. A number of edible roots, tubers and leafy vegetables are also found in the forests and are abundantly used by the Kamars as items of food. They eat almost anything; jungle fruits, jungle birds, rats, squirrels, wild boars are some of the items which are all eaten. The dress of the Kamars is very simple. Among Kamars both men and women wear very few ornaments. They do not have any ceremonial or special dresses for dance. For the chherchhera dance, however they put on gourd masks and cloaks of bear's skin. The women are tattooed on the shoulders, back of hands and legs. The population is economically backward. High percentages of nuclear households are below poverty line.

3.1.3.2 Bhunjia:

In Chhattaisagh, the Bhunjiyas are all confined to Bindranawagarh region and Dhamtari and Raipur districts, the former being their principal habitat. The Bhunjiyas are divided into two endogamous groups- Choukhtia Bhunjiyas and Chinda Bhunjiyas. The former of these have 'arrow marriage' system and they construct their kitchen separated from the main house at some distance. The Cinda Bhunjiyas do not observe these customs. The Bhunjiyas are a tribal group with a low population. They are believed to have originated from gond women. The Bhunjiyas live with Kamars, Gonds etc. in the villages. They wear simple dress. The Bhunjiya women wear godnas on legs, hands and face. They wear ornaments on all parts of the body. The staple food of Bhunjias is rice, kodai, basi pej. Sometimes they also cook kulthia dal, urad dal. Among non-vegetarian food they eat goat, hare, fowl,

fish, and different types of wild birds. Drink mahua liquor and smoke bidi. Their livelihood mainly depends on agriculture, collection of minor forest produce, labor work, etc. earlier they used to do hunting also. There is traditional Cast Panchayat among Bhunjia tribes. They perform wedding dance on wedding ceremony, Padki performed by women on diwali, men perform Ram-saptah on holi. They sing dadariya, phag, padki geet, ram saptah geet, etc. The major problem which they face is economic backwardness as the agricultural land is unirrigated the production is very less.

3.1.3.3 Oraon:

The Oraon are found in Raigarh and Sarjuga districts. This tribe has largely come under the sway of Christianity and in the Census of 1971; more than 8 percent of them had returned Christianity as their religion in Raigarh district. Because of this the Oraons are divided into two groups- the Christian Oraon and Sansaria Oraon (the non-Christian Oraon). Oraon could easily be said to be the most literate tribe of the state. The original name of the tribe is believed to be Kurukh and this is the name of the speech of the tribe. It is quite different from Gondi. One characteristic feature of the tribe used to be 'Dhumkuria', but this institution has disappeared in Madhya Pradesh. The Oraon are an important tribe of Central Indian Tribal Zone, but their native place is Chotanagpur, now in Jharkhand State. The chief income sources are agriculture, collection of minor forest products and labor work. The major festivals of Oraon tribe are Karma puja, Sarhul, Nawakhai, Phagun, etc. on these occasions they offer goat, fowl, etc. The Oraon have strong belief on ghost and spirits, black-magic. Such priests are called 'Pahan'. Songs and

dances form their chief winter-night entertainment. Their most popular dances are Jadar, Sarhal and Jatrakharia. The Oraon have evolved democratic institutions like tribal council, called "Partha Panch". The Oraon show indifferent to hygiene and that is why other tribes have nicknamed them as 'Ravan Bans' taking the euphony of the word Oraon to suggest Ravan. However, the Oraons are cheerful in disposition and 'eat, drink and be merry' is their characteristic style of living. The biggest problem of Oraon is lack of irrigation which influences their economic life.

3.1.3.4 Baiga:

The Baiga tribe is concentrated in Rajnandgaon and Bilaspur districts of Chhattisgarh. The Baigas are known for their shifting cultivation known as Bewar. This has been prohibited now. The tribe is divided into 12 endogamous divisions known as jat. The Baigas of Mandla and Bilaspur area are known as Bhumia. The term Bhumia means 'holder of land' and is, in this respect, an honorific term. The forests in which they were living since centuries have now been deprived of their possession. The pressures due to outsiders invasion in their area is increasing. Neither there is transmission of education nor have they got new modes for income. The Baigas call themselves as 'King of the Forest'. All the Baigas live in dense forests, on the sides of rivers, nallahs. The Baiga tribes are also said to be 'Son of Nature'. The Baigas wear general, simple clothing, but both men and women like to wear ornaments. Men wear bracelet and one or two brass ear-rings. Women wear a lot of ornaments. During dance Baiga men and women are well decorated with ornaments. Due to their behavior they like to live on high places and inside forests. They like to live in groups. They prepare their own

houses Eat and drink in donas and pattals made of mahul leaf. They drink pej and mand (liquor prepared out of mahua flowers). They are non-vegetarians and eat different types of meat. They hunt sambhar, jungle kharha, etc. padki, kabootar, haril, mayor, etc. throughout the year they drink pej prepared out of kodai, kutki and makka. The Baiga tribe blindly faiths blackmagic. They have strong belief on ghosts, spirits, etc. Guniya Baiga is the doctor of the tribal group. The economic base is agriculture, cottage industries, animal husbandry and labor work, but the earnings are not sufficient enough to raise their living standard.

3.1.3.5 Gonds:

The Gonds are the largest indigenous tribes of Central India, constituting about three-fourth of its total tribal population. They are found in almost all the districts of Madhya Pradesh and Chhattisgarh, though their major concentration is in the southern and eastern parts. Regarding the original home of the tribe, nothing was known till recently. The dialect that Gonds use in their daily life is called 'Gondi'. The Gonds like to live in scarcity. They believe in fate and live a cheerful life. Liquor is the favorite drink of Gonds which is consumed by people of all age groups. On festivals and rituals they offer liquor to god. Mahua is one of the major foods of the Gonds. They are non-vegetarians and fowl, goat are their favorite dishes. Hunting has very important place in Gond life, earlier it was a major occupation of the tribe. Another source of income is collection of minor Forest products. Generally Gonds take two crops from their fields, but due to practice of old traditional farming system they could not get much output. The 'gudna' tradition is prevalent among the Gond tribe. They believe it to be

the real jewels of women. The Gonds can hardly be called poor people and they have centuries of experience and a tradition of struggle and achievement. Given chance true to their ancestral tradition, they are bound to emerge as a strong element of the larger Hindu society.

3.2 Experimental Details:

3.2.1 Sampling:

The study for species composition and species diversity was conducted after repeated survey of Udanti Wildlife Sanctuary and Achanakmar- Amarkantak Biosphere Reserve. For ecotourism approach the sampling sites inside the sanctuary near the tourist spots were selected. Six sites – three at Udanti and three at Achanakmar Sanctuary were selected. At Udanti the sites selected were one around the circular road tank (bison site), second in Sal patch and third in a mixed patch near rest house where the probability of watching wild animals is high. At Achanakmar-Amarkantak Biosphere Reserve, the three sites selected were- one site at Achanakmar mixed patch, second at Chhapparwa Sal patch and third at Lamni on the way to Mendri Sarai mixed patches. The selections of sites were made purposively.

3.2.2 Method

The stratified random sampling procedure was adopted for characterization of vegetation as both the forests were heterogeneous. The phytosociological analysis in each forest sites was carried by randomly laying sample plots of 10x10 m in size for trees, 5x5 m sample plots for shrubs and 1x1 sample plots were laid down for herbs and grasses. Randomly 10 sample plots were laid down in each site. In each quadrat, gbh (girth at breast height) of each adult individual tree was measured. Stem girth of each adult

individual tree was measured at 1.37m gbh, from the ground level. For shrubs the diameter of the plants at crown level was measured using digital caliper. For herbs number of individuals and for grasses number of tillers was counted. Thus all individuals were enumerated by species and measured.

3.2.3 Phytosociological analysis:

The vegetation data in each forest sites was quantitatively analyzed for frequency, density and abundance by using following expressions (Curtis and Mc Intosh, 1950).

$$\text{Density (tree/ha)} = \frac{\text{Total number of individuals of a species}}{\text{Total number of quadrates studied}}$$

$$\text{Frequency (\%)} = \frac{\text{Number of sampling units in which species occurred}}{\text{Total number of sampling units studied}} \times 100$$

$$\text{Abundance (\%)} = \frac{\text{Total number of individual of the species in all sampling units}}{\text{Number of sampling units in which the species occurred}} \times 100$$

Basal area of trees was calculated as cross sectional area of stem at breast height i.e. at 1.37 m from the ground level, and for shrubs the collar diameter was measured few centimeters above ground level with the help of digital caliper. The relative density, relative frequency, relative basal area, relative abundance was calculated using following equation.

$$\text{Relative density (RD)} = \frac{\text{Density of the individual species}}{\text{Total density of all species}} \times 100$$

$$\text{Relative frequency (RF)} = \frac{\text{Frequency of the individual species}}{\text{Total frequency of all the species}} \times 100$$

$$\text{Relative basal area (RBA)} = \frac{\text{Basal area of the individual species}}{\text{Total basal area of all species}} \times 100$$

$$\text{Relative abundance (RA)} = \frac{\text{Abundance of the individual species}}{\text{Total abundance of all species}} \times 100$$

The Importance Value Index (IVI) was determined as the sum total of relative frequency (RF), relative density (RD) and relative dominance (RD) (Phillips, 1959).

$$\text{Importance value index (IVI)} = \text{RF} + \text{RD} + \text{RBA}$$

3.2.4 Plant diversity analysis:

Plant diversity in different sites was quantified by following diversity indices:

- a. **Shannon Index** Shannon and Weaver, 1963 was used for the species diversity

$$H' = - \sum P_i \log_2 P_i$$

Where,

- i. P_i is the proportion of total stand basal area represented by the i th species. The working formula given by Smith 1974 was used here

$$H' = 3.3219 [\log_{10} N - (\sum \frac{N_i}{N} \log_{10} \frac{N_i}{N})]$$

Where,

N_i was the total basal cover of species i and N was the total basal area of all the species. The factor 3.3219 was used to convert the index value to \log_2 .

b. **Concentration of dominance** was measured by Simpson Index (Simpson, 1949)

$$Cd = (N_i / N)^2$$

Where,

N_i and N were same as explained above and it varies between 0-1.

c. **Equitability (E)** was calculated as suggested by Pielou (1966).

$$E = H' / \ln S$$

H' = Shannon Index and

S = the number of species.

d. **Species richness (d)** was calculated by the following equation (Marglef, 1958).

$$d = S - 1 / \ln N.$$

Where,

S = total number of species,

N = basal area of all species ($m^2 ha^{-1}$)

e. **Beta diversity (bd)** was calculated as (Whittaker, 1972)

$$bd = S_c / S$$

Where,

S_c = total number of species in all site,

S= average species per site,

These indices were calculated following Sagar and Singh (1999), the data thus generated were synthesized and potential diversity of each site was characterized. The diversity value of each site was assessed. The diversity across the forest site selected was correlated with the structure parameters IVI, basal area, density etc.

3.3 Sample and Sampling Procedure:

3.3.1 Selection of Respondents:

For collection of primary data two types of respondents were selected in each of the study area:

1. Tourists/ Visitors.
2. Local people.

Selection of Tourists/ Visitors as respondent was done for collection of information about the ecotourism awareness among the Tourists/ Visitors visiting the protected area. Their idea of visiting, knowledge about protected area and its importance and their expectations in relation to the infrastructure and facilities available in the protected area. Local people were selected as respondents to know whether they have knowledge of ecotourism principles or not, if they are aware of the benefits they can get through ecotourism or not, whether they understand what is protected area, conservation and their importance.

3.3.2 Method of enquiry and collection of data:

The enquiry was conducted by survey method and collection of information was based on primary data. The information was gathered through interview using separate questionnaires for tourists/ visitors and local

people. Information regarding their occupation, sources of income, knowledge about the forest area, flora and its local utilization were collected. The tourists available in different seasons in both the study areas were interviewed and were asked to fill the questionnaires. The local people from different occupation classes were interviewed and asked to fill the performa. The interview was made from the villagers of the village where experiment was conducted. Prior to interview, the respondents were taken into confidence by revealing the actual purpose of the study and also care was taken to develop good rapport with them. The interview was conducted in the most informal and friendly atmosphere.

CHAPTER – IV

RESULTS AND DISCUSSION

The results of present investigation entitled “*Studies on prospects and potentials of ecotourism in Chhattisgarh with special reference to biodiversity conservation of protected areas*” are discussed in this chapter. The findings are presented in three separate parts on the basis of the objectives of study.

4.1 To study the ecotourism activities in Achanakmar-Amarkantak biosphere reserve (particularly in Chhattisgarh region) and Udanti wildlife sanctuary, on various aspect like

Tourist Entry fees:

The entry fee structure in both the places has variations. The results of Achanakamar-Amarkantak Biosphere Reserve result are shown in table 4.1. The entrance fee of individual person was Rs 15/- for Indians and for foreigners Rs 150/- per head. The entry fee for a group was Rs 200/- . The vehicle charges were Rs. 50/- for car, gipsy, station vegan, etc. however, for minibus and buses the charges were Rs. 200/-. The charge of still camera was Rs. 25/- and guide charges Rs. 75/- . In case of Udanti Wildlife Sanctuary the fee for individual person was Rs 10/- for Indians and for foreigners Rs 100/- per head. The entry fee for group was Rs 100/- for one group. The vehicle charges were Rs. 25/- for car, gipsy, station vegan, etc. however, Rs. 100/- for

the minibus and bus. The charge of still camera was Rs. 10/- and guide charge was Rs. 50/- and collected by the forest department. This variation in the entry fees may be due to the difference in the unit of protected area, Achanakamar-Amarkantak Biosphere Reserve is a larger unit and Udanti Wildlife Sanctuary comes under smaller unit of protected area.

Nelson (2004) studied the evolution and impacts of community based Ecotourism in northern Tanzania. In his study he found that a gate has been setup at the southern end of Engare Sero and tourists entering the area have to pay US \$ 15 per person and this fee goes to Ngorongoro district council and not to the villages. Because it has not put itself in a position to control and manage the tourism enterprises carries out in the area. The Engare Sero village estimated US \$ 2500 annually from payment made by Lodge, only 5 to 10 percent. The result showed that the Engare Sero has a little stack in the income produced by increasing number of tourist staying in beautiful spot. The entry fee structure was very high as reported by above worker because the tourist sites are not managed by the Government of Tanzania. However, in present study the fee structure is very less the revenue earned by the study area is also low. These lower fee charges attract more people in ecotourism so that the indirect benefit of biodiversity conservation may be full filled with this awareness programme. Whereas the livelihood and employment generated would uplift the economic status of the local residents. This shows confirmation of the present investigation.

Infrastructure and facilities:

The result of the infrastructure and facilities available at both the study sites are depicted in table 4.2. The result reveals that the infrastructure facilities at Achanakmar-Amarkantak Biosphere Reserve were more. Government rest house provides 15 rooms to accommodate 60-65 people and the private resorts with 4 rooms and dormitory of 10 bed can accommodate 30-35 people. There were some rest houses and restaurants under construction in the reserve forest area of the Achanakmar-Amarkantak Biosphere Reserve. For transport there were two gipsies available from the forest department, the tourists could bring their own vehicle also. The food facility was also good. There were restaurant and dhabas where food is easily available. There were interpretation centres at Achanakmar and Lamni barrier, boards having information about plants, animals and tourist spots. Similar boards having information about plants and animals were shown on boards at rest house. A medicinal garden had been setup at Ataria (5km. from Lamni) along with a forest nursery of medicinal plants which can be used to educate the tourist regarding medicinal plants and their respective uses. There were some more medicinal gardens at Keonchi as we proceed towards Amarkantak.

The infrastructure facilities in Udanti Wild Life Sanctuary were provided only by the Government. There are 6 Rest houses with 14 rooms, 5 dormitory and still some mud huts under construction. There were staying facilities available in which 50-60 people can be accommodated. No vehicle was provided by the forest department to visit inside. There were few shops inside the wildlife sanctuary; however the food was prepared at the rest house

by placing the order. A restaurant had been newly constructed at the Koyeba ecocenter by the forest department. Koyeba ecocenter is one of the information centre for the tourists. It had been observed that due to increase in infrastructure and other facilities at the two sites the number of tourists has been increased in last few years as shown in table 4.3 and Figs. 4.1 (a) and 4.1 (b). To collect the response of the tourists visiting the present study sites a interview schedule was conducted and summarized in table 4.4 and from these observations the suggestions has been drawn which are shown in table 4.5.

Bhattacharya *et. al.* (2006) studied the Environmental Auditing in ecotourism in Van Vihar National Park, Bhopal (M.P.) India. Information received from visitors were not having good infrastructure facilities where about 66% visitors felt that the facilities inside the Van Vihar were inadequate, 26% were satisfied with the adequacy of facilities and rest did not responded. In present study of infrastructure facilities were better in Achanakmar-Amarkantak Biosphere Reserve; however the less infrastructure facilities were available at Udanti Wildlife Sanctuary. This difference may be because of the site specific and the large unit of protected area at Achanakmar-Amarkantak Biosphere Reserve as compared to Udanti Wildlife Sanctuary. The result revealed that still there is a need to improve the infrastructure facilities in both the study sites and the tourist would not be discouraged for the unavailability of the facilities e.g., staying, transport, guide etc. The results showed that the inadequate infrastructure facilities

would not attract and will adversely affect ecotourism. Therefore the results of present investigation are in confirmity with the above mentioned report.

Kenya Wildlife Services Report (2004) on ecotourism potential and development within Nakuru National Park and its catchments stated that the tourist activities need to be diversified and they may be encouraged to extend their stay and repeated visits. The Gazette Menengai Crater is a conservation area and needs to develop tourist facilities like natural trails and campsites to encourages visits and maintenance of old colonial houses. In this report they have emphasized to develop the ecotourism marketing strategy to create a credit line for local people who would like to venture into ecotourism. The litter and other wastes should be properly disposed off in the park. They concluded that the infrastructure facilities may play a significant role to attract the people for ecotourism. The result of above report and present investigation are similar showing that inadequate infrastructure will not increase the ecotourism industry.

Mukerji (2006) in his study for conservation and management of Biodiversity in Indian forests has suggested that as ecotourism is very popular in India, the management of visitors should be an important component in park management plan. The local people should be involved as trained guides and to provide staying facilities to visitors, limited number of tourists should be allowed on the basis of carrying capacity of the park. The hotel which has been setup in the park is the chief attraction has to pay 5% surcharge of all room rents to the park authorities for implementing ecodevelopment programme. In present investigation no such surcharge has been collected by

the forest department. This may be to attract more number of tourists for ecotourism programmes. The results of the investigation conducted are almost similar as reported by the above study shows the confirmation of our findings.

Rawat & Sharma (2003) suggested that infrastructure for developing Stakeholder based ecotourism in Uttaranchal, India. According to them the facilities for “3A” (Approach, Arrival and Accommodation, available for the development of ecotourism in Uttaranchal is highly inadequate. There was a need of participatory approach for village level existing institutions for formulating the infrastructural support to the government for ecotourism. But for “approachability” and “arrival” the state governments and the local people play significant role for the proper management of ecotourism, training is another issue to be addressed by the state government. They suggested that local communities must be trained for wider participation and distribution of benefits. These training programmes should be conducted not only for direct participation in the tourism industry, but also for indirect participation in ancillaries industries, training in the agricultural sector and the maintenance of hygiene standards as without such programme’s benefits, goods and services may be limited from being provided to the needy ecotourism industries. The findings received in the present investigation showed that proper management and trained people will play a significant role to enhance the ecotourism industries in Chhattisgarh. The results are almost similar as reported by above worker.

Tourist Spots:

The list of tourist spots of Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary are given in table 4.6 and 4.7. There were about 20 major tourist spots at Achanakmar-Amarkantak Biosphere Reserve some of which are Sihawal Sagar, Pandwani Talab, Lakshman Pav, Nagbahra, Lakshman Dongri, Mendri Sarai, Manjhi Dongri, Jhandi Dongri, Tangli Pather, Amarkantak, Raksha Chat Waterfall. Whereas at Udanti Wildlife Sanctuary there were about 13 major spots which includes Godena Waterfall, Deodarha Waterfall, Chowksill Hill, Mann Dongri Hills, Chulha Dongri Hills, Sikarser Water Reserve etc. there were many other spots which can be developed as tourist attraction place for adventure tourism. To develop these spots proper planning and advertisement is needed, brochures of flora and fauna would be made available as provided by other tourist spots in India and abroad, which will enhance the development work of the area.

The Kenya Wildlife Services Report (2004) found that Lake Nakuru, Menengi Hill, Lake Solai, Bahati area with attractive environmental features like open water, hills and cliffs, ancient lake flow, solai rangeland, open grasslands, etc. also possess cultural attractions within the major ecotourism zones. These zones possess high potential to attract the tourists and thus promote ecotourism. Similar ecotourism zones have high potential for ecotourism have been found in the present study areas also.

Bhattacharya *et. al.* (2006) conducted a study at Van Vihar National Park, Bhopal, M.P. (India) and found that the National Park being the smallest National Park of the country has most of the area covered with hilly and undulated varying gentle to steep slopes. The park with greenery reflects capacity of nature and the lake adds immense beauty by attracting migratory birds. The tourist spots of the present study areas also possess beautiful features which immensely attract the tourists for ecotourism.

4.2 Documentation of important flora and fauna having commercial, aesthetic and medicinal value.

Documentation of flora: The flora documentation was done by quadrat method using stratified random sampling method. A list of flora documented at the two study sites Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary are listed in table 4.8 and 4.9. The diversity study was conducted at three different sites of each of the study area. The study was conducted for three vegetation layers viz., trees, shrubs and herbs. The three sites of Achanakmar-Amarkantak Biosphere Reserve were site-I – Sal forest (Chhapparwa village), site-II – Mixed forest (Lamni village) and site-III – Mixed forest (Achanakmar village). The three sites of Udanti Wildlife Sanctuary were site-I – Compartment No. 81 (Bison site), site-II – Compartment No. 80 (Tourist path) and site-III – Compartment no. 85 (site for easy view of wild animals).

In the phytosociological study conducted at Achanakmar-Amarkantak Biosphere Reserve total 1607 plants were encountered of which 635 trees, 452

shrubs and 520 herbs representing 33 families, 63 genera and 77 species were encountered shown in table 4.10 and Fig. 4.2 (a). Most diverse families were Fabaceae (13), Acanthaceae (5), Anacardiaceae(4), Combretaceae(4), Euphorbiaceae(4), Zinziberaceae(4), Tiliaceae(3), Moraceae(3), Malvaceae(3) and Asteraceae(3). A total of 37 species of trees belonging to 20 genera and 19 families had been documented. The shrubs and climbers belonging to 18 species, grouped in 17 genera and 13 families and herbs and grasses in 22 species, 19 genera and 8 families were encountered.

The phytosociology of Udanti Wildlife Sanctuary encountered 2327 species of plants, which includes 690 trees, 747 shrubs and 890 herbs belonging to 35 families, 81 genera and 96 species shown in table 4.10 and Fig. 4.2 (b). The dominant families are Fabaceae(18), Poaceae(7), Acanthaceae(5), Euphorbiaceae(5), Anacardiaceae(4), Rubiaceae(4), Asteraceae(4), Zinziberaceae(4), Moraceae(3) and Malvaceae(3). Out of the plant species encountered there are 43 species of trees belonging to 35 genera and 21 families, 23 species of shrubs and climbers belonging to 20 genera and 14 families and 28 species of herbs and grasses belonging to 25 genera and 10 families were found.

The biodiversity indices were calculated for different study sites in two different seasons (winter and summer). The values of various vegetation layers of Achanakmar-Amarkantak Biosphere Reserve are given in table 4.11 and Fig. 4.3 (a) and 4.3 (b). The species richness ranged from 11.9 (site-I) to 5.027 (site-III) for trees, for shrubs richness value ranged from 2.555 (site-II)

to 0.717 (site-II) and for herbs ranged from 3.232 (site-II) to 0.2529 (site-III). But during summer the ground vegetation could not be recorded at site-I due to loss of vegetation due to forest fire. This shows that overall richness of species is more for site-II and site-III is least rich in species.

The diversity index (H') for trees ranged from 2.387 (site-II) to 0.307 (site-III), for shrubs the value ranged from 1.84 (site-III) to 0.307 (site-III) and for herbaceous species diversity ranged from 4.04 (site-II) to 0.76 (site-III). Evenness index or equitability (E) for trees ranged from 2.093 (site-I) to 0.61 (site-II), for shrubs the equitability ranged from 1.026 (site-III) to 0.35 (site-II) and for herbs the value ranged from 1.401 (site-II) and 1.103 (site-III). This shows that overall evenness of distribution of individuals within each species is better for site-II as compared to site-I and least at site-III.

The Concentration of dominance (C_d) ranged from 0.9 (site-III) to 0.3 (site-II). C_d for shrubs ranged from 0.9 (site-II) to 0.5 (site-III) and for herbs it ranged from 0.7 (site-III) to 0.1 (site-I). The range of beta diversity for the trees was 3.467 (site-I) to 1.62 (site-I), for shrubs ranged from 1.875 (site-II) to 0.833 (site-III) and for herbs it was 1.892 (site-I) to 0.991 (site-III). This shows that concentration of dominant species was highest for site-I, then for site-II and least for site-III. Overall beta diversity was highest for site-I and least for site-II and site-III, thus site-III is most disturbed site.

At Udanti Wildlife Sanctuary the species richness for trees ranged from 18.76 (site-III) to 8.236 (site-I), for shrubs the value ranged from 1.897

(site-II) to 0.996 (site-I) and for herbs this value ranged from 3.29(site-III) to 0.465 (site-I). The shrubs and herbs showed lower species richness during summer season. At two sites (II and III) no species could be recorded as the ground vegetation was lost due to forest fire at these two sites. The diversity indices are shown in table 4.12 and Fig. 4.4 (a) and 4.4 (b). This shows that overall richness of species is more for site-III and site-II is least rich in species.

The diversity index (H') for trees ranged from 3.996 (site-III) to 2.047 (site-II). The H' value for shrubs ranged from 2.29 (site-II) to 1.16 (site-III) and for herbs the diversity value ranged from 3.88 (site-I) to 1.49 (site-I). Equitability (E) value for trees ranged from 1.334 (site-III) to 0.672 (site-II), for shrubs the equitability values ranged from 0.956 (site-II) to 0.559 (site-III) and for herbaceous species ranged from 1.344 (site-I) to 1.085 (site-II). This shows that overall evenness of distribution of individuals within each species is better for site-I as compared to site-III and least at site-II.

The Concentration of dominance (C_d) for tree species ranged from 0.5 (site-II) to 0.1 (site-III), for shrub species ranged from 0.5 (site-III) to 0.3 (site-II) and for herbs the values ranged from 0.4 (site-I) to 0.1 (site-I and III). This shows that concentration of dominant species was highest for site-I, then for site-II and least for site-III. Beta diversity (bd) for tree species ranged from 3.253 (site-III) to 1.756 (site-I), for shrubs the diversity value ranged from 0.838 (site-I) to 0.588 (site-III) and for herbaceous diversity ranged

from 1.5 (site-I) to 0.718 (site-II). Overall beta diversity was highest for site-III and least for site-I and site-II, thus site-III is the most disturbed site.

The vegetation structure for the plant species for the two study sites is shown in table 4.13 and 4.14. The data for Achanakmar-Amarkantak Biosphere Reserve shows that *Shorea robusta* remained the dominant tree at all the three sites (Fig. 4.5 ai and 4.5 aii). At site-I the distribution of most of the tree species were contiguous but at site-II and III the distribution of most of the species was random. The dominant shrub species was *Ventilago maderaspatana* at site-I, *Leea macrophylla* is dominant at site-II and *Ventilago maderaspatana* and *Grewia hirsuta* were dominant species at site-III (Fig. 4.5 bi and 4.5 bii). In winter, the distribution of most of the species was random at all the three sites. While in summer the distribution pattern changes from random to contiguous at site-II. The dominant herbaceous species was *Elephantopus scaber* at site-I, *Curcuma angustifolia* at site-II and *Vetiveria zizanioides* at site- III (Fig. 4.5 ci and 4.5 cii). The distribution pattern of herbs shows regular distribution of most of the species at site-I and contiguous at site-II and III. But in the summer season *Lepidogathis trinervis* was dominant at site-II and III where the distribution was contiguous at site-II and regular at site-III.

At Udanti Wildlife Sanctuary the dominant tree species was *Shorea robusta* at site-I and II while *Diospyros melanoxylon* was dominant at site-III as shown in Fig. 4.6 (ai) and 4.6 (aii), the three sites showed contiguous distribution of most of the species. Among the shrub species *Grewia hirsuta* was dominant at site-I and *Cromolaena odorata* was dominant at site II and

III (Fig. 4.6 bi and 4.6 bii). The distribution of species was contiguous at all the three sites in winter. But during winter the distribution pattern was random for most of the species at site-I. The dominant herbaceous species in winter was *Curcuma angustifolia* at site-I, *Imperata cylindrica* at site II and *Heteropogon contortus* at site-III (Fig. 4.6 ci and 4.6 cii). The distribution was random at site-I and II and contiguous at site-III. The dominant species in summer was *Desmodium trifolium* and the distribution pattern was random for most of the species.

Kushwah and Kumar (2000), studied the status of flora in Protected Areas of Madhya Pradesh, India and showed that the status of biodiversity of flora was: MNP > BNP > INP > SNP (MNP- Madhav Naitonal Park, BNP- Bandhavgarh Naitonal Park, INP- Indravati Naitonal Park, SNP- Satpuda Naitonal Park). This indicated that better biodiversity was present at Madhav Naitonal Park where the values were 2.505 site-1 and 2.511 site-2. Species evenness values were 0.752 site-1 and 0.754 site-2. The diversity index (H') in the present study was lower at Achanakmar-Amarkantak Biosphere Reserve but for Udanti Wildlife Sanctuary the values are almost similar in the above report. This shows that more measures are needed for the protection and conservation of biodiversity at Achanakmar-Amarkantak Biosphere Reserve than those at Udanti Wildlife Sanctuary where the conditions were better than Achanakmar-Amarkantak Biosphere Reserve. The reasons for such conditions may be that Achanakmar-Amarkantak Biosphere Reserve than Udanti Wildlife Sanctuary.

Pathak *et. al.* (1993), performed a quantitative analysis of woody vegetation within an elevation range of 2100-2700 m in the Almora district of Central Himalaya. The results showed that species richness ranged from 15-23 per stand. Diversity index (H') and Concentration of dominance (C_d) ranged from 2.180 to 2.649 and 0.014 to 0.155, respectively. The distribution pattern analysis showed that trees and sapling layers with a few exceptions were randomly distributed in all the stands. The overall distribution pattern of woody species (tree + saplings + seedlings + shrubs) on each stand followed the trend: contiguous > random > regular. Almost similar results were found in the present investigation.

Khurana and Kalpana (2008) studied the phytodiversity in natural forest of Hastinapur. The biodiversity trend was studied in three attributes namely Biodiversity index, Alpha diversity and Beta diversity. Biodiversity index for trees, seedlings and saplings for three study sites were calculated. These values were calculated highest for the vegetation layers of Block-2 forest and lowest for Hillock forest concluding that Block-2 was least disturbed site and Hillock was highly disturbed site. Total number of plants recorded was highest for highly disturbed site Hillock (4001), then for moderately disturbed Block-1 (3833) and least for least disturbed site Block-2 (3650). Maximum number of shrubs was recorded for Hillock due to open forest canopy. Alpha diversity was maximum for Hillock forest and minimum for Block -2. Block-1 and Block-2 recorded lowest values of beta diversity. Hillock forest showed finer division of habitat due to biotic and anthropogenic disturbances. In the present study, beta diversity values are

higher for Achanakmar-Amarkantak Biosphere Reserve in comparison to Udanti Wildlife Sanctuary showing that the community of the former study area is more disturbed.

Chandra *et. al.* (1989) analysed the herbaceous vegetation under Oak and Pine forests along an altitudinal gradient in Central Himalaya. Among the ground floor vegetation greater diversity was found in stands of *Pinus* forest compared to *Quercus leucotrichophora* forest. This showed that greater light intensity in *Pinus roxburghii* forest increased the diversity; uniform greater shade under *Quercus leucotrichophora* forest canopy reduced the diversity. Concentration of dominants (Cd) was found greater in hill top (0.294) of Oak-forest followed by hill base (0.180) of the same forest and hill top (0.166) of pine-forest and lowest in hill base (0.114) of pine-forest. The species richness of herb strata was greater in hill base stand (21) of *Pinus roxburghii* forest and least under *Quercus leucotrichophora* (9) forest. In the present study greater diversity of shrubs and herbs was at site-III of Achanakmar-Amarkantak Biosphere Reserve which had less canopy density whereas, in Udanti Wildlife Sanctuary greater diversity of shrubs and herbs was found at site-II which is the tourist path having patches of grasses at this site. In summer season Achanakmar-Amarkantak Biosphere Reserve site-III shows, more density of shrubs and herb vegetation was rare because tree leaf shedding by deciduous trees covered the ground during this season. In summer, at the floor vegetation was lost at two sites (II and III) of Udanti Wildlife Sanctuary due to forest fire.

Singh (2004) studied the biodiversity of Ratanmahals Wildlife Sanctuary in Malwa region in Gujarat state, India. In his study an overview of floral and faunal diversity and their conservation strategy was presented. The Sanctuary had high floral diversity and conservation values in terms of both flora and fauna. During the enumeration of flora, 515 species of plants were recorded, out of which, 124 species of trees, 31 shrubs, 241 herbs, 39 grasses, 72 climbers and 8 species of epiphytes were encountered. *Tectona grandis* was found to have maximum density. Some other dominant species were *Lagerstroemia parviflora*, *Terminalia crenulata*, *Diospyros melanoxylon*, *Casearia graveolens*, *Butea monosperma*, *Miliusa tomentosa*, *Anogeissus latifolia*, *Mitragyna parviflora*. Among the reported shrubs, climbers and grasses species, some were having high medicinal and economic importances which were less in number. They have also recorded about 70 plant species of ethnobotanical importance in that forest. Whereas, in the present investigation more plants were recorded having medicinal values.

Sundriyal and Sundriyal (2003) studied the species area richness and economic value of small representative-landscapes in the eastern Himalaya. Total 215 species have been recorded in which *Stephania elegans*, *Urena lobata*, *Geranium sp.*, *Casearia glomerata*, *Artemisia vulgaris*, *Viola serpens*, *Rubia sp.*, *Pogonatherum sp.*, *Achyranthes sp.*, *Plantago major*, *Commelina chinensis*, etc. were common species. Most frequently occurring climbers were *Dioscorea sp.*, *Thunbergia coccinea*, *Jasminum primulinum*, *Piper spp.*, *Vitis sp.*, *Smilax sp.*, etc. According to them the economic value of the existing flora is an important consideration for any park/reserve. Of the total

species recorded at all the sites, 26 % of the flora had fodder value, 16 % fuel, 10 % timber, 10 % wild edibles, 5 % medicinal plants and another 13 % were of miscellaneous uses. Thus 80 % of the total flora had some kind of economic value. In the present study at Achanakmar-Amarkantak Biosphere Reserve among 60 identified plants 48.33 % plants are of medicinal importance, 58.33 % of commercial importance, 11.67 % aesthetic importance and 38.33 % are of some other uses. In Udanti Wildlife Sanctuary a total of 64 plants were identified with their importance 48.44 % plants have medicinal importance, 56.25 % plants have commercial importance, 14.06 % plants have aesthetic importance and 35.94 % with some other uses. Table 4.15 and 4.16 shows the list of plant species found at different study sites of Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary along with their utilization whether medicinal, commercial or aesthetic and other uses.

Singh (2007) has given a general account of the vegetation pattern of the Valmiki National Park. About 700 species belonging to 459 genera and 117 families were reported. Apart from general vegetation, endemic, rare, threatened plants had been identified. He has also reported plants having high economic potential, useful as edible (*Curculigo orchioides*, *Dioscorea alata*, *Cassia tora*, *Dendrocalamus strictus*, etc.), timber (*Anogeissus latifolia*, *Gmelina arborea*, *Terminalia alata*, *Toona ciliate*, etc.), fodder (*Moringa oleoifera*, *Bauhinia verigata*, *Dalbergia sissoo*, and a number of grasses and sedges), dyes (*Acacia catechu*, *Indigofera astragalina*, *Wendlandia tinctoria*, *Woodfordia fruticosa*, etc.), gums and resins (*Anogeissus latifolia*, *Boswellia*

serrata, *Sterculia urens*, etc.), medicinal (*Abrus precatorius*, *Andrographis paniculata*, *Elephantopus scaber*, *Helicteres isora*, etc.). He also identified some of the common causes for degradation of the natural vegetation in the park and suggested conservation strategies for the same. The observations and results in the present investigation are similar as reported by above worker.

Subramani *et. al.* (2007) studied the floristic composition, life-forms and biological spectrum of Renuka Wildlife Sanctuary, Himachal Pradesh. A total of 395 species belonging to 316 genera and 115 families were collected and identified. Out of 110 families of angiosperms the eight dominant families Fabaceae (31 species), Asteraceae (26), Euphorbiaceae (20), Poaceae (15), Lamiaceae and Apocynaceae (each 12), Rubiaceae (11) and Acanthaceae (10) accounted for 137 (34.68%) species and 110 (34.81%) genera. The collection included two endemic species, 228 (59.84%) medicinal plants, 85 exotic taxa (21.52%) belonging to 79 genera and 34 families of angiosperms. In the present study also Fabaceae was found as most dominant species and other families reported as dominant families were same as found in the above study.

Shrivastava and Choudhary (2007) in a case study of floristic scenario of Itanagar Wildlife Sanctuary revealed that the habitat is getting denuded and the indigenous flora getting replaced by the introduced invader alien species due to biotic interference. The biodiversity indices of the present study sites indicated that Achanakmar-Amarkantak Biosphere Reserve is facing the problem of biotic interference by the local residents as well as by the visitors.

One of the major problems identified at Udanti Wildlife Sanctuary is invasion of invasive species (*Cromalaena odorat*). Eradication of such species is very important to protect the indigenous flora.

Documentation of fauna:

The fauna documentation was done from records available in the respective Divisional Forest Offices of both the protected areas and interpretation centres as well through regular visits to the sites. Some of the wild animals of Achanakmar-Amarkantak Biosphere Reserve are tiger, Leopard, Spotted deer, Sambhar, Kotri, Python, Wild dog, Sloth bear, Rhesus monkey, Common langur, Flying squirrel, Peacock, etc. Some wild animals found in Udanti Wildlife Sanctuary are Common langur, Tiger, Gaur, Wild buffalo, Indian fox, Sloth bear, Nilgai, Sambhar, Barking deer, Procupine, Peacock, etc. list of fauna species found in the study site are given in table 4.17 and 4,18.

Singh (2004) studied the biodiversity of Ratanmahals Wild life Sanctuary and presented an overview of faunal diversity and their conservation strategy in Gujarat state, India. The faunal diversity revealed that there are 164 species of invertebrates, 10 species of amphibians, 23 species of reptiles, 147 species of birds, 28 mammalian species (recorded) and 22 species (common Langur, Leopard, Ruddy hedgehog, Sloth bear, etc.). It was found that bird species diversity and encounter rate varied with seasonal changes. The presence of tribal population had lowered the population of majority of mammalian species. Population of sloth bear was

relatively very high for numerous plant species provide food through out the year. The fauna documentation in the present study revealed that the visible encounter rates of wild animals had been observed to be low. The reasons for lower encounter rates at Achanakmar-Amarkantak Biosphere Reserve are that animals hide themselves in the forest from community, hunting, the time of the tourist safari does not matches the time of animals movements. At Udanti Wildlife Sanctuary we also found the similar reasons for low encounter rate along with the other reasons, i.e., high density of the forest. To overcome the second cause clearing of lower vegetation is being done on the tourist routs. Also grasslands are being developed on the roadsides for the herbivores, through such activities attempt to increase the visibility of animals.

Shukla (2004) has given an account of Kanha National Park where an approach for conservation of Tigers is being done. Kanha has succeeded in developing excellent situation for conservation of wildlife and particularly tiger. The park harbours a viable population of Tiger and also responsible for saving the barasingha from extinction. Other animal species found in the park are Gaur, Sambhar, Barking deer, Blackbuck, Chousingha, Chital, Langur, Wild pig, Nilgai. For wild animals the Kanha meadows have been maintained by excercising proper grazing management and eradicating obnoxious weeds such as *Cassia tora* and *Lantana camara* for herbivores. The present study areas Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary have been declared as Tiger Reserves also because of which more work is being done to make the conditions of the Protected Areas as pre the Tiger Reserve. Udanti Wildlife Sanctuary is natural habitat

of Wild buffalo (the state animal of Chhattisgarh) thus its importance for conservation has increased.

4.3 To know the impacts of ecotourism on sustainable livelihood of local people.

The relations of local inhabitants of the area with the forest and the impact of the ecotourism activities on sustainable livelihood of local residents were carried out in the protected areas. The inhabitants of the forest villages are mainly tribes and their development being one of the primary concerns for the government for which ecodevelopment programmes are being carried out. To know the knowledge of local residents in relation to ecotourism of these two protected areas, performas were filled by them, Some people feel that there are negative impacts on the forest as well as on the livelihood of local residents since the forest area has been declared as protected area. Though there are some who believe the conservation of the flora and fauna an immediate necessity, but these people are those who are members of forest protection committee. This clearly indicated that there is need of awareness among people in relation to protected area and ecotourism then only the aim of ecotourism can be achieved.

Nelson (2004) studied the evolution and impacts of community-based ecotourism in northern Tanzania and studied that ecotourism has clearly benefited the local communities. The income generated from such activities had provided new development options. The process of developing ecotourism had helped to improve the community's

capacity to manage its natural resources. Some conservation organizations supported community participation in wildlife management and trained two people each from seven villages as village game scouts, and worked to raise awareness for natural resource management at village level. The village council and communities of Lake Natroh area had limited knowledge of tourism and even of nearby community tourism ventures due to remoteness of the area and lack of information and empowerment at village level. In the present investigation also it was found that due to lack of information among the local residents they cannot gain the benefit from it. It is evident from the above study that if the residents are aware about ecotourism they can obtain development benefits from it. A tabulated form of the information collected from them is shown in table 4.19 and 4.20 from which it can be observed that residents of Achanakmar-Amarkantak Biosphere Reserve understand the importance of ecotourism but are not aware about the impacts. For awareness generation there is need to organize training programmes. Similar work is required at Udanti Wildlife Sanctuary also.

Himberg (2004) in the study found community-based ecotourism as a sustainable development option in Taita-Taveta, Kenya. Here ecotourism had been considered to be of high value providing direct benefits. There was joint venture between village communities' type companies and outside investors. These companies rent the banda and the investor had the responsibility for its management and marketing. Local people were employed in management work. Part of the income generated from such ventures was used to facilitate conservation and socio-economic development of those regions. Villagers

considered tourism important as it brings income and offers local youth meaningful job opportunities. The multipurpose use of forests had been introduced for communities and many of them had started with small scale enterprises like beekeeping and tree nurseries. Ecotourism-forest values with direct benefits had also raised people's consciousness about forest's indirect values. The percentage of people of different occupation classes is given in table 4.21 and 4.22 and Fig. 4.7 (a) and Fig. 4.7 (b).

The information collected from the local residents showed that at Achanakmar-Amarkantak Biosphere Reserve 28.60% people were involved in agriculture, 14.30% people in cattle farming, 14.30% in collection of minor forest products (although it is banned inside the protected areas), 57.20% people in labour work, 14.30% people do job/service, 47.60% people in business (eg. Small shops, hotels, dhabas), 9.5% people do other works. Thus a majority of people depend upon the development work provided by the forest department. Similar was the case at Udanti Wildlife Sanctuary. The introduction of sustainable utilization methods of forest resources in the forest villages through trainings can improve their condition.

Stem *et. al.* (2003) studied community participation in ecotourism benefits which revealed that communities where tourism was economically viable alternative, people had left environmentally destructive practices. The reason that has been put forward is fully employed people have less time to hunt or cut trees. Some people have claimed that feeling the value of the forest covered land for tourism they have left their land. But the residents of

the present study area did not give any such response. They did not find any such benefit of ecotourism.

Schoeman (2003) studied the sociopolitical problems involved in establishing ecotourism in Qwa-Qwa National Park. The study revealed that the residents of the park share the benefits in the form of employment and use of natural resources of the park without paying for it. About 90% of the park residents are involved in some form of employment generated by the park, the residents make upto 50% of the permanent workforce. A substantial amount of secondary employment is also generated due to such activities. Residents used the natural resources mainly for cattle farming which had created certain problems influencing the diversity and conservation of natural resources. The park management had to face problems due to the presence of residents in the park.

In the present study interview of local residents was conducted which revealed that at Achanakmar-Amarkantak Biosphere Reserve 28.60% people are involved in agriculture, 14.30% people do cattle farming, 14.30% in collection of minor forest products (although it is banned inside the protected areas), 57.20% people in labour work, 14.30% people do job/service, 47.60% people do business (eg. Small shops, hotels, dhabas), 9.5% people do other works. Similarly at Udanti Wildlife Sanctuary the results revealed that 100% people are involved in collection of minor forest products (mainly mahua flowers, wild fruits), 91.7% people do labour work and 16.17% people do job/service. The results clearly show that the income depends mainly upon the ecotourism development works (construction of roads, rest house, etc.

provided by the forest department and village panchayat), minor forest products and small business (shops, dhabas, hotels).

Stem *et. al.* (2003) in a comparative case study of ecotourism in Costa Rica found that ecotourism provides local economic benefits (e.g. employment, improved infrastructure, increased business for local stores) simultaneously maintaining resource integrity, low-impact on the resources and non-consumptive resource use. They suggested that direct benefits were minimal. They conducted interview of local residents which showed that hunting and deforestation had decreased due to tourism (15.8% and 12.5%), environmental awareness (19.2% and 12.5%), work sources (12.5% and 9.4%), law (35.85 and 47.7%), few animals (2.5%), few trees (2.3%), others (7.5% and 6.3%). People were benefited more from tourism through ideas exchange, training and infrastructure improvements. Some negative impacts of tourism had also been identified in the form of increased solid waste generation, cultural loss. Although through the interview it was found that their lives had improved since tourism's arrival, some people have noted the negative impacts. They felt that ecotourism negatively influence conservation through unintended economic, cultural, social and environmental side effects. Stem *et. al.* (2003) also suggested that indirect benefits were more important than direct benefits.

In the present study an interview schedule was conducted among the local residents of the study area to know the level of knowledge and awareness about protected area, ecotourism and conservation. The results showed that at Achanakmar-Amarkantak Biosphere Reserve 77.7% feel the

importance of protected areas, 5.5% do not feel its maintenance to be important, 22.2% have no information about it, 33.3% people are fully aware about ecotourism and its benefits, 11.1% know it but do not about its impacts, 22.2% do not feel that it will benefit them, 33.3% have no knowledge about it, 44.4% are aware about conservation, 33.3% have little knowledge about conservation and its benefits, 5.5% do not feel that there is need of conservation, 11.1% have no knowledge about it. The awareness level of the local residents of Achanakmar-Amarkantak Biosphere Reserve is shown in table 4.23 and Fig. 4.8 (a).

At Udanti Wildlife Sanctuary 81.8% feel the importance of protected areas, 18.1% have no information about it, 18.1% people are fully aware about ecotourism and its benefits, 63.6% know it but do not about its impacts, 18.1% have no knowledge about it, 54.5% are aware about conservation, 9.09% have little knowledge about conservation and its benefits, 27.2% have no knowledge about it. The awareness level of the local residents of Udanti Wildlife Sanctuary is shown in table 4.24 and Fig. 4.8 (b). This clearly indicates that the local people have to be educated through different awareness programme like importance of ecotourism, how it could help for employment opportunities and help in livelihood of local people. How it help to conserve the flora and fauna which is highly required for bright future of their children. Similar findings were also received by above worker shows the confirmation of the result of present findings.

CHAPTER – V
SUMMARY, CONCLUSION AND SUGGESTIONS
FOR FUTURE RESEARCH WORK

The present investigation entitled *“Studies on prospects and potentials of ecotourism in Chhattisgarh with special reference to biodiversity conservation of protected area.”* was carried out at Udanti Wildlife Sanctuary of Gariaband Forest Division, Raipur district and Achanakmar- Amarkantak Biosphere Reserve, Bilaspur Forest division, Bilaspur district of Chhattisgarh during the year 2007-2008.

The findings of the investigation are summarized below:

- The study of ecotourism activities in the two study sites was done to know the prospects and potentials of ecotourism.
- The flora and fauna documentation was done in the two study areas to know the diversity and species richness which attract the tourists to visit such travel destinations.
- The impacts of ecotourism on sustainable livelihood of local people were studied in the study sites.
- It was found that the fee structures of both the areas are adequate and under the reach of common people.
- The attractive tourist spots bear great potentials for ecotourism, still some spots which need to be promoted.
- Some of the places can be developed as adventure tourism spots. The richness of medicinal flora and presence of herbal gardens in

Achanakmar-Amarkantak Biosphere Reserve provide opportunity for being developed as herbal tourism destination.

- For such development the first need is proper infrastructure and facilities which are more satisfactory at Achanakmar-Amarkantak Biosphere Reserve as compared to those at Udanti Wildlife Sanctuary.
- The interpretation centre at Achanakmar and Lamni barriers of the Biosphere Reserve are good, but there is only one interpretation centre at Udanti Wildlife Sanctuary at Koeba ecocentre which is much interior.
- Three sites were selected within the Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary and study was done in two seasons (winter and summer).
- The flora documented at Achanakmar-Amarkantak Biosphere Reserve represents 33 families, 63 genera and 77 species. The maximum species were represented by family Fabaceae (13) followed by Acanthaceae (5) as dominant families.
- The phytosociology of Udanti Wildlife Sanctuary represented 35 families, 81 genera and 96 species. With Fabaceae (18) as the dominant family followed by Poaceae (7).
- Study at Achanakmar-Amarkantak Biosphere Reserve showed the species richness range from 11.9 (site-I) to 5.027 (site-III) for trees, 2.555 (site-II) to 0.717 (site-II) from shrubs and 3.232 (site-II) to 0.2529 (site-III) for herbs.

- The diversity index for trees ranged from 2.387 (site-II) to 0.307 (site-III), 1.84 (site-III) to 0.307 (site-III) for shrubs and from 4.04 (site-II) to 0.76 (site-III) for herbs.
- Equitability for trees ranged from 2.093 (site-I) to 0.61 (site-II), 1.026 (site-III) to 0.350 (site-II) for shrubs and 1.401 (site-II) and 1.103 (site-III) for herbs.
- The Concentration of dominance ranged from 0.9 (site-III) to 0.3 (site-II), 0.9 (site-II) to 0.5 (site-III) for shrubs and 0.7 (site-III) to 0.1 (site-I) for herbs.
- Beta diversity for the trees ranged from 3.467 (site-I) to 1.62 (site-I), 1.875 (site-II) to 0.833 (site-III) for shrubs and 1.892 (site-I) to 0.991 (site-III) for herbs.
- During summer the ground vegetation could not be recorded at site-I due to forest fire.
- At Udanti Wildlife Sanctuary, the species richness for trees ranged from 18.76 (site-III) to 8.236 (site-I), 1.897 (site-II) to 0.996 (site-I) for shrubs and 3.29 (site-III) to 0.465 (site-I) for herbs.
- The diversity index ranged from 3.996 (site-III) to 2.047 (site-II) for trees, 2.29 (site-II) to 1.16 (site-III) for shrubs and 3.88 (site-I) to 1.49 (site-I) for herbs.
- Equitability ranged from 1.334 (site-III) to 0.672 (site-II) for trees, 0.956 (site-II) to 0.559 (site-III) for shrubs and 1.344 (site-I) to 1.085 (site-II) for herbs.

- The Concentration of dominance ranged from 0.5 (site-II) to 0.1 (site-III) for trees, 0.5 (site-III) to 0.3 (site-II) for shrubs and 0.4 (site-I) to 0.1 (site-I and III) for herbs.
- Beta diversity for tree species ranged from 3.253 (site-III) to 1.756 (site-I), 0.838 (site-I) to 0.588 (site-III) for shrubs and 1.5 (site-I) to 0.718 (site-II) for herbs.
- It was observed that shrubs and herbs showed lower richness of species during summer season.
- At two sites (II and III) the ground vegetation was not recorded at both the sites.
- The vegetation structure shows that the species composition and dominant species (mainly in case of ground vegetation) varied with season at both sites.
- *Shorea robusta* was the dominant tree at Achanakmar-Amarkantak Biosphere Reserve.
- The dominant shrub species are *Ventilago maderaspatana* (site-I and III), *Leea macrophylla* (site-II) and *Grewia hirsuta* (site-III).
- The dominant herbaceous species are *Elephantopus scaber* (site-I), *Curcuma angustifolia* (site-II) and *Vetiveria zizanioides* (site- III).
- The dominant species in summer was *Lepidogathis trinervis* (site-II and III) where the distribution was contiguous at site-II and regular at site-III.
- At Udanti Wildlife Sanctuary the dominant tree species were *Shorea robusta* (site-I and II) and *Diospyros melanoxylon* (site-III).

- The shrubs dominant species were *Grewia hirsuta* (site-I) and *Cromalaena odorata* (site II and III).
- The dominant herbaceous species in winter were *Curcuma angustifolia* (site-I), *Imperata cylindrical* (site-II) and *Heteropogon contortus* (site-III) and dominant species in summer was *Desmodium trifolium*.
- The biodiversity indices of the present study sites indicate that Achanakmar-Amarkantak Biosphere Reserve is facing the problem of biotic interference.
- The major problem identified at Udanti Wildlife Sanctuary was invasion of alien species, one such plant identified was *Cromalaena odorata*.
- The fauna documentation observed that the encounter rates of major mammalian species are less at both the places.
- The causes have been identified and measures are being taken to increase the visibility of animals.
- To know the impacts of ecotourism on sustainable livelihood of local people purposive selection method of sampling was adopted.
- The local residents were interviewed and knowledge and awareness about the ecotourism among them was known.
- At Achanakmar-Amarkantak Biosphere Reserve 28.60% people are involved in agriculture and 57.20% in labour work and 47.60% people do business.
- At Udanti Wildlife Sanctuary 100% people were involved in collection of minor forest products (mainly mahua flowers, wild

fruits), 91.7% people do labour work and 16.17% people do job/service.

- The results clearly showed that the income of the local people depended mainly upon the ecotourism development works and collection of minor forest products. At Achanakmar-Amarkantak Biosphere Reserve only 33.3 % local people were fully aware about ecotourism and its benefits. 22.2 % believed that ecotourism will not benefit them and has shown negative impacts as collection of minor forest products is not allowed.
- At Udanti Wildlife Sanctuary 81.8% feel the importance of protected areas, 54.5% are aware about conservation but only 18.1% people are fully aware about ecotourism and its benefits. Though 63.6 % local people were well aware about the ecotourism but do not know its impacts. Thus there is need to aware the local residents of both the protected areas about ecotourism as well as its impacts.
- The awareness of these people is necessary and it should be done by the forest department, Non-government Organisations and other environmental organizations.
- To get the conservational benefits of ecotourism, awareness among both the tourists as well as the local inhabitants of the ecotourism area is needed.

Conclusion:

The present investigation entitled studies on prospects and potentials of ecotourism in Chhattisgarh with special reference to biodiversity conservation of protected area was carried out at two study sites are in Achanakmar-Amarkantak Biosphere Reserve and another in Udanti Wildlife Sanctuary. The study was carried out on the basis of one year data. There is need to replicate such studies in different areas of Chhattisgarh particularly in protected areas. To arrive on sound conclusion on prospects and potentials of ecotourism has very wide scope. Chhattisgarh is having 44 % forest cover and so many sanctuaries. If the tourist spots of these sanctuary area are properly identified and the publicity made then the ecotourism industry will play a significant role in employment generation for local residents as well as to uplift their livelihood. Awareness among the tourists along with local residents in relation to flora and fauna through the environmental education should be provided, so that the people could learn more and more about the importance of the biodiversity conservation.

Suggestions for future research work:

- Institutional facilities like provision of infrastructure to the tourists for their comfortable stay, good number of economic stay hotels, motels should be increased.
- Good food arrangements like restaurants, dhabas should be available for different economic class tourists.
- Proper guide should be provided for each group to learn about different species and tourist spots.

- Various movie shows has to be conducted for tourists in relation to environmental awareness activities.
- Local available handicrafts and articles should be sold by the local people in relation to income generation to the local people.

**STUDIES ON PROSPECTS AND POTENTIALS OF
ECOTOURISM IN CHHATTISGARH WITH SPECIAL
REFERENCE TO BIODIVERSITY CONSERVATION OF
PROTECTED AREAS**

By

BHARATI SINGH

ABSTRACT

In the present study an attempt was made to investigate the prospects and potentials of ecotourism in Chhattisgarh with special reference to biodiversity conservation of protected areas. The study was conducted in the year 2007-2008. The study sites were located in Achanakmar-Amarkantak Biosphere Reserve. (Bilaspur Forest Division, Bilaspur) – a larger unit of Protected Area and Udanti Wildlife Sanctuary (Gariaband Forest Division, Raipur) – a smaller unit of Protected Area. The study themes included the study of ecotourism activities being carried out in both the protected areas. The documentation of flora and fauna at both the protected areas was done. The flora documentation was carried out through phytosociological study, collection of unidentified species, their identification and fauna documentation was done from records available with the forest department and self visits. The impacts of ecotourism on sustainable livelihood of local inhabitants were studied.

The infrastructure and facilities available in the protected areas for the promotion of ecotourism were studied. The infrastructure at both the sites needs to be increased however the facilities need much improvement at Udanti Wildlife Sanctuary. The phytosociological analysis revealed that

biotic and abiotic factors were responsible for composition and diversity of the forests. At Achanakmar-Amarkantak Biosphere Reserve a total 1607 plants representing 33 families, 63 genera and 77 species and at Udanti Wildlife Sanctuary, 2327 species of plants belonging to 35 families, 81 genera and 96 species were encountered. The biodiversity indices were calculated in winter and summer seasons. The values of various vegetation layers of Achanakmar-Amarkantak Biosphere Reserve showed the diversity of plants at Udanti Wildlife Sanctuary was more. The forest at Udanti Wildlife Sanctuary is less disturbed.

The awareness among the local inhabitants was documented by purposive selection of respondents, and it was found that there is very less awareness among them and there is need of awareness programmes, then only the forest department can get full cooperation from the local inhabitants.

From these observations, it is evident that as a result of ecotourism the opportunities for development have increased in the state. Tourism being one of the rapidly developing industries, through ecotourism has opened the ways for hand-clumped development of state as well as the inhabitants of the forest villages. The conservative approach of ecotourism has raised its value. But there is need to create awareness among the local people about ecotourism and how they can be benefited from it, as without knowledge it is not possible for the local people to accept the policies of ecotourism.

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REFERENCES

- Al-Sayed,-M, Al-Langawi,-A. 2003. Biological resource conservation through ecotourism development. *Journal of Arid Environment*. 54(1): 225-236.
- Badola, Ruchi, Bharadwaj, A.K. and Mukharjee, S.K. 2000. Inegrating Conservation and Development in Protected Area Management-Can we do it? *Indian Forester*. 126(10): 1054-1067.
- Bhattacharya, A.K.; Banerjee, Suchitra and Saksena, Vandana. 2003. Local initiatives to localize ecotourism: an exploratory study in Kerwa, Van Vihar National Park catchments. *Tourism Recreation Research*. 28(1): 97-102.
- Bhattacharya, A.K., Saksena, Vandana and Banerjee, Suchitra. 2006. Environmental auditing in Ecotourism: A study on visitor's management in Van Vihar National Park, Bhopal, M.P. (India). *Indian Forester*. 132(2): 139-148.
- Bist, M. S. 2000. Monitoring of Vegetation cover and land use in Nanda Devi Biosphere Reserve. *Indian Forester*. 126(6): 664-673.
- Bradley, A. 2004. Community based ecotourism in Cambodia: a case study in Chambok commune, Kompong Speu and the Community-Based Ecotourism Network. Sustainable tourism resource management-A report on the WTO/UNESCAP National Seminar on sustainable Tourism Management, Combodia (9-10 June, 2003. 2004): 135-138.

- Brown, K., Turner, R.K., Hameed, H., Bateman, I. 1997. Environmental carrying capacity and tourism development in the Maldives and Nepal. *Environmental Conservation*. 24(4): 316-325.
- Card, J.A. and Vogelsong, M. J. 1995. Ecotourism as a mechanism for economic enhancement in developing countries. General Technical Intermountain Research Station-USDA Forest Service. (INT-323): 57-60.
- Chakravarty, Ilika. 2003. Marine ecotourism and regional development: a case study of the proposed marine park at Malvan, Maharashtra, India. In: Marine ecotourism:- issues and experiences. Ed: Garrod, B. and Wilson, J.C. Channel View Publications, UK. 177-197.
- Chandra, R., Upadhyay, V.P. and Bargali, S.S. 1989. Analysis of Herbaceous Vegetation under Oak and Pine Forests along an altitudinal gradient in Central Himalaya. *Environment and Ecology*. 7(3): 521-525.
- Corcoran, P. 1996. Ecotourism as a rural development strategy in Oregon. Special report Oregon state University extension service. (953): 90-95.
- Cristian, Navarro,-H. 2002. Ecotourism, the great economic hope. *Chile Forestal*. (294): 3-6.
- Davenport, L., Brockelman, W.Y., Wright, P.C.; Ruf, K., Rubio-del- Valle, F.B. 2002. Ecotourism tools for parks. In: Making parks work:- strategies for preserving tropical nature. Ed. Terborgh, J, Schaik, C-von, Davenport, L., Madhu, R. Washington, USA: Inland press. 279-306.

- Duim, R-van-der and Philipen, J. 2002. How eco is Costa Rica's ecotourism?
In: Dahles, H. and Keune, L. (eds.) tourism development and local participation in Latin America. Elmsford, USA pp.60-71.
- Getzner, M. 2002. Ecotourism, stakeholders and regional sustainable development. Environmental cooperation and institutional change: theories and policies for European agriculture. 315-341.
- Gossling, S. 1999. Ecotourism: A means to safeguard biodiversity and ecosystem functions. *Ecological Economics*. 29: 303-20
- Himberg, Nina. 2004. Community-based ecotourism as a sustainable development option in Taita Taveta, Kenya. In: Pellikka, P., J. Ylhaisi and B. Clark (eds.) Taita Hills and Kenya, 2004 – seminar, report and journal of a field excursion to Kenya. Expending reports of the Department of Geography, University of Helsinki 40, 87-95. Helsinki 2004, ISBN 952-10-2077-6, 148pp.
- Kenya Wildlife Service. 2004. Ecotourism potential and development within Lake Nakuru National Park and its catchment. Banrock Station (February, 2004).
- Khurana, P and Kalpana. 2008. Phytodiversity study in natural forest of Hastinapur. *Indian Forester*. 134(4): 554-562.
- Khushwah, R.B.S. and Kumar, V. 2000. Status of flora in Protected Areas- The case studies of Satpuda, Bandhavgarh, Indiravati and Madhav National Parks of Madhya Pradesh, India. *Indian Forester*. 126(2000): 71-77.

- Koch, E. 1997. Ecotourism and rural reconstruction in South Africa: reality or rhetoric? Social change and conservation: environmental politics and impacts of national parks and protected areas. 214-238.
- Kumar, R.U. and Rangaswamy, V. 2002. Ecotourism in Karnataka- an insight. *Myforest*. 38(2): 99-106.
- Lindberg, K., Enriquez, J. and Sproule, K. 1996. Ecotourism questioned: case studies from Belize. *Annals of Tourism Research*. 23(3): 543-562.
- Lindberg, K., Wood, M. E. and Engeldrum, D. 1998. Economic aspects of ecotourism. *Ecotourism: a guide for planners and managers*. 87-117.
- Maikhuri, R.K., Rana, U, Rao, K.S., Nautiyal, S. and Saxena, K.G. 2000. Promoting ecotourism in the buffer zone areas of Nanda Devi Biosphere Reserve: an option to resolve people-policy conflict. *International Journal of Sustainable Development and World Ecology*. 7(4): 333-342.
- Maliya, S.D. 2007. Rare species of Katrniyaghat Wildlife Sanctuary, district Bahraich, Uttar Pradesh, India. *Indian Forester*. 133(8): 1052-1056.
- Mukerji, A.K. 2006. Conservation and management of Biodiversity in Indian Forests- New Eco-Development approach. *Indian Forester*. 132(8):921-929.
- Nelson, Fred. 2004. The evolution of community-based ecotourism in northern Tanzania. International Institute for Environment and Development. Issue paper no. 131. 1-34.
- Obua, J. 1997. the potential, development and ecological impact of ecotourism in Kibale National Park. *Journal of Environmental Management*. 50(1): 27-38.

- Oommachan, M. 1977. The Flora of Bhopal. J. K. Jain Brothers, Bhopal.
- Pathak, M.C., Bargali, S.S. and Rawat, Y.S. 1993. Analysis of woody vegetation in a high elevation Oak forest of Central Himalaya. *Indian Forester*. 119(9): 722-731.
- Rao, G.P., Shukla, B.K. and Datta, Bhaskar. 1992. Flora of Madhya Pradesh. Ashish Publishing House, New Delhi.
- Rawat, R.B.S. and Sharma, Jagmohan. 2003. Developing stakeholder based Ecotourism in Uttaranchal, India. *Indian Forester*. 129(2): 321-331.
- Reddy, CH. S., Pattanaik, C., Dhal, N.K. and Biswal, A.K. 2006. Vegetation and floristic diversity of Bhitarkanika National Park, Orissa, India. *Indian Forester*. 132(6): 664-680.
- Salam, M.A. 2000. Ecotourism to protect the reserve mangrove forest the Sinderbans and its flora and fauna. *Anatalio*. 11(1): 56-66.
- Schoemann, T. 2003. Socio-political aspects of establishing ecotourism in the Qwa-Qwa National Park, South Africa. In: Global ecotourism policies and case studies:- perspectives and constraints. Ed: Luck, M., Kristges, T. Channel View Publications, UK. 115-136.
- Schulze, H. 1998. nature conservation through ecotourism development – a case study of a village in the lower Kinabatangan Area, Sabah. *Tigerpaper*. 25(3): 12-17.
- Serrano, R.C. 1997. Ecotourism enjoying and protecting nature. *PCARRD Monitor*. 25(3): 6-7, 12.
- Shukla, Rakesh. 2004. The Kanha approach to Tiger conservation. *Indian Forester*. 130(10): 1105-1112.

- Shrivastava, R.C. and Choudhary, R.K. (2007). Floristic scenario of Itanagar Wildlife Sanctuary: A case study. *Indian Forester*; 133(10): 1425-1428.
- Singh, H. S. 2004. Biodiversity of Ratanmahals Wildlife Sanctuary – An overview of floral and faunal diversity and their conservation strategy in Malwa region in Gujarat state, India. *Indian Forester*. 130(4): 359-366
- Singh, R.K. 2007. Floristic wealth of Valmiki National Park, Bihar- An overview. *Indian Journal of Forestry*. 30(2): 159-166
- Stem, C.J., Lassoie, J.P., Lee, D.R. and Deshler, D.J.(2003). How 'eco' is ecotourism? A comparative case study of ecotourism in Costa Rica. *Journal of sustainable tourism*. 11(4): 322-347
- Stem, C.J., Lassoie, J.P., Lee, D.R., Deshler, D.D. and Schelhas, J.W. 2003. Community participation in ecotourism benefits: the link to conservation practices and perspectives. *Society and Natural Resources*. 16(5): 387-413
- Subramani, S. P.; Jishtu, Vaneet; Verma, R.K. and Kapoor, K.S. 2007. Floristic composition, life forms and biological spectrum of Renuka Wildlife Sanctuary, Himachal Pradesh. *Indian Forester*. 133(1):79-91
- Sundriyal, R.C. and Sundriyal, Manju. 2003. Species area richness and economic value of small representative-landscapes in the eastern Himalaya: Its implications for Conservation Reserve. *Indian Journal of Foresry*. 26(3): 235-253.

Tisdell, C. 1997. tourism development in India and Bangladesh: general issues, illustrated by ecotourism in the Sunderbans. *Tourism Recreation Research*. 22(1): 26-33.

Weaver, D.B. 2002. the evolving concept of ecotourism and its potential impacts. *International Journal of Sustainable Development*. 5(3): 251-264.

WWF (World Wildlife Fund). 1995. Ecotourism: Conservation tool or threat? *Conservation issues*. 2(3): 1-10

PROFORMA PROVIDED TO THE LOCAL RESIDENTS

दिनांक

१. नाम गाँव
२. जातिविकास खण्ड
३. आयुजिला.....
४. शिक्षाग्राम सेवक कार्यक्षेत्र
५. (अ) परिवार का प्रकार - एकाकी/संयुक्त
(ब) परिवार की सदस्य संख्या पुरुष महिला बच्चे कुल
६. व्यवसाय संबंधी जानकारी

क्र.	व्यवसाय	प्रमुख व्यवसाय	सहायक व्यवसाय	कुल वार्षिक आय
१.	कृषि			
२.	पशुपालन			
३.	लघुवनोपज संग्रहण			
४.	मजदूरी			
५.	नौकरी			
६.	व्यापार			
७.	शराब, ताड़ी निर्माण			
८.	अन्य			
कुल वार्षिक आय (रूपयों में)				

७. आपकी कुल जमीन का कितना हिस्सा सिंचित है ?
१. सिंचित हेक्टेयर
२. असिंचित हेक्टेयर
३. कुल भूमि हेक्टेयर
८. पिछले वर्ष आपने खेतों में कौन-कौन सी फसलें ली ?
कृपया विवरण दीजिये

क्र.	मौसम	फसल का नाम	कुल क्षेत्रफल हेक्टेयर में	औसत उत्पादन (प्रति हेक्टेयर)
१.	खरीफ			
२.	रबी			

क्र.	भूमि का उपयोग	क्षेत्रफल	पानी की पूर्ति		
			पूर्ण	आंशिक	निरंक
१.	कृषि				

२.	पशुपालन				
३.	वनोपज				
४.	चराई हेतु				
५.	अन्य				

६. कृपया अपने पशुधन के बारे में जानकारी दीजिये

क्र.	पशु	संख्या				कुल	इनसे होने वाली आमदनी (रु.)
		दूध देने वाले		कार्य करने वाले			
		उन्नत	देशी	उन्नत	देशी		
१.	गाय						
२.	भैंस						
३.	भेड़/बकरी						
४.	सुअर						
५.	अन्य						

१०. ग्राम में कार्यरत संस्थाएं एवं उसमें सहभागिता

क्र.	संस्था	है/नहीं	सदस्य	पदाधिकारी
१.	पंचायत			
२.	युवा मण्डल			
३.	सहकारी समिति			
४.	महिला मण्डल			
५.	अन्य			

११. जानकारी हेतु सूचना स्रोत

		बहुधा	कभी-कभी	कभी नहीं	जानकारी की विश्वसनीयता		
					पूर्ण	आंशिक	नगण्य
अ.	व्यक्तिगत स्रोत						
१.	वैज्ञानिक						
२.	कृषि विस्तार अधिकारी						
३.	ग्रामीण नेता						
४.	उन्नत किसान						
५.	मित्र पड़ोसी						
ब.	दृश्य श्रव्य साधन						
१.	टेलीविजन						
२.	रेडियो						
स.	लिखित सामग्री						
१.	पत्रिका/बुलेटिन						
२.	समाचार पत्र						
द.	अन्य संपर्क						
१.	प्रदर्शन						
२.	वार्तालाप						

३.	प्रशिक्षण						
४.	बैठक						
५.	किसान मेला						

१२. आपको निम्न प्रतिबंधित क्षेत्र के विषय में कितनी जानकारी दें -

१. अभ्यारण्य क्षेत्र के बारे में क्या समझते हैं।

२. अभ्यारण्य बनने से पहले एवं बाद में क्या परिवर्तन महसूस करते हैं।

३. अभ्यारण्य पर्यटन क्षेत्र बनने से आपको फायदा हुआ है कि नुकसान

४. अभ्यारण्य के पर्यटन हेतु किस तरह के विकास की आवश्यकता महसूस करते हैं।

५. क्या अभ्यारण्य क्षेत्र में पर्यावरणीय पर्यटन घोषित होने के बाद आपको रोजगार के अवसर बढ़ेगा।

६. वनोपज संग्रहण

वनो से संग्रहित किये जाने वाले उत्पाद	आमदनी (रु./वर्ष)

७. वन्य पशुओं एवं वनस्पतियों के संरक्षण के लिये सरकार को क्या पहल करनी चाहिये।

८. गाईड को पर्यटन से कितनी आमदनी हो रही है।

९. प्रमुख त्यौहार

प्रमुख त्यौहार	माह	दिन

१०. बैगा आदि से इलाज करवाते हैं अथवा नहीं

११. कौन-कौन से औषधि पौधे प्रयोग में लाए जाते हैं

औषधी पौधे का नाम	प्रयोग

92. क्या औषधि पौधों की खेती की जाती है हॉ/नहीं यदि हॉ

औषधि पौधों का नाम	क्षेत्र जिसमें खेती की जाती है (एकड़)	आमदनी (रु.)

अन्य अधिक आपदनी देने वाले पौधे जिसकी खेती की जाती है

पौधों का नाम	क्षेत्र जिसमें खेती की जाती है (एकड़)	आमदनी (रु.)

93. अन्य

9. अभ्यारण्य वन्य पर्यावरण पर्यटन क्षेत्र के बाद आपके क्षेत्र के कितने लोग गाईड के तौर पर कार्य कर रहे है।

2. जनजातियों के विषय में जानकारी

जनजाति का नाम	त्यौहार/विशेष कार्यक्रम	व्यवसाय

QUESTIONNAIRE PROVIDED TO VISITORS

1. Name-
2. Age-
3. *QUALIFICATION*-
4. Occupation-
5. Income-
6. Mode of transport-
7. Purpose of visit-
8. Duration of stay-
9. Number of visits per year-
10. What fascinates most-
11. Plants seen and known-
12. Animals seen and known-
13. Awareness about eco-tourism and environmental law-
14. Awareness about eco-tourism codes and conduct-
15. Guidelines and instructions by the sanctuary/ park staff-
16. Food brought in the park/ sanctuary-
17. Use of wrappers/ carry bag/ polythene-
18. Willingness to pay for the guide-
19. Information from the interpretation center-
20. Awareness about involvement of the public in the PA management-
21. Facilities in the area-
22. Suggestions regarding the area in ranking order-

Table 4.10 : Total number of trees, shrubs and herbs recorded (alpha diversity) at different study sites of the two study areas.

Achanakmar-Amarkantak Biosphere Reserve				
Site	Trees	Shrubs	Herbs	Total
Site – I	217	135	111	463
Site – II	194	134	188	516
Site – III	224	183	221	628
Total	635	452	520	1607
Udanti Wildlife Sanctuary				
Site – I	261	280	218	759
Site – II	243	229	376	848
Site – III	186	238	296	720
Total	690	747	890	2327

*** Achanakmar-Amarkantak Biosphere Reserve**

- Site-I** – Sal forest (Chhapparwa village)
- Site-II** – Mixed forest (Lamni village)
- Site-III** – Mixed forest (Achanakmar village)

*** Udanti Wildlife Sanctuary**

- Site-I** – Compartment No. 81 (Bison site)
- Site-II** – Compartment No. 80 (Tourist path)
- Site-III** – Compartment no. 85 (site for easy view of wild animals)

Table 4.11 : Biodiversity index of vegetation layers at different study sites of Achanakmar- Biosphere Reserve in Bilaspur district of Chhattisgarh.

Study Seasons	Vegetation Layers	Study sites	Biodiversity indices				
			Species richness (d)	Diversity Index (H')	Equitability (e)	Concentration of Dominance (Cd)	Beta Diversity
Winter	Trees	Site-I	9.396	1.645	0.593	0.5	3.467
		Site-II	11.9	1.797	0.61	0.5	2.889
		Site-III	5.027	0.307	0.124	0.9	2.476
	Shrubs	Site-I	2.274	1.35	0.585	0.6	1.333
		Site-II	2.555	1.27	0.53	0.6	1.875
		Site-III	2.136	1.48	0.643	0.5	1.818
	Herbs	Site-I	1.388	2.610	1.255	0.2	1.892
		Site-II	3.232	4.04	1.399	0.1	1.148
		Site-III	2.066	2.878	1.158	0.2	0.991
Summer	Trees	Site-I	10.065	1.999	2.093	0.4	1.62
		Site-II	10.538	2.387	0.949	0.3	2.213
		Site-III	7.554	1.96	0.724	0.4	1.933
	Shrubs	Site-I	-	-	-	-	-
		Site-II	0.717	0.48	0.35	0.9	1.842
		Site-III	1.077	1.84	1.026	0.5	0.833
	Herbs	Site-I	-	-	-	-	-
		Site-II	0.271	0.971	1.401	0.5	6
		Site-III	0.253	0.76	1.103	0.7	3.33

Table 4.12 : Biodiversity index of vegetation layers at different study sites of Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

Study Seasons	Vegetation Layers	Study sites	Biodiversity indices				
			Species richness (d)	Diversity Index (H')	Equitability (e)	Concentration of Dominance (Cd)	Beta Diversity
Winter	Trees	Site-I	9.002	2.546	0.899	0.3	2.077
		Site-II	9.879	2.047	0.672	0.5	2.195
		Site-III	12.67	3.147	1.089	0.2	3.253
	Shrubs	Site-I	1.5209	1.81	0.8245	0.4	0.838
		Site-II	1.8966	2.29	0.9556	0.3	0.611
		Site-III	1.2627	1.16	0.5591	0.5	0.588
	Herbs	Site-I	3.2096	3.88	1.3435	0.1	1.364
		Site-II	2.5111	2.94	1.0853	0.2	0.718
		Site-III	3.2899	3.76	1.2757	0.1	0.912
Summer	Trees	Site-I	8.96	2.544	0.898	0.3	1.756
		Site-II	8.2354	2.3171	0.8178	0.3	1.917
		Site-III	18.76	3.996	1.334	0.1	2.233
	Shrubs	Site-I	0.9957	1.87	0.8972	0.4	0.708
		Site-II	-	-	-	-	-
		Site-III	-	-	-	-	-
	Herbs	Site-I	0.4650	1.49	1.3521	0.4	1.5
		Site-II	-	-	-	-	-
		Site-III	-	-	-	-	-

Table 4.1 : Fee structure of Ecotourist centres (Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary) in Chhattisgarh.

S. No.	Protected Area	Present fee structure	Suggestion
1.	Achanakmar-Amarkantak Biosphere Reserve	Indian :Rs.15.00/ person Foreigners :Rs.150.00/ person Educational institute/ registered Nature club/ NGO: : Rs.200.00/ group Car/ Gipsy/ Jeep/ Station vegan : Rs.50/ vehicle Minibus : Rs.100.00/ group Still camera : Rs. 25/ camera Guide : Rs. 75/ group	The present fee structure is appropriate to attract more tourists for Ecotourism. After visiting the various sites they will be creating awareness among other people regarding conservation of natural resources.
2.	Udanti Wildlife Sanctuary	Indian :Rs.10.00/ person Foreigners :Rs.100.00/ person Educational institute/ registered Nature club/ NGO: : Rs.100.00/ group Car/ Gipsy/ Jeep/ Station vegan : Rs.25/ vehicle Minibus : Rs.100.00/ group Still camera : Rs. 10/ camera Guide : Rs. 50/ group	

Table 4.3 : No. of tourists/ visitors visited Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary during different years.

S.No.	Year	No. of tourists/ visitors		
		Indian tourists	Foreign tourists	Total
Achanakmar-Amarkantak Biosphere Reserve				
1.	2003-04	1529	0	1529
2.	2004-05	2211	0	2211
3.	2005-06	2720	0	2720
4.	2006-07	3210	0	3210
5.	2007-08	8573	0	8573
* It can be seen that after declared as a Biosphere Reserve the number of tourists has increased.				
Udanti Wildlife Sanctuary				
1.	2000	148	10	158
2.	2001	150	-	150
3.	2002	196	-	196
4.	2003	91	-	91
5.	2004	151	-	151
6.	2005	375	-	375
7.	2006	499	-	499
* The number of tourists reduced in the middle but since the ecotourism programmes initiated the number of visitors has increased.				

Table 4.21 : Occupations of the local residents of Achanakmar-Amarkantak Biosphere Reserve.

S. No.	Occupation	% of people
1	Agriculture	28.60
2	Cattle farming	14.30
3	NTFP collection	14.30
4	Labour work	57.20
5	Job/Service	14.30
6	Business	47.60
7	Others	9.5

Table 4.22 : Occupations of the local residents of Udanti Wildlife Sanctuary.

S. No.	Occupation	% of people
1	Agriculture	14.30
2	NTFP collection	100
3	Labour work	91.70
4	Job/Service	16.17

Table 4.23 : Awareness about ecotourism and conservation of biodiversity among local residents of Achanakmar-Amarkantak Biosphere Reserve.

S.No.	Awareness about ecotourism	% of people	Awareness about conservation	% of people
1	Fully aware	33.30	Fully aware	44.40
2	Little awareness	11.10	Little awareness	33.30
3	Do not feel it beneficial	22.20	Do not feel it important	5.50
4	Not aware	33.30	Not aware	11.10

Table 4.24 : Awareness about ecotourism and conservation of biodiversity among local residents of Udanti Wildlife Sanctuary.

S.No.	Awareness about ecotourism	% of people	Awareness about conservation	% of people
1	Fully aware	18.10	Fully aware	54.50
2	Little awareness	63.60	Little awareness	9.90
3	Do not feel it beneficial	1.10	Do not feel it important	8.10
4	Not aware	18.10	Not aware	27.20

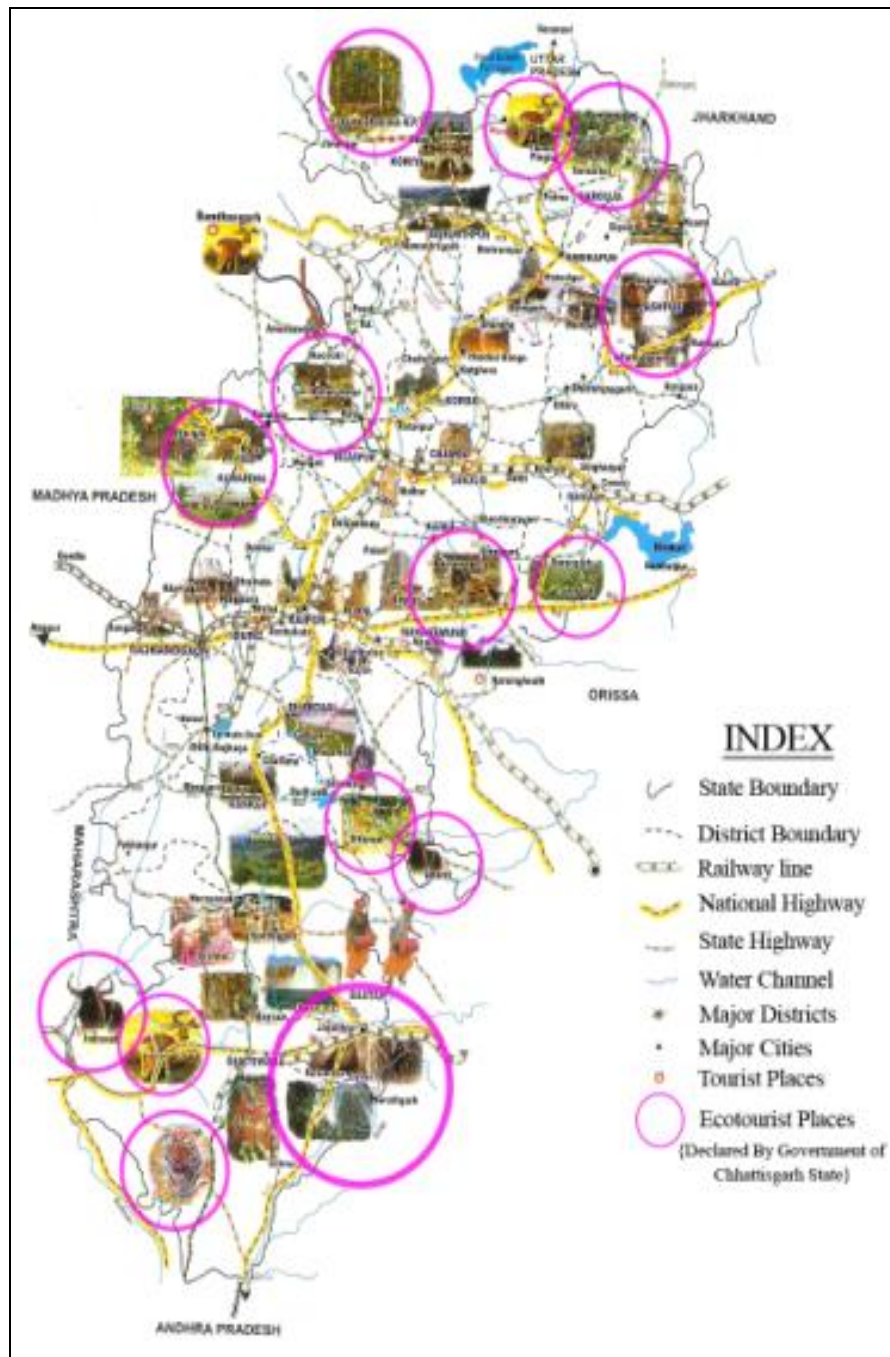


Fig.: ECOTOUR MAP OF CHHATTISGARH.

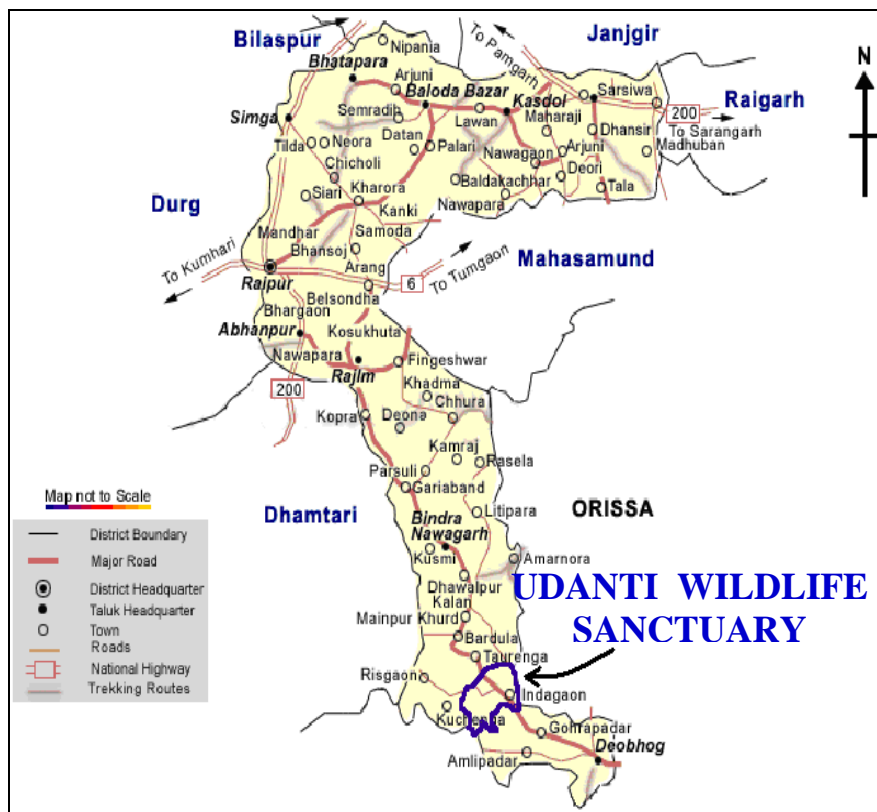
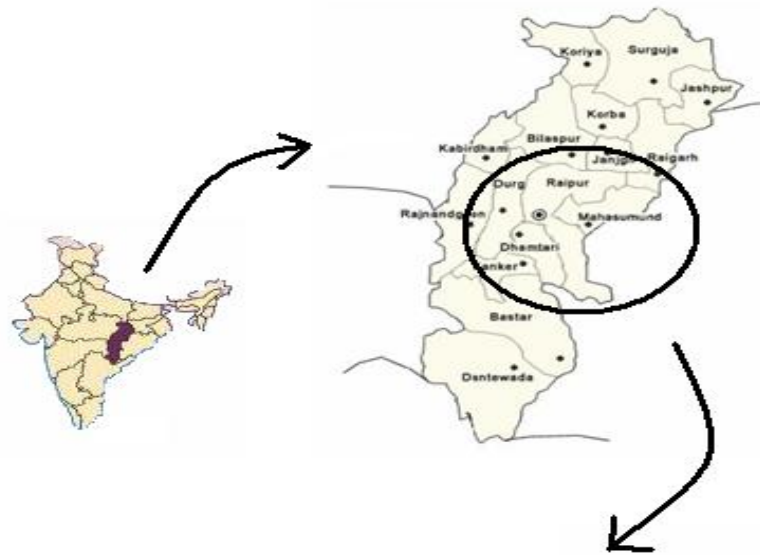


Fig. 3.3 (a): LOCATION MAP OF UDANTI WILDLIFE SANCTUARY IN RAIPUR DISTRICT.

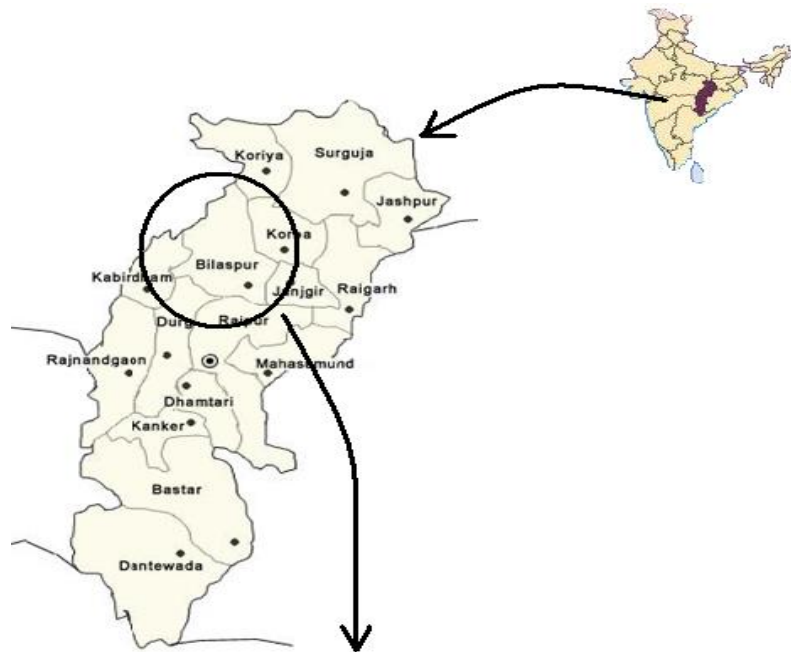


Fig. 3.1 (a): LOCATION MAP OF ACHANAKMAR-AMARKANTAK BIOSPHERE RESERVE IN BILASPUR DISTRICT.

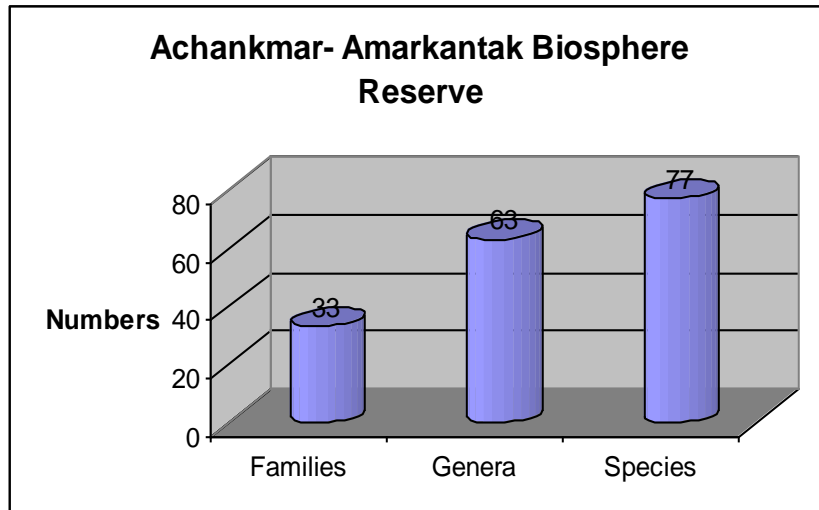


Fig. 4.2 (a): Total number of families, genera and species recorded at Achanakmar-Amarkantak Biosphere Reserve in Bilaspur district of Chhattisgarh.

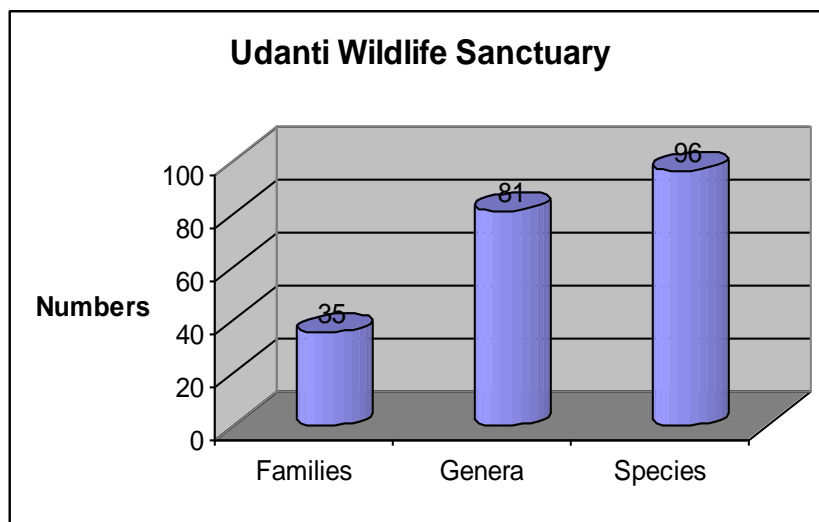


Fig. 4.2 (b): Total number of families, genera and species recorded at Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

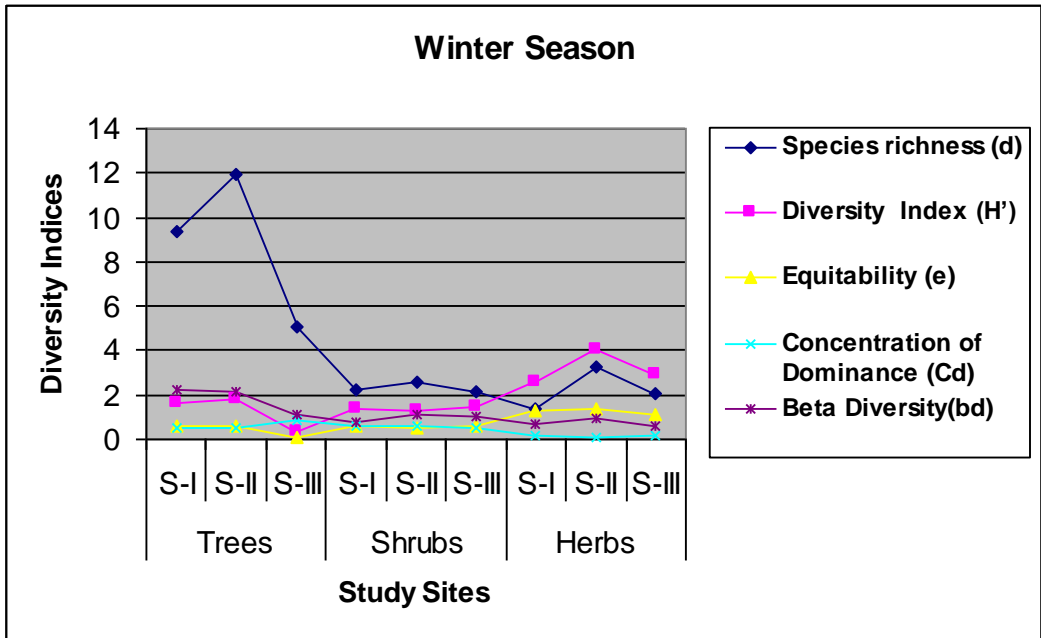


Fig. 4.3 (a)

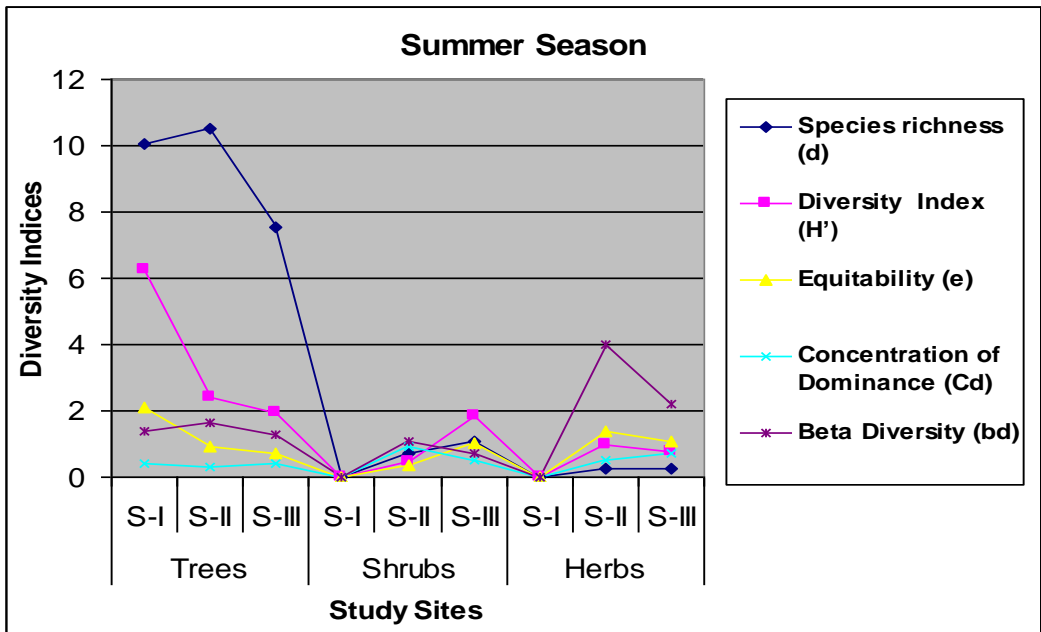


Fig. 4.3 (b)

Fig. 4.3 : Biodiversity index of vegetation layers in different study sites of Achanakmar- Amarkantak Biosphere Reserve in Bilaspur district of Chhattisgarh.

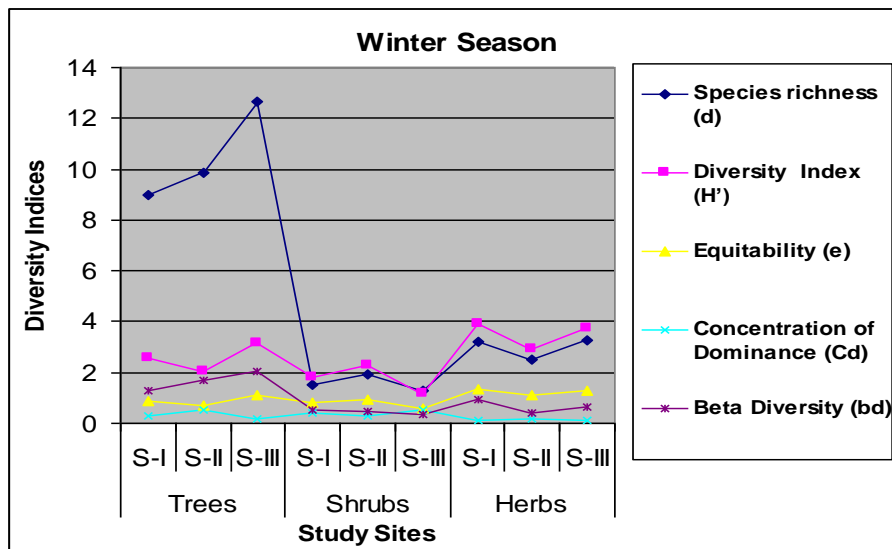


Fig. 4.4 (a)

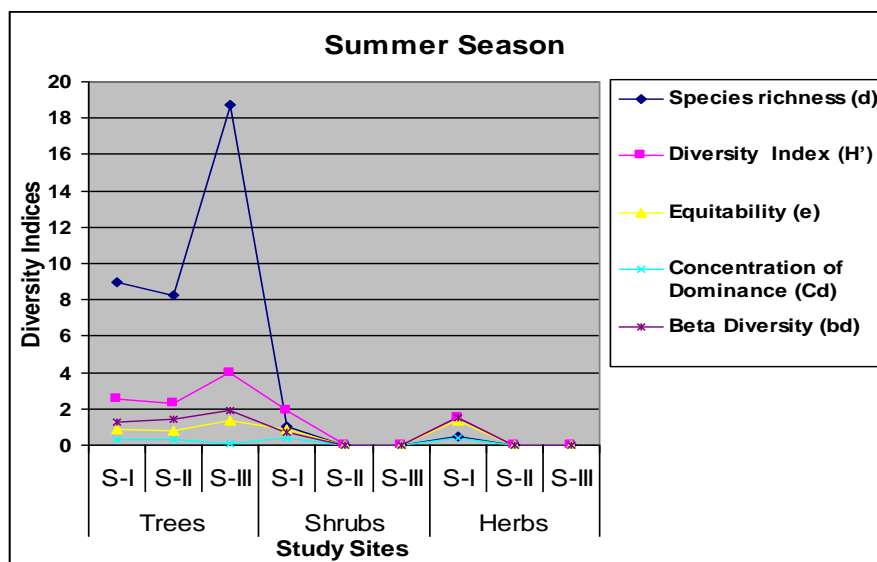


Fig. 4.4 (b)

Fig. 4.4: Biodiversity index of vegetation layers in different study sites of Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

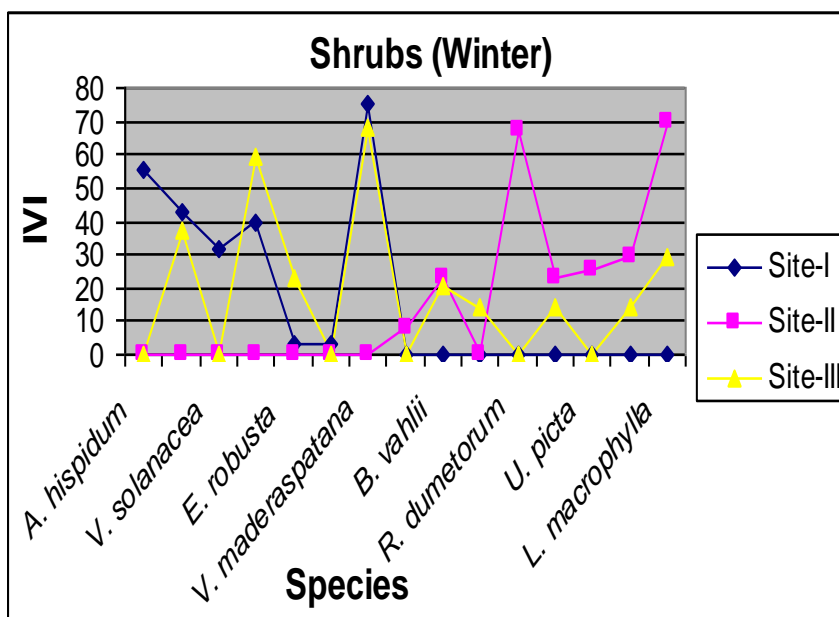


Fig. 4.5 (bi)

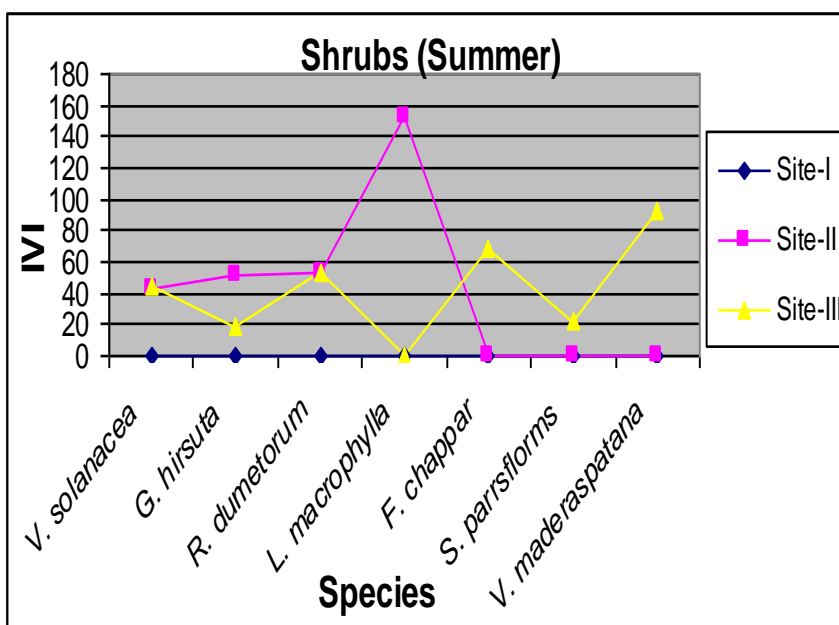


Fig. 4.5 (bii)

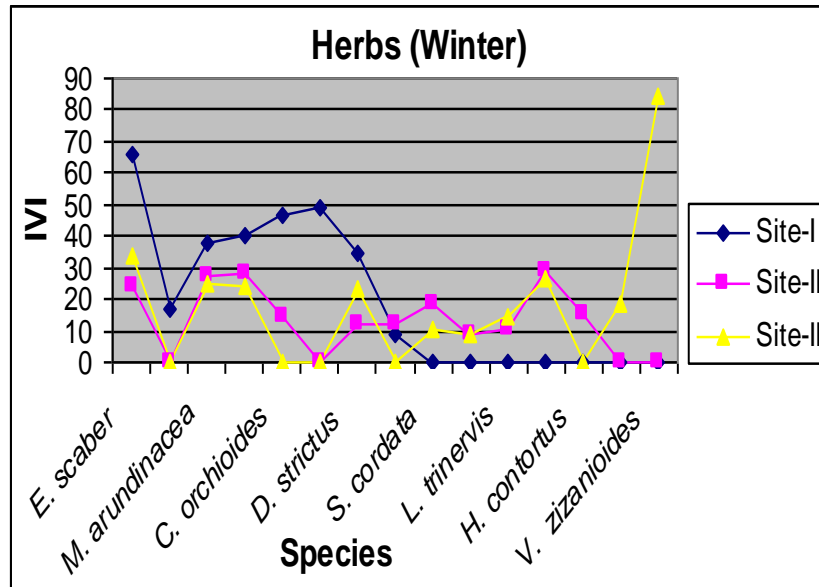


Fig. 4.5 (ci)

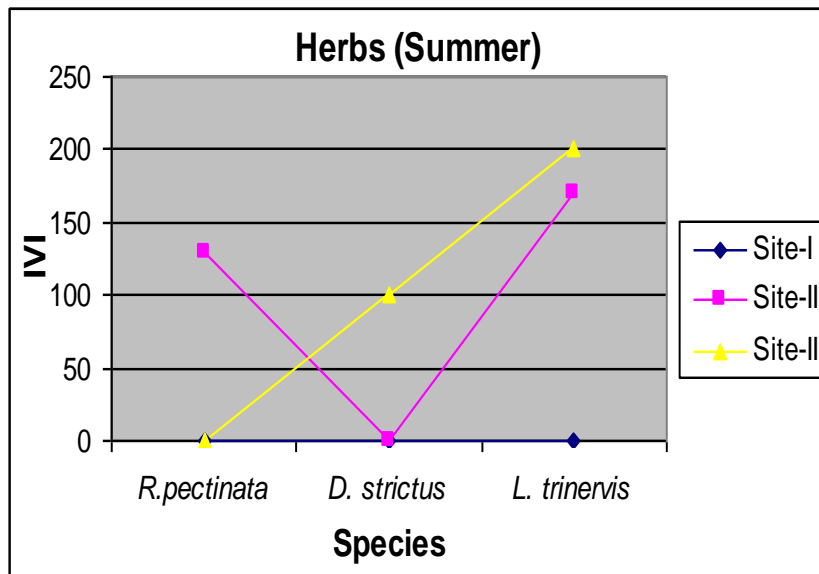


Fig. 4.5 (cii)

Fig. 4.5 (a) to (c) : Vegetation structure of herbaceous species at study sites of Achanakmar- Amarkantak Biosphere Reserve in Bilaspur district of Chhattisgarh.

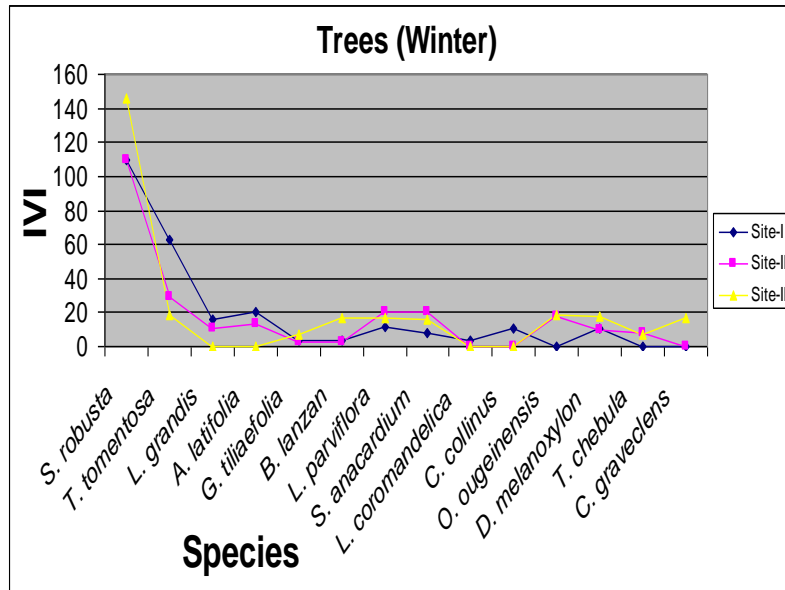


Fig. 4.5 (ai)

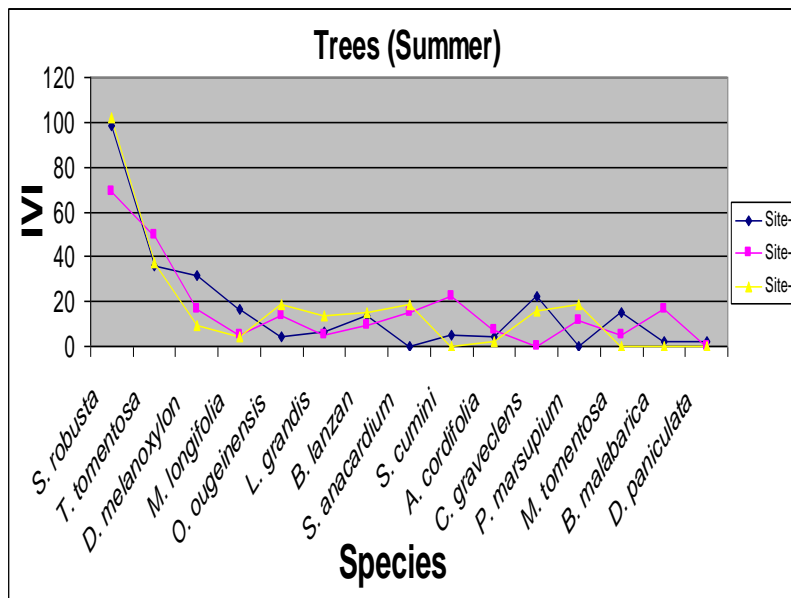


Fig. 4.5 (aii)

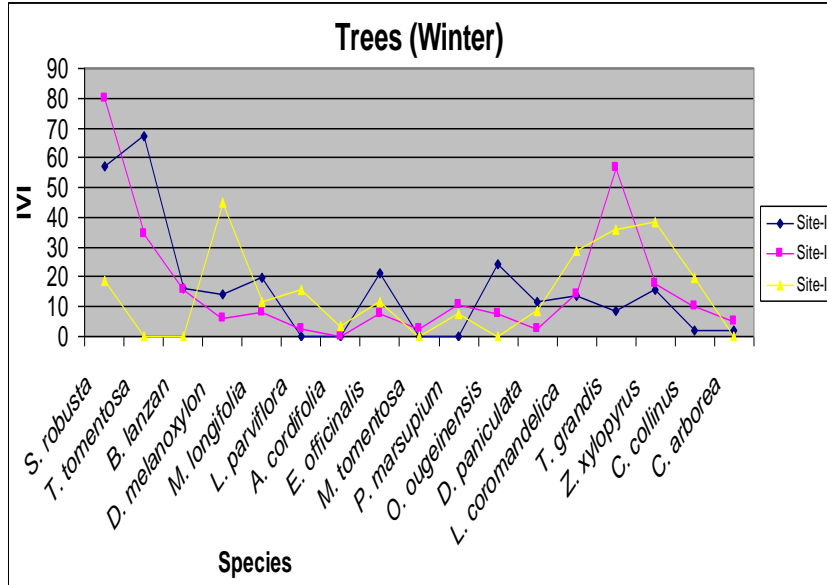


Fig. 4.6 (ai)

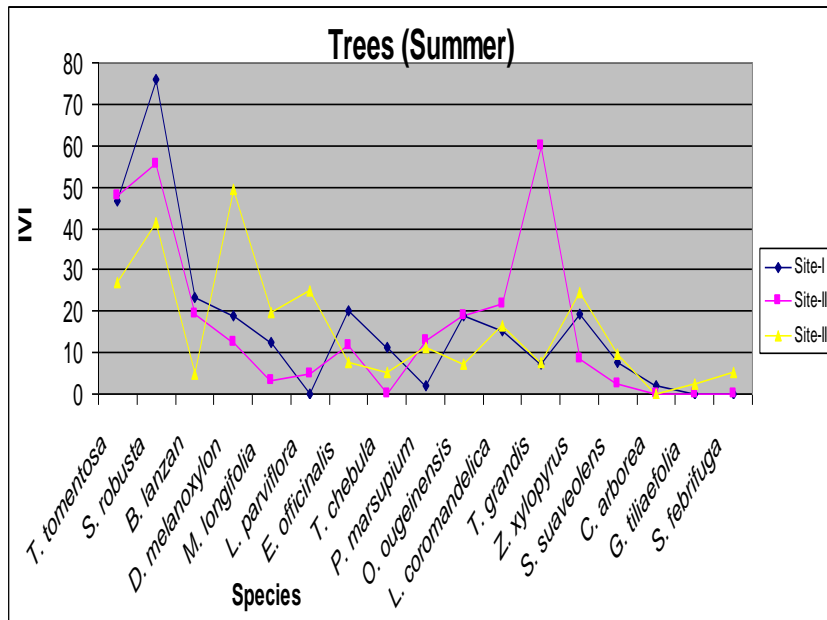


Fig. 4.6 (aii)

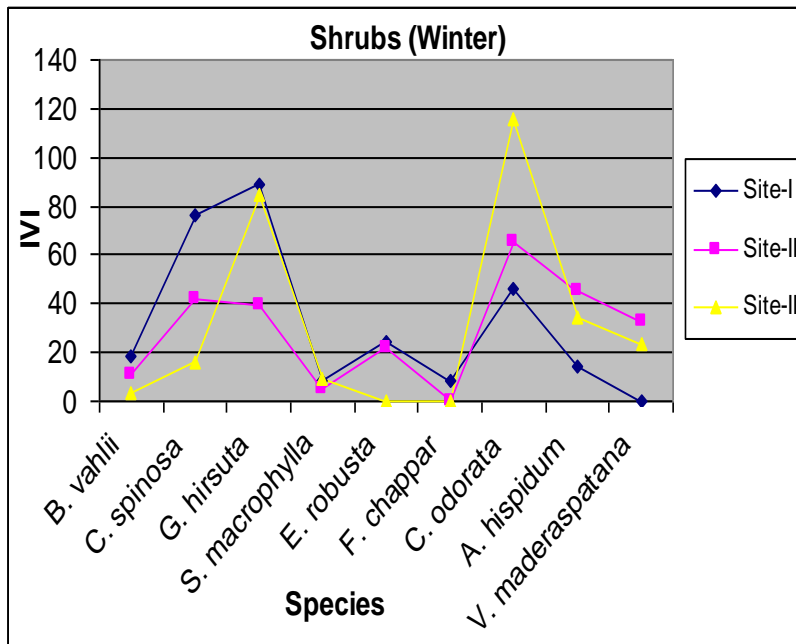


Fig. 4.6 (bi)

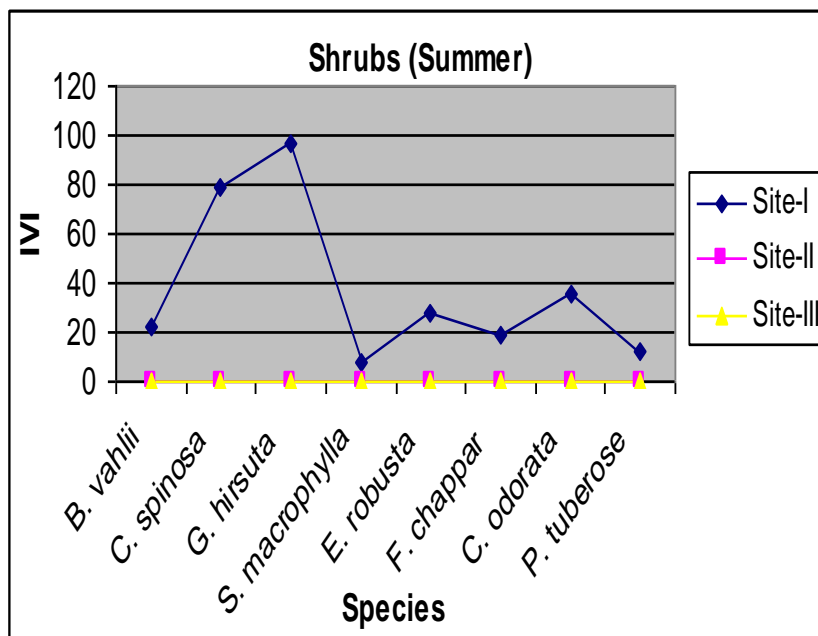


Fig. 4.6 (bii)

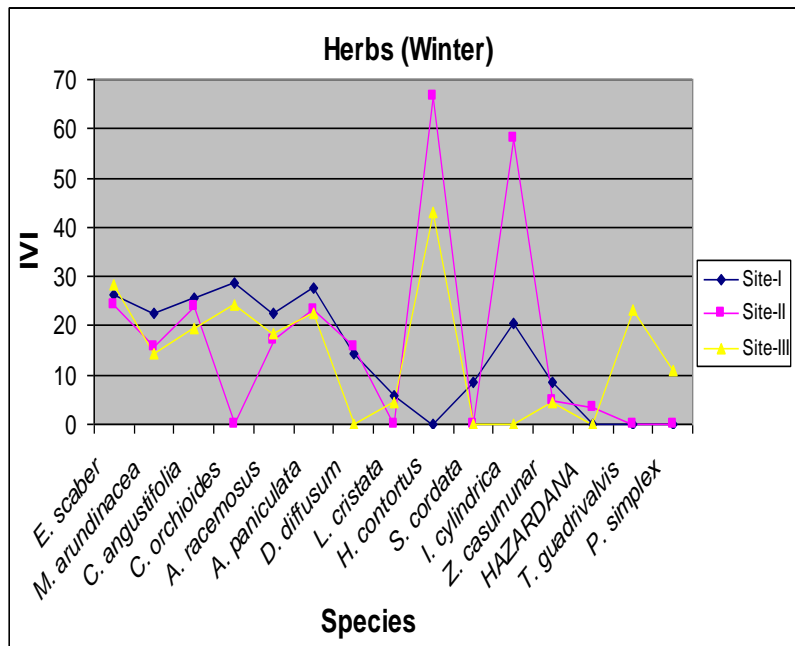


Fig. 4.6 (ci)

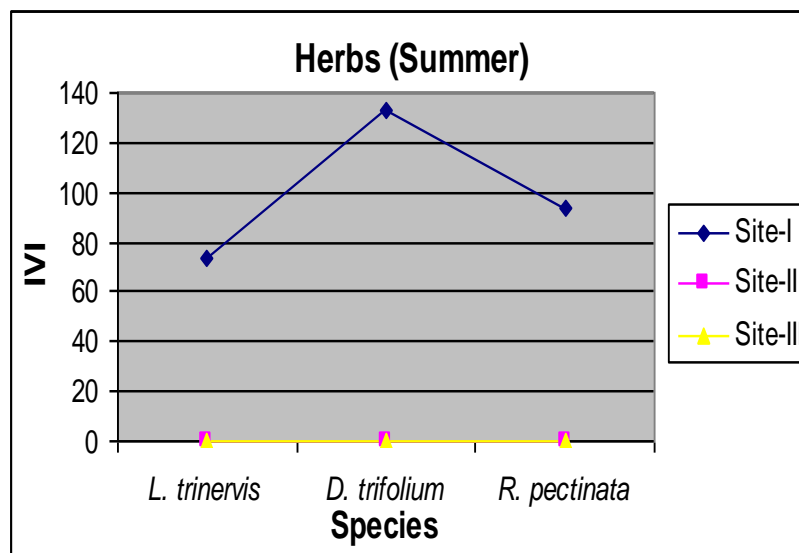


Fig. 4.6 (cii)

Fig. 4.6 (a) to (c) : Vegetation structure of herbaceous species at study sites of Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

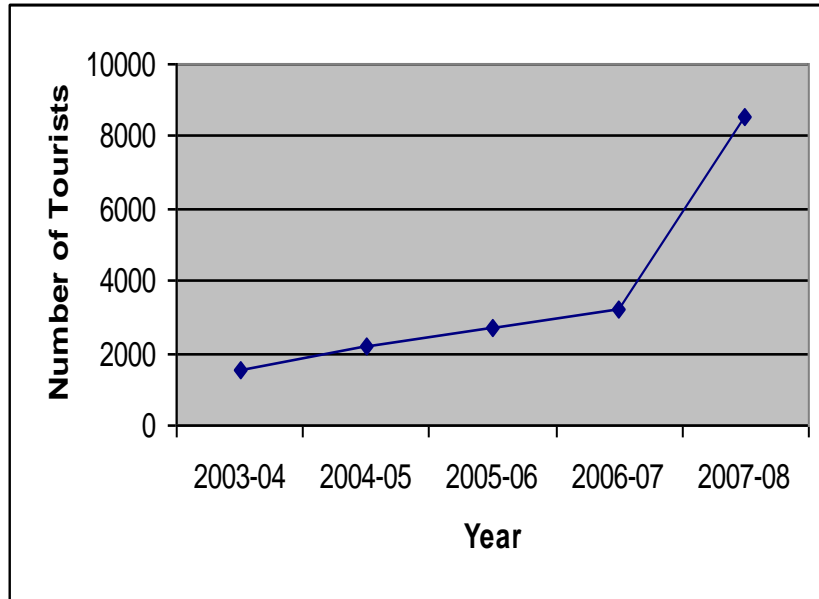


Fig. 4.1 (a): Number of tourists visiting Achanakmar-Amarkantak Biosphere Reserve.

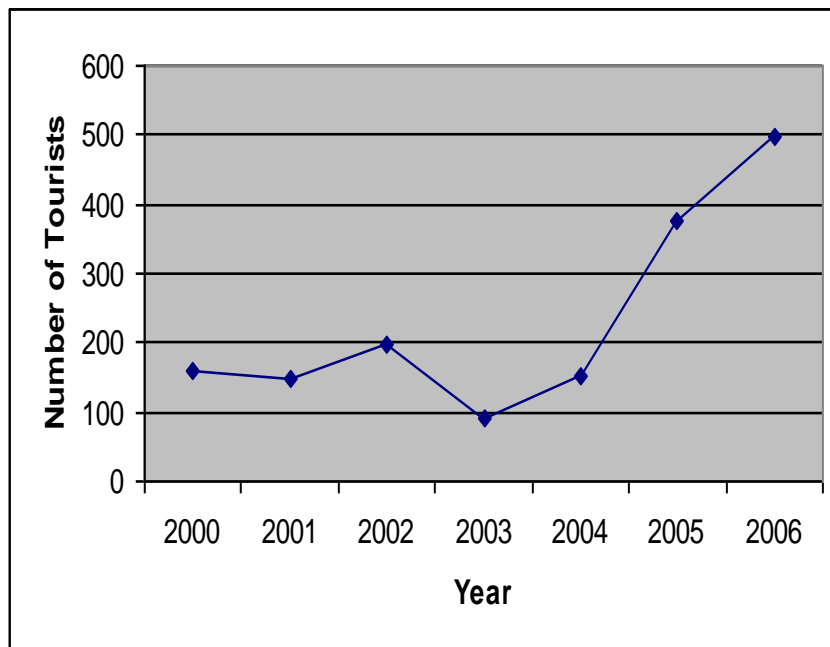


Fig. 4.1 (b): Number of tourists visiting Udanti Wildlife Sanctuary.

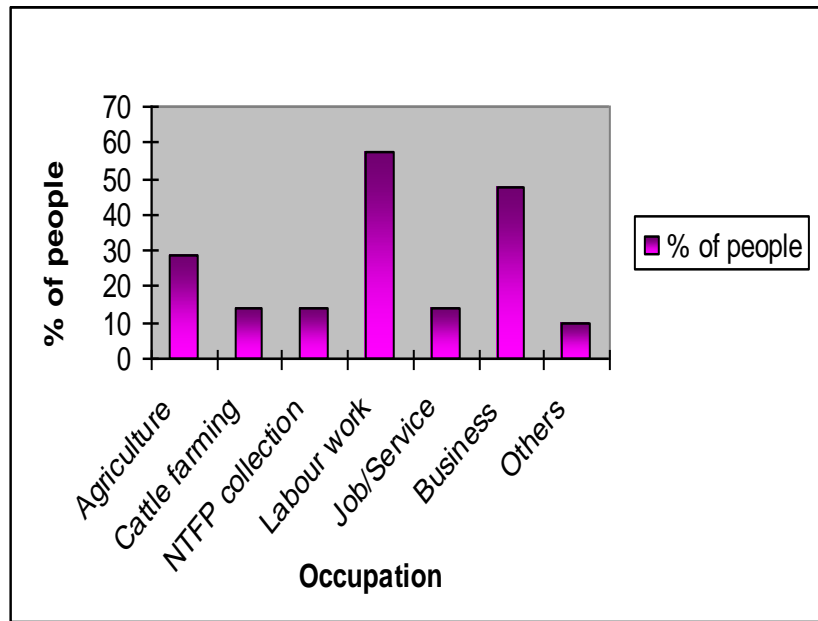


Fig. 4.7 (a) : Occupations of the local residents of Achanakmar-Amarkantak Biosphere Reserve.

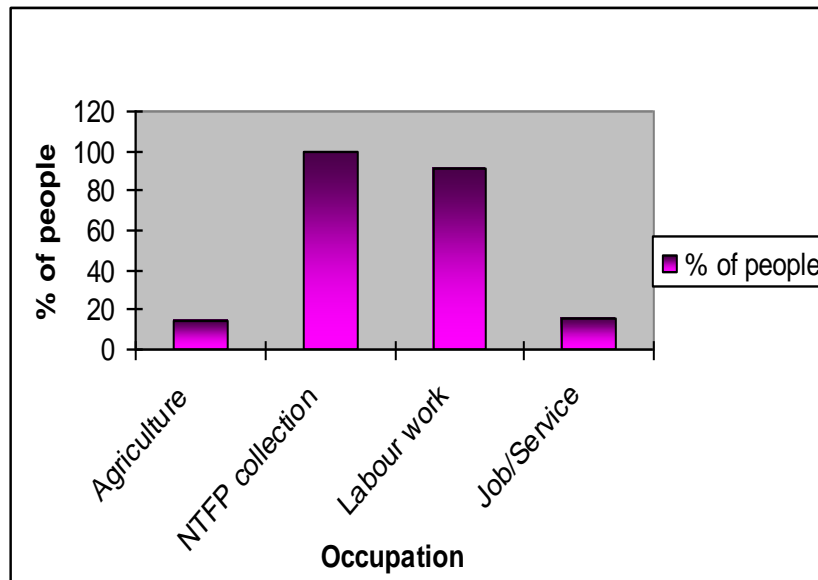


Fig. 4.7 (b) : Occupations of the local residents of Udanti Wildlife Sanctuary.

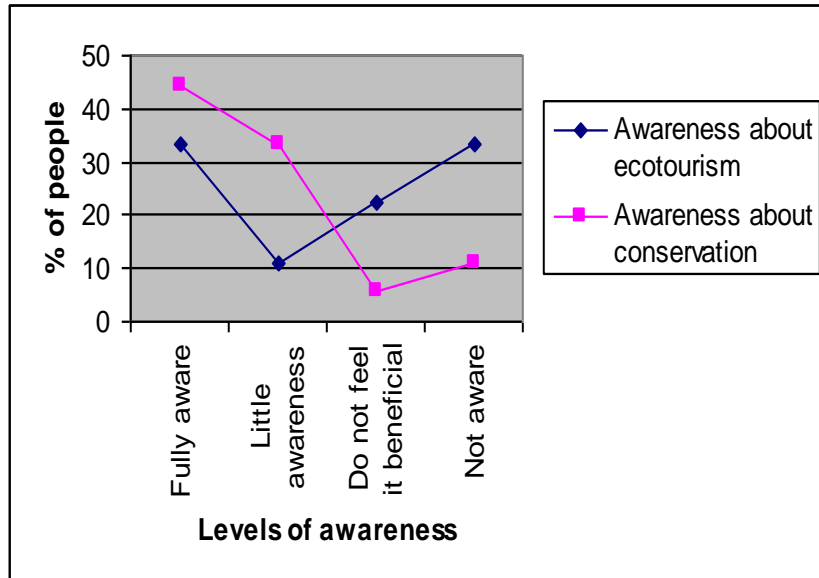


Fig. 4.8 (a) : Awareness about ecotourism and conservation of biodiversity among local residents of Achanakmar-Amrkantak Biosphere Reserve.

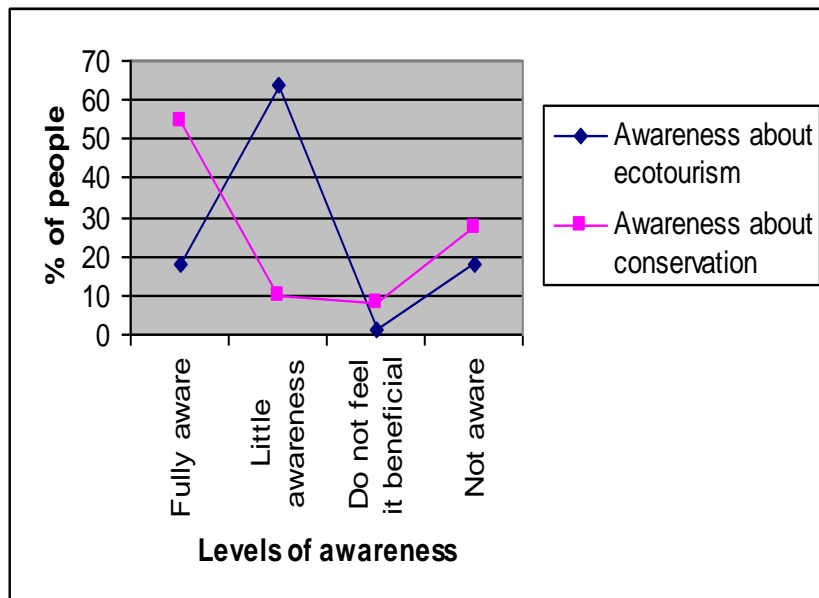


Fig. 4.8 (b) : Awareness about ecotourism and conservation of biodiversity among local residents of Udanti Wildlife Sanctuary.

Table 4.8 : Flora documented at different study sites of Achanakmar-Amarkantak Biosphere Reserve in Bilaspur district of Chhattisgarh.

Botanical Name	Common Name	Habit	Family	Botanical Name	Common Name	Habit	Family
<i>Abrus precatorius</i>	Gumchi	Cl	<i>Fabaceae</i>	<i>Grewia tiliaefolia</i>	Dhamin	T	<i>Tiliaceae</i>
<i>Acanthospermum hispidum</i>	Chotigokhru	Sh	<i>Zygophyllaceae</i>	<i>Heteropogon contortus</i>	Sukla grass	Gr	<i>Poaceae</i>
<i>Adiantum philippense</i>	-	H	<i>Adiantaceae</i>	<i>Kydia calycina</i>	Bargah	T	<i>Malvaceae</i>
<i>Adina cordifolia</i>	Haldu	T	<i>Rubiaceae</i>	<i>Lagerstroemia parviflora</i>	Lendia	T	<i>Lythraceae</i>
<i>Ageratum conyzoides</i>	Gubbhi phool	H	<i>Asteraceae</i>	<i>Lannea coromandelica</i>	Maida	T	<i>Anacardiaceae</i>
<i>Anacyclus pyrethrum</i>	Akarkara	H	<i>Asteraceae</i>	<i>Lannea grandis</i>	Gunja	T	<i>Anacardiaceae</i>
<i>Andrographis paniculata</i>	Kalmegh	H	<i>Acanthaceae</i>	<i>Leea macrophylla</i>	Hasia dhapar	Sh	<i>Leeaceae</i>
<i>Anogeissus latifolia</i>	Dhawda	T	<i>Combretaceae</i>	<i>Lepidogathis cristata</i>	-	H	<i>Acanthaceae</i>
<i>Asparagus racemosus</i>	Satarav	H	<i>Liliaceae</i>	<i>Lepidogathis trinervis</i>	Bhalukhopa	H	<i>Acanthaceae</i>
<i>Barlaria cristata</i>	-	Sh	<i>Acanthaceae</i>	<i>Madhuca indica</i>	Mahua	T	<i>Sapotaceae</i>
<i>Bauhinia malabarica</i>	Amti	T	<i>Fabaceae</i>	<i>Mallotus philippinensis</i>	Sinduri	Sh	<i>Euphorbiaceae</i>
<i>Bauhinia vahlii</i>	Mahul	Cl	<i>Fabaceae</i>	<i>Maranta arundinacea</i>	Arrowroot	H	<i>Zinziberaceae</i>
<i>Boswellia serrata</i>	Salai	T	<i>Burseraceae</i>	<i>Miliusa tomentosa</i>	Kari	T	<i>Annonaceae</i>
<i>Bridellia retusa</i>	Kashi	T	<i>Euphorbiaceae</i>	<i>Ougeinia ougeinensis</i>	Tinsa	T	<i>Euphorbiaceae</i>
<i>Buchanania lanzan</i>	Char	T	<i>Anacardiaceae</i>	<i>Phoenix dactylifera</i>	Jangli khajur	T	<i>Arecaceae</i>
<i>Butea superba</i>	Palash bel	Cl	<i>Fabaceae</i>	<i>Pterocarpus marsupium</i>	Bija	T	<i>Fabaceae</i>
<i>Casearia graveclens</i>	Gilchi	T	<i>Samydaceae</i>	<i>Randia dumetorum</i>	Kharhar	S	<i>Rubiaceae</i>
<i>Casearia tomentosa</i>	Bherry	T	<i>Samydaceae</i>	<i>Rungia pectinata</i>	-	H	<i>Acanthaceae</i>
<i>Cassia fistula</i>	Amaltas	T	<i>Fabaceae</i>	<i>Sida acuta</i>	Biryari	H	<i>Malvaceae</i>
<i>Catunaregam spinosa</i>	Manhar	Sh	<i>Rubiaceae</i>	<i>Sida cordata</i>	-	H	<i>Malvaceae</i>
<i>Costus speciosus</i>	Keo kand	H	<i>Zinziberaceae</i>	<i>Spatholibus parrsflorms</i>	Dokar bel	Cl	<i>Fabaceae</i>
<i>Crotalaria albida</i>	Kulthia	H	<i>Fabaceae</i>	<i>Schleichiera oleosa</i>	Kusum	T	<i>Sapindaceae</i>
<i>Cleistanthus collinus</i>	Karra	T	<i>Tiliaceae</i>	<i>Semecarpus anacardium</i>	Bhelwa	T	<i>Anacardiaceae</i>
<i>Curculigo orchioides</i>	Kali musli	H	<i>Hypoxidaceae</i>	<i>Smilax macrophylla</i>	Ram datun	Cl	<i>Smilacaceae</i>
<i>Curcuma angustifolia</i>	Tikhur	H	<i>Zinziberaceae</i>	<i>Shorea robusta</i>	Sal	T	<i>Dipterocarpaceae</i>
<i>Dendrocalamus strictus</i>	Bamboo	Gr	<i>Poaceae</i>	<i>Syzygium cumini</i>	Jamun	T	<i>Myrtaceae</i>
<i>Desmodium diffusum</i>	Tinpinia	H	<i>Fabaceae</i>	<i>Tectona grandis</i>	Sagwan	T	<i>Verbenaceae</i>
<i>Desmodium gangeticum</i>	Salparni	Sh	<i>Fabaceae</i>	<i>Terminalia arjuna</i>	Arjun	T	<i>Combretaceae</i>

<i>Desmodium pulchellum</i>	Taungtamin		<i>Fabaceae</i>	<i>Terminalia bellerica</i>	Baheda	T	<i>Combretaceae</i>
<i>Desmodium trifolius</i>	-	Sh	<i>Fabaceae</i>	<i>Terminalia chebula</i>	Harra	T	<i>Combretaceae</i>
<i>Diospyros melanoxylon</i>	Tendu	H	<i>Ebenaceae</i>	<i>Terminalia tomentosa</i>	Saja	T	<i>Combretaceae</i>
<i>Elephantopus scaber</i>	Mormukut	T	<i>Asteraceae</i>	<i>Uraria picta</i>	Prashniparni	Sh	<i>Fabaceae</i>
<i>Embelia robusta</i>	Bibding	H	<i>Myrsinaceae</i>	<i>Vallaris solanacea</i>	Dudhia	Cl	<i>Apocynaceae</i>
<i>Embllica officinalis</i>	Anola	Sh	<i>Euphorbiaceae</i>	<i>Ventilago maderaspatana</i>	Keoti	Cl	<i>Rhamnaceae</i>
<i>Ficus benghalensis</i>	Bargad	T	<i>Moraceae</i>	<i>Vetiveria zizanioides</i>	Orai	Gr	<i>Poaceae</i>
<i>Ficus glomerata</i>	Gular	T	<i>Moraceae</i>	<i>Woodfordia fruticosa</i>	Dhawai	Sh	<i>Lythraceae</i>
<i>Ficus religiosa</i>	Peepal	T	<i>Moraceae</i>	<i>Zinziber casumunar</i>	Makarad	H	<i>Zinziberaceae</i>
<i>Gauruga pinnata</i>	Karpot	T	<i>Burseraceae</i>	<i>Zizyphus xylopyrus</i>	Ghont	T	<i>Rhamnaceae</i>
<i>Grewia hirsuta</i>	Gur-sukri	T	<i>Tiliaceae</i>				
		Sh					

Table 4.9 : Flora documented at different study sites of Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

Botanical Name	Common ame	Habit	Family	Botanical Name	Common ame	Habit	Family
<i>Abrus precatorius</i>	Gumchi	Cl	<i>Fabaceae</i>	<i>Flemingia chappar</i>	Tangin dara	Sh	<i>Fabaceae</i>
<i>Acanthospermum hispidum</i>	Chotigokhru	Sh	<i>Zygophyllaceae</i>	<i>Gauruga pinnata</i>	Karpot	T	<i>Burseraceae</i>
<i>Adiantum philippense</i>	-	H	<i>Adiantaceae</i>	<i>Gloriosa superba</i>	Kalihari	H	<i>Liliaceae</i>
<i>Adina cordifolia</i>	Haldu	T	<i>Rubiaceae</i>	<i>Grewia hirsuta</i>	Gur-sukri	Sh	<i>Tiliaceae</i>
<i>Ageratum conyzoides</i>	Gubbi phool	H	<i>Asteraceae</i>	<i>Grewia tiliaefolia</i>	Dhamin	T	<i>Tiliaceae</i>
<i>Anacardium occidentale</i>	Kaju	T	<i>Anacardiaceae</i>	<i>Helicteres isora</i>	Attain	Sh	<i>Sterculiaceae</i>
<i>Anacyclus pyrethrum</i>	Akarkara	H	<i>Asteraceae</i>	<i>Heteropogon contortus</i>	Sukla grass	Gr	<i>Poaceae</i>
<i>Andrographis paniculata</i>	Kalmegh	H	<i>Acanthaceae</i>	<i>Imperata cylindrica</i>	Gheer	Gr	<i>Poaceae</i>
<i>Anogeissus latifolia</i>	Dhawda	T	<i>Combretaceae</i>	<i>Lagerstroemia parviflora</i>	Lendia	T	<i>Lythraceae</i>
<i>Arundinella setosa</i>	Phul bahari	Gr	<i>Poaceae</i>	<i>Lannea coromandelica</i>	Madga	T	<i>Anacardiaceae</i>
<i>Asparagus racemosus</i>	Satavar	H	<i>Liliaceae</i>	<i>Lannea grandis</i>	Gunja	T	<i>Anacardiaceae</i>
<i>Barlaria cristata</i>	-	Sh	<i>Acanthaceae</i>	<i>Leea macrophylla</i>	Hasia dhapar	Sh	<i>Leeaceae</i>
<i>Bauhinia malabarica</i>	Amti	T	<i>Fabaceae</i>	<i>Lepidogathis cristata</i>	-	H	<i>Acanthaceae</i>
<i>Bauhinia vahlii</i>	Mahul	Cl	<i>Fabaceae</i>	<i>Lepidogathis trinervis</i>	Bhalukhopa	H	<i>Acanthaceae</i>
<i>Biophytum sensitivum</i>	Hazardana	H	<i>Euphorbiaceae</i>	<i>Madhuca indica</i>	Mahua	T	<i>Sapotaceae</i>
<i>Boswellia serrata</i>	Salai	T	<i>Burseraceae</i>	<i>Mallotus philippinensis</i>	Sinduri	Sh	<i>Euphorbiaceae</i>
<i>Bridellia retusa</i>	Kashi	T	<i>Euphorbiaceae</i>	<i>Maranta arundinacea</i>	Arrowroot	H	<i>Zinziberaceae</i>
<i>Buchanania lanzan</i>	Char	T	<i>Anacardiaceae</i>	<i>Miliusa tomentosa</i>	Kari	T	<i>Annonaceae</i>
<i>Butea superba</i>	Palash bel	Cl	<i>Fabaceae</i>	<i>Ougeinia ougeinensis</i>	Tinsa	T	<i>Euphorbiaceae</i>
<i>Careya arborea</i>	Kumbhi	T	<i>Myrtaceae</i>	<i>Phoenix sylvestris</i>	Jangli khajur	T	<i>Arecaceae</i>
<i>Casearia graveclens</i>	Gilchi	T	<i>Samydaceae</i>	<i>Phyllanthus simplex</i>	Bhui anola	H	<i>Euphorbiaceae</i>
<i>Casearia tomentosa</i>	Bherry	T	<i>Samydaceae</i>	<i>Pterocarpus marsupium</i>	Bija	T	<i>Fabaceae</i>
<i>Cassia fistula</i>	Amaltas	T	<i>Fabaceae</i>	<i>Pueraria tuberosa</i>	Patal kumda	Cl	<i>Fabaceae</i>
<i>Catunaregam spinosa</i>	Manhar	Sh	<i>Rubiaceae</i>	<i>Randia dumetorum</i>	Kharhar	Sh	<i>Rubiaceae</i>
<i>Catunaregam uliginosa</i>	Kharhar	T	<i>Rubiaceae</i>	<i>Rungia pectinata</i>	-	H	<i>Acanthaceae</i>
<i>Chlorophytum tuberosum</i>	Safed musli	H	<i>Liliaceae</i>	<i>Saccharum spontaneum</i>	Kans	Gr	<i>Poaceae</i>
<i>Cochlospermum religiosum</i>	Galgal	T	<i>Cochlospermaceae</i>	<i>Sida acuta</i>	Biryari	H	<i>Malvaceae</i>
<i>Costus speciosus</i>	Keo kand	H	<i>Zinziberaceae</i>	<i>Sida cordata</i>	-	H	<i>Malvaceae</i>
<i>Cromalaena odorata</i>	Gandhri	Sh	<i>Asteraceae</i>	<i>Spatholibus parrsflorms</i>	Dokar bel	Cl	<i>Fabaceae</i>
<i>Crotalaria albida</i>	Kulthia	H	<i>Fabaceae</i>	<i>Sphareanthus indicus</i>	Gorakhmundi	H	<i>Asteraceae</i>
<i>Cleistanthus collinus</i>	Karra	T	<i>Tiliaceae</i>	<i>Schleichiera oleosa</i>	Kusum	T	<i>Sapindaceae</i>
<i>Curculigo orchioides</i>	Kali musli	H	<i>Hypoxidaceae</i>	<i>Semecarpus anacardium</i>	Bhelwa	T	<i>Anacardiaceae</i>
<i>Curcuma angustifolia</i>	Tikhur	H	<i>Zinziberaceae</i>	<i>Shorea robusta</i>	Sal	T	<i>Dipterocarpaceae</i>
<i>Cyperus rotundus</i>	Nagarmotha	Gr	<i>Poaceae</i>	<i>Smilax macrophylla</i>	Ram datun	Cl	<i>Smilacaceae</i>

<i>Dalbergia latifolia</i>	Kala sheesham	T	<i>Fabaceae</i>	<i>Stereospermum suaveolens</i>	Pander	T	<i>Bignoniaceae</i>
<i>Dalbergia paniculata</i>	Dhobin	T	<i>Fabaceae</i>	<i>Sterculia urens</i>	Kulu	T	<i>Sterculiaceae</i>
<i>Dalbergia sissoo</i>	Sheesham	T	<i>Fabaceae</i>	<i>Syzygium cumini</i>	Jamun	T	<i>Myrtaceae</i>
<i>Dendrocalamus strictus</i>	Bamboo	Gr	<i>Poaceae</i>	<i>Tectona grandis</i>	Sagwan	T	<i>Verbenaceae</i>
<i>Desmodium diffusum</i>	Tinpinia	H	<i>Fabaceae</i>	<i>Terminalia arjuna</i>	Arjun	T	<i>Combretaceae</i>
<i>Desmodium gangeticum</i>	Salparni	Sh	<i>Fabaceae</i>	<i>Terminalia bellerica</i>	Baheda	T	<i>Combretaceae</i>
<i>Desmodium pulchellum</i>	Taungtamin	Sh	<i>Fabaceae</i>	<i>Terminalia chebula</i>	Harra	T	<i>Combretaceae</i>
<i>Desmodium trifolium</i>	-	H	<i>Fabaceae</i>	<i>Terminalia tomentosa</i>	Saja	T	<i>Combretaceae</i>
<i>Diospyros melanoxylon</i>	Tendu	T	<i>Ebenaceae</i>	<i>Themeda quadrivalvis</i>	-	Gr	<i>Poaceae</i>
<i>Elephantopus scaber</i>	Mormukut	H	<i>Asteraceae</i>	<i>Uraria picta</i>	Prashniparni	Sh	<i>Fabaceae</i>
<i>Embelia robusta</i>	Bibding	Sh	<i>Myrsinaceae</i>	<i>Vallaris solanacea</i>	Dudhia	Cl	<i>Apocynaceae</i>
<i>Emblica officinalis</i>	Anola	T	<i>Euphorbiaceae</i>	<i>Ventilago maderaspatana</i>	Keoti	Cl	<i>Rhamnaceae</i>
<i>Evolvulus nummularis</i>	-	H	<i>Convolvulaceae</i>	<i>Vetiveria zizanioides</i>	Orai	Gr	<i>Poaceae</i>
<i>Ficus benghalensis</i>	Bargad	T	<i>Moraceae</i>	<i>Woodfordia fruticosa</i>	Dhawai	Sh	<i>Lythraceae</i>
<i>Ficus glomerata</i>	Gular	T	<i>Moraceae</i>	<i>Zinziber casumunar</i>	Makarad	H	<i>Zinziberaceae</i>
<i>Ficus religiosa</i>	Peepal	T	<i>Moraceae</i>	<i>Zizyphus xylopyrus</i>	Ghont	T	<i>Rhamnaceae</i>

Table 4.2 : Infrastructure and facilities available in Achanakmar-Amarkantak Biosphere Reserve and Udanti Wildlife Sanctuary.

S. No.	Area (sq. km.) and Location	Accommodation		Destination (How to reach?)	Transportation facility	Food facilities	Other infrastructures and facilities
		Facility	Carrying capacity of different rest houses				
Achanakmar-Amarkantak Biosphere Reserve							
1.	551.55 (60 km. from Bilaspur)	<p>Forest Rest House:</p> <p>I. Tiger resort, Chaparwa (140km. from Raipur)- 3 suits</p> <p>II. Rest house, Chaparwa (110km. from Raipur)- 2 suits</p> <p>III. Lamni Rest House (155km. from Raipur)- 4 suits</p> <p>IV. Forest rest House, Pendra- 2 suits</p> <p>V. Forest Rest House, Surhi - 2 suits</p> <p>VI. Forest Rest House, Achanakmar (148km. from Raipur)- 2 suits</p> <p>Private resorts:</p> <p>II. Jungle Resort, Achanakmar: (148 km. from Raipur)- 4 suits Dormitory- 10 beds</p> <p>II. Paryatak kutir, Achanakmar (148km. from Raipur)</p>	<p>10-12 people</p> <p>8-10 people</p> <p>12-16 people</p> <p>8-10 people</p> <p>8-10 people</p> <p>8-10 people</p> <p>16-20 people</p> <p>10-15 people</p>	<p>By air- Nearest airport is Raipur (176km.)</p> <p>By rail- Nearest railway stations are Kargi road (30km.) and Pendra road (25km.)</p> <p>By road- tourists can hire jeep, car or bus from Bilaspur/ Kota/ Pendra/ Amarkantak. Also some privet buses follow the route from the centre of the sanctuary area through which the tourists.</p>	<p>I. Tourists can use their privet jeep, car or bus or hire from Bilaspur/ Kota/ Pendra/ Amarkantak.</p> <p>II. Two Gipsy, one at Achanakmar and one at Chaparwa have been provided by the government that can be hired by paying the provided charges.</p>	<p>I. Bison Restaurant, Achanakmar</p> <p>II. Chaparwa dhaba.</p> <p>II. Surhi and Lamni rest house (food can be made available on prior information)</p>	<p>Interpretation centers at Achanakmar and Lamni barriers.</p> <p>At some tourist spots and on hills watch towers have been constructed for view of the beauty of the forests.</p>

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S. No.	Area (sq. km.) and Location	Accommodation		Destination (How to reach?)	Transportation facility	Food facilities	Other infrastructures and facilities
Udanti Wildlife Sanctuary							
2.	237.28 (175km. from Raipur)	<p>I. Forest Rest house, Taurenga (159km. from Raipur)- 4 suits</p> <p>II. Forest Rest House, Mainpur (137km. from Raipur)- 2 suits</p> <p>III. Forest Rest House, Karlajhar (177km. from Raipur)- 2 suits</p> <p>IV. Forest Rest House, Indagaon, Koyeba (172km. from Raipur)- 2 suits, 5 dormitory; 3 huts under construction.</p> <p>V. Forest Rest House, Jugad (166km. from Raipur)- 2 suits</p> <p>VI. P.W.D.rest house, Mainpur- 2 suits</p>	<p>16-20 people</p> <p>8-10 people</p> <p>8-10 people</p> <p>30-35 people</p> <p>8-10 people</p> <p>8-10 people</p>	<p>By air- Nearest airport is Raipur (175 km.)</p> <p>By rail- Most convenient railhead is Raipur</p> <p>By road- tourists can use their privet jeep/car or hire it from Gariaband and Mainpur. Also some privet buses follow the route from the centre of the sanctuary area through which the tourists.</p>	<p>I. Tourists can use their private jeep/car or hire from Raipur, Gariaband, Dhamtari or Mainpur.</p> <p>II. No government vehicle is available for tourists at present.</p>	<p>I. Restaurants and hotels at Mainpur and Gariaband.</p> <p>II. Coldrink corners at Taurenga and on road between Taurenga and Jugad.</p> <p>III. One Restaurant under construction at Koyeba eco-centre.</p> <p>IV. At the rest houses on prior information food can be made available.</p>	<p>I. Interpretation centers at Koyeba ecocentre and Taurenga.</p> <p>II. 3 watch-towers to see the gregarious forests of Udanti, and two towers are under construction phase.</p>

Source: As per information available in brochures and from Forest Department staff.

Table 4.5 : Some important suggestions through which the ecotourism can be made comfortable and enjoyable for common man.

S. No.	Accommodation	Transportation facility	Food facilities	Other infrastructures and facilities
Achanakmar-Amarkantak Biosphere Reserve				
1.	The accommodation facilities need to be improved and their number should be increased so that the tourists do not face problems in the peak tourist season.	There is availability of transport vehicles but at the time of peak tourist season, the tourists have to face the problems which should be taken into consideration by the government.	<p>The food available should include the local recipes for its preparation.</p> <p>The place of eating and food available should be improved so that hygiene conscious people can also enjoy eating at dhaba.</p>	<p>The maintenance of the bungalows should be done. Trained guides must be made available. Reservation policy from any place can be made available for the rest houses, motels, etc. Forest officials must be made available as and when required by the tourists. Some modes of entertainment must be made available at the rest house.</p> <p>In the evenings and nights folk dances and mini-theatres should be conducted near rest house where information about the area, its floral richness, faunal wealth and the tribal traditions can be given through audios and videos.</p>
Udanti Wildlife Sanctuary				
2.	The number of rest house or cottages should be increased so that more number of persons can be accommodated at a time very easily, such as school and college students can be taken for educational tours/ excursions for one or two days and shown the nature and the flora and fauna in their natural form. They can be explained the concept of ecotourism, local flora, fauna, their special characteristics, etc.	There is lacuna of the transport facilities in this sanctuary, as all the types of vehicles cannot go inside the forest area, therefore gypsy, jeeps or safari vehicles should be provided by the government to facilitate the tourists.	The food availability is difficult; some refreshment centers must be opened at one or two spots, so that tourists can enjoy the food.	<p>The interpretation centers must be maintained properly. At the tourist spots shades, resting place, refreshment centers must be constructed with the help of locally available materials, such as mud huts. Some modes of entertainment must be made available at the rest house. Proper facility to dispose off garbage must be available.</p> <p>In the evenings and nights folk dances and mini-theatres should be conducted near rest house where information about the area, its floral richness, faunal wealth and the tribal traditions can be given through audios and videos.</p>

Table 4.6 : Tourist places in Achanakmar-Amarkantak Biosphere Reserve.

S. No.	Tourist places	Special features
1.	Sihawal Sagar	It is situated at a distance of 12 k.m. from Achanakmar forest village. This beautiful spot is situated between dense forests. This spot is origin of Maniyari river, where a pond and a watch tower has been constructed. With the help of this watch tower the birds coming to the pond can be seen, the pond also nurtures crocodiles.
2.	Pandwani Talab	It is situated at a distance of 45 k.m. from Achanakmar forest village. There is an old mythological pond where there is a ruined Shiva temple also. It is said that this temple was built by the Pandavas.
3.	Lakshman Pav	At a distance of 16 k.m. from Achanakmar forest village, there are two ditches on rock. It is said that Lakshman had shot arrow from that place because of which the footprints have got marked there. Situated in the center of the forest, it is very beautiful place.
4.	Nagbahra	10 k.m. away from Achanakmar, it is very old rock which looks like snake. On the occasion of nagpanchami this snake drinks milk.
5.	Lakshman Dongri	This spot is at a distance of 30 k.m. from Achanakmar forest village. It is said that Rama had spent a little time during his exile at this place. The ruins of old statues are found here.
6.	Mendri Sarai	At a distance of 30 k.m. from Achanakmar, there is this large Sal tree which is believed to be the oldest tree and has a girth of 480 c.m.
7.	Amarkantak	This holy place is origin of Narmada and Sonbhadra rivers, at the border of Chhattisgarh and Madhya Pradesh. This place has religious and historical importance. This is an important holy tourist spot.
8.	Majhi Dongri	From this hill top, 2/3 part of the reserve area is visible. Its height is 2100 foot. A watch tower has also been constructed at this place to have a bird's eye-view of the forest area.
9.	Jhandi Dongri	The watch tower provides bird's eye-view of 2/3 part of the reserve area. It's height is 2300 foot.
10.	Tangli Pathar	23 k.m. away from Achanakmar, a watchtower has been constructed from where beautiful site of the Biosphere Reserve can be observed.
11.	Raksha Chak Waterfall	Inside the Biosphere Reserve, near Birarpani forest village, this beautiful waterfall is on the border of Madhya Pradesh and Chhattisgarh. It is at a distance of 45 k.m. from Achanakmar and an important tourist attraction spot.
12.	Banyan Tree Monument	This magnificent tree is 32 k.m. from Achanakmar at Patparha forest village. It's age is about 125 years. The local people believe that lord Brahma has resides in this tree and they worship it.

S. No.	Tourist places	Special features
13.	Maikumath	It is 6 k.m. away from Achanakmar. The math is built in the memory of a Gond Maiku who was killed by a killer tigress while fighting.
14.	Khudiya Water Reserve	On the boundry of the Biosphere Reserve, this water reserve is very old, built during the British rule. About 200 years old this water reserve is good site for bird watchers and ornithologists to view birds.
15.	Jwaleshwar (Jaleshwar)	This spot is at the state border of Madhya Pradesh and Chhattisgarh, at a distance of 9 k.m. from Amarkantak. There is an old Shiva temple, also it is the origin of Johila river. It is 19 k.m. away from Pendra Road.
16.	Rajmergarh	Situated inside the forest area, this area seems to be the ruins of an old fort. It is 5 k.m. away from Jaleshwar on the plateau of Amarkantak. From this point a bird's view of Pendra Road is visible. This is a perfect place for trekking and camping.
17.	Malniya Bandh	7 k.m. away from Pendra Road, this newly built, large water reservoir has tremendous potentials to be developed as water sport and entertainment. On the occasion of Anola Navmi, every year a fair is organized here.
18.	Dharampani	35 k.m. away from Pendra Road on Amarkantak road, this is the second highest point next to Rajmergarh. In its valley flows the Amanala river, on the origin of which lies the Durga Dhara Waterfall.
19.	Vilambhgarh	This spot is near Gaurella, near Karangara Village, where there is a cave which attracts the tourists. This forest area is good trekking spot.
20.	Brahmagarh	This spot lies in between the meeting point of Son and Johila rivers. Its height is more than 50 m. and is a good trekking site.

Table 4.7 : Tourist places in Udanti Wildlife Sanctuary.

S. No.	Tourist places	Special features
1.	Godena Waterfall	The waterfall is situated at a distance of 8 k.m. from Karlajhar forest village. To reach the fall one has to cover a distance of 800 m. besides river and dense forest on foot. The fall is about 250m. with steep slope on colourful rocks. The fall is at a lonely place with rippling sound of water falling from the rocks pleasing the heart of one and all.
2.	Deodarha Waterfall	This waterfall is 17 k.m. from Taurenga forest village. To reach one has to walk a distance of about 1 ^{1/2} k.m. This beautiful place is surrounded by mixed forests. The rock cuttings show a beautiful look of nature. The water is falling from 40 feet of height.
3.	Chowksill Hill	The Chowksill Hill lies near the Nagesh water reserve inside the sanctuary. The structures on the hill show naturally constructed temple and caves – a nature's creativity which has no comparison with human art.
4.	Mann Dongri Hill	The hill is 8-10 k.m. from Jugad forest village. The hill top gives beautiful view of the Sanctuary area. This site can be developed as trekking site supporting adventure tourism in the area.
5.	Chulha Dongri Hill	This hill is also 8-10 k.m. from Jugad forest village. The hill top gives birds eye view of the Sanctuary. This place can be developed as a spot for adventure tourism. The trekking to the hill gives a winners feeling. The trekking path covers dense forest, caves of wild animals like, leopard, bear, as well as openings of porcupine, wild fowl etc. The hill also has cave which is still unexplored.
6.	Shahidi sthal	On 30 May 1989 Shri B. D. Kawaria who was lover of wild animals and an active senior officer, lost his life while trying to provide medical aid wild buffalo. In the memory of such dedicated officer a stage has been constructed at this place.
7.	Sikaser Water Reserve	This water reserve is situated on the way to Udanti Wildlife Sanctuary, at a distance of 19 k.m. from Dhawalpur. The reserve is build upon River Pairi, at both the places, above and below there are temples. On the hill there is a beautiful temple where fair is organized every year. The nearby forest area covered with rocks is beautiful. The water flowing about 700 m. on slanting rocks looks very beautiful.
8.	Udanti River	The river is lifeline of Udanti Wildlife Sanctuary. The hills and rocks on the banks can be developed as spots to attract the tourists. The river bank will refresh the tourists to forget all the worries for a little time and enjoy the leisures provided by nature.
9.	Dasin River	The river is situated inside the Sanctuary and is a beautiful spot with full potential to attract tourists and provides perfect spot for some refreshment.
10.	Raksa-had Hill	This hill in the Sanctuary has mythological importance. It is said that this hill looks like bones of large demon, and after rains, its smell strongly like bones of animals.
11.	Koyeba Ecocentre	A building has been constructed as ecocentre which is also an interpretation centre where information about the wild animals has been displayed.
12.	Rescue Centre	A rescue centre has been maintained near Karlajhar where a wild buffalo has been kept protected also wounded animals if found are brought here and kept in protection till it gets well and then left in the forest.
13.	Haldu Tree	A large tree of Haldu (<i>Adina cordifolia</i>) with girth measuring 6.20 m. in 2007. This tree is believed to be the largest Haldu tree of Chhattisgarh.

Table 4.15 : Some plant species found at different study sites of Achanakmar-Amarkantak Biosphere Reserve along with their uses.

S. No.	Common name	Botanical name	Family	Utilization			Other uses
				Medicinal	Commercial	Aesthetic	
TREES							
1.	Bargah	<i>Kydia calycina</i>	<i>Malvaceae</i>	-	Inferior building, ploughs, matchsticks.	-	-
2.	Salai	<i>Boswellia serrata,</i>	<i>Burseraceae</i>	Fowers and seeds used in diarrhoea, dysentery, asthma. Oleo-gum resin for impotency.	Inferior planking, cheap furniture, cases, rough packing, match sticks.	-	-
3.	Karpot	<i>Garuga pinnata,</i>	<i>Burseraceae</i>	-	Inferior building, planks.	-	-
4.	Bhelwa (Marking nut)	<i>Semecarpus anacardium</i>	<i>Anacardiaceae</i>	Seed oil has varied uses. Beneficial in tumors and warts, acute rheumatism, asthma, neuralgia, piles, fever, loss of apatite. Oil is powerful antiseptic. Kernel is a good cardiac tonic and general respiratory stimulant.	Wood is good for matchsticks and match boxes.	-	-
5.	Amti	<i>Bauhinia malabarica</i>	<i>Caesalpiaceae</i>	-	Yields minor wood.	-	-
6.	Bahera	<i>Terminalia bellerica</i>	<i>Combretaceae</i>	Dried fruis are used in stomach disorders. Given as brain tonic and applied as a soothing lotion. Useful in	The wood keeps well under water and is used for making boats, etc. also for miscellaneous	-	Fruit yields tannin for leather tann-ing, making inks and

				piles, leprosy, dropsy and fever.	agricultural tools.		dyi-ng cloth and leather for.
7.	Harra	<i>Terminalia chebula</i>	<i>Combretaceae</i>	Dried fruits can be applied on ulcers, wounds and scalds; as gargle in inflammation of mucous membrane of mouth. Used as laxative. Have effect on blood pressure as cardiac tonics. Powder used as dentifrice for the strength of gums.	Wood is used for making agricultural implements.	-	Fruit yields tannin for dyeing leather and cloth.
8.	Saja	<i>Terminalia tomentosa</i>	<i>Combretaceae</i>	-	House building, rough articles of furnitures, ploughs, harrows, shafts and axles, boat and ship building.	-	-
9.	Dhaura	<i>Anogeissus latifolia</i>	<i>Combretaceae</i>	-	Poles and rafters, cart building, axels and shafts, agricultural implements, tool handles, spinning wheels, furniture, boat building and mining timber.	The dry inflorescence becomes golden yellow and looks beautiful and can be used for dry decoration.	-
10.	Bheri	<i>Casearia tomentosa</i>	<i>Samydaceae</i>	-	Wood used for temporary huts, fuelwood.	-	-
11.	Haldu	<i>Adina cordifolia</i>	<i>Rubiaceae</i>	-	Wood is used for building, planking of river boats,	-	-
12.	Mahua	<i>Madhuca indica</i>	<i>Sapotaceae</i>	-	Wood used for house building, ship, boats, oil-mills, drums, cart axles.	-	Flower is used for preparation of liquor. Edible oil is extracted from seeds called 'kori'.
				Root and bark is used as astringent. Bark used in			

13.	Gunja (Kashi)	<i>Bridellia retusa</i>	<i>Euphorbiaceae</i>	rheumatism, extract is antiviral, hypotensive and anticancer, decoction for diarrhoea and earache. Paste is applied on wounds and taken internally in snakebite.	Wood used for building work, carts, yokes, agricultural implements.	-	-
14.	Char	<i>Buchanania lanzan</i>	<i>Anacardiaceae</i>	-	Wood used for small beams and rafters, door and window frames, cheap furniture, mining timber, match boxes.	-	Fruits are edible. Seeds are having high commercial value as 'chironji'.
15.	Kari	<i>Miliusa tomentosa</i>	<i>Anacardiaceae</i>	-	Wood yields small beams, rafters, knees of boats, agricultural implements, spoons and other utensils.	-	-
16.	Amaltas	<i>Cassia fistula</i>	<i>Caesalpeniaceae</i>	Root is astringent, tonic, febrifuge, purgative and useful in skin diseases, tuberculous glands, syphilis. Root bark, seeds and leaves are laxative. Leaf juice is useful in skin diseases. Pulp is used for inflammations. Fruit cures leprosy, heart diseases and is applied externally in rheumatism and snake bite.	Wood is used for bridge posts, house building, wheels, boat building, tool handles and turnery.	The yellow gorgeous inflorescence possesses ornamental value for being planted in gardens, parks, avenues. The fruits can be used for dry decoration.	Yellow dye is obtained from flower petals.
17.	Tendu	<i>Diospyros melanoxyton</i>	<i>Ebenaceae</i>	-	Wood used for building, carts, furniture, walking sticks, toys, carvings, picture frames and general fancy work. Leaf used for making bidis and forms an important base for cottage industry.	-	Fruit are edible by humans as well as animals.

18.	Jamun	<i>Syzygium cumini</i>	<i>Myrtaceae</i>	Bark is astringent used specifically for dysentery, cures haemorrhages, burning sensation, diarrhoea, diabetes, cough and asthma, in preparation of gargles and washes. Seed used in diabetes.	Wood is used for house building, common furniture, common furniture, agricultural implements, railway sleepers, carving and turnery.	-	Fruits are edible.
19.	Pipal	<i>Ficus religiosa</i>	<i>Moraceae</i>	-	Packing cases and occasionally used for felloes of wheels.	The grand tree is planted as an ornamental tree in home, gardens etc. Bonsai is prepared easily.	-
20.	Karra	<i>Cleistanthus collinus</i>	<i>Tiliaceae</i>	-	Wood used as shoulder poles and for purposes requiring elasticity.	-	Seeds are poisonous.
21.	Dhamin	<i>Grewia tiliaefolia</i>	<i>Tiliaceae</i>	-	Wood used for making boats, masts, door and window frames.	-	-
22.	Senha (Lendia)	<i>Lagerstroemia parviflora</i>	<i>Lythraceae</i>	-	House building, carts, shafts, boats, tool handles.	The tree is planted for its ornamental value.	-
23.	Tinsa	<i>Ougeinia ougeinensis</i>	<i>Euphorbiaceae</i>	-	Wood used for building (chiefly posts), carriage building, furniture, ploughs and other implements, boat building, handles of axes and other tools.	-	-

24.	Bija (Indian kino)	<i>Pterocarpus marsupium</i>	<i>Papilionaceae</i>	It is a reputed drug for treatment of leprosy, and other skin diseases. It is an esteemed remedy for diabetes. Plant and gum- laxative, anthelmintic, useful in diseases of blood, eruptions on body, leprosy, urinary discharges also in eye troubles and elephantiasis.	Wood used for house building, furniture, agricultural implements, railway wagons, boat building.	-	-
25.	Ghont	<i>Zizyphus xylopyrus</i>	<i>Rhamnaceae</i>	-	Wood used for building, poles, furniture, agricultural implements, ploughs and other implements, handles of axes and other tools	-	The tree is used for lac cultivation.
26.	Kusum	<i>Schleichera oleosa</i>	<i>Sapindaceae</i>	-	The tree rears silkworm insect which provides silk for textiles.	-	-
27.	Anola	<i>Emblica officinalis</i>	<i>Euphorbiaceae</i>	Root, bark, leaf, flower and fruits are used in toothache, sores, fever, anaemia, epilepsy, pimples, gonorrhoea. Fr- an ingredient of 'triphala' and 'chyavanprash'.	Wood used for medium grade furnitures, building etc.	-	The tree is worshiped by hindus.
28.	Jangli khajur	<i>Phoenix dactylifera</i>	<i>Arecaceae</i>	-	Sugar/ jaggry is prepared from its sap.	-	Fruits are edible.

29.	Sal	<i>Shorea robusta</i>	<i>Dipterocarpaceae</i>	-	Timber is the best in the country. Used for carving, building construction, furniture making and general carpentry, etc. Seed provides edible oil.	-	Sal dhoop-exudated from wounds on stem is used for making agarbatis and dhoop.
30.	Teak	<i>Tectona grandis</i>	<i>Verbenaceae</i>	-	Superior timber used for furniture as well as building, ship industries, etc.	-	A red dye is obtained from fruit.
31.	Arjun	<i>Terminalia arjuna</i>	<i>Combretaceae</i>	Bark powder is used to relieve hypertension, is diuretic and tonic in cirrhosis of liver, given internally with milk in bone fractures. The decoction is used as wash in ulcers and cancer. Bark ash is prescribed for scorpion sting.	The wood is used for making boat, general carpentry, carving, etc.	It is planted as Avenue tree.	The bark yields dye for tanning of leather.
32.	Sinduri (Ainthe)	<i>Mallotus philippinensis</i>	<i>Euphorbiaceae</i>	Glands and hairs of fruits are anthelmintic, expels worms of intestine, useful for ringworm, pityriasis and freckles, also applied over syphilitic ulcers.	Wood for tool handles and suitable for match boxes.	-	The red dye obtained from fruit is used for dyeing fabrics.

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SHRUBS and CLIMBERS

1.	Salparni	<i>Desmodium gangeticum</i>	<i>Papilionaceae</i>	Root is a constituent of 'Dashamoola', antipyretic and used for hazy vision and dysentery. It is a good cardio tonic also used in chronic fever, biliousness, cough, vomiting, asthma, snake-bite, scorpion sting.	-	-	-
2.	Mahul	<i>Bauhinia vahlii</i>	<i>Caesalpiniaceae</i>	-	Leaves are used for preparation of donas and pattals which is an important cottage industry providing employment to lots of people.	-	The stem is used for making baskets, apparatus for keeping water and keeps water cool inside.
3.	Dhawai	<i>Woodfordia fruticosa</i>	<i>Lythraceae</i>	Bark is pungent, cooling and used as uterin sedative. Leaves used in bilious sickness. Dried flowers used in dysentery, meno-rrhagia, liver disorders, disorders of mucous membrane, haemorrhoids, head-ache and fever.	-	A large ornamental shrub- the bright red flowers add beauty to the location where it occurs, thus can be planted in gardens and parks.	Flower is used for dyeing silk.
6.	Baibrang	<i>Embelia robusta</i>	<i>Myrsinaceae</i>	Root improves digestion and cures flatulence and colic, used as an antifertility drug. Fruits are acrid astringent, carminative, anthelmintic, stimulant;	-	-	-

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				reputed for expelling tapeworms, cures dental, oral and throat troubles.			
7.	Ramdatun	<i>Smilax macrophylla</i>	<i>Smilacaceae</i>	Root is given with sugar crystals in menstrual problems.	-	-	Stem used for making ropes and for cleaning mouth.
8.	Palash bel	<i>Butea superba</i>	<i>Fabaceae</i>	-	-	-	Root is used for sacred works. Stem is used for making ropes, baskets etc.
9.	Gursukri	<i>Grewia hirsuta</i>	<i>Tiliaceae</i>	Root and fruit used in ayurvedic preparations as sweetner, taken in weakness and applied on wounds.	-	-	Fruit is sweet like jaggry and is eaten raw.
10.	Kewati	<i>Ventilago maderaspatana</i>	<i>Rhamnaceae</i>	-	-	-	The stem is used for making ropes.
12.	Kharhar	<i>Randia dumetorum</i>	<i>Rubiaceae</i>	Root paste is prescribed in piles. Bark is used in snake bite.	-	-	-
13.	Hasia dhapar	<i>Leea macrophylla</i>	<i>Leeaceae</i>	Root powder is mixed with jaggry and prescribed in weakness.	-	-	-
14.	Prashniparni	<i>Uraria picta</i>	<i>Fabaceae</i>	It is an ingredient of 'dashmoola' and several other ayurv-edic preparations.	-	-	-
15.	Gumchi	<i>Abrus precatorius</i>	<i>Papilionaceae</i>	Root powder is given in cough and cold.	-	-	The seeds are used in ornaments by local people.

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HERBS and GRASSES

1.	Hanspadi	<i>Adiantum philippense</i>	<i>Adiantaceae</i>	Whole plant used in diseases related to blood, burning sensation, epileptic fits, epileptic ulcers and dysentery. Rhizome prescribed in fever due to elephantiasis. Fronds and fruits used in leprosy, fever, swellings and tumours.	-	The fresh plants can be used for interior decoration.	-
2.	Gojivha	<i>Elephantopus scaber</i>	<i>Asteraceae</i>	Root and leaf are astringent, cardiac tonic, diuretic, febrifuge. Decoction given in diarrhoea, swelling or stomach pain. Root powder with pepper applied to toothache.	-	-	-
3.	Bhalukhopa	<i>Lepidogathis trinervis</i>	<i>Acanthaceae</i>	Root is used in treatment of skin problems like leprosy, etc.	-	-	-
4.	Kalmegh	<i>Andrographis paniculata</i>	<i>Acanthaceae</i>	Whole plant is use-ful for all types of fevers, in constipati-on, dysentery and dyspepsia, in spleen complaints. Root and leaf is used in tonic, stomachic, antipyretic, anthelm-intic. Used as curati-ve in snake bite.	-	-	-

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5.	Khus (Orai)	<i>Vetiveria zizanioides</i>	<i>Poaceae</i>	Root oil is used as carminative in flatulence and colic, as anthelmintic and is stimulant and refrigerant.	Oil extracted from roots is used in perfumery, cosmetics and scenting soaps.	-	-
6.	Biryari (Mahabala)	<i>Sida acuta</i>	<i>Malvaceae</i>	An ingredient of 'chyavanprash'. Roots useful in nervous and urinary diseases. Leaf juice is boiled in oil and applied to reticular swellings and in elephantiasis.	-	-	-
TUBEROUS PLANTS							
1.	Keokand	<i>Costus speciosus</i>	<i>Zingiberaceae</i>	Rhizome is bitter, astringent and used as tonic, aphrodisiac and anthlmintic. Used in catarrhal fevers, cough, dyspepsia, worms and skin diseases.	-	-	-
2.	Tikhur	<i>Curcuma angustifolia</i>	<i>Zingiberaceae</i>	-	-	-	The rhizome is edible.
3.	Arrowroot	<i>Maranta arundinacea</i>	<i>Zingiberaceae</i>	-	The starch obtained from tubers is used in industries.	-	-

4.	Tinpinia	<i>Desmodium diffusum</i>	<i>Fabaceae</i>	Root powder used in Asthma and tuberculosis, cough and cold	-	-	-
5.	Satawar	<i>Asparagus racemosus</i>	<i>Liliaceae</i>	Root powder is nerve tonic, rejuvenative, antispasmodic, nervous disorders, diarrhoea, hepatopathy, cardiac debility, hypertension.	-	-	-
6.	Kali musli	<i>Curculigo orchoides</i>	<i>Hypoxidaceae</i>	Rhizome is rejuvenative, aphrodisiac; used in piles, jaundice, asthma, diarrhoea, gonorrhoea, menorrhagia, leucorrhoea, powder heals wounds externally	-	-	-
7.	Makarad	<i>Zingiber casumunar</i>	<i>Zinziberaceae</i>	Rhizome is used in migraine, chewed in gastric and respiratory problems, paste is applied externally in body ache and muscular pain.	-	-	-

Table 4.16 : Some plant species found at different study sites of Udanti Wildlife Sanctuary along with their uses.

S. No.	Common name	Botanical name	Family	Utilization			Other uses
				Medicinal	Commercial	Aesthetic	
TREES							
1.	Bargah	<i>Kydia calycina,</i>	<i>Malvaceae</i>	-	Inferior building, ploughs, matchsticks.	-	-
2.	Salai	<i>Boswellia serrata,</i>	<i>Burseraceae</i>	Flowers and seeds used in diarrhoea, dysentery, asthma. Oleo-gum resin for impotency.	Inferior planking, cheap furniture, cases, rough packing, match sticks.	-	-
3.	Karpot	<i>Garuga pinnata,</i>	<i>Burseraceae</i>	-	Inferior building, planks.	-	-
4.	Bhelwa (Marking nut)	<i>Semecarpus anacardium</i>	<i>Anacardiaceae</i>	Seed oil has varied uses. Beneficial in tumors and warts, acute rheumatism, asthma, neuralgia, piles, fever, loss of apatite. Oil is powerful antiseptic. Kernel is a good cardiac tonic and general respiratory stimulant.	Wood is good for matchsticks and match boxes.	-	-
5.	Amti	<i>Bauhinia malabarica</i>	<i>Caesalpiaceae</i>	-	Yields minor wood.	-	-
6.	Bahera	<i>Terminalia bellerica</i>	<i>Combretaceae</i>	Dried fruits are used in stomach disorders. Given as brain tonic and applied as a soothing lotion. Useful in piles, leprosy, dropsy and fever.	The wood keeps well under water and is used for making boats, etc. also for miscellaneous agricultural tools.	-	Fruit yields tannin for leather tanning, making inks and dyeing cloth and leather for.

7.	Harra	<i>Terminalia chebula</i>	<i>Combretaceae</i>	Dried fruits can be applied on ulcers, wounds and scalds; as gargle in inflammation of mucous membrane of mouth. Used as laxative. Have effect on blood pressure as cardiac tonics. Powder used as dentifrice for the strength of gums.	Wood is used for making agricultural implements.	-	Fruit yields tannin for dyeing leather and cloth.
8.	Saja	<i>Terminalia tomentosa</i>	<i>Combretaceae</i>	-	House building, rough articles of furnitures, ploughs, harrows, shafts and axles, boat and ship building.	-	-
9.	Dhaura	<i>Anogeissus latifolia</i>	<i>Combretaceae</i>	-	Poles and rafters, cart building, axels and shafts, agricultural implements, tool handles, spinning wheels, furniture, boat building and mining timber.	The dry inflorescence becomes golden yellow and looks beautiful and can be used for dry decoration.	-
10.	Bheri	<i>Casearia tomentosa</i>	<i>Samydaceae</i>	-	Wood used for temporary huts, fuel wood.	-	-
11.	Haldu	<i>Adina cordifolia</i>	<i>Rubiaceae</i>	-	Wood is used for building, planking of river boats,	-	-
12.	Mahua	<i>Madhuca indica</i>	<i>Sapotaceae</i>	-	Wood used for house building, ship, boats, oil-mills, drums, cart axles.	-	Flower is used for preparation of liquor. Edible oil is extracted from seeds called 'kori'.

13.	Gunja (Kashi)	<i>Bridellia retusa</i>	<i>Euphorbiaceae</i>	Root and bark is used as astringent. Bark used in rheumatism, extract is antiviral, hypotensive and anticancer, decoction for diarrhoea and earache. Paste is applied on wounds and taken internally in snakebite.	Wood used for building work, carts, yokes, agricultural implements.	-	-
14.	Char	<i>Buchanania lanzan</i>	<i>Anacardiaceae</i>	-	Wood used for small beams and rafters, door and window frames, cheap furniture, mining timber, match boxes.	-	Fruits are edible. Seeds are having high commercial value as 'chironji'.
15.	Kari	<i>Milusa tomentosa</i>	<i>Anacardiaceae</i>	-	Wood yields small beams, rafters, knees of boats, agricultural implements, spoons and other utensils.	-	-
16.	Tendu	<i>Diospyros melanoxylon</i>	<i>Ebenaceae</i>	-	Wood used for building, carts, furniture, walking sticks, toys, carvings, picture frames and general fancy work. Leaf used for making bidis and forms an important base for cottage industry.	-	Fruit are edible by animals as well as humans.
17.	Pipal	<i>Ficus religiosa</i>	<i>Moraceae</i>	-	Packing cases and occasionally used for felloes of wheels.	The grand tree is planted as an ornamental tree in home, gardens etc. Bonsai of	-

						the tree can be prepared easily.	
18.	Karra	<i>Cleisthenus collinus</i>	<i>Tiliaceae</i>	-	Wood used as shoulder poles and for purposes requiring elasticity.	-	Seeds are poisonous.
19.	Dhamin	<i>Grewia tiliaefolia</i>	<i>Tiliaceae</i>	-	Wood used for making boats, masts, door and window frames.	-	-
20.	Senha (Lendia)	<i>Lagerstroemia parviflora</i>	<i>Lythraceae</i>	-	House building, carts, shafts, boats, tool handles.	The tree is planted for its ornamental value.	-
21.	Tinsa	<i>Ougeinia ougeinensis</i>	<i>Euphorbiaceae</i>	-	Wood used for building (chiefly posts), carriage building, furniture, ploughs and other implements, boat building, handles of axes and other tools.	-	-
22.	Bija (Indian kino)	<i>Pterocarpus marsupium</i>	<i>Papilionaceae</i>	It is a reputed drug for treatment of leprosy, and other skin diseases. It is an esteemed remedy for diabetes. Plant and gum- laxative, anthelmintic, useful in diseases of blood, eruptions on body, leprosy, urinary discharges also in eye troubles and elephantiasis.	Wood used for house building, furniture, agricultural implements, railway wagons, boat building.	-	-
23.	Ghont	<i>Zizyphus xylopyrus</i>	<i>Rhamnaceae</i>	-	Wood used for building, poles, furniture, agricultural implements, ploughs and other implements, handles of axes and other tools	-	The tree is used for lac cultivation.

24.	Kusum	<i>Schleichera oleosa</i>	<i>Sapindaceae</i>	-	The tree rears silkworm insect which provides silk for textiles.	-	-
27.	Anola	<i>Emblica officinalis</i>	<i>Euphorbiaceae</i>	Root, bark, leaf, flower and fruits are used in toothache, sores, fever, anaemia, epilepsy, pimples, gonorrhoea. Fr- an ingredient of triphala and chyavanprash.	Wood used for medium grade furnitures, building etc.	-	The tree is worshiped by hindus.
28.	Galgal	<i>Cochlospermum gossypium</i>	<i>Cochlospermaceae</i>	-	Gum obtained from stem has medicinal as well as industrial importance.	Avenue planta-tion tree and for afforestation .	-
29.	Jangli khajur	<i>Phoenix sylvestris</i>	<i>Arecaceae</i>	-	Sugar/ jaggry is prepared from its sap.	-	Fruits are edible.
30.	Sal	<i>Shorea robusta</i>	<i>Dipterocarpaceae</i>	-	Timber is the best in the country. Used for carving, building construction, furnitu-re making and gener-al carpentry, etc. Seed provides edible oil.	-	Sal dhoop-exudated from wounds on stem is used for making agarbatis and dhoop.
31.	Teak	<i>Tectona grandis</i>	<i>Verbenaceae</i>	-	Superior timber used for furniture as well as building, ship industries, etc.	-	A red dye is obtained from fruit.
32.	Arjun	<i>Terminalia arjuna</i>	<i>Combretaceae</i>	Bark powder is used to relieve hypertension, is diuretic and tonic in cirrhosis of liver, given internally with milk in bone fractures. The decoction is used as wash in ulcers and cancer. Bark ash is prescribed for scorpion sting.	The wood is used for making boat, general carpentry, carving, etc.	It is planted as Avenue tree.	The bark yields dye for tanning of leather.

33.	Rohan	<i>Soymida febrifuga</i>	<i>Meliaceae</i>	Bark used as astringent, bitter tonic; prescribed in malaria, general debility, intermittent fever, diarrhoea and dysentery. Applied to rheumatic swelling, used as gargle in stomatitis and as vaginal douch in leucorrhoea.	-	-	-
34.	Kumbhi	<i>Careya arborea</i>	<i>Myrtaceae</i>	-	Wood used for house building, planking, bridge-piles, furniture, cabinet work.	The white-red flowers give ornamental value to the tree.	-
35.	Kulu gum	<i>Sterculia urens</i>	<i>Sterculiaceae</i>	-	The tree yields kulu gum for industrial utilization.	-	-
<i>SHRUBS and CLIMBERS</i>							
1.	Salparni	<i>Desmodium gangeticum</i>	<i>Papilionaceae</i>	Root is a constituent of 'Dashamoola', antipyretic and used for hazy vision and dysentery. It is a good cardio tonic also used in chronic fever, biliousness, cough, vomiting, asthma, snake-bite, scorpion sting.	-	-	-
2.	Tangin dara	<i>Flemingia chappar</i>	<i>Papilionaceae</i>	-	-	-	The tribals keep the branches near the bed or the furniture to get rid of bed-bugs.
					Leaves are used for preparation of donas and		The stem is used for making baskets,

3.	Mahul	<i>Bauhinia vahlii</i>	<i>Caesalpinaceae</i>	-	pattals which is an important cottage industry providing employment to lots of people.	-	apparatus for keeping water and keeps water cool inside.
4.	Dhawai	<i>Woodfordia fruticosa</i>	<i>Lythraceae</i>	Bark is pungent, cooling and used as uterin sedative. Leaves used in bilious sickness. Dried flowers used in dysentery, meno-rrhagia, liver disor-ders, disorders of mucous memb-rane, haemorrhoids, head-ache and fever.	-	A large ornamental shrub- the bright red flowers add beauty to the location where it occurs, thus can be planted in gardens and parks.	Flower is used for dyeing silk.
5.	Baibrang	<i>Embelia robusta</i>	<i>Myrsinaceae</i>	Root improves digestion and cures flatulence and colic, used as an antiferti-lity drug. Fruits are acrid astringent, carminative, anthel-mintic, stimulant; reputed for expel-ing tapeworms, cures dental, oral and throat troubles.	-	-	-
6.	Patal kumda	<i>Pueraria tuberosa</i>	<i>Fabaceae</i>	Root tuber used in arthritis.	Root sold in local markets for preparat-ion of certain edibles and medicines.	-	Tribal people eat the roots, boiled or cooked.
7.	Ramdatun	<i>Smilax macrophylla</i>	<i>Smilaceae</i>	Root is given with sugar crystals in menstrual problems.	-	-	Stem used for making ropes and for cleaning mouth.
							Root is used for sacred works. Stem is used for

8.	Palash bel	<i>Butea superba</i>	<i>Fabaceae</i>	-	-	-	making ropes, baskets etc.
9.	Marorphali (Attain)	<i>Helicteres isora</i>	<i>Sterculiaceae</i>	Root juice is beneficial in stomach affections, diabetes. Bark used in diarrhoea, dysent-ery and biliousness. Dried fruit is useful in intestinal compla-ints and prescribed for colic flatulence and diarrhoea.	-	-	-
10.	Gursukri	<i>Grewia hirsuta</i>	<i>Tiliaceae</i>	Root and fruit used in ayurvedic preparations as sweetner, taken in weakness and applied on wounds.	-	-	Fruit is sweet like jaggry and is eaten raw.
11.	Kewati	<i>Ventilago maderaspatana</i>	<i>Rhamnaceae</i>	-	-	-	The stem is used for making ropes.
12.	Hasia dhapar	<i>Leea macrophylla</i>	<i>Leeaceae</i>	Root powder is mixed with jaggry and prescribed in weakness.	-	-	-
13.	Gumchi	<i>Abrus precatorius</i>	<i>Papilionaceae</i>	Root powder is given in cough and cold.	-	-	The seeds are used in ornaments by local people.

HERBS and GRASSES

1.	Hanspadi	<i>Adiantum philippense</i>	<i>Adiantaceae</i>	Whole plant used in diseases related to blood, burning sensation, epileptic fits, epileptic ulcers and dysentery. Rhizome prescribed in fever due to elephantiasis. Fronds and fruits used in leprosy, fever, swellings and tumours.	-	The fresh plants can be used for interior decoration.	-
2.	Gojivha	<i>Elephantopus scaber</i>	<i>Asteraceae</i>	Root and leaf are astringent, cardiac tonic, diuretic, febrifuge. Decoction given in diarrhoea, swelling or stomach pain. Root powder with pepper applied to toothache.	-	-	-
3.	Gorakhmundi	<i>Sphareanthus indicus</i>	<i>Asteraceae</i>	Whole plant is used in sanity, bronchitis, diseases of spleen, pain in uterus and vagina, piles, decoction used as diuretic. Flower swallowed to cure conjunctivitis.	-	-	-
4.	Nagarmotha	<i>Cyperus rotundus</i>	<i>Cyperaceae</i>	Rhizome is antihelminthic, astringent, arthritis, amoebiasis and digestive disorders.	-	The inflorescence is beautiful and planted in gardens and home gardens.	The oil from rhizome is used as an adulterant in preparation of scents.

5.	Bhalukhopa	<i>Lepidogathis trinervis</i>	<i>Acanthaceae</i>	Root is used in treatment of skin problems like leprosy, etc.	-	-	-
6.	Kalmegh	<i>Andrographis paniculata</i>	<i>Acanthaceae</i>	Whole plant is use-ful for all types of fevers, in constipati-on, dysentery and dyspepsia, in spleen complaints. Root and leaf is used in tonic, stomachic, antipyretic, anthelm-intic. Used as curati-ve in snake bite.	-	-	-
7.	Khus (Orai)	<i>Vetiveria zizanioides</i>	<i>Poaceae</i>	Root oil is used as carminative in flatulence and colic, as anthelmintic and is stimulant and refrigerant.	Oil extracted from roots is used in perfumery, cosmetics and scenting soaps.	-	-
8.	Biryari (Mahabala)	<i>Sida acuta</i>	<i>Malvaceae</i>	An ingredient of 'chyawanprash'. Roots useful in nervous and urinary diseases. Leaf juice is boiled in oil and applied to reticular swellings and in elephantiasis.	-	-	-

TUBEROUS PLANTS

1.	Keokand	<i>Costus speciosus</i>	<i>Zingiberaceae</i>	Rhizome is bitter, astringent and used as tonic, aphrodisiac and anthelmintic. Used in catarrhal fevers, cough, dyspepsia, worms and skin diseases.	-	-	-
2.	Tikhur	<i>Curcuma angustifolia</i>	<i>Zingiberaceae</i>	-	-	-	The rhizome is edible.
3.	Araroot	<i>Maranta arundinacea</i>	<i>Zingiberaceae</i>	-	The starch obtained from tubers is used in industries.	-	-
4.	Safed musli	<i>Chlorophytum tuberosum</i>	<i>Liliaceae</i>	Dry roots are well known tonic, aphrodisiac treat genital debility, impotency and weakness.	-	-	-
5.	Satawar	<i>Asparagus racemosus</i>	<i>Liliaceae</i>	Root powder is nervine tonic, rejuvenative, antispasmodic, nervous disorders, diarrhoea, hepatopathy, cardiac debility, hypertension.	-	-	-

6.	Kali musli	<i>Curculigo orchioides</i>	<i>Hypoxidaceae</i>	Rhizome is rejuvenative, aphrodisiac; used in piles, jaundice, asthma, diarrhoea, gonorrhoea, menorrhagia, leucorrhoea, powder heals wounds externally	-	-	-
7.	Makarad	<i>Zingiber casumunar</i>	<i>Zinziberaceae</i>	Rhizome is used in migraine, chewed in gastric and respiratory problems; paste is applied externally in body ache and muscular pain.	-	-	-
8.	Kalihari	<i>Gloriosa superba</i>	<i>Liliaceae</i>	Root is abortifacient, anthelmintic, germicidal, antiperiodic, purgative, used in leprosy, scorpion sting and snake bite.	-	-	-

Table 4.19 : Awareness of ecotourism, forest conservation and importance of protected area among local inhabitants of Achanakmar- Amarkantak Biosphere Reserve.

S . No.	Name of the respondent and village	Occupation	Knowledge about Protected Area and its importance	Knowledge in relation to ecotourist centre and its benefits	Are they involved in NTFP collection?	Importance of Forest Conservation
1	Augesh Jaiswal (Lamni)	Business (Nashta centre)	In protected areas the wild animals remain protected.	The employment will increase but not aware how.	No collection is done.	It is important to conserve forests because we depend on forests for each and every thing.
2	Budhram Singh Armo (Lamni)	Panchayat member and Farming.	Due to protected area the villages are settled outside of the Protected Area and we have to face so many problems therefore, it should not be declared as Protected Area.	Do not know about direct or indirect benefit.	Only honey collection.	After being declared protected area the forest density has decreased, so it was better when it was not protected.
3	Inder Singh (Lamni)	FPC, farming	The forest, trees, wild animals are protected.	The work is going on slowly, if continues in proper way outcome will be beneficial, however, till now no benefit has been observed.	Honey, some medicinal plants.	Conservation of both plants and animals is necessary as they are the components which maintain the forests. For plants nurseries must be prepared.
4	Ghundul (Lamni)	FPC, farming	The forest and wild animals remain protected.	There are benefits but are not visible. The tourism can be increased through exhibitions.	Medicinal plants.	Both plants and wildlife conservation is essential for maintaining the wilderness and attraction of the forest.
5	Asgar Ali (Chhapparwa)	Business	In protected area cutting of trees and hunting is prohibited to protect them.	No benefit as collection of NTFPs is prohibited.	Now no collection.	The forest should be protected.

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6	Munna Sakat (Chhapparwa)	Labour work	Protected area is a forest where hunting is prohibited, if caught fine/ penalty is charged also imprisonment.	Tourists come from distant places and now mischief is done inside the forest. Due to the employment has increased which if provided by panchayat, forest department, etc.	No collection is done.	It is necessary to protect plants and animals to maintain the soul of forest.
7	Raju Yadav (Chhapparwa)	Labour work	To protect wildlife. Also protect forest from fire.	Do not feel any change and benefit. The employment will not increase, it will remain as such.	No collection is done.	Do not know about conservation. We live here and we have to protect it from fire.
8	Ramayan (Chhapparwa)	Labour work	No knowledge	No knowledge	No collection is done.	No knowledge
9	Ganapati (Chhapparwa)	Labour work	No knowledge	No knowledge	No collection is done.	No knowledge
10	Ramesh Sakat (Chhapparwa)	FPC, guide, Labour work	The protected areas are meant to protect forest and wildlife.	The more the number of tourists, the employment for guide increases.	Now no collection is done.	The forest must be protected as we as well as wild animals depend on these forests for livelihood.
11	Phagni (Chhapparwa)	Anganbadi, mitanin	The areas for protection of forest and wildlife.	No knowledge	Now no collection is done.	No knowledge
12	Suryakant Sonwani (Achanakmar)	Farming	Forest area where hunting, collection of NTFPs, extraction of timber are prohibited.	Unaware of ecotourism Benefits are there but do not know what benefits.	Now no collection is done.	The forests are reducing thus there is need to conserve the plants and wildlife.
13	Jhagar Singh (Achanakmar)	FPC, guide, labor work, farming, business (shop), animal husbandry	Protected area is to protect forest and its inhabitants.	The employment will increase if more tourists come to visit, because of guide work, food requirement of the tourists.	Now no collection is done.	The conservation of plants and animals of the forest is important as they are our god and parents.

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14	Mangal Singh Dhurge (Achanakmar)	Labour work	In protected area cutting of trees and hunting is prohibited to protect them.	Do not feel any change and benefit. The employment for us will not increase, it will remain as such.	Now no collection is done.	The forest should be protected.
15	Sumitra Sagela (Chhapparwa)	Anganbadi	The protected areas are meant to protect forest and wildlife.	No knowledge	Now no collection is done.	The forest should be protected.
16	Latif Khan (Chhapparwa)	Labour work	The forest and wild animals remain protected.	No knowledge	Now no collection is done.	The forest should be protected.
17	Ram Singh (Chhapparwa)	FPC, animal husbandry, labour work, farming	The protected areas are meant to protect forest and wildlife.	Few benefits due to employment and tourists and loss also due to restrictions on NTFP collection.	Now no collection is done.	The forest should be protected.
18	Sevakram (Chhapparwa)	Labour work	Forest which has to be protected.	No knowledge	Now no collection is done.	The forest should be protected.

Table 4.20 : Awareness of ecotourism, forest conservation and importance of protected area among local inhabitants of Udanti Wildlife Sanctuary.

S. No.	Name of the respondent	Occupation	Knowledge about Protected Area and its importance.	Knowledge in relation to ecotourist centre and its benefits	Are they involved in NTFP collection?	Importance of Forest Conservation
1.	Sudarshan (Jugad)	Labour work, guide	Forest where cutting of trees is prohibited and animals are protected from hunters and poachers.	Not aware of ecotourism and its direct or indirect benefits.	Yes, it is a source of income.	There is need to protect the forest as we live in and we depend on it.
2.	Lalit (Jugad)	Service, guide, FPC	Forest protected for protection of its plants and animals.	There are many good spots, plants and animals to see. There are many benefits of tourism.	Yes, mahua collection.	The forest must be protected from being destroyed. The animals must not be disturbed and hunting should not be done.
3.	Arjun (Jugad)	Labour work	Do not know much about Protected Area.	No information in these aspects.	Yes, some financial support is obtained.	Forest must be protected.
4.	Kewal (Jugad)	Labour work	The forest area protected for protecting its plants and animals.	Don't have any information about ecotourism benefits.	Yes, some collection is done.	The animals are protected by conserving forest.
5.	Haresh (Jugad)	Labour work	Importance of protected area is to protect flora and fauna.	Don't have knowledge about ecotourism benefits.	Yes, little collection is done.	The forest must be protected as we depend on it for our livelihood.
6.	Mohan (Jugad)	Labour work	Do not have much knowledge about Protected Area and its importance.	Do not have information about ecotourism benefits.	Yes, collection of few NTFPs is done.	Not aware of conservation and its importance.

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S . No.	Name of the respondent	Occupation	Knowledge about Protected Area and its importance.	Knowledge in relation to ecotourist centre and its benefits	Are they involved in NTFP collection?	Importance of Forest Conservation
7.	Human Singh (Jugad)	FPC, labour work	The forest area protected to protect its flora and fauna.	Not much information, but there are benefits and there is need to provide more facilities.	Yes, some collection is done.	The forest area must be protected to protect its wilderness.
8.	Bodhan (Jugad)	Labour work	The forest where prohibitions on utilization of plants is there, hunting is prohibited.	Not much knowledge about ecotourism and its benefits is there.	Yes, it is a source of food and income.	Not aware about conservation and its importance.
9.	Rupdhar (Jugad)	Teachership	Protected area is to protect the flora and fauna in its natural environment.	As an ecotourist spot it is very good place and has many direct and indirect benefits.	Yes, collection for food and income is done.	Forest conservation is important to conserve its flora and fauna.
10.	Ramratan (Jugad)	Labour work	Protected area is protected forest.	Do not have knowledge about any direct or indirect benefits.	Yes, collection of mahua and some other NTFPs is done.	Do not have information about conservation.
11.	Bhajan Lal (Jugad)	Labour work	The plants and animals are protected in the forest.	Not aware of any direct or indirect benefit.	Yes, some collection is done; it is a source of income.	Not aware about conservation.

Table 4.4 : Awareness among tourists regarding ecotourism and their suggestions for improvement in facilities made available for comfortable stay.

S. No	Name	Purpose of visit	Duration of stay	What fascinated most?	Knowledge about ecotourism	Tourist expectations regarding lodging and barding facilities.
1	Rajkumar Rastogi	Travel for entertainment.	1day-1night	Trees, Natural beauty, Bison	Never heard about it.	Every month package tour must be conducted by the Udanti Sanctuary staff.
2	Sayyed Ashiq Ali	Picnicking	1day-1night	The clean and green atmosphere.	Greenery should be maintained everywhere.	Good service by the staff.
3	Ashok Awasthi	Travel for entertainment.	2 days-1night	Dense and green forest.	Greeneries of forest bring happiness in life, so understand the importance of forest and protect it.	Facility of drinking water must be there and proper information related to forest must be given.
4	O.P. Chandrakar	Tour to Abhyaranya.	1day	Dense forest.	No knowledge about ecotourism.	Good facilities.
5	Sanjay Vishwakarma	Tourism	1day-1night	Wild animals, especially Wild buffaloes.	No knowledge about it.	Nice place, rest house is good.
6	Raipur group- YUVA	Educational tour.	1day	Wild animals.	No knowledge about ecotourism.	The food facilities and rest house should be improved.
7	Pratima Rajiv	Entertainment with knowledge.	2days-1night	Nothing (as could not see a single animal)	Not aware.	Well trained guide must be made available; tourist must be treated as guest; information about ecotourism and about animals should be displayed in rest house; refreshment should be made available.

S . No	Name	Purpose of visit	Duration of stay	What fascinated most?	Knowledge about ecotourism	Tourist expectations regarding lodging and barding facilities.
8	Sandip Halder and group	To enjoy forests.	3days-2nights	Nature in the wild	Fully aware. Also aware that it is not being followed.	Guidelines or instructions either written or verbal must be given to facilitate new tourists; maintenance of bungalows should be done; trained guide must be provided; to contact forest officialc must be easy; facility to reserve rest house from other state.
9	Sanjay Rautiya	Service	5days	Curiosity to know the unknown aspects of nature	The local people as well as the tourists must be made aware about ecotourism, forests, wildlife and their importance.	Vehicle must be available to visit inside the forest; availability of trained guide must be there; refreshment center must be there.
10	Shambhu Karmarkar and team	Tourism	1day	Wild life	Not much aware about ecotourism and its code of conduct. But as read the rules of Sanctuary did not spread polybags in forest area.	The regulations must be a bit flexible so that tourists may not get harassed.
11	Gautam Mukharji and family	Tour to forests.	1day	Dense forest and its wildlife	Aware about ecotourism and are always abide by the guidelines and instructions to be followed while visiting such places.	Vehicle must be available for visiting inside the forest; the forest department staff must do their work properly and helping natured; food and refreshment must be available.

Table 4.13 : Vegetation structure for the plant species at Achanakmar-Amarkantak Biosphere Reserve in Bilaspur district of Chhattisgarh.

Trees

Species	Site - I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
WINTER SEASON									
<i>Shorea robusta</i>	150	109.6	0.024	210	109.7	0.021	520	145.54	0.052
<i>Terminalia tomentosa</i>	220	63.08	0.027	110	29.38	0.031	80	18.65	0.032
<i>Mallotus philippinensis</i>	70	18.63	0.078	-	-	-	-	-	-
<i>Lannea grandis</i>	40	16.31	0.025	40	10.65	0.045	-	-	-
<i>Anogeissus latifolia</i>	60	20.11	0.067	50	13.24	0.031	-	-	-
<i>Cassia fistula</i>	10	3.692	0.1	-	-	-	-	-	-
<i>Grewia tiliaefolia</i>	10	3.707	0.1	10	2.704	0.1	20	6.81	0.05
<i>Buchanania lanzan</i>	10	3.677	0.1	10	2.698	0.1	50	16.61	0.031
<i>Diospyros melanoxylon</i>	30	10.92	0.075	40	9.87	0.045	60	18.11	0.038
<i>Madhuca longifolia</i>	10	3.889	0.1	10	2.707	0.1	-	-	-
<i>Lagerstroemia parviflora</i>	30	11.8	0.033	70	20.39	0.028	60	16.41	0.038
<i>Adina cordifolia</i>	10	4.981	0.1	20	6.116	0.05	20	7.70	0.05
<i>Emblica officinalis</i>	10	3.775	0.1	-	-	-	40	12.33	0.045
<i>Semecarpus anacardium</i>	20	7.829	0.05	80	19.95	0.032	50	15.56	0.031
<i>Lannea coromandelica</i>	10	3.677	0.1	-	-	-	-	-	-
<i>Cleistanthus collinus</i>	50	10.27	0.5	-	-	-	-	-	-
<i>Schleichiera oleosa</i>	10	4.001	0.1	-	-	-	-	-	-
<i>Bauhinia malabarica</i>	-	-	-	30	8.953	0.034	-	-	-
<i>Caesalpinia sepiaria</i>	-	-	-	20	5.458	0.05	-	-	-
<i>Syzygium cumini</i>	-	-	-	50	12.53	0.056	-	-	-
<i>Miliusa tomentosa</i>	-	-	-	10	2.703	0.1	-	-	-
<i>Terminalia chebula</i>	-	-	-	30	8.39	0.033	20	6.81	0.05
<i>Pterocarpus marsupium</i>	-	-	-	30	8.427	0.033	-	-	-
<i>Ougeinia ougeinensis</i>	-	-	-	50	17.8	0.02	50	18.32	0.031
<i>Casearia tomentosa</i>	-	-	-	30	8.344	0.033	-	-	-
<i>Casearia graveclens</i>	-	-	-	-	-	-	80	17.07	0.089
Total	750	300	1.679	900	300	0.941	1050	299.92	0.54

SUMMER SEASON									
<i>Shorea robusta</i>	340	98.32	0.034	160	68.67	0.025	300	101.8	0.03
<i>Terminalia tomentosa</i>	170	36	0.021	150	49.23	0.042	120	37.47	0.015
<i>Lannea grandis</i>	30	6.108	0.033	20	5.12	0.05	70	13.36	0.028
<i>Anogeissus latifolia</i>	50	9.159	0.031	60	14.85	0.038	60	14.36	0.024
<i>Cassia fistula</i>	10	1.956	0.1	-	-	-	-	-	-
<i>Buchanania lanzan</i>	90	14	0.025	40	9.247	0.045	70	15.23	0.02
<i>Diospyros melanoxylon</i>	170	31.36	0.027	60	16.75	0.024	50	9.018	0.056
<i>Madhuca longifolia</i>	70	16.52	0.02	20	5.144	0.05	20	4.534	0.05
<i>Lagerstroemia parviflora</i>	50	9.165	0.031	50	13.15	0.02	60	12.45	0.024
<i>Adina cordifolia</i>	20	4.481	0.05	30	7.124	0.075	10	2.187	0.1
<i>Emblica officinalis</i>	90	14.59	0.036	-	-	-	40	8.86	0.025
<i>Semecarpus anacardium</i>	-	-	-	70	14.89	0.044	100	18.63	0.028
<i>Schleichiera oleosa</i>	10	1.971	0.1	-	-	-	-	-	-
<i>Syzygium cumini</i>	30	4.776	0.075	90	22.34	0.036	-	-	-
<i>Miliusa tomentosa</i>	80	15.18	0.022	20	5.059	0.05	-	-	-
<i>Terminalia chebula</i>	20	4.064	0.05	40	10.51	0.045	-	-	-
<i>Pterocarpus marsupium</i>	-	-	-	40	11.37	0.025	70	18.61	0.02
<i>Ougeinia ougeinensis</i>	20	3.968	0.05	60	13.79	0.038	90	18.8	0.036
<i>Casearia tomentosa</i>	-	-	-	70	16.38	0.028	50	8.773	0.056
<i>Casearia graveclens</i>	140	22.4	0.029	-	-	-	80	15.97	0.022
<i>Dalbergia paniculata</i>	10	1.987	0.1	-	-	-	-	-	-
<i>Ficus religiosa</i>	10	2.009	0.1	-	-	-	-	-	-
<i>Bauhinia malabarica</i>	10	1.988	0.1	60	16.38	0.017	-	-	-
Total	1420	300	1.034	1040	300	0.649	1190	300	0.532

Shrubs

Species	Site - I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
WINTER SEASON									
<i>Ventilago maderaspatana</i>	380	75.16	0.038	-	-	-	230	68.20	0.023
<i>Bauhinia vahlii</i>	60	18.32	0.024	70	23.36	0.028	60	20.82	0.038
<i>Acanthospermum hispidum</i>	260	55.50	0.032	-	-	-	-	-	-
<i>Catunaregum spinosa</i>	200	42.84	0.041	-	-	-	130	37.13	0.052
<i>Vallaris solanacea</i>	140	32.06	0.039	-	-	-	-	-	-
<i>Grewia hirsuta</i>	190	39.47	0.053	50	13.93	0.125	230	59.51	0.064
<i>Smilax macrophylla</i>	40	11.59	0.045	20	7.68	0.05	-	-	-
<i>Embelia robusta</i>	10	3.37	0.1	-	-	-	70	22.84	0.044
<i>Pueraria tuberosa</i>	10	3.37	0.1	-	-	-	-	-	-
<i>Randia dumetorum</i>	60	18.32	0.024	240	67.54	0.024	-	-	-
<i>Sida acuta</i>	-	-	-	40	13.60	0.045	-	-	-
<i>Desmodium gangeticum</i>	-	-	-	30	11.51	0.033	-	-	-
<i>Woodfordia fruticosa</i>	-	-	-	60	23.03	0.017	40	14.60	0.045
<i>Uraria picta</i>	-	-	-	70	25.11	0.02	-	-	-
<i>Desmodium pulchellum</i>	-	-	-	40	15.35	0.025	60	18.64	0.067
<i>Flemingia chappar</i>	-	-	-	90	29.28	0.025	40	14.60	0.045
<i>Leea macrophylla</i>	-	-	-	250	69.63	0.025	90	29.05	0.036
<i>Barlaria cristata</i>	-	-	-	-	-	-	40	14.60	0.045
Total	1350	300	0.495	960	300	0.416	990	300	0.456
SUMMER SEASON									
<i>Ventilago maderaspatana</i>	-	-	-	-	-	-	270	92.41	0.033
<i>Vallaris solanacea</i>	-	-	-	40	42.48	0.045	110	44.94	0.031
<i>Grewia hirsuta</i>	-	-	-	70	51.13	0.175	50	18.15	0.125
<i>Randia dumetorum</i>	-	-	-	60	53.01	0.067	160	53.72	0.064
<i>Flemingia chappar</i>	-	-	-	-	-	-	210	68.75	0.058
<i>Leea macrophylla</i>	-	-	-	210	153.3 8	0.059	-	-	-
<i>Spatholibus parrsflorms</i>	-	-	-	-	-	-	40	22.02	0.025
Total	-	-	-	380	300	0.345	840	300	0.336

Herbs

Species	Site - I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
WINTER SEASON									
<i>Elephantopus scaber</i>	32000	65.54	0.032	18000	24.343	0.028	25000	34.146	0.025
<i>Zinziber casumunar</i>	4000	16.72	0.045	-	-	-	-	-	-
<i>Maranta arundinacea</i>	14000	38.12	0.017	20000	26.964	0.02	15000	24.587	0.0234
<i>Curcuma angustifolia</i>	15000	40.56	0.015	21000	27.77	0.021	15000	23.89	0.0306
<i>Curculigo orchioides</i>	19000	46.44	0.019	14000	20.43	0.029	-	-	-
<i>Adiantum philippense</i>	21000	49.38	0.021	8000	14.52	0.089	-	-	-
<i>Dendrocalamus strictus</i>	5000	34.78	0.5	-	-	-	13000	23.485	0.1445
<i>Asparagus racemosus</i>	1000	8.44	0.1	6000	11.71	0.067	-	-	-
<i>Sida acuta</i>	-	-	-	6000	11.71	0.067	-	-	-
<i>Crotolaria albida</i>	-	-	-	7000	12.69	0.044	-	-	-
<i>Desmodium trifolium</i>	-	-	-	8000	14.34	0.022	6000	13.250	0.0667
<i>Anacyclus pyrethrum</i>	-	-	-	5000	11.36	0.125	-	-	-
<i>Sida cordata</i>	-	-	-	4000	8.891	0.045	4000	10.814	0.1
<i>Andrographis paniculata</i>	-	-	-	12000	18.19	0.048	10000	18.122	0.04
<i>Desmodium diffusum</i>	-	-	-	8000	14.34	0.022	3000	8.8639	0.0333
<i>Lepidogathis trinervis</i>	-	-	-	4000	9.117	0.025	7000	14.472	0.0438
<i>Lepidogathis cristata</i>	-	-	-	5000	10.75	0.02	-	-	-
<i>Rungia pectinata</i>	-	-	-	9000	15.00	0.036	16000	26.262	0.0198
<i>Heteropogon contortus</i>	-	-	-	18000	28.59	0.2	-	-	-
<i>Ageratum conyzoides</i>	-	-	-	9000	15.08	0.056	10000	18.115	0.0625
<i>Vetiveria zizanioides</i>	-	-	-	-	-	-	88000	83.994	0.1087
Total	111000	299.99	0.033	182000	299.99	0.04	212000	299.99	0.6982
<i>Rungia pectinata</i>	-	-	-	2000	130	0.05	-	-	-
<i>Dendrocalamus strictus</i>	-	-	-	-	-	-	2000	99.67	0.2
<i>Lepidogathis trinervis</i>	-	-	-	3000	170	0.033	7000	200.34	0.02
Total	-	-	-	5000	300	0.083	9000	299.99	0.22

Table 4.14 : Vegetation structure for the plant species at Udanti Wildlife Sanctuary in Raipur district of Chhattisgarh.

Species	Site - I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
WINTER SEASON									
<i>Shorea robusta</i>	220	57.14	0.061	240	79.66	0.049	50	18.81	0.056
<i>Terminalia tomentosa</i>	210	67.5	0.026	170	34.33	0.047	-	-	-
<i>Anogeissus latifolia</i>	-	-	-	30	5.897	0.075	30	8.188	0.075
<i>Buchanania lanzan</i>	90	16.16	0.036	70	15.5	0.028	-	-	-
<i>Diospyros melanoxylon</i>	70	14.18	0.028	30	5.985	0.075	120	44.82	0.048
<i>Madhuca longifolia</i>	90	19.61	0.025	30	8.267	0.033	40	11.7	0.1
<i>Lagerstroemia parviflora</i>	-	-	-	10	2.441	0.1	50	15.76	0.0313
<i>Adina cordifolia</i>	-	-	-	-	-	-	10	3.355	0.1
<i>Embllica officinalis</i>	110	21.14	0.023	30	7.581	0.033	40	11.83	0.045
<i>Schleichiera oleosa</i>	-	-	-	10	2.441	0.1	-	-	-
<i>Miliusa tomentosa</i>	-	-	-	10	2.433	0.1	-	-	-
<i>Terminalia chebula</i>	40	9.606	0.025	-	-	-	30	10.73	0.033
<i>Pterocarpus marsupium</i>	-	-	-	40	10.57	0.025	20	7.42	0.05
<i>Ougeinia ougeinensis</i>	110	24.43	0.023	30	7.513	0.033	-	-	-
<i>Dalbergia paniculata</i>	50	11.54	0.02	10	2.449	0.1	30	8.591	0.3
<i>Lannea coromandelica</i>	70	13.44	0.028	60	14.18	0.024	70	28.64	0.028
<i>Tectona grandis</i>	50	8.489	0.056	240	56.86	0.15	40	35.96	0.025
<i>Zizyphus xylopyrus</i>	80	15.72	0.032	90	17.86	0.025	100	38.18	0.04
<i>Stereospermum suaveolens</i>	60	10.18	0.067	30	5.906	0.075	70	17.77	0.078
<i>Catunaregam uliginosa</i>	20	4.262	0.05	-	-	-	-	-	-
<i>Boswellia serrata</i>	10	2.234	0.1	-	-	-	-	-	-
<i>Cleisthenus collinus</i>	10	2.124	0.1	60	10.14	0.15	70	19.91	0.7
<i>Careya arborea</i>	10	2.25	0.1	20	5.028	0.05	-	-	-
<i>Dalbergia latifolia</i>	-	-	-	10	2.494	0.1	-	-	-
<i>Grewia tiliaefolia</i>	-	-	-	10	2.481	0.1	20	6.855	0.05
<i>Soymida febrifuga</i>	-	-	-	-	-	-	30	8.188	0.075
<i>Anacardium occidentale</i>	-	-	-	-	-	-	10	3.282	0.1
Total	1300	300	0.798	1230	300	1.473	830	300	1.933

Species	Site - I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
SUMMER SEASON									
<i>Shorea robusta</i>	180	46.58	0.037	150	47.85	0.042	80	27.09	0.032
<i>Terminalia tomentosa</i>	230	76.08	0.023	220	55.4	0.035	120	41.33	0.019
<i>Anogeissus latifolia</i>	-	-	-	20	3.271	0.2	20	5.16	0.05
<i>Buchanania lanzan</i>	120	23.3	0.019	80	19.41	0.016	20	4.956	0.05
<i>Diospyros melanoxylon</i>	90	19.02	0.019	50	12.53	0.02	150	49.54	0.031
<i>Madhuca longifolia</i>	60	12.65	0.024	20	3.269	0.2	60	19.57	0.024
<i>Lagerstroemia parviflora</i>	-	-	-	20	4.629	0.05	80	24.81	0.032
<i>Adina cordifolia</i>	-	-	-	-	-	-	20	5.732	0.05
<i>Embllica officinalis</i>	120	20.02	0.048	60	11.82	0.038	30	7.618	0.033
<i>Miliusa tomentosa</i>	-	-	-	30	6.986	0.033	-	-	-
<i>Terminalia chebula</i>	60	11.15	0.067	-	-	-	20	5.128	0.05
<i>Pterocarpus marsupium</i>	10	2.078	0.1	60	12.98	0.038	40	11.18	0.025
<i>Ougeinia ougeinensis</i>	80	18.83	0.013	80	19.07	0.016	30	7.136	0.075
<i>Dalbergia paniculata</i>	40	7.419	0.045	30	5.556	0.075	70	18.47	0.028
<i>Lannea coromandelica</i>	80	15.15	0.022	90	21.85	0.014	60	16.34	0.024
<i>Tectona grandis</i>	40	7.138	0.045	200	60.02	0.056	30	7.679	0.075
<i>Zizyphus xylopyrus</i>	90	19.18	0.019	60	8.444	0.15	90	24.66	0.025
<i>Stereospermum suaveolens</i>	40	7.485	0.045	10	2.301	0.1	40	9.547	0.045
<i>Boswellia serrata</i>	30	6.941	0.033	-	-	-	-	-	-
<i>Cleistanthus collinus</i>	30	4.793	0.075	20	4.627	0.05	40	6.306	0.4
<i>Careya arborea</i>	10	2.187	0.1	-	-	-	-	-	-
<i>Grewia tiliaefolia</i>	-	-	-	-	-	-	10	2.422	0.1
<i>Soymida febrifuga</i>	-	-	-	-	-	-	20	5.332	0.05
Total	1310	300	0.730	1200	300	1.132	1030	300	1.217

Shrubs

Species	Site – I			Site - II			Site - III		
	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F	D(stems/ha)	IVI	A/F
WINTER SEASON									
<i>Ventilago maderaspatana</i>	-	-	-	250	32.95	0.051	140	23.39	0.056
<i>Bauhinia vahlii</i>	90	18.10	0.1	50	10.72	0.031	10	3.17	0.1
<i>Acanthospermum hispidum</i>	80	14.46	0.2	370	45.01	0.058	240	34.12	0.067
<i>Catunaregum spinosa</i>	430	75.89	0.043	300	42.07	0.03	80	16.03	0.05
<i>Vallaris solanacea</i>	-	-	-	100	15.08	0.063	-	-	-
<i>Grewia hirsuta</i>	540	89.06	0.054	320	39.06	0.065	730	84.60	0.073
<i>Smilax macrophylla</i>	30	8.47	0.075	20	4.92	0.05	30	9.50	0.033
<i>Embelia robusta</i>	140	24.08	0.156	140	21.75	0.039	-	-	-
<i>Desmodium gangeticum</i>	-	-	-	60	10.00	0.067	-	-	-
<i>Flemingia chappar</i>	30	8.47	0.075	-	-	-	-	-	-
<i>Barlaria cristata</i>	-	-	-	-	-	-	50	13.50	0.031
<i>Cromalaena odorata</i>	280	45.73	0.112	600	65.10	0.094	1100	115.69	0.11
<i>Pueraria tuberosa</i>	50	15.74	0.031	-	-	-	-	-	-
<i>Butea superba</i>	-	-	-	80	13.34	0.05	-	-	-
Total	1670	300	0.846	2290	300	0.597	2380	300	0.520
SUMMER SEASON									
<i>Bauhinia vahlii</i>	70	21.91	0.044	-	-	-	-	-	-
<i>Catunaregum spinosa</i>	310	78.68	0.031	-	-	-	-	-	-
<i>Grewia hirsuta</i>	410	96.38	0.041	-	-	-	-	-	-
<i>Smilax macrophylla</i>	20	8.30	0.05	-	-	-	-	-	-
<i>Embelia robusta</i>	90	27.83	0.036	-	-	-	-	-	-
<i>Flemingia chappar</i>	50	18.37	0.031	-	-	-	-	-	-
<i>Cromalaena odorata</i>	150	36.07	0.094	-	-	-	-	-	-
<i>Pueraria tuberosa</i>	30	12.45	0.033	-	-	-	-	-	-
Total	1130	300	0.360	-	-	-	-	-	-

Herbs

WINTER SEASON									
<i>Elephantopus scaber</i>	21000	26.25	0.021	28000	24.31	0.028	36000	28.49	0.036
<i>Maranta arundinacea</i>	16000	22.38	0.016	13000	15.66	0.020	9000	14.26	0.009
<i>Curcuma angustifolia</i>	20000	25.48	0.02	27000	23.83	0.027	19000	19.54	0.019
<i>Curculigo orchioides</i>	24000	28.57	0.024	-	-	-	28000	24.28	0.028
<i>Asparagus racemosus</i>	16000	22.38	0.016	16000	17.24	0.025	17000	18.48	0.017
<i>Sida acuta</i>	7000	12.81	0.078	-	-	-	-	-	-
<i>Crotolaria albida</i>	-	-	-	8000	10.98	0.032	12000	13.36	0.048
<i>Desmodium trifolium</i>	5000	10.01	0.056	-	-	-	5000	8.33	0.125
<i>Anacyclus pyrethrum</i>	-	-	-	-	-	-	13000	15.46	0.145
<i>Sida cordata</i>	-	-	-	-	-	-	10000	11.92	0.063
<i>Andrographis paniculata</i>	23000	27.79	0.023	26000	23.35	0.026	25000	22.69	0.025
<i>Desmodium diffusum</i>	9000	14.39	0.036	15000	15.83	0.042	-	-	-
<i>Lepidogathis trinervis</i>	4000	8.61	0.045	7000	9.928	0.044	-	-	-
<i>Lepidogathis cristata</i>	2000	5.69	0.05	-	-	-	2000	4.47	0.05
<i>Rungia pectinata</i>	12000	17.51	0.048	2000	4.827	0.05	7000	9.64	0.078
<i>Heteropogon contortus</i>	-	-	-	117000	66.65	0.117	60000	43.17	0.123
<i>Ageratum conyzoides</i>	-	-	-	-	-	-	7000	9.64	0.078
<i>Sida cordata</i>	4000	8.61	0.045	-	-	-	-	-	-
<i>Imperata cylindrica</i>	10000	20.49	0.25	99000	58.09	0.099	-	-	-
<i>Zinziber casumunar</i>	4000	8.61	0.045	2000	4.83	0.05	2000	4.47	0.05
<i>Costus speciosus</i>	7000	12.67	0.02	3000	6.14	0.075	6000	9.06	0.024
<i>Chlorophytum tuberosum</i>	7000	14.95	0.175	-	-	-	-	-	-
<i>Evolvulus nummularis</i>	7000	12.89	0.078	-	-	-	5000	8.33	0.125
<i>Arundinella setosa</i>	-	-	-	12000	14.88	0.133	-	-	-
<i>Biophytum sensitivum</i>	-	-	-	1000	3.462	0.1	-	-	-
<i>Themeda quadrivalvis</i>	-	-	-	-	-	-	26000	23.39	0.104
<i>Phyllanthus simplex</i>	-	-	-	-	-	-	7000	10.90	0.175
Total	198000	300	1.043	376000	300	0.868	296000	299.91	1.319
SUMMER SEASON									
<i>Lepidogathis trinervis</i>	4000	73.65	0.045	-	-	-	-	-	-
<i>Desmodium trifolium</i>	10000	132.73	0.021	-	-	-	-	-	-
<i>Rungis pectinata</i>	6000	93.62	0.024	-	-	-	-	-	-
Total	20000	300	0.089	-	-	-	-	-	-

Table 4.17 : Some fauna species of Achanakmar-Amarkantak Biosphere Reserve.

S. No.	Common name	Scientific name	S. No.	Common name	Scientific name
1.	Tiger	<i>Panthera tigris</i>	22.	Peafowl	<i>Pavo cristatus</i>
2.	Leopard	<i>Panthera pardus</i>	23.	Pangolin	<i>Manis crassicaudata</i>
3.	Spotted deer	<i>Axis axis</i>	24.	Python	<i>Python sp.</i>
4.	Sambhar	<i>Cervus unicolor</i>	25.	Mongoose	<i>Herpestes sp.</i>
5.	Kotri	-	26.	Banded krait	<i>Bungarus fasciatus</i>
6.	Gaur	<i>Bos gaurus</i>	27.	Sloth bear	<i>Melursus ursinus</i>
7.	Wild dog	<i>Cuon alpinus</i>	28.	Indian procupine	<i>Hystrix indica</i>
8.	Wild pig	<i>Sus scrota</i>	29.	Mongoose	<i>Herpestes sp.s</i>
9.	Lakadbagha	-	30.	Shikra	<i>Accipiter badius</i>
10.	Jackal	<i>Canis aureus</i>	31.	Drongo cuckoo	<i>Surniculus lugubris</i>
11.	Rhesus monkey	<i>Macaca mulatta</i>	32.	Red-wattled Lapwing	<i>Vanellus indicus</i>
12.	Common langur	<i>Prebyitis entellus</i>	33.	Brahminy Kite	<i>Haliastur indus</i>
13.	Wild fowl	<i>Gallus gallus</i>	34.	Indian Roller	<i>Coracias benghalensis</i>
14.	Porcupine	<i>Hystrix indica</i>	35.	Cattle Egret	<i>Bubulcus ibis</i>
15.	Fox	<i>Vulpes bengalensis</i>	36.	Rufos Treepie	<i>Dendrocitta vegabunda</i>
16.	Jungle cat	<i>Felis chaus</i>	37.	Oriental Magpie Robin	<i>Copsychus saularis</i>
17.	Mouse deer	<i>Tragulus memenna</i>	38.	Jungle Babbler	<i>Turdoides striatus</i>
18.	Flying squirrel	<i>Hylopetes sp., Eupetaurus sp.</i>	39.	Jungle Owlet	<i>Glaucidium radiatum</i>
19.	Hare	<i>Lepus nigricollis</i>	40.	Eurasian Collared Dove	<i>Streptopelia decaocto</i>
20.	Peacock	<i>Polyplectron bicalcaratum</i>	41.	Greater Coucal	<i>Centropus sinensis</i>
21.	Grey tit	<i>Paruus major</i>	42.	Alexandrine parakeet	<i>Psittacula eupatria</i>

Table 4.18 : Some fauna species of Udanti Wildlife Sanctuary.

S. No.	Common name	Scientific name	S. No.	Common name	Scientific name
1.	Common langur	<i>Presbitis entellus</i>	25.	Short nosed fruit bat	<i>Cynopterus sphinx</i>
2.	Tiger	<i>Panthera tigris</i>	26.	Indian pipistrelle	<i>Pipistrellus coromandara</i>
3.	Leopard	<i>Panthera pardus</i>	27.	Three striped squirrels	<i>Funambulus palmarum</i>
4.	Jungle cat	<i>Felis chaus</i>	28.	Brooks	<i>Hamidactylus brooki</i>
5.	Wild dog	<i>Canis alpinus</i>	29.	Forest Calotes	<i>Calotes rouxi</i>
6.	Jackal	<i>Canis aureus</i>	30.	Yellow legged Green Pegion	<i>Treron phoenicoptera</i>
7.	Indian fox	<i>Vulpes bengalensis</i>	31.	Rufous turtle dove	<i>Streptopelia orientalis</i>
8.	Sloth bear	<i>Melusus ursinus</i>	32.	Blossom headed parakeet	<i>Psittacula cyanocephala</i>
9.	Gaur	<i>Bos gaurus</i>	33.	Common Hawk	<i>Cuculus varius</i>
10.	Wild buffalo	<i>Bubalus bubalis</i>	34.	Grey tit	<i>Paruus major</i>
11.	Indian procupine	<i>Hystrix indica</i>	35.	Franklin nightjar	<i>Caprimulgus affins</i>
12.	Indian hare	<i>Lepus nigricollis</i>	36.	Chestnut headed bee eater	<i>Merpos leschenaulti</i>
13.	Five striped squirrel	<i>Funambulus pennanti</i>	37.	Indian Roller	<i>Coracias benghalensis</i>
14.	Nilgai	<i>Boselaphus tragocamelus</i>	38.	Malabar pied hornbill	<i>Anthracoceros cornatus</i>
15.	Barking deer	<i>Muntiacus muntjack</i>	39.	Redrumped swallow	<i>Hirundo striata</i>
16.	Spotted deer	<i>Axis axis</i>	40.	Large cuckoo shrike	<i>Coracina novahollandiae</i>
17.	Sambar	<i>Cervus unicolor</i>	41.	Scarlet minivet	<i>Pericrocotus flammeus speciosus</i>
18.	Indian wild boar	<i>Sus scrofacristatus</i>	42.	Redvented bulbul	<i>Pycnonotus cafer bengalensis</i>
19.	Rock geckoe	<i>Hamidactylus maculatus</i>	43.	Blacknapped flycatcher	<i>Hypothymis azurea</i>
20.	Indian cobra	<i>Naja naja</i>	44.	Alexandrine parakeet	<i>Psittacula eupatria</i>
21.	Rose ringed parakeet	<i>Psittacula krameri</i>	45.	Spotted dove	<i>Streptopelia chinensis</i>
22.	Indian cuckoo	<i>Cuculus micropterus</i>	46.	Yellow throated sparrow	<i>Petronia xanthocollis</i>
23.	White breasted kingfisher	<i>Halcyon amyrnensis</i>	47.	White eyes	<i>Zosterops palpebroza</i>
24.	Rufous woodpecker	<i>Micropteruns brachyurus</i>	48.	Magpie robin	<i>Copsychis saularis</i>

Status of Protected Areas and their area in Chhattisgarh.

S. No.	Protected areas	Area in sq. Km.	District
Biosphere Reserve (Larger unit, declared by Government of India-MoEF, India)			
1	<i>Achanakmar- Amarkantak Biosphere Reserve</i>	2610.53 sq. km.(C.G.) and 1224.98 sq. km Total area – 3283.96 sq. km.	Bilaspur(68.1%, C.G.) and Anuppur (16.2%), Dindori(15.7%) (M.P.)
National Parks (Medium unit, declared by Government of India, India)			
1	<i>Indaravati</i>	1258.000	Dantewada
2	<i>Kanger Ghati</i>	200.000	Bastar
3	<i>Guru Ghasidas</i>	1440.705	Sarguja/Korea
	Subtotal 1	2898.705	
Wildlife Sanctuaries (Smaller unit, declared by State Government, Chhattisgarh)			
1	<i>Badalkhol</i>	104.55	Jashpur
2	<i>Bhairamgarh</i>	139.00	Dantewada
3	<i>Barnawapara</i>	244.66	Raipur
4	<i>Gomarda</i>	411.20	Raigarh
5	<i>Pameda</i>	262.00	Dantewada
6	<i>Samarsot</i>	430.36	Sarguja
7	<i>Sitanadi</i>	553.36	Dhamtari
8	<i>Tamor Pingla</i>	608.52	Sarguja
9	<i>Udanti</i>	237.28	Raipur
10	<i>Bhoremdev</i>	163.80	Kawardha
	Subtotal 2	3154.73	
	Grand Total	9888.95	

Source: Chhattisgarh Forest Department Report, 2001.



Fig. 3.3 (b): Detail map of Udanti Wildlife Sanctuary, Raipur district.

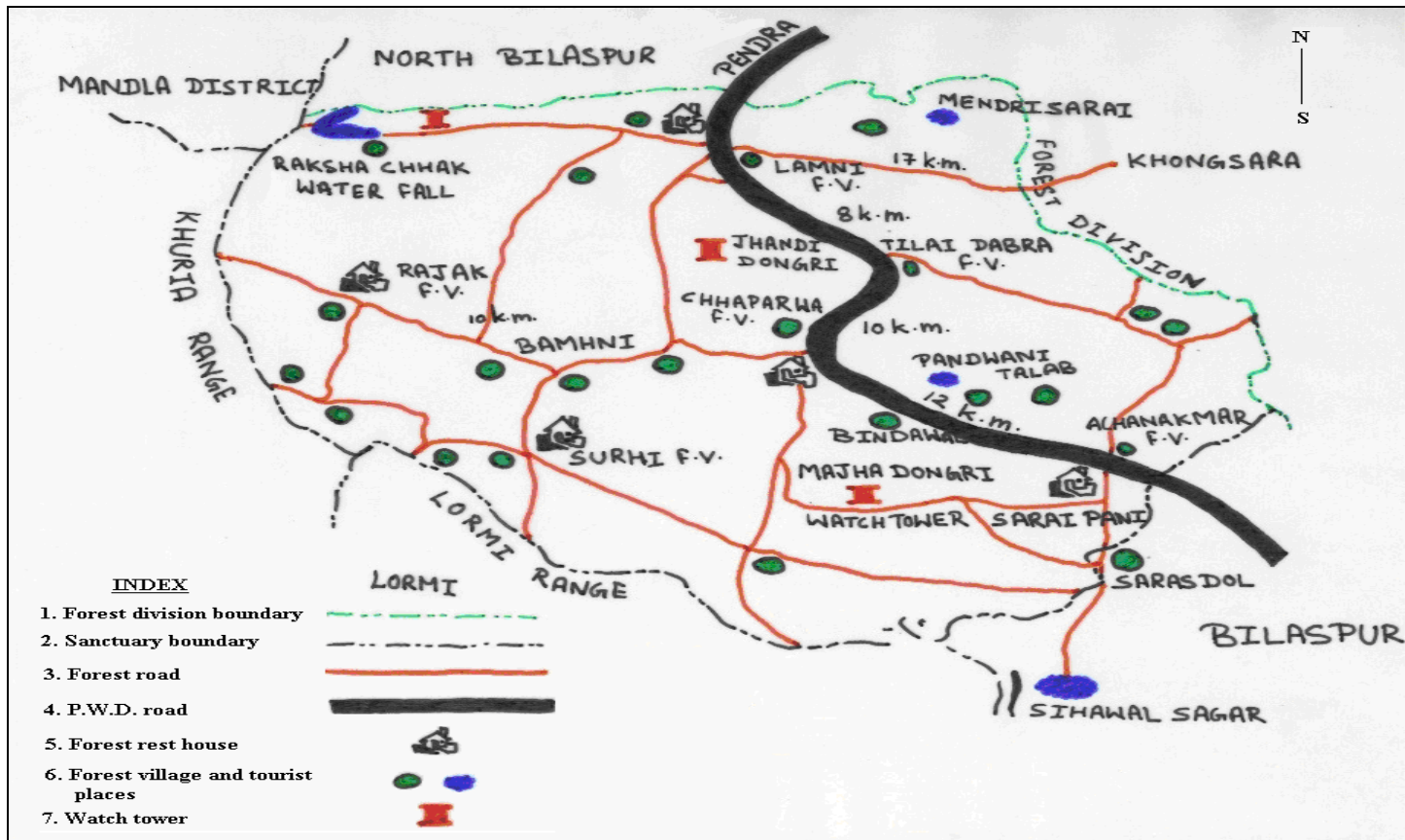
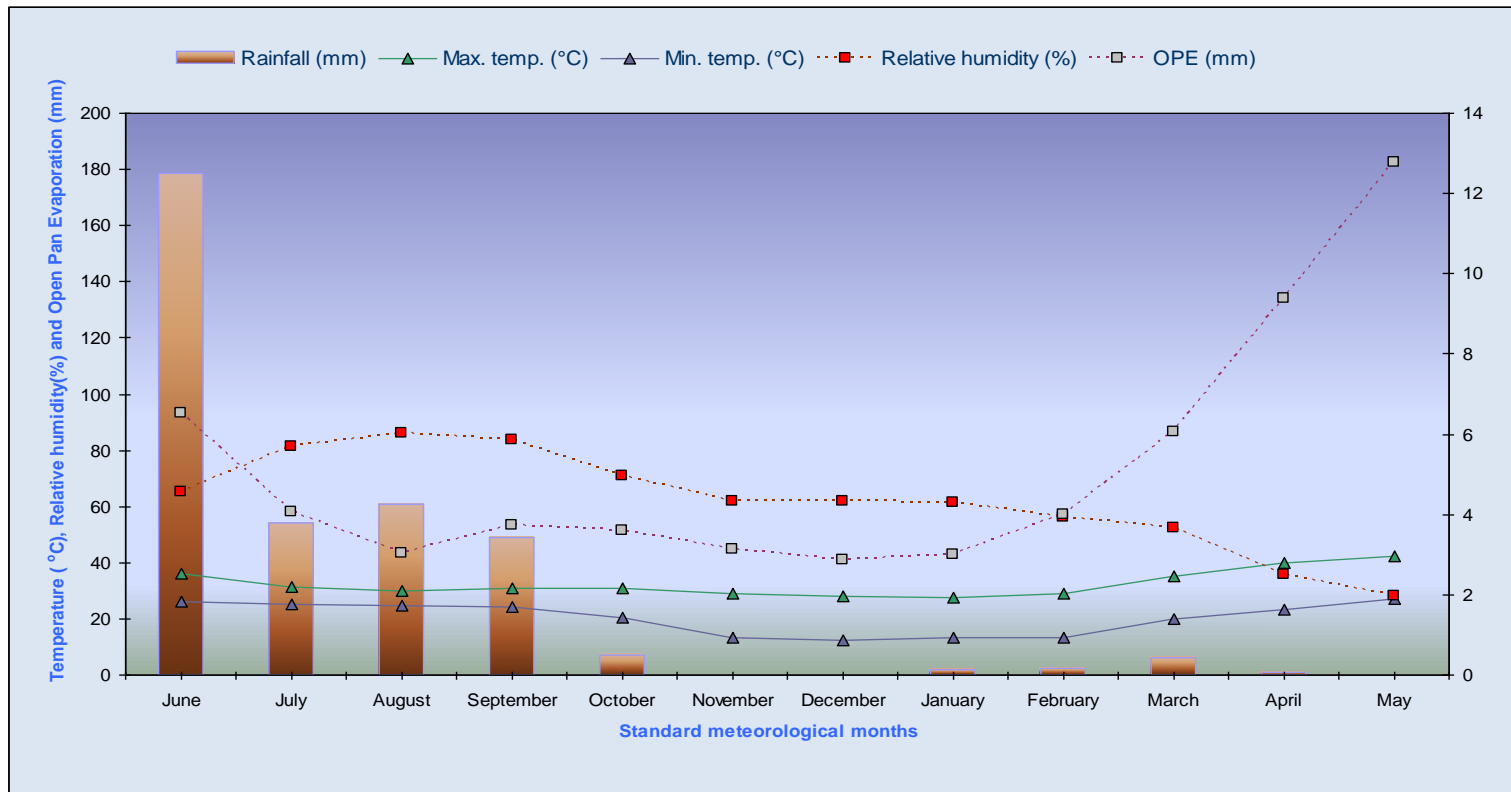
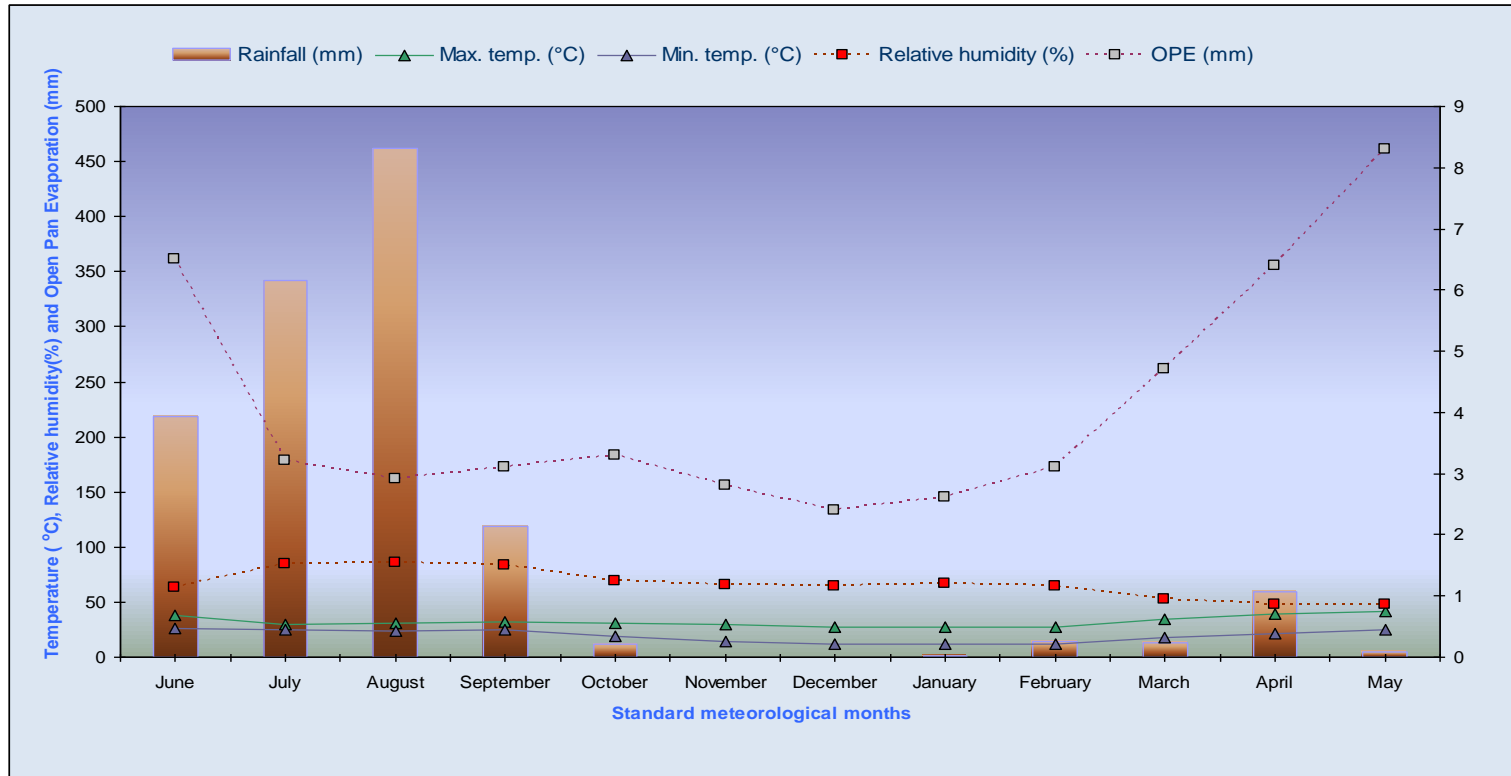


Fig. 3.1 (b): Detail map of Achanakmar-Amarkantak Biosphere Reserve, Bilaspur district.



Source: Department of Agricultural Meteorology, IGKV, Labhandi station, Raipur.

Fig. 3.4 : Monthly meteorological observations recorded during the study year 2007-2008 in Raipur district.



Source: College of Agriculture, Bilaspur observatory, Koni station, Bilaspur.

Fig. 3.2 : Monthly meteorological observations recorded during the study year 2007-2008 in Bilaspur district.



Pueraria tuberosa



A bottle cover of *Pueraria tuberosa* stem.



Terminalia chebula



Dendrocalamus strictus



Embelia robusta



Woodfordia fruticosa



Curculigo orchioides



Cromalaena odorata

PLATE IV



Vetiveria zizanioides



Lepidogathis trinervis



Agave americana



Madhuca latifolia



Butea superba



Careya arborea



Diospyros melanoxylon



Helectris isora

PLATE V



Anacyclus pyrethrum



Sida acuta



Desmodium diffusum



Uraria picta



Desmodium gangeticum



Chlorophytum tuberosum



Zinziber casumunar



Costus speciosus



Grewia hirsuta



Asparagus racemosus

PLATE VI



Cervus unicolor



Melusus ursinus



A Wild buffalo (*Bubalus bubalis*) grazing with the common buffalo at Jugad village of Udanti Wildlife Sanctuary.



Sus scrofacristatus



Muntiacus muntjack



CHAUSINGA



Vulpes bengalensis

PLATE VII



GIANT SQUIRREL



Coracias benghalensis



Polyplectron bicalcaratum



Cuon alpinus



Bos gaurus



Hystrix indica



Macaca mulatta



Presbytis entellus



Panthera tigris

PLATE VIII



LOCAL MARKET



Construction of a stop dam.



Construction of a rapta (road).



Solar panels to light the forest villages.



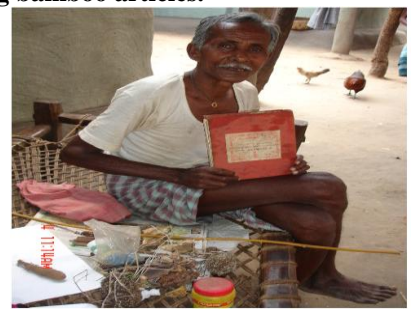
A woman collecting mahua flowers.



A woman preparing bamboo articles.



Tribal women preparing herbal products.



A well known vaidraj of forest.

PLATE IX



A GOND family.



A BAIGA family.



A KAMAR with his articles.



A KAMAR woman.



A BHUNJIA family.



Tourists at Udanti Wildlife Sanctuary.

PLATE X



Sal forest at Achanakmar-Amarkantak Biosphere Reserve.



Degrading Sal forest at Udanti. Lower vegetation in mixed forest.



Bison site at Udanti.



Opening of forest to increase animal visibility.

PLATE III



GODENA WATERFALL



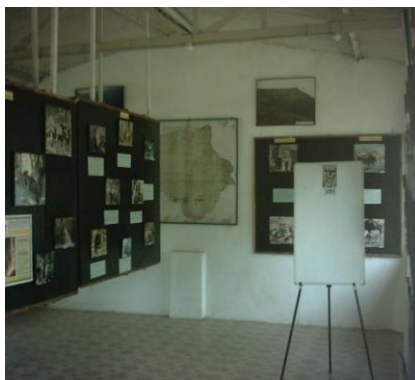
DEODARHA WATERFALL



MENDRI SARAI



HALDU



Achanakmar interpretation centre.

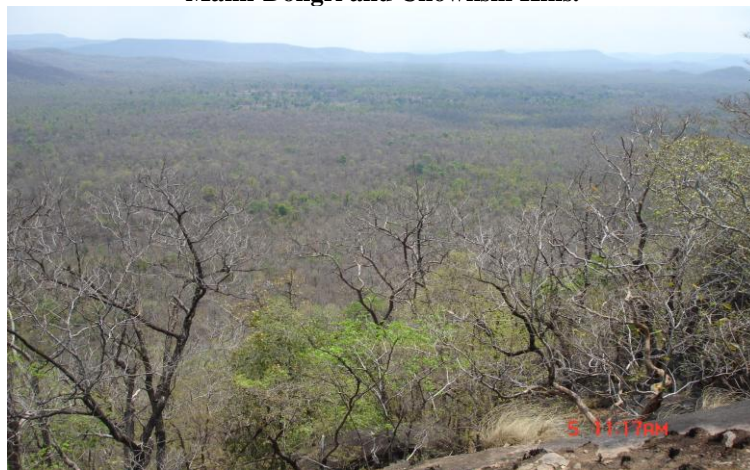


A tree burnt during picnicking near Maniyari River.

PLATE I



Mann-Dongri and Chowksill Hills.



A bird's eyeview of Udanti Wildlife Sanctuary from Chowksill Hill.



A view of Nagesh Hill from Jugad Rest House.

PLATE II