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**A Lead / Coordinating Institution of Pachmarhi Biosphere
Reserve**

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Preface

Pachmarhi Biosphere Reserve, located at Satpura hill ranges in Central India, is one of the major geographical features of India. This was designated as Biosphere Reserve in March 1999. Environmental Planning & Coordination Organization (EPCO) is the Nodal Agency on behalf of Govt of Madhya Pradesh for Implementation of Management Action Plan.

The Central Government has constituted an Indian National Man and Biosphere (MAB) Committee to advise and oversee implementation of management action plan and various research projects in the Biosphere Reserve. One of the important features of Biosphere Reserves is to provide venues for interdisciplinary research programmes, to develop models for sustainable conservation of the ecosystem and to develop sustainable systems for degraded areas. They also serve as important center for education and training of scientists, resource managers, protected area administrators, visitors and local people.

For collection, synthesis and dissemination of research based information, interaction with regional research organisations for development of suitable research projects, interaction with BR managers to assess research needs and crucial issues requiring research efforts and biannual publication of information. The Ministry of Environment & Forests, Govt. of India, has also identified Lead/Coordinating Institutions for various Biosphere Reserves to serve as a focal point. EPCO is one of the Lead/Coordinating Institutions, which is responsible for Pachmarhi Biosphere Reserve.

In order to fulfil the objectives, the information have been collected from various published research papers, literatures, books, journals, internet, newspapers etc. In this issue, attempt has been made to include bibliography, ongoing research projects, news items, abstracts /summaries of research papers.

It is hoped that information will be helpful to researchers, managers, local inhabitants, planners, administrators, scientists, NGOs, CBD etc. I request to our all readers specially researchers/scientists to provide us a copy of the their research papers/project reports/ books on Pachmarhi Biosphere Reserve so that we may incorporate the summary / abstracts of these for disseminating to larger users through our subsequent publications. This would also result in creation of data bank in EPCO. These would also help to identify the main issues, to find out the gaps, to avoid duplication and also to devise appropriate applied research projects for the management action plan of Pachmarhi BR, which would ultimately be helpful in conservation of biodiversity of the area and socio-economic upliftment of the people residing in area.

Financial assistance from the Ministry of Environment & Forests, New Delhi is highly acknowledged.

I commend **Dr. R.P. Singh**, Project Coordinator and his team members who worked hard to bring out this publication.

The comments / suggestions for improvement of BRIS publication is welcomed.

October 2001

A P Shrivastava
Executive Director

Biosphere Reserves - General Information

Salient Features of Biosphere Reserves of India

The Government of India, Ministry of Environment & Forests constituted a committee of experts in 1979 to identify potential areas for recognition as Biosphere Reserve as per the guidelines of UNESCO (MAB). The experts identified 14 sites to be designated as Biosphere Reserves. Subsequently, 14 sites were suggested by the committee /states/experts. So far, 12 Biosphere Reserve have been declared by August 2001 and their important features are given in Table-1.

The main objectives of the Biosphere Reserve programme in India are:

- To conserve the diversity and integrity of plants and animals within the natural ecosystems
- To safeguard genetic diversity of species on which their continuing evolution depends
- To provide areas for ecological research and monitoring
 - To provide facilities for education and training.
- To ensure sustainable use of natural resources through traditional methods for improvement of economic living of local people.

Table-1: Biosphere Reserves and their important features

<i>Name of Reserve</i>	<i>Vegetation Types</i>	<i>Important Plant Species</i>	<i>Important Animal Species</i>
Nilgiri (5520 km ²), Tamil Nadu, Kerala & Karnataka	Evergreen, moist deciduous, dry deciduous, thorn forests	Adenoon sp., Frerea sp. Baeolepsis sp., Wagatea sp. Calacanthus sp.	Nilgiri Tahr, Lion tailed macaque, Nilgiri langur, Elephant, Great Indian horn bill, Frog mouth
Nanda Devi (5860.69 km ²) Uttaranchal	Mixed tepmerate coniferous, mixed temperate deciduous, temperate pasture, alder forest	Potentilla sp., Androsac sp., Primula sp., Orchis latifolia, Rhododendron sp., Sisoria sps.	Snow leopard, Himalayan Tahr, musk deer, brown bear, Monal pheasant, golden eagle
Nokrek (820 km ²) Meghalaya	Evergreen, semi evergreen, deciduous forests, riverine forests,	Altingia excelsa, Shorea asamica Bamboosa pallida, Amoora wallichii Zalacca	Hoolock gibbons, Assamese macaque, Slow loris, golden

	grasslands, bamboo thickets	sp., <i>Michelia insignis</i>	langur, clouded leopard, Indian black crested baza, green magpie, longtailed broad bill, king cobra
Great Nicobar (885 km ²) Andaman & Nicobar Islands	Tropical wet evergreen, semi evergreen, moist deciduous, mangrove forest	<i>Cyathea alba-setacea</i> (tree fern) <i>Phalaenopsis speciosa</i> (orchid) <i>Dipterocarpus</i> sp. <i>Garcinia</i> spp. <i>Pandanus</i> spp. <i>Dendrocalamus</i>	Crab eating macaque, dugong, Nicobar tree shrew, megapode, salt water crocodile, Reticulated python
Gulf of Mannar (10,500 km ²) Tamil Nadu	Algal flora of coral reefs, sea grass ecosystem, mangroove vegetation	Algae (160sp) - <i>Ulva reticulata</i> , <i>Halimed opuntia</i> , <i>Turbinaria</i> spp.; Grasses (10 sp.)- <i>Enhalus acoroides</i> , <i>Thalassia hemprichii</i> , <i>Halophilla</i> spp. Mangrove sp. <i>Rhizophora</i> sp. <i>Avicennia</i> sp. <i>Bruguiera</i>	Coral reef (120 sp.), Dugong dugon, Indian skimmer, Star tortoise, Fishes (Salmon so. Heckel sp.)
Manas (2837 km ²) Assam	Tropical wet evergreen, semi evergreen, cane and bamboo brakes, mixed deciduous forests, grasslands	<i>Shorea assamica</i> , <i>Altingia excelsa</i> , <i>Bambusa</i> sp., <i>Calamus</i> spp., <i>Vatica</i> sp., <i>Glochidion</i> sp.	One horned rhino, elephant, sloth bear, hoolock gibbon, clouded leopard, golden langur (endemic) pigmy hog (endemic), salvator lizard
Sunderbans (9630 km ²) West Bengal	Littoral and swamp forest, Magroove, salt water mixed forest, brackish water mixed forest	<i>Heritiera fomes</i> , <i>Avicennia</i> sp. <i>Zylocarpus</i> spp., <i>Excoecaria agallocha</i> , <i>Ceriops</i> spp., <i>Rhizophora apiculata</i>	Tiger, salt water crocodile, fishing cat, Bengal monitor lizard, green turtle, olive ridley turtle, Salvator lizard
Simlipal (4374 km ²) Orissa	Tropical semi evergreen, tropical moist, deciduous hill forest, grassland, savannah	<i>Terminalia arjuna</i> , <i>Dalbergia sissoo</i> <i>Madhuca</i> sp., <i>Michelia champaca</i> , <i>Shorea robusta</i>	Elephant, tiger, leopard, fishing cat four-horned antelope, red breasted falconet, grey headed fishing, eagle ruddy mongoose
Dibru- Saikohwa	Deciduous forest,	<i>Salix tetrasperma</i> ,	Elephant, tiger, wild

(765 km ²) Assam	riverine forest	Bischofia javanica Ficus spp., Kadamba sp., Dalbergia sp., Stenochaena palustre (edible fern)	buffalo, feral horse, hoolock gibbon, white winged wood duck
Dehang-Debang (5111.5 km ²) Arunachal Pradesh	Tropical evergreen, Sub tropical evergreen, Grassland	Terminalia myriocarpa, Ailanthus grabis, Ficus spp., Macaranga sp., Pandanus sp., Rhododendron sp., Orchids, Dendrobium sp., Gymbidium sp., Eria sp.	Leopard, musk deer, serrow, takin, goral, sclater's monal, blood pheasant, khalis pheasant
Pachmarhi (4926.28 km ²) Madhya Pradesh	Mixed deciduous forests, dry deciduous forests, central Indian sub- tropical hill forests	Tectona grandis, Shorea robusta, Melastoma malabaricum, Murraya paniculata, Blumea lanceolaria, Isoetes panchanii, Lycopodium cerenum	Tiger, leopard, sambar, bison, barking deer, rhesus macaque, giant squirrel, crested serpent eagle
Khanchen-jonga (2619.92 km ²) Sikkim	Sub tropical broad leaved hill forests, Himalayan wet temperate forests, mixed coniferous forests, alpine forests	Threatened flora, Aconitum spp., Rhododendron spp., Meconopsis sp., Costus speciosa, Paphiopedilum sp. (orchid)	Leopard cat, panther, snow leopard, musk deer, clouded leopard, red panda, Himalayan bearded vulture, black eagle

The management of these reserves rests with the respective State Government. Most reserves are co-terminus with existing wildlife sanctuaries and national parks. The Central Government provides financial support to the Biosphere Reserves through a centrally sponsored scheme. The first Biosphere Reserve in the country was designated in 1986 in the Nilgiri Mountains in the southern Indian States of Tamil Nadu, Kerala and Karnataka.

(Sources: (i)<http://www.cpree.org/econews/bios.htm>

(ii)Proceedings of the Review Meeting: Biopshere and their Management, 8-11 September 2000, Peechi, Kerala.)

General Information about Pachmarhi Biosphere Reserve

Name of Villages / Urban Settlements of Pachmarhi Biosphere Reserve

As per information provided by Remote Sensing and Application Centre (M.P.Council of Science & Technology) Bhopal, the total area of Pachmarhi Biosphere Reserve is 4981.00 sq.km. It covers three civil districts of M.P, namely, Hoshangabad (59.54%), Betul (11.26%) and Chhindwara (29.20%). Thus maximum area falls under Hoshangabad district. Forests comprises as much as 62.47% of the area, while agriculture land is 29.38%. The wasteland covers 2.18% while 4.94% area is under water due to the inclusion of the Tawa reservoir within the reserve. Built-up land is 0.54% which includes the larger settlements of Pachmarhi, Babai, Sohagpur, Pipariya, Tamia etc. The area comprises of 583 settlements under 10 tehsils / blocks viz. Kesla, Hoshangabad, Babai, Sohagpur, Pipariya, Bankhedi blocks of Hoshangabad district, Ghoradongri and Shahpur blocks of Betul and Tamia and Jamai (Junnardeo) blocks of Chhindwara district. The district wise list of settlements falling in Biosphere Reserve is given in Annexure- I.

There are total of 575 villages of which 508 belongs to revenue village and rest 67 forest villages. There are 8 urban agglomeration. Of these only two viz. Pachmarhi and Tawa Nagar (Ranipura) fall within central part of Biosphere Reserve and the rest of them are located on periphery of the boundary. The tehsilwise numbers of settlements are given in Table-1. In revenue villages, 34 villages are inhabited, 314 settlement comes below 500 population. 132 settlement comes under 500-1000 population, while 3 settlements come under more than 5000 population. In Forest villages, 12 villages are inhabited, while 44 settlements come under 500 population. Only one settlement comes under 500-1000 population.

As per the census report of 1991, the total population of the BR area is about 4,07,504. Out of this 67.76% of the population fall in revenue villages, 29.35% in urban area and rest 1.98% in the forests villages. Hoshangabad district contributes 62.69% of the total BR population, where Betul and Chhindwara districts contributes 9.66% and 27.64% respectively. The higher population contribution is of Pipariya, Jamai and Sohagpur block with percentage of 20.39%, 17.65% and 15.13%, respectively of the total BR population. The percentage of Forest village population is maximum in Ghoradongri block.

Table-1: Block wise Revenue, Urban & Forest Settlements

Districts	Block/ Tehsil	Number of Settlements			Total
		Revenue	Urban	Forest Village	
Hoshangabad	Kesla	42	2	15	59
	Hoshangabad	5	0	0	5
	Babai	24	1	0	25
	Sohagpur	66	1	24	91
	Pipariya	81	2	10	93
	Bankhedi	51	0	0	51
	Sub Total	269	6	49	324
Betul	Ghoradongri	28	0	17	45
	Shahpur	23	0	1	24
	Sub Total	51	0	18	69
Chhindwara	Tamia	125	0	0	125
	Jamai	63	2	0	65
	Sub Total	188	2	0	190
	Grand Total	508	8	67	583

The scheduled caste and scheduled tribes constitute a significant chunk of population of BR. The area is mainly inhabited by the Gond tribe. Percentage wise population of Scheduled castes & Scheduled tribes to the total population is given in Table –2.

Table-2: District wise Scheduled Caste and Scheduled Tribes population of BR

Name of District	Scheduled Caste		Scheduled Tribe	
	Population	% in Total BR Population	Population	% in Total BR Population
Hoshangabad	42592	16.67	57487	22.50
Betul	2501	6.35	15789	40.09
Chhindwara	14867	13.20	55145	48.95
Grand Total of PBR	59960	14.70	158421	31.50

It is evident that Chhindwara and Betul district are the most prominent tribal belt, as Scheduled tribes constitute 48.95% and 40.04%, respectively of the total population. Tamia block of Chhindwara district has the largest scheduled tribe population, as about 2/3 rd of its population is tribal.

Critical Issues Requiring Management Intervention

The Pachmarhi Biosphere Reserve area, especially the areas within the Satpura National Park and the two sanctuaries, have, to considerable extent, been free of the ecological disasters that has befallen other hill resorts and their surrounds in India. However, there

are problems which, if not urgently tackled, could lead to serious consequences. Many of these problems are in a nascent stage and relatively easy to overcome if tackled immediately. Also, there are the socio-economic problems that exist in an underdeveloped area - problems of employment and opportunities for earning a livelihood. Compounding these there are various restrictions on the people that arise from an area being within a National Park or Wildlife Sanctuary. Overall, the Pachmarhi Biosphere area presents a unique opportunity for a planner to design and promote development in an ecologically sound and sustainable mould. To achieve this, the following are the critical issues that need to be addressed for effective solutions

Threat to Gene Pool Reserve Areas: Pachmarhi Plateau, popularly known as "the Queen of the Satpuras", is Botanist's paradise. About 60 sq.km. of this plateau consists of deep gorges having many waterfalls, marshy places, perennial streams and hills of various elevations. Even the sun rays are unable to reach the bottom of the perennial streams, which flow within narrow gorges. Such perennial streams and dark shady gorges have created micro climatic conditions in the area and provide a hospitable environment for luxuriant growth of several moisture loving species of ferns, orchids, bryophytes, algae and many tiny herbs having immense ecological as well as economic value. Some of the important and rare species are localised in areas that may be considered as gene banks of rare species in these localities. The places where these species are met with are Jalgali, Jambudeep, Bee Fall, Sunder Kund, Ramyakund, Vanshree Vihar, Pather Chatta, Sangam, Kua khad, Handikhoh, Apsara vihar, Big Fall, Lady Point, Little Fall, Dutches Fall, Bada Mahadev, Chhota Mahadev, Jatashankar, Panarpani, Dorothy Deep, Children's Valley, Tridhara, etc.

These sites are visited by tourists constantly, specially the groups of students of Universities and local medicinal plant collectors for exploiting such rare, endemic and important species in the area. Repeated exploitation of such species from the last many years has resulted in the disappearance of various species from many places. The existences of many species like *Psilotum nudum*, *Lycopodium cerenum*, *Cyathea spinulosa*, *Selaginella exigua* etc and many medicinal plants are in danger and need urgent protection measures for their in situ conservation and cultivation in existing conditions for their propagation.

Threat to meadows \ open glades of Pachmarhi: **The meadows/ open glades, which are grassy patches on the Pachmarhi Plateau, is a unique natural gift of the Pachmarhi Biosphere Reserve. Whereas, the meadows of Ootacamund have already been converted into potato fields and other uses, the meadows of Pachmarhi area still in their natural state. However, due to human interference and proliferation of *Lantana camara*, the very existence of the meadows is under threats and it needs conservation measures. The streams passing through these meadows are also engulfing them due to serious erosions.**

Threats to Medicinal Plants and the indigenous knowledge thereof: The topography and climate of the two plateaus of Pachmarhi and Tamia harbour a multitude of plants that are rare and have medicinal value. These plants, formerly present in substantial quantities, are now becoming rare because of biotic interference and physical removal by local medicinal practitioners and traders. The traditional knowledge of the indigenous people regarding these plants, their habitat and uses are also being gradually lost for want of organised documentation. Urgent efforts are needed to:

- In-situ conservation of the medicinal plants
- Promote cultivation and propagation of medicinal plants *ex situ*
- Maintenance of the traditional knowledge base of the local practitioners

Arrested Succession: Arrested succession is a common feature on the Pachmarhi plateau area. The *Lantana camara* weed has spread on open places in the cantonment areas, revenue lands and even the forest areas. As a consequence there is continuous decimation of germplasm of shrubs and trees threatening the unique gift of nature to Pachmarhi plateau. Therefore, there is urgent need for eradication and mopping operation for Lantana in the area.

Soil Erosion

Soil erosion is a critical problem in and around Pachmarhi and is severe in areas along the steep edge of the plateau. Mining on the plateau for moorum has caused considerable damage. Denudation of catchment areas have resulted in the formation of gullies and the collapse of nala banks leading to new gullies being formed.

Immediate cessation of all mining activities is required and soil and moisture conservation measures need to be implemented immediately. This will reduce the quantum of soil erosion and also help recharge the ground water resources of the plateau, which is another critical area of concern.

Threats to Indigenous Fruit Bearing Trees: The Biosphere Reserve, especially the higher reaches around Pachmarhi and Tamia are rich in a variety of fruit bearing trees namely- Mango (*Magnifera indica*), Jamun (*Syzygium cuminum*), Aonla (*Embllica officinalis*), Khirni (*Manilkara hexandra*) etc. Each species has several indigenous varieties. In order to preserve these wild varieties, steps are required urgently.

Threats to Indigenous Crop & Vegetable Varieties: The Biosphere Reserve area, especially the large belt of the sparsely populated tribal areas harbours numerous crop and vegetable varieties. Efforts are expeditiously needed to conserve these crop and vegetable varieties so that they are not lost due to the introduction of hybrid and exotic varieties.

Excess Withdrawal of Groundwater Resources: Being a plateau ringed by hills on all sides, Pachmarhi has substantial but ecologically sensitive ground and surface water resources. The catchment areas of the neighboring forest clad hills channel water into the plateau where it collects in the Pachmarhi Lake before flowing out of the plateau. The major attractions of Pachmarhi are its cascading waterfalls and idyllic forest pools.

With the increase in tourist pressure and the general increase in the town population, the demand for water has been increasing steadily. The municipal supply of the town is already overtaxed and unable to provide water to many localities. The municipal supply where it exists is also irregular. This has resulted in a large number of tube wells being sunk all over the plateau to pump out ground water directly. This together with loss of forest cover in the catchment areas all round the plateau has resulted in an increase in surface run off and erosion and a consequent decrease in the recharging of the ground water table. This has already manifested itself in a perceptible decrease in the flow of streams and water falls. An urgent need is, therefore felt for a comprehensive hydrological survey of the plateau so those necessary counter measures can be put in place before it is too late.

Water Pollution Problem: M.P.Pollution Control Board analysed surface and ground water quality of Pachmarhi area in 1993. In most of the locations the water quality conformed to the limits designated for natural water quality. However, the water quality of Jatashankar, Pachmarhi Lake and Bainganga

nallah was found to be polluted. The main cause of water pollution problem is the discharge of domestic sewage from cantonment nallah to the Jatashankar Nallah. Similarly sewage pollution problems of Pachmarhi Lake is mainly from sewage flow through two main nallah which joins the Pachmarhi lake and also direct discharge of sewage water from a part of Cantonment Board area. The outflow of the Pachmarhi lake pass through the cantonment residential area and Bazaar before joining the Bainganga Nallah. Therefore, the aquatic ecosystem of Bainganga nallah and the human habitations situated along the Bainganga nallah is adversely affected and needs suitable conservation measures.

The pools/falls lying in the Bainganga nallah have already been affected due to pollution problems and there is an urgent need for determining exact point sources quantification of water flow and its quality for establishing proper treatment before being let out in the Bainganga nallah.

State of Tourism and its Impacts: The title "Queen of Satpuras" is richly deserved by Pachmarhi, As one begins the bonejarring road journey from Hoshangabad to Piparia one wants to question the wisdom of setting out to enjoy a holiday in the hills of Central India but once beyond the village of Matkuli, the visitor is more than adequately compensated until the sheer calm and beauty of plateau take him completely by surprise.

At Pachmarhi, Dhoopgarh peak the highest peak of Central Indian hills is located which provides one of the best areas for scenic beauty especially during morning and evening at sunrise and sunset. The hill comprise mainly of Mahadeo sandstone, a soft rock easily cut into deep gullies by water erosion. This has also created spectacular waterfalls all around Pachmarhi plateau, aided by rifts in the geological strata. The little fall, Dutches fall, Big fall, and Bee fall are major ones. The small streams meet down below to create scenic spots like Picadilly circus (Tridhara), and Fleetwood junctions (Agam Triveni). Pansy pool, Sunder's pool, Fuller's khud, White fish gorge etc.

Tamia in Chhindwara district is also a scenic spot with PWD and Forest Rest Houses and is a tourist spot visited by small groups in summer. Close by is Patakot, a small hamlet of Adivasis, approachable by a steep footpath and hence insulated by civilization an anthropologist's paradise. Asirgarh Fort (in ruins) in Betul district is an old seat of Gond/Korku rule but is only accessible on foot. Presently it is in neglected form.

In 1971 the annual tourist inflow to Pachmarhi was about 4500. This has increased to about 66000 in 1992. Presently the inflow of tourist is around 75,000 to 80,000. Domestic tourists mostly visit Pachmarhi. Maximum number of tourists visits in the month of May. However, April, May and June prior to on-set of monsoon and October to December after rainy season are the main tourist inflow months. Mostly people from Maharashtra, Gujrat and West Bengal visit the area. The people visiting the area can be grouped in two categories, viz. students, and general tourists. In addition. Annually around 3-4 lakhs of pilgrims flock the shrines of Mahadeo and Nagdwari during Shivratri and Nag Panchami festivals. During these festivals, people travel along the roads enmasse, camp over night, cook their food and defecate as per their convenience, creating a lot of environmental problems. Therefore it is necessary to regulate the activities of the pilgrims. Being the only hill resort in the state, the number of tourist arrivals has increased considerably during the last decade. The growth of tourism has resulted in negative impacts like pollution of water at tourist's spots, vandalism littering and problems of garbage disposal. The increase in tourist arrivals has also resulted in the increase in the number of hotels and tourist lodges. This has led to migration of labour from neighbouring villages and the mushrooming of Shanty towns. There has been a substantial increase in vehicular traffic on Pachmarhi leading to air emissions and noise pollution.

Threats to Wildlife: Wildlife poaching is not yet highly organised in the area. It is significant in a few areas especially in south of the Bori Sanctuary in Chhindwara and Betul districts. This area is extremely remote with limited access by road and without wireless communication. In the area to the north, the population of Black bucks living in agricultural land is threatened. In some areas like Matkuli and Piparia electric lines are known to be used for poaching by electrocuting the wild animals. Poisoning of kills is prevalent throughout the area is the major threat to Carnivores like Tiger and the Leopard. Various kinds of traps and snares also used by the villagers especially in the southern part of the Biosphere Reserve. Wildlife also faces a threat in the northern and western areas where cases of use of firearms are known. It is, therefore, imperative that anti poaching measures including an improvement in movement facilities and wireless improved roads and additional vehicles are provided.

Use of Chemical Fertilizers & Pesticides: Many farmers in Tawa command area of the Biosphere Reserve areas are switching over from traditional systems of pest management to the heavy use of chemical pesticides. This could, in the long run, endanger the ecosystem of the area and pollute the natural resources. However, resistant varieties of pests are leading to larger quantities and more potent forms of pesticides being used.

The use of chemical fertilizers like-wise has increased the input costs for the farmers and threatens to undermine the environment of the area. The traditional system and knowledge of composting and manufacture of farmyard manure is being lost with detrimental effects on the soil fertility and productivity.

Efforts are, therefore, needed for integrated pest management to be introduced in a large scale so that traditional methods are reinforced with modern non-hazardous methods like the use of pheromone traps. The cultivators must be encouraged to use organic, locally produced fertilizers, using traditional methods like Nadep, pits etc.

Unregulated fuel wood extraction: In the forest areas a lot of trees and shrubs are felled illegally by the local people for meeting their local requirements especially for fuel wood. Despite total ban on felling and removal of forest produce from National Park, and sanctuary areas, a lot of fuel wood is being removed through free head load for sale in urban areas/markets. The irregular/illegal felling to meet fuel wood requirement for cooking and heating during winter nights have caused considerable damage to the forest and its wildlife. In order to meet the requirement of fuel wood there is need for additional plantation for fuel wood and also encouragement of alternate sources of non-conventional energy like gobar gas, fuel-efficient chulhas, solar cooker, etc.

Degradation of Forests: A landuse analysis based on satellite imagery indicates that an area of 136 sq.km. of Pachmarhi Biosphere Reserve constitute degraded forests. This comes to be 4.2% of the total forest area. Out of the forest area 66% is within notified area and remaining 34% comes under other forests. These areas are mostly confined to steep slopes within the notified forest areas and to some extent near human settlements. The degradation has been also due to natural factors like thin soil cover, rocky out crops etc.

Destruction of Rock Paintings & Archaeological Sites: There are over 130 rock shelters with ancient rock paintings around Pachmarhi. Most of these are of the historical period, being 1500 to 2500 years old while some are estimated to be around 10,000 years old, belonging to the Paleolithic period. While most of the rock painting sites is away from habitation and areas frequented by tourists, a few are located close to the township of Pachmarhi and some are frequently visited by tourists. These paintings have unfortunately, suffered in the hands of the visitors because of vandalism. Urgent measures are required to safeguard these priceless treasures of our cultural heritage. Proper documentation of these rock paintings is required at the earliest.

Issue Related to Cattle and Poultry: The cattle, goat and poultry is, economically, a supplement to most households in the area and is almost universal in its coverage. In parts, e.g., the wheat lands the cattle are reared on agriculture by-products but in the vicinity of the forest tracts they are left for foraging in the forests. The present state is highly negative in terms of environmental parameters. The large cattle biomass grazing in the forest is beyond the capabilities of forests in terms of fodder and forage production. In order to reduce the number of unproductive cattle, there is an urgent need for disposal of scrub cattle and introduction of stall fed indigenous improved variety of cattle. Poultry farming are primitive in nature. In most of the area, it is in unorganized forms. Due to lack of proper immunization most of them are affected with disease and have high mortality rates.

Lack of Employment Opportunities: Pachmarhi Biosphere Reserve area is largely an agricultural rural setting with preponderance of forests.. Agriculture is the main stay of the population. As per 1991 census, the total population of Biosphere Reserve is 4.08 lakhs, of which agriculturists accounts for 55.10%, agricultural labours 35.46%, industrial labours were only 4.48 % and people following other trades are professionals are 4.96% of total primary sector. The total working population is 3.2% of total population. The literacy rate is low. The scheduled caste accounts for 14.7% while the scheduled tribes accounts for 31.5% of the total population. Agriculture is the main sources of income. Cattle and goats are in large number. Village houses are constructed with mud and wooden poles, bamboo slats, handmade tiles etc.

The cultivators comprise of the well to do and the medium and marginal farmers. The command area of Tawa Dam irrigating wheat lands on black cotton soil is a system of rich agricultural production. The next is the rainfed black cotton soil field. In the forested belts, the Adivasis generally, resort to marginal and sub subsistence level agriculture. The agro-ecosystems are generally poor in organic matter, moisture and nutrients due to long spells of continuous cultivation and poor, marginal soil in hilly tracts.

As most of the area except the areas in north is suitable for intensive agriculture, the opportunities are limited. The major part of the area being forests, forest labour and the collection of forest produce constitute the main employment potential. After the creation of the National Park and Sanctuaries, the management is as per the Wildlife Protection Act (1991). Consequently there has been a drastic decline in the amount of forest labour. This has resulted a decline in the economic condition and extensive dependent of forest produce. Around major area like Pachmarhi, Piparia, etc. fuel collection, and sale has become major source of livelihood leading to degradation of the forest. The limited employment opportunities have resulted in the degradation of forests and therefore alternative employment opportunities are urgently required to be provided to the villagers so that the degradation of the forest can be reduced.

Lack of Awareness: While there exists a deep-rooted traditional knowledge base and awareness about the fragility of the Eco-system, there is a substantial lack of awareness of the harmful effect of our daily activities on the environment especially in the urban and semi-urban centers. The tourists who come to Pachmarhi and other parts of the biosphere reserve and the local residents do not have adequate exposure or awareness about the threats to the environment in general and to the ecology of the Pachmarhi biosphere reserve in particular. Most are also ignorant about the concept behind and the

purpose of National parks, Sanctuaries and Biosphere Reserves. This has led to the prevalence of incidences of littering, vandalism etc. Efforts to spread awareness among the local populace and the visitors and suggestions about leading an ecofriendly lifestyle and other means that imposes reduced pressure on the natural resources are therefore needed.

Schemes Sanctioned for Management Action Plan of Pachmarhi Biosphere Reserve during 1999-2000

The thrust of Biosphere is *in situ* conservation of biodiversity, promotion of developmental schemes, which helps in upliftment of the socio-economic status of the local people and promotion of research activities, which helps in preparation of suitable management schemes.

Management includes the management of the buffer zone, that ensures local community participation in conservation and utilization of the resources as well as the means by which economic well being of local people is secured. It also involves the development of management measures that protect the core by relieving pressures on buffer's natural resources. Research and monitoring are extremely important and crucial components of effective management for long term maintenance of ecosystem. Education and training is equally important for devising viable and effective management and participatory approaches to achieve the objectives of the BR's and also to cope up with the episodic events arising out of environmental uncertainties in the core zone.

The State Government of Madhya Pradesh has designated Environmental Planning & Coordination Organization (EPCO) as Nodal Agency for Implementation of Management Action Plan of Pachmarhi Biosphere Reserve. The Executive Director, EPCO is the Ex-officio, Director of Pachmarhi BR, while the Field Director of Satpura Tiger Reserve is Ex-officio, Field Director, Pachmarhi BR.

Under Management Action Plan (MAP), Government of India, Ministry of Environment & Forests (MOEF) approved following schemes during year 1999-2000 for Management Action Plan of Pachmarhi BR. These in brief are as follows:

S.No	Name of the Project	Financial (Rs. in lakhs)
1.0	Habitat Improvement	
1.1	Restoration of Meadow/Open Glades	1.45
1.2	Lantana Eradication at Pachmarhi Plateau	3.00
1.3	Catchment Area Treatment	3.00
2.0	Eco-tourism	
2.1	Eco-Tourism Information Center	0.50
2.2	Interpretation Centre and Field Research Station	5.00
2.3	Establishment of Nature Trails and Trekking Routes	3.50
3.0	Eco-development	
3.1 & 3.2	Eco-Dev (Horticulture & Sericulture)	5.00
3.3	Pilot Project for Fuelwood /Fodder in Degraded Forest Area	1.50
4.0	Ex-situ Conservation and Demonstration of Medicinal Plants	3.00
5.0	Promotion of Non-conventional Energy Sources	
5.1	Promotion of Gobar Gas Plant	1.00
6.0	Promotion of Activities related to Horticulture	
6.1	Conservation of Indigenous Species of Fruit Plants	1.50
7.0	Cattle & Poultry Management	
7.1	Genetical Improvement of Live stock (Stall Feeding)	1.0 0
7.2	Animal Health Care Immunization & Improvement of Poultry	0.50
8.0	Environmental Awareness, Education & Training	
8.1	Bio-diversity Conservation Awareness Campaign for General Public	1.00
8.2	Publication and Exhibitions	1.00
8.3	Documentation and Information	0.50
8.4	Technical Training/ Workshop for Implementing Agencies	0.50

8.5	National Seminar on Biodiversity Conservation	2.00
9.0	Techno-economic Feasibility Studies	
9.1	Techno-economic Feasibility studies on Ground Water Resources	3.00
9.2	Tech-economic Feasibility Study of Water Pollution	1.00
9.3	Techno-economic Feasibility study of Shifting of some Institutions	1.00
10.0	Infrastructure Development	
10.1	Equipments (Computer, binocular etc.)	2.95
10.2	Communications (wireless with accessories)	2.00
11.0	Organisation of Health Camps	1.00
	Total	47.40

These projects are being implemented through various field level online departments/Organization like, Forests Agriculture, Horticulture, Health, Animal Husbandry as well as EPCO, NGO's, Schools, WWF-MP State etc. These are being monitored by the Feld Level Implementing Committee as well as State level Coordination Committees constituted by the State Governments. The suggestions /feedback on variuos would be greatly welcomed.

Ongoing Research Projects related to Pachmarhi BR

Development of Indicators (Ecological, Economic and Social in Institutional Terms) for Sustainable Management of Forest Ecosystem in Buffer Zone of Pachmarhi Biosphere Reserve

Dr. R. K Pandey

Senior Scientist, Ecology & Biodiversity Division
State Forest Research Institute, Polypather, Jabalpur (MP)

Objectives: Considering the theme of the project development of indicators for sustainable forest management of forest ecosystem within the buffer zone and transition areas of Pachmarhi Biosphere Reserve, the following objectives are considered for identifications of indicators:

- Assessment of structure and function, of forest ecosystem in the study area.
- Biological diversity sustained in the study site.
- Assessment of utilizable resources and dependency (earning sources) on forest of local inhabitants (villagers)
- Social organization and their occupational pattern of people residing in the project site.

Population Dynamics of Some Endangered Species (Mammalian Rodent Species) around Falls in the Pachmarhi Biosphere Reserve

Dr. Vinoy Kumar Shrivastava

Reader, Dept of Biosciences, Barkatullah University, Bhopal

Objectives: The main objective of this study is to observe the habit and habitat, population dynamic, determination of home range and territory and effect of human interference (due to tourism, hunting by tribal, water pollution created by tourism) on the various endangered mammalian rodent species. Besides this, captive breeding will also be done to increase the population of endangered mammalian rodent species by natural and artificial treatment i.e., hormonal treatment. The utility of the project will be to save and increase the population of endangered mammalian rodent species in Pachmarhi Biosphere Reserve.

Conservation Strategy for Sustenance of Threatened Bioresources of Pachmarhi Forest Division (M.P.)

Dr. Ashok K. Jain

Professor, School of Studies in Botany, Jiwaji University, Gwalior

Objective: The main objective of the study is:

- To make extensive survey of various forests areas of Pachmarhi.
- To collect information regarding multifarious uses of plants for various purposes
- To find out the rare, threatened and endangered plant species of the region.
- To study conservation practices of plants by local people or tribals.
- To propagate rare and threatened plants with low reproductive capacities through standard techniques.
- To study the herbivore pattern amongst different animal species and its impact on rate of survival of plants.
- To study the biotic and natural factors affecting the survival of threatened species.
- To prepare the computer simulations of the species diversity model.
-

Analysis of Landuse Changes in and around Pachmarhi Biosphere Reserve using Remote Sensing and GIS Technique

Dr. S.Khan, Dr. R. K. Singh & Alok Choudhary

Remote Sensing Application Centre, Council of Science & Technology,
Kisan Bhawan, Arera Hills, Bhopal

Objectives: The main objective of the project is to study the temporal changes in Biosphere Reserve area within a span of 10 years (1990–2000) through remote sensing techniques and develop methodology to monitor changes in landuse /land cover of the area as a result of management practices in the study area.

Documentation of Indigenous Knowledge of Inhabitants Living in Pachmarhi Biosphere Reserve

Dr R P Singh and Dr. S. N Chaudhary*

Senior Research Officer, Environmental Planning & Coordination Organisation
(EPCO), Paryavaran Parisar, E-5 Arera Colony, Bhopal

* Reader, Department of Sociology, Barkatullah University, Bhopal.

Objectives: The study would be conducted to achieve the following Research objectives;

- To trace traditional knowledge of villagers (mostly tribals in the study area) pertaining to various land and water based natural resources such as agricultural and forestry activities, fishing, touring and so

on.

- To find out the level of their traditional knowledge pertaining to socio-economic and cultural institutions and practices.
- To search their traditional techniques to overcome or cope with crisis pertaining to health, natural calamities, birth death.
- To discuss the mechanisms employed by the villagers to legitimize their traditional knowledge
- To explain the inhibiting/facilitating factors experienced by the tribals to conserve, monopolize and manipulate the traditional knowledge.
- To identify the techniques that they use to update traditional knowledge, and continue it form generation to generation.
- To know their views and opinions in order to strengthen their traditional knowledge, store it and make it available to others for developmental purpose.
- To make the traditional knowledge economically more viable from the point of view of improvement in quality of life of the locals.

Zoning Atlas for Environmental Management Plan of Pachmarhi Biosphere Reserve

Dr. R.P.Singh

Senior Research Officer, Environmental Planning & Coordination Organisation
(EPCO), Paryavaran Parisar, E-5 Arera Colony, Bhopal

Objectives:- The specific objectives areas follows :-

- To evaluate present status of the area through preparation of thematic maps and mapping of characteristics of the area for identifying the critical zones.
- To understand the relationship between local people, forest, wildlife and assessment of demand and supply like fuel wood, fodder etc.
- To inventorise flora, fauna, natural resources of the area, present status of tourism and its supportive activities in area and assess their socio-economic and environmental impacts including identifying the unsuitable landuses, the inadequacies of infrastructural facilities for housing, water supply, transport, garbage etc. areas of overuse, areas needing relocation/rehabilitation etc.
- Assessment of environmental fragile / sensitivity of the area vis-a vis development need.
- To prepare an Environmental Management Plan for conservation of biodiversity of the area including:
 - (i) Preservation and protection of environmentally fragile area, ecological area, Biodiversity, tribal areas, cultural /scenic/religious /heritage sites.
 - (ii) Environmental quality improvement through appropriate landuse planning measure and regulating tourism activity.
 - (iii) Appropriate technologies for treatment and disposal of sewage, garbage etc. suiting to the conditions of area.

Abstract/ Summary of Research Papers

Sighting of Indian Tree Shrew *Anathana ellioti* at Bori Wildlife Sanctuary, Hoshangabad district, Madhya Pradesh

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Tribals and forest dwellers use large number of wild plants in various ways. The plants are used by local people medicinally to cure diseases by their traditional methods. In order to fulfill their nutritional deficiency the edible parts are used while other parts/plants extracts are used for obtaining gum, resins, fuel, timber, cordage, mats, basketry, wood work, agricultural tools, house building, utensils etc., Plants are also being used for socio-economic ceremonies.

Independent sightings of the Indian tree shrew were recorded at Bori Wildlife Sanctuary, (22° 19' 28" to 22° 30' 10" N. Latitude and 77° 56' 41" to 78° 20' 40" E. Longitude) during the period February - June 1993. *Anathana ellioti* has three distinct populations in India. The distribution of *A.E. wroughtoni* is localised and confined to the Satpura range and a northern part of the Western Ghats. The animal was sighted on five independent occasions while feeding on the ground. When alarmed, it instantly raced up a tree trunk disappearing into the foliage, while on one occasion the tree shrew sought refuge within a cavity in a mature teak tree. In four cases, the animal was sighted in close proximity to a Nala on ravine, or actually on the slope of such a formation. In all instances, the vegetation type was moist to semi- moist deciduous forest consisting of *Anogeissus* /*Tectona* /*Diospyros* /*Terminalia* associations. Two sightings of the tree shrew were made in semi-moist deciduous forest patches within an overall dry deciduous zone. Such patches may be located in depressions, where a compact forest structure and dense top canopy significantly increases insulation, maintains a humid microclimate, and contribute to conspicuous amounts of leaf litter and deadwood.

(Source: J. Bombay Nat. Hist. Soc. 92: 410-411,1995.)

New Records of Two Species of Paussidae (Coleoptera) from Pachmarhi Biosphere Reserve, Madhya Pradesh

Kailash Chandra and R K Singh

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Kamla Nehru, Nagar, Jabalpur-482002 (M.P.) India.

This paper describes two new species of Beetles of the family Paussidae (sub order Adephaga) collected from Pachmarhi Biosphere Reserve. The peculiar shape of their antennae and elytra easily identifies them. Beetles of this family are known to be mycophilous in habit and formed in or near the ants nests. About 400 species of family Paussidae (sub order Adephaga) are known all over the world (Saha et.al, 1995), of which 43 species under eight genera are represented in India (Fowler, 1912). Only two species are presently known from Madhya Pradesh, namely *Platyrhopalus angustus* Westwood from Nimach and *Paussus denticulatus* Westwood from Mhow, Indore. During June 1999, two new species of family Paussidae have been collected, namely *Platyrhopalus denticornis* (Donovan) and *Paussus hearseyanus* Westwood. These species were examined in Pachmarhi Biosphere Reserve, Bori W.L. sanctuary, Churna. The distribution of *P. denticornis* (Donovan) species is confined to Madhya Pradesh, Maharashtra and West Bengal and the *Paussus hearseyanus* westwood is found in Madhya Pradesh, Maharashtra, Gujarat, Karnataka and Uttar Pradesh.

(Source: Bionotes, Vol.2 (1) pp. 15, March 2000)

***Asterell khasiana* Griff - A New Record for Pachmarhi**

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Asterella khasiana Griff is reported for the first time from Pachmarhi where it grows on roadsides. As *Asterella khasiana* is a new addition to the hepatic flora of Pachmarhi, this has bridged up a wide gap between the Himalayas and Peninsular India in its distribution. It grows on the soil, small pebbles and on the rocks in scattered patches. Average thallus length is 9.6 mm and average width is 2.4 mm. Average length of the stalk of carpocephalum is 7.0 mm. Average length of smooth-walled and tuberculated rhizoid is 16.8 μ m and 12.0 μ m, respectively. Spore size is 96.0 μ m and elater length is 273.33 μ m. This taxon completes its life cycle during June to September. The species is associated with other bryophytes namely *A. angusta*, *P.intermedium*, *P.appendiculatum*, *Targionia hypophilla*, *Cyathodium cavernarum*, *Fossombronina himalayensis* and some mosses.

(Source: Recent Studies on Indian Bryophytes, 249-252,1995 Published by Bishan Singh Mahendra Pal Singh, Dehradun, India)

Influence of Moisture Levels in Growth of *Plagiochasma appendiculatum* Lehm. ET Lindenb and *Reboulia hemisphaerica* (L) Raddi on a Comparative Basis

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Culture studies in relation to influence of moisture levels on growth revealed that *P. appendiculatum* possesses a wider range of tolerance to soil moisture than does *R. hemisphaerica*. In *P. appendiculatum* all the produced new branches at moisture levels ranging from 10 to 100 % whereas in *R. hemisphaerica* branching occurred at moisture levels between 40% and 90%. Thalli of *P. appendiculatum* produced maximum number of branches, fresh weight and dry weight at 60% moisture, whereas in *R. hemisphaerica*, maximum number of branches was obtained at 80% moisture, and fresh weight and dry weight of newly formed branches at 70%.

Culture studies clearly revealed that both *P. appendiculatum* and *R. hemisphaerica* occur only at certain specific places whereas wider distribution of *P. appendiculatum* at Pachmarhi is just due to tolerance to a wider range of soil moisture.

(Source: Cryptogamie, Bryol, Lichenol.1998, 9 (4): 337-341)

Culture Studies on *Riccia gangetica* Ahmad V-Influence of Mineral Nutrients on Growth

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The mineral-ion concentration within the plants varies considerably, not so much in relation to species but to environment, and to some extent to growth form which is strongly correlated with environment. It is observed by Smith (1978) that different species associated with particular habitat tend to have similar concentrations of specific mineral elements, where as the same species growing in a variety of sandy habitats tends to have a range of mineral – ion concentrations.

Most of the Marchantiales are ecologically specialized, not only in respect to climate and microclimatic factors, but also to mineral nutrition. The present experiment reveals that the different nutrients at different concentrations affect the growth performance of newly formed branches.

The effects of five mineral nutrients on vegetative growth of *Riccia gangetica* Ahmad was studied under controlled condition. Data are based on 60-day-old cultures. When the concentration of all five nutrients were increased, there was no significant increase in dry weight of thalli and abnormal growth was noted between 0.02% to 0.1% in potassium nitrate, 0.02% to 1.0% in potassium dihydrogen orthophosphate, 0.02% to 0.5% in calcium nitrate, 0.02% to 0.5% in calcium chloride and 0.02% to 1.0% in magnesium sulphate. The increase in nutrient concentration of 0.02% adversely influenced growth. In the present experiments, 0.02% concentration was generally optimum to sustain healthy growth as measured by revival capacity, number, average length and breadth and fresh and dry weight production.

The present experiment suggests that effect of mineral nutrients is particularly important for controlling growth in *R. gangetica*.

For controlling the growth in *R. gangetica*, the effect of mineral nutrients at reduced concentration is observed. Sood (1974) stated that almost all the nutrients are toxic if present in excess and ineffective when found in less concentration.

(Source: Cryptogamie, Bryol, Lichenol. 1989, 9 (2): 149-154.)

Studies on Liverworts Litter Fungi

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The most common process of vegetative propagation of liverworts is the progressive death and decaying of older thalli. The succession of micro fungi on the older thalli and the decaying is a part of litter decomposition. The succession of microfungi on the older thalli results in the decomposition of such litter, since liverworts constitute an integral part of the terrestrial ecosystem.

In the present study, the pattern of fungal colonization on liverwort litter was investigated by examining three categories of Marchantiales thallus T1, T2, and T3. These categories represent progressive stages of decomposing (decaying thallus) litter. The number of fungal species varied with the variation of liverworts species. Greater number of species were recorded on T2 and T3 compared to T1. Many fungal species were found common on all the Marchantiales species and some of them however were specific for a particular species. Although certain species were found frequently on all the three categories of litter, their colonization efficiency was not the same. The fungal colonizations have a correlation with the habitat or natural abode. The species that were growing near water streams i.e. *Dumortiera hirsuta* Bull, and *Marchantia palacea* Bert. have active fungal colonization on T1 litter are *Beltrania rhombica*, *Camposporium pellucidum*, *Diplocladiella scalroides*, *Robillarda sp*, *Chaetospermum chaetosporum*, *Nigrospora sphaerica*, and *Alternaria alternata*. *Camposporium pellucidum*, *Diplocladiella scalaroides* and *Robillarda sp*, were specific on *Dumortiera hirsuta* and *Cladosporium oxysporum* and *Reboulia hemispherica*. On T2 litter *Henicospora coronata*, *Beltrania rhombica*, *Chaetospermum chaetosporum*, *Tetraploa aristata*, *N. sphaerica*, *D. holodes*, *Alternaria alternata*, *Cladosporium herbarum* and *Alternaria tenuis* and on T3 the most active species were *T. aristata*, *Alternaria. sp*, and *Spegazzinia deightonii*.

(Source: Yushania 1 (4): 27-32 Dec. 1984.)

Culture Studies on *Riccia gangetica* Ahmad - III – Influence of Moisture Regime on Growth

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Water is one of the most important environmental factors for rapid and luxuriant growth of bryophytes. Different species of liverworts differ considerably in moisture demand. In natural habitats moisture regime is difficult to maintain constant around rhizoids of a transpiring thallus. The present paper deals with the growth pattern under controlled conditions at different moisture level correlated to field moisture in *R. gangetica*. Growth may be regarded as revival capacity, number, average length and breadth, and fresh and dry wet, production of the newly formed branches.

This paper deals with the effect of moisture regime on growth of *Riccia gangetica* Ahmad. Data based on 60-day-old cultures revealed that the percentage revival, number, average length, average breadth, and fresh and dry weight production of newly formed branches of thalli were maximum at 50% moisture level. In the field, best growth occurred approximately at 50% moisture level in June 1978 as measured by monthly increase in length and breadth. Higher moisture percentage in experimental condition and in the field, due to heavy rains, inhibited the growth.

Present results provide clear evidence that *R. Gangetica* is well adapted to a wide range of moisture. Here the plants were more uniform than the *in-situ* population (field population).

(Source: Cryptogamie, Bryol, Lichenol. 1984,5.3,307 – 312)

Cost-benefit Analysis of the Protected Areas - A Case Study of Satpura National Park, M.P.

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Natural areas are complex systems whose resources have adapted to their individual environment and the overall system over long period of time. It may take centuries to return to its former state if the area is disrupted by harvesting some of these resources. It is well known that the establishment of protected area is socially beneficial though the benefits cannot be made use by an individual and on the contrary an individual does not agree to provide protection or preservation on a commercial basis.

In many cases it may be difficult to determine whether the net benefits of protecting a natural area are positive or negative. The costs of protection may be known but the benefits may be hard to measure. With establishing and maintaining PAs direct costs, indirect costs and opportunity costs are associated. Some

form of benefit cost analysis can be carried out if estimates of both benefits and their associated costs are known.

In the present study an attempt has been made to identify, quantify and valuing the benefits and cost items which were considered. It has been observed that the major benefits associated with the PAs are non-rival in nature. The incentives to preserve natural areas are reduced because of non-excludable and external effects. At one of the Protected Areas (PAs) – The Satpura National Park, a study was done on the Economic indicators i.e, with accrued benefits and without accrued benefits. After analysing the cost and benefits for both the situation, a conclusion was drawn that there has been remarkable change (rise) in the values of NPV and BCR both at any rate of discount when the accrued benefits is taken into analysis. In case of without accrued benefits, this rise in BCR is roughly four times and in NPV about five times higher than that. The study reveals that both NPV and BCR decreases with the increase in the rate of discount in both the cases.

NPV- Net Present value, BCR-Benefit Cost Ratio

{Source: Journal of Tropical Forestry, April-June, 1998, Vol.14 (11)}

Notes on the Taxonomy and Distribution of the Pachmarhi Hare, *Lepus nigricollis mahadeva*-Wroughton & Ryley (Mammalia- Lagomorpha: Leporidae)

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In the present study, the Pachmarhi hare, *Lepus nigricollis mahadeva* Wroughton & Ryley, which is a restricted and aberrant form, occurs only in Mahadeo Hills, Hoshangabad and Balaghat districts, Madhya Pradesh. Two others, namely *Simcoxi* (Wroughton) and *Ruficaudatus* (Geoffroy) also occur in M.P, the former in Khandwa & Khargone, Berar and Central Provinces in south Madhya Pradesh, and the latter in Gwalior in Central India.

Madhya Pradesh forms a very suitable area for hares by possessing large tracts of bush and jungle interspread with cultivated patches. Due to varying physiographic and climatic conditions within the State, at least three sub species of hares are known to occur there. On the basis of the specimens present in the zoological survey of India, it would appear that:

- (1) *L.nigricollis ruficaudatus* occupies the northern slopes of Mahadeo and Maikal ranges and the northern plains of Madhya Pradesh.
- (2) *L. nigricollis mahadeva* occurs on the higher parts of Mahadeo and Maikal ranges of Madhya Pradesh in Hoshangabad, Balaghat and Shahdol districts.

- (3) *L. nigricollis simcoxi* is distributed on the southern slopes of Mahadeo and Maikal ranges and the adjacent plains of Madhya Pradesh and also occurs in the southwestern slopes and adjacent plains of the Mahadeo Hills.

{Source : Journal, Bombay Natural History Society, Vol. 64 (2)}

The genus *Riccardia gray* in India III. *Riccia platyclada* Schefn

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R. platyclada is found on the side of stream or in very wet place at a height of 3,500 ft., Satpura range. The present paper deals with the taxonomic distribution of *R. platyclada* Schffu. On the basis of collections made by him, *R. platyclada* was instituted by Schiffer (1998) from Java and Sumatra. He collected it from Pachmarhi in the Satpuras, which is the first record of this liverwort from India and thus extends the range of its distribution. *Riccardia platyclada* is dioecious. The male plants are smaller in size and less in number than the female plants. Out of 50 specimens segregated 23 are sterile plants, 22 are female and 5 are male plants on the basis of sexuality. *Riccardia platyclada* growing at Pachmarhi is dioecious where as the plants from Java and Sumatra are polyoecious.

Description of this rare plant is as follows- Plants small, caetipitose, living plants yellowish green, dried specimen dirty green or brown. Thalli upto 1.2 cm long, 0.8 to 1-mm broad, anterior part more or less semi-erect; basal part stoloniferous, opaque, fixed to substratum. Pinna \pm flat, somewhat palmately arranged with generally 2-4 pinnules; narrow at base and broad in the middle, translucent, wings 4-5 cells broad. Male branches thick, short, slightly crenulate at margin, antheridia in two alternating rows on dorsal surface. Very mature male plants not seen. Female branches short, laciniate, calyptra upto 2.5 mm long, 0.5 mm broad, cylindrical or clavate, scaly or hairy with crown of papillae on the tip. Scales or cilia lacking in dried specimens.

(Source : Journ. Hattori Bot. Lab No. 36 1992.)

Effects of pH on the Growth of *Riccia discolor* L.et. L

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pH is one of the important factors which affects the growth of bryophytes. Liverworts grow better in an alkaline range of pH. On the contrary some workers have observed that certain species of *Ricci*,

Marchantia and Sphaerocarpus grow better in acidic range of pH. The present study deals with the effect of pH on the revival capacity, length, breadth, fresh and dry weight production of the newly formed branches. Data based on 60-day old cultures revealed that the percentage revival of thallus, the number of the newly formed branches and their fresh and weights were maximum at pH 4.5. Average length of newly formed branches was maximum at pH 4.5 and the breadth at pH 4.0. Data based on dry weight show that better growth occurred between pH 3.0 to 5.0 than at any other pH.

(Source: Hikobia 9: 61-63. 1984)

Litter Accumulation at different Substrata in Liverwort Community

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The present communication gives the magnitude of difference in litter accumulation at different substrata. The organic matter left by liverwort in the substratum has some importance in the nutrient cycle of a forest.

Liverworts have flat thalli and thus constitute a thick layer over substrata. The thickness of litter layer is directly proportional to its weight. In the present study, low accumulation of litter over different substrata was observed, which is partly due to high rate of disappearance of dried liverwort vegetation. The rate of decomposition was influenced by the environment and type of species. A high turn over value was also observed in case of bryophytes. This is because of the fact that decomposition is quick in bryophytes as they generally lack lignin. It was also observed that high vegetational cover has less accumulation of litter over soil, while poor vegetation over rock has more litter production.

Less accumulation over soil is due to high decomposition of labile organic matter present in liverwort plants and consumption of plant by micro and macro fauna of the substrata. Present observation revealed that low accumulation of litter over different substrata is partially due to the high rate of disappearance of dried liverwort vegetation.

(Source: Geobios, 6: 223 225,1979)

***Exormotheca tuberifera* Kash. - A New Report from Central India**

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The present study is part of the field survey of Pachmarhi for preparing a complete list of bryoflora. *Exormotheca tuberifera* is an important addition in the hepatic flora of Pachmarhi in Central India. In the Himalayan zone it grows in the Western Himalayan territory at Mussoorie and Shimla. In the southern zone it is reported from Madras and Purandar in the Western Ghats of Maharashtra. Its discovery bridges a wide gap between its distribution in the Himalayas and the South India. It grows on the soil in scattered patches over practically exposed rocks in association with *Plagiochasma intermedium*, *Asterella angusta*, *Riccia discolor*, *Lejunea species* and *Bryum species*. Tubers at the end of the growth period are the lifeline during unfavourable conditions and vegetative propagation. Plants are yellowish green, dorsiventral, thallus branched dichotomously, monoecious.

Life cycle of the species is completed within a short period of two months, between middle of June to the end of August. Sporophytes become mature in August. Spores are smaller than those of the Western Himalayan populations and that of South India but elaters are comparatively longer.

{**Source:** Recent Studies on Indian Bryophytes, 142-154,1995 Published by Bishan Singh Mahendra Pal Singh, Dehradun (India)}

Some Aspects of Spore Germination of Liverworts

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Spore Germination of *Asterella angusta* St and Revival Capacity: *Asterella* shows many features of ancestral stock from which the Marchantial thallus has been evolved as a result of adaptation to the dryer condition. *Asterella angusta* grows in various habitats such as soil, rock and wall. It is seen in extremely xeric habitats and is the best-adjusted species. Like many other bryophytes its spores also do not germinate in dark even when supplied with inorganic salts and sugars. In presence of light quite a high germination percentage was obtained. This is one of the reasons of its satisfactory growth in exposed and lighted places than in the valley portion.

Light quality was also found to affect germination and the germ cell in majority of cases was elongated into a germ tube in which cell division were also suppressed.

After the end of the rainy season the thalli become dry in natural condition, which can easily revive within one hour in room conditions. Dry thalli can successfully survive upto 70°C without losing revival capacity. Thalli could revive within the temperature range of 4°C to 30°C and maintained green natural colour for about a month. Revival capacity was lost on dry storage gradually.

Spore Germination of *Targionia hypophylla* L: Spores of *Targionia hypophylla* are much sensitive to light conditions. In the presence of diffused and continuous light percentage of germination was quite high but no germination was seen in darkness. It was also noted that in light quality invariably germ cell developed into the germ tube. Secondary germ tubes were also seen. Percentage of germination was maximum in orange light, far-red had adverse affect on germination. Spores were germinated up to 30°C.

Effects on some environmental factors on Spores Germination of *Plagiochasma intermedium*: Here also the spores of *Plagiochasma intermedium* did not germinate in dark. It showed that light is quite important during germination. Spores showed better tolerance towards calcium chloride solution than potassium nitrate. Rate of germination per capsule was different and average germination percentage per capsule was better in

the spores collected from the wall than rock. It is clear that spores from different habitats do show some variations during germination.

Effect of Nutrition and pH on Spore germination of *Targionia hypophylla* L.: Spores of *Targionia hypophylla* can germinate in distilled water but inorganic substances seem to affect the germination. In case of the spores collected from the soil and rock in the absence of CaSO_4 , MgSO_4 or KNO_3 , germination percentage was not much affected but those of the wall showed certain variations. In general spores can tolerate a wide range of calcium chloride solutions where as spores collected from the rock germinated better in lower concentrations.

Spores of all the habitats are poorly adapted to potassium nitrate, and germinated upto 0.3% solution only. Spores germinated quite satisfactorily in the acidic range of pH.

(Source : Journ. Hattori Bot.Lab.No.38: 283-297, July 1974)

Influence of Growth Substances on Spore Germination of *Plagiochasma appendiculatum* L et L.

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The spore of bryophytes is the first cell of gametophytic generation. It is a specialised structure with a potentiality of developing into a new individual. Growth regulator depicts substances other than nutrients, which even in small quantities alter the growth. There has been a revival of interest in the investigation of the role of growth substances on the growth of moss protonema and gametophore on *Plagiochasma appendiculatum*. Growth substances fall under various categories and all of them influence spore germination of *Plagiochasma* to a great extent. Auxins were found to be more stimulating at 0.05 and 0.005 ppm while higher concentrations inhibit spore germination and IPA, - NAA and 2,4-D give a lethal effect at 50 ppm.

Gibberellic acid also promoted clear spore germination at 0.5, 0.05 and 0.005 ppm during present study. Benzoic acid also promotes spore germination a low concentration (0.05 ppm) while extreme high dilution and high concentration inhibits spore germination. Vitamins have a catalytic effect and regulatory function in cell metabolism, they participate in enzyme system. Ascorbic acid is water-soluble vitamin and affects spore germination to a great extent. The endogenous substances, which are synthesized inside the plants, may influence other plants in their environment. Ecologically such a mechanism would confirm an advantage on a plant, which has a low germination capacity. During the rainy season spores appear on *Plagiochasma* and the accumulating growth substances in substrates get diluted during rainy season.

(Source: Yushania 8: 33-40, 1991)

Transplantation Effect on Induction of Sexual Stages in *Marchantia nepalensis* L.E.L.F.

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In the present study the induction of sexual branches was observed after changing the natural ecological condition. *Marchantia nepalensis* growing in the valley of little fall (purely vegetative) along with sufficient amount of soil was collected and transferred near the streams of plain areas. Ecological conditions such as light intensity, humidity, temperature and soil moisture were observed. Transplantation experiments have clearly revealed that the ecological conditions of the plains of Pachmarhi are more suitable as compared to the valley regions for the development of sexual branches.

One of the important considerations for the induction of sexual branches is that the plains get sun rays for 10-12 hr while in vallies only 2-3 hr of direct sunlight is available. Present study confirms that the light intensity with duration is important factor that regulates the sexual growth of *M. nepalensis* than humidity, as the vallies are far humid than the plains of Pachmarhi.

(Source: Geobios 3: 64 - 65,1976)

***Plagiochila fruticosa*, Mitt. - An Addition to the Bryoflora of Central Indian zone**

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Plagiochila fruticosa is reported for the first time in Central Indian Zone. The species particularly habitats on rocks and on the bases of trees in shady humid conditions particularly the lower evergreen and deciduous forest at an elevation of 100-600 m. It was collected in pure tuft as small patches on wet rock near water streams.

Plants are 5-10 cm long, 2.0-2.5 mm wide blackish to brownish green somewhat glossy stem about 0.5 mm thick, blackish brown, apex yellowish green, erect spreading oil bodies. 3-7 per cell, 8x3.5 - 4 μ fusiform or spherical with globules. Perianth bowl-shaped, 1mm long and wide. The species are very close to *P. frondescens* but in this species leaves on main stem are larger. Plants are more winding and more robust, cell-wall is distinctly thickened, male bract are less than 8 pairs, cells of middle leaf are 13-17 x (23)-30-40 μ .

(Source: Yushania 6(4), 1989)

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mYys[kuh; gSfd ¼[kj ½ okys tkuojka ea gksus okyh ; g l Øked chekh ok; j l tfur gA gok vks feÍh ds l gkjs rsth l s QSyrh gA bl ea i Hkfor tkuoj ds egj vks i s ka ds [kj ka ea cM&cM-Nkys vk tkr gA bl dh otg l s tkuoj u rks py i krk gS vks u gh dQ [kk i krk gA ifj.kkeLo: i Hk[k&l; kl l s ml dh eR; q gks tkrh gA eknk tkuojka ea ; g chekh vDI j tkuyok l kfor gsrh gA MKW i Vsy ds epkfd bl l s xHk kr rks gsrk gh gS l kFk gh tkuoj bruk detkj gks tkrk gdfd og py fQj Hkh ugha l drkA og yxkrkj , d gh LFkku ij cBk jgrk gA i s ka ds ?kkoka ea i l i M+ tkus ds dkj.k tkuoj bl s thk l s pkVrk gS ft l s og , Q , e Mh ok; j l l s f?kjrj tkrk gA ckn ea ml dh eR; q gks tkrh gA ouxteka ds eos'k; ka ea QSy , Q , e Mh l s vlt; kj.; ds txyh tkuojka ea Hkh ; g jks QSyus dk [krjk cuk gqk gA bl l mHkz ea ckjh jbt ds , l Mh vks vks ih frokjh dgrs gdfd l gh fLFkr OhYM ea ns[kus ds ckn gh i rk pysxA , Q , e Mh QSyus dh l puk i'kq vksk/kky; l s t: j feyh gA xte ?kbl ds eos'k; ka ea , Q , e Mh ds y{k.k gA mlgkaus dgk fd ouxteka ea oSDI usku dj; s tkus dh rS kjh py jgh gA i'kq vksk/kky; dks bl ckor i = fy[kk tk pdk gA l # crks gdfd ; g chekh [kj okys l Hkh i kf.k; ka ea 'kfrz k rks ij gks tkrh gA txyh HkA k ij bl dk l cl s tYnh vks rst vl j gsrk gA bl ds vykok fpdlj] uhyxk;] l kkkj] phry l fgr l Hkh 'kkdkgkjh tkuoj bl ds f'kdj curs gA bl l Øked jks ds rsth l s QSyus dk , d vks e[;

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oSDI usku fn; s tkus dh vko'; drk

(**I** : nSud HkkLdj 7-10-2001)

List of Publications related to Pachmarhi BR

Total References on Pachmarhi Biosphere Reserve

1. Anonymous, 1994: Project Document for consideration of Pachmarhi as Eco-Sensitive zone, Environmental Planning and Coordination Organisation (EPCO), Bhopal.
2. Anonymous, 1996: Pachmarhi Biosphere Reserve - project document. Environmental Planning and Coordination Organisation (1996); EPCO, Bhopal, 1-107.
3. Anonymous, 1998: Ethnobotany of traditional herbal medicine. Jaipur, College Book Depot, 1998, 242 P
4. Ansari A.A., 1987: Working Plan of Hoshangabad Dvn. 1987-88 to 2001-02, Govt.of M.P., Deptt.of Forest, Bhopal.
5. Bir S S & Kumari S., 1982: Additions to the papilionaceous flora of Pachmarhi hills, Madhya Pradesh Bull. Bot Surv. India. 22: 45 – 50.
6. Bir S.S and Vasudeo S.M., 1973: Ecology and phyto-geographical observation on the pteridophytic flora of Pachmarhi hills (Central India). India. J. Bot. Sci, 51: 297-304.
7. Bor N L and Raizada M B., 1982: Some beautiful Indian climbers and shrubs, 2nd Edition. Bombay, Bombay Natural history Society, 321 P
8. Bor N.L., 1984: Manual of Indian forest botany,.Periodical Expert Book agency..441p; XXXI plants.
9. Buch M.N., 1991: The Forests of Madhya Pradesh. Govt. of Madhya Pradesh. Madhyam, Bhopal
10. Chandra Kailash, 2000: Inventory of Scarabeid beetles (coleoptera) from Madhya Pradesh, India., Zoo's print journal 15 (11): 359-362.
11. Chandra Kailash and Singh R.K., 2000: New record of two species of paussidae (coleoptera) from Pachmarhi Biosphere Reserve, Madhya Pradesh. Bionotes 2(1): 15pp.
12. Dave P.S., 1977: Working plan of East +West Chhindwara Dvn. 1977-78 to 1991-92, Govt.of M.P., Deptt.of Forest, Bhopal
13. Dwivedi A.P., 1993: Forestry in India ., Surya Publications, Dehradun.
14. Gangopadhay P.B., 1985: Working plan of Pachmarhi, 1985-86 to 1994-95, Govt.of M.P. Deptt. of Forest, M.P., Bhopal.
15. Graham J.D., 1915: Notes on ferns collected on Pachmarhi, C.P.
16. Haines H H., : List of the trees, shrubs and economic herbs of Southern Forest Circle of the Central Provinces. Indian For. 38: 495- 509, 1912: 39: 149-69. 1913: 40: 194-229, 264 – 283, 330-335 392-403, 429-449, 472-502. 1914.
17. Hosetti BB and Venkateshvarlu M., 2001: Trends in wild life biodiversity conservation and management Delhi, Daya Publishing house, 2V
18. Jain J K et.al., 1977: Flora of Bhopal., Angiosperms .475P
19. Jain D and Kaul A., 1986: New additions of leafy jungermanniales in hepatic flora of Pachmarhi. Indian Sci.Assoc.73rd Cong. Delhi, January, Botany Section.

20. Jain D and Kaul A., 1986: Preliminary report of epiphytic mosses of Pachmarhi (Central India, Madhya Pradesh). Indian. Sci. Cong.Assoc.73rd Cong. Delhi, January 1986, Botany Section.
21. Jayson E.A., 1990: An ecological survey at Satpura National Park, Pachmarhi and
22. Bori sanctuaries, Madhya Pradesh – Indian Journal of Forestry. Vol. 13 (4) 288-294.
23. Joseph J., 1963: A contribution to the flora of Bori Reserve forests, Hoshangabad,
24. Bull.Bot.Surv.India. Vol5, Nos. 3 & 4 pp: 281-299, 1963.
25. Kaul A., 1974: Some aspects of spore germination of liverworts. J. Hattori. Bot. Lab No. 38: 283-297, July.
26. Kaul A, Pareek A.K and Jain D., 1995: *Exormotheca tubifera* Kash, A. new report from Central India. Recent studies on Indian Bryophytes, 141- 145, Published by Bishen Singh Mahendra Pal Singh. Dehradun (India).
27. Kaul A, Jain D and Pareek A K., 1995: *Asterella khasiana* (Griff). A new report for Pachmarhi, Recent studies on Indian Bryophytes, 249–259, Published by Bishen Singh Mahendra Pal Singh Dehradun (India).
28. Khan TI and Dhari N Alajuni, 1999: Global biodiversity conservation measures, Jaipur, Pointer Publishes, 468P.
29. Kurup A M., 1986: Community and change in a little Community; A study of the Bharias of Pataalkot in Madhya Pradesh. Edited by New Delhi Concept Publishing Company, 140P.
30. Kushwaha R.B.S and Kumar Vijay, 1998: Cost benefits analysis of the protected areas. A case study of Satpura National Park, Madhya Pradesh. Journal of Tropical Forestry April – June, Vol. 14 (11).
31. Lacey W.S., 1975: Some problems in the 'mixed' floras in the Permian of Gondwana land. In Gondwana Geology, ed K.S.W Campbell pp 125-35, Canberra: Australian National University Press.
32. Ladha K.K., 1977: A study of isoetes in Madhya Pradesh. Acta botanica India 5:85-86.
33. Loudon J.C., 1989: Encyclopedia of plants. New Delhi, by A Falcon Book from Cosmo Publications, 2V in 3 parts.
34. Mishra R.M, Mishra P and Rao S.V.S., 1993: Phytosociological analysis of tropical deciduous forests of Central India. Indian J. Trop. Biodiversity, 1:183-187.
35. Mukherjee A K., 1986: Migration of temperate flora of Peninsular India. J. Econ. Tax. Bot. 7:361-364.
36. Mukherjee S.K., 1923: Plant succession in Satpura range near Pachmarhi (M.P.)-A preliminary survey, J. Indian. Bot. Soc. 31: 342-351.
37. Negi S.S., 1983: Environmental conservation, Dehradun, Bishen Singh Mahendra Pal Singh, 78p (Fundamentals of Forestry, 5)
38. Oomachan M and Shrivastava J L., 1996: Flora of Jabalpur. Jodhpur, Scientific Publishers., 354 P
39. Oomachan M, Bajaj A and Masih S.K., 1990: Ethnobotanical observations at Pachmarhi. (Madhya Pradesh). Journ, Tropical Forestry. 6 (11): 157-161.
40. Pandey S.C, Murty M.S and Kuruvilla K., 1967: Forest eco-system classification of forests in the river Narmada catchment area. J. Indian. Bot. Soc. 46: 412-427.
41. Panigrahi G & Dixit R D., 1986: New records of ferns for Madhya Pradesh. I b: I. 36 (2): 135-144.

42. Patidar K.C and Kaul A., 1984: Effect of pH on the growth of *Riccia discolor* L. et L. source- H.kobia 9: 61-63.
43. Patidar K.C. and Kaul A., 1984: Culture studies on *Riccia gangetica* Ahmed III – Influence of moisture regime on growth. *Cryptogamie, Bryol. Lichenol.*, 5,3: 307-312.
44. Patidar K.C Solanki C.M and Kaul A., 1988: Culture studies on *Riccia gangetica* Ahmed V. Influence of mineral nutrients on growth. *Cryptogamie, Bryol. Lichenol.* 9 (2): 149- 154.
45. Rao V.S, Sagaraiya K.P, Bhadran C.A.R and Venkatramany P., (Eds), Hundred Years of Indian Forestry. F.R.I. Dehradun.
46. Sagreiya K.P & Singh B., 1959: Botanical and standardized Hindi Names of important and common forest plants of M.P For Bull. 1. Gwalior.
47. Santapau H & Henry A.N., 1983: Dictionary of the flowering plants in India. New Delhi, Publication and Information Directorate. Distt. (M.P) Bull. Bot. Surv. India. 5: 281-299.
48. Saxena G., 1990: The Forest Crisis. Natraj Publishers, Dehradun.
49. Saxena H O & Shukla S G., 1970: On a collection of plants from Patalkot (M P) Bull. Bot Surv. Indian 12; 188-202.
50. Saxena H O., 1972: A contribution to the flora of M P -I (New records of plants from Central India). *Indian For.* 98: 363-365.
51. Sen G., 1992: Indigenous Vision (Ed). Sage Publications, Dehradun.
52. Shrivastav Divya, 2000: Development of scheduled tribes in Madhya Pradesh, New Delhi, Gyan Publishing House., 246p.
53. Shrivastav R.J., 1995: Sighting of Indian tree shrew *Anathana ellioti* at Bori Wildlife Sanctuary, Hoshangabad district, Madhya Pradesh. *Journ. Bombay Natural History. Soc.* 92: 410-411.
54. Shrivastava K.P., 1982: The genus *Riccardia gray* in India III. *Riccardia platydata* schefu. *J Hattori bot. lab.* No 36,.
55. Shrivastava Ravi, 1992: Working plan of North+West Betul. Dvns. 1992-93 to 2001-2002, Govt.of M.P. Deptt. of Forest.
56. Shukla R.M, Dubey B and Kaul A., 1984: Studies on Liverworts Litter Fungi. *Yushania* 1 (4).
57. Shukla R.M, Sharma P.K and Kaul A., 1976: Transplantation effect on induction of sexual stages in *Marchantia nepalensis* L.et.L. F; *Geobios* 3: 64-65, 1976.
58. Shukla RM and Kaul A.,1979: Litter accumulation at different substrata in liverwort community- *Geobios* 6: 223-225,.
59. Shukla RM and Kaul A., 1991: Influence of growth substances on spore germination of *Plagiochasma appendiculatum* L. Et L. *Yushania* 8: 33-40,.
60. Stebbing E.P., 1982: The Forests of India. A.J. Reprints Agency, New Delhi.
61. Samvatsar Swati, 1996: The flora of western tribal Madhya Pradesh (India). JodhpurScientific Publishers, 441P

62. Thakur Devendra, 1994: Tribal life and forests (Tribal Life in India-I) (Ed). Deep & Deep publications, New Delhi.
63. Verma DM et.al, 1993: Flora of Madhya Pradesh: Pteridophytes and Angiosperms and others Calcutta, Howrah Botanical Survey of India, V1 (Flora of India Series 2).
64. Vishwakarma K.S and Kaul A., 1988: Influence of moisture level on growth of *Plagiochasma appendiculatum* Lehm.et.Lindenb and *Reboulia hemisphaerica* (L). Raddi on a comparative basis. *Crytogamie, Bryol. Lichenol.* 1988, 9(4) : 337 – 341.
65. Wroughton and Ryley, 1913: Notes on the taxonomy and distribution of the Pachmarhi hare *Lepus nigricollis*, Mahadev A.J. Bombay nat. List Soc. 22: 15
66. Yadav H.S., 1998: Patalkot; An Integrated Plan Bhopal, M.P. Vigyan Sabha (mimeo).

Research Papers/Reports Available in EPCO on Pachmarhi BR

1. Anonymous, 1996: Pachmarhi Biosphere Reserve-project document Environmental Planning and Coordination Organisation (1996), EPCO, Bhopal, 1-107.
2. Anonymous, 1994: Project Document for consideration of Pachmarhi as Eco-Sensitive Zone, Environmental Planning and Coordination Organisation, EPCO Bhopal.
3. Bir S.S and Vasudeo S.M., 1973: Ecology and phyto-geographical observation on the pteridophytic flora of Pachmarhi hills (Central India). *India. J. Bot. Sci*, 51: 297-304.
4. Chandra Kailash and Singh R.K., 2000: New record of two species of paussidae (Coleoptera) from Pachmarhi Biosphere Reserve, Madhya Pradesh. *Bionotes* 2(1): 15pp.
5. Chandra Kailash, 2000: Inventory of Scarabeid beetles (coleoptera) from Madhya Pradesh, India., *Zoo's print journal* 15 (11): 359-362.
6. Kaul A., 1974: Some aspects of spore germination of liverworts. *J. Hattori. Bot. Lab No.* 38: 283-297, July.
7. Kaul A, Pareek A.K and Jain D., 1995: *Exormotheca tubifera* Kash, A new report from Central India. *Recent studies on Indian bryophytes*, 141- 145, Published by Bishen Singh & Mahendra Pal Singh. Dehradun India.
8. Kaul A, Jain D and Pareek A K., 1995: *Asterella khasiana* (griff). A new report for Pachmarhi, *Recent studies on Indian Bryophytes*, 249 – 259, 1995. Published by Bishen Singh Mahendra Pal Singh, Dehra Dun.(India)
9. Kushwaha R.B.S and Kumar Vijay, 1998: Cost-benefits Analysis of the protected areas -- A case study of Satpura National Park, Madhya Pradesh. *Journal of Tropical Forestry* April – June, 1988, Vol. 14 (11).
10. Oomachan M, Bajaj A and Masih S.K., 1990: Ethnobotanical observations at Pachmarhi. (Madhya Pradesh). *Journ, Tropical Forestry.* 6 (11): 157-161.
11. Patidar K.C. and Kaul A., 1984: Culture studies on *Riccia gangetica* Ahmed III – Influence of moisture regime on growth. *Crytogamie, Bryol. Lichenol.* 1984, 5,3: 307-312.
12. Patidar K.C. and Kaul A., 1984: Effect of pH on the growth of *Riccia discolor* L. et L. source-*H.kobia* 9: 61-63.
13. Patidar K.C, Solanki C.M and Kaul A., 1988: Culture studies on *Riccia gangetica* Ahmed V. Influence of mineral nutrients on growth. *Crytogamie, Bryol. Lichenol*, 9 (2): 149- 154.

14. Shrivastav R.J., 1995: Sighting of Indian Tree Shrew, *Anathana ellioti* at Bori Wildlife Sanctuary, Hoshangabad district, Madhya Pradesh. Journ. Bombay Natural History. Soc. 92: 410-411.
15. Shrivastava K.P, 1982: The genus *Riccardia gray* in India III. *Riccardia platclada* Schcfu. J Hattori bot. lab. No 36.
16. Shukla R.M, Dubey B and Kaul A., 1984: Studies on liverworts litter fungi. Yushania 1 (4).
17. Shukla R.M., Sharma P.K and Kaul A., 1976: Transplantation effect on induction of sexual stages in *Marchantia nepalensis* L.et.L. F; Geobios 3: 64-65,.
18. Shukla R.M and Kaul A., 1979: Litter accumulation at different substrata in liverwort community- Geobios 6: 223-225,.
19. Shukla R.M and Kaul A., 1991: Influence of growth substances on spore germination of *Plagiochasma appendiculatum* L. Et L. Yushania 8: 33-40,.
20. Vishwakarma K.S. and Kaul A., 1988: Influence of moisture level on growth of *Plagiochasma appendiculatum* Lehm.et.Lindenb and *Reboulia hemisphaerica* (L). Raddi on a comparative basis. Cryptogamie, Bryol. Lichenol. 9(4): 337 – 341.
21. Wroughton and Ryley, 1913: Notes on the taxonomy and distribution of the Pachmarhi Hare, *Lepus nigricollis*, Mahadev A.J. Bombay Nat. Hist Soc. 22: 15

List of Books related to Pachmarhi BR available in EPCO Library

1. Anonymous, 1998: Ethnobotany of Traditional Herbal Medicine. Jaipur, College book depot, 242 P.
2. Bor N L & Raizada M B., 1982: Some beautiful Indian Climbers and Shrubs, 2nd ED. Bombay, Bombay Natural history Society, 1982. 321 P
3. Bor NL,1984: Manual of Indian Forest Botany, Periodical Expert Book Agency,441p; XXXI plants.
4. Hosetti B B & Venkataswarlu M., 2001: Trends in Wild life Biodiversity Conservation and Management Delhi, Daya Publishing house, 2V.
5. Jain J K et al., 1977: Flora of Bhopal- Angiosperms (ed), 475P.
6. Khan TI and Alajuni Dhari N.,1999: Global biodiversity conservation measures Jaipur, Pointer Publishes, 468P
7. Kurup A M., 1986: Community and Change in a little Community: A study of the Bharias of Patakot in Madhya Pradesh. (Eds) New Delhi Concept Publishing Company, 140P.
8. Loudon J C., 1989: Encyclopedia of plants. New Delhi, A Falcon book from Cosmo Publications, 2V in 3 parts.
9. Negi S S., 1983: Environmental Conservation, (Ed) Dehradun, Bishen Singh Mahendra Pal Singh, 78p (Fundamentals of Forestry,5).
10. Oomachan M & Shrivastava J L., 1996: Flora of Jabalpur by Jodhpur, Scientific Publishers, 354 P.
11. Samavatsar Swati,1996: The Flora of western Tribal Madhya Pradesh (India). Jodhpur Scientific Publishers, 441P.
12. Santapau H, Henry A N.,1983: Dictionary of the Flowering Plants in India.New Delhi, Publication and Information Directorate,198P.
13. Shrivastav Divya, 2000: Development of Scheduled Tribes in Madhya Pradesh, (ed) New Delhi, Gyan Publishing House, 246p.

Revised List of Villages in Pachmarhi Biosphere Reserve

District – Hoshangabad			
Block- Kesla		Tehsil- Itarsi	
S.No	Village Name	S.No	Village Name
1.	Nagpur Khurd	2.	Jamai Damami*
3.	Ghatli	4.	Karkha Jamai
5.	Guwadikalan	6.	Mohala
7.	Dhobi khapa*	8.	Dhansai
9.	Bichhua	10.	Kesla*
11.	Belawada	12.	Amjhira
13.	Sontalai	14.	Piparia Kalan
15.	Kotha	16.	Ratakans
17.	Gajapur	18.	Jujadeh
19.	Batkui	20.	Morpani
21.	Nandner	22.	MandiKhoh
23.	Kandai Kalan*	24.	Bhargada
25.	Jhirmau	26.	Kotmimal
27.	Manamau	28.	Ghograpura
29.	Chhipi Khapa	30.	Borkheda
31.	Dob	32.	Chaukipura*
33.	Pandri	34.	Kotmi Ryt
35.	Chandon*	36.	Silwani*
37.	Khapa*	38.	Bardha Ryt (Suk Tawa)
39.	Nagpur Kalan	40.	Dhandiwada*
41.	Pandu khedi*	42.	Kesla (UA)
43.	Jamai Kala	44.	Ranipura(Tawanagar)(NM) (UA)
45.	(ii) Pathrauta (OG) (UA)	46.	Lalpani F.V
47.	Dhatram F.V	48.	Bhatna F.V
49.	Chicha F.V	50.	Ranjhi F.V
51.	Pipal Kheda F.V	52.	Golandon F.V
53.	Chatua F.V	54.	Chichadhan F.V
55.	Jalikheda* F.V	56.	Banglapura F.V
57.	Ojhapura F.V	58.	Dodi F.V
59.	Jhunkar F.V	60.	Hiranchapa F.V
Block Hoshangabad		Tehsil- Hoshangabad (Sadar)	
1.	Gurra*	2.	Kandai Khurd*
3.	Silari*	4.	Chitlai*
5.	Rupapur		
Block Babai		Tehsil- Babai	
1.	Rajon*	2.	Alakhedi*
3.	GuradiyaKalan*	4.	Pehantala
5.	Budhwada*	6.	Kansiya
7.	Ankhmau*	8.	DolariyaKhurd
9.	Gujarwada	10.	Gulon
11.	Kotgaon	12.	Meghli*
13.	Singhpur	14.	Khutiya

15.	Managaon	16.	Jhalon
17.	Mohgaon	18.	Kharda
19.	GuradiyaKhurd	20.	Dobh
21.	Kajal Khedi	22.	Dhamaniya
23.	Mahendrawadi	24.	Babai (M) (UA) *
25.	Kans Kheda		
Block Sohagpur		Tehsil- Sohagpur	
1.	Gorigaon	2.	Bichua
3.	Bodi*	4.	Manakwada
5.	Banskhapa*	6.	Nawalgaon
7.	Semri Harchand	8.	Jijwada
9.	Jamuniya*	10.	Bhajiya dhana
	Keolari*	11.	Chargaon
12.	Guram khedi*	13.	Bhatti
14.	Paraswada	15.	Niwari
16.	Pathari	17.	Raipura
18.	Nibhora	19.	Baruadhana
20.	Hirapur	21.	Akola
22.	Jirran	23.	Sukari
24.	Karanpur*	25.	Tala khedi
26.	Amadehi	27.	Bamari
28.	Gundrai	29.	Nakatua
30.	Samna pur	31.	Shobhapur
32.	Nayagaon	33.	Jhirmita
34.	Sitiya Gohna	35.	Pipariya kalan
36.	Dunda khapa	37.	Bhankhedi khurd
38.	Turakhapa	39.	Mokalwadi
40.	Godikhedi malgujari	41.	Sohagpur (M) (UA)
42.	Dundadeh	43.	Bineka F.V
44.	Godikhedi Ryt.	45.	Paraspani F. V
46.	Singwada	47.	Pathai F. V
48.	Raini pani	49.	Dhaba F. V
50.	Kamti	51.	Khapa F. V
52.	Magariya	53.	Rata Mati F. V
54.	Bija kheri	55.	Suakachhar F. V
56.	Ghoghari	57.	Podar F. V
58.	Sarangpur	59.	Churna F. V
60.	Urdon	61.	Sankai F. V
62.	Kharpawad	63.	Mana F.V
64.	Naya kheda	65.	Malni F.V
66.	Gonadeh Raiyatwari	67.	Sakot F.V
68.	Gonadeh Malgujari	69.	Suplai F.V
70.	Godi Markadhana	71.	Jhalai F.V
72.	Sihar kheda	73.	Mallupupra F.V
74.	Shri Rangpur	75.	Khamda F.V
76.	Chedka	77.	Khakrapura F.V
78.	Tekapar chourmahri	79.	Barbhud F.V
80.	Kukara	81.	Ratti Bandar F.V
82.	Sonpur	83.	Jam F.V
84.	Nandner	85.	Chanaghar F.V
86.	Chitor pattan	87.	Bori F.V

88.	Pipariya Bandichod	89.	Dhain F.V
90.	Sukri		
Block Pipariya		Tehsil- Pipariya	
1.	Bakanj*	2.	Kursi khapa
3.	Singodi	4.	Khari
5.	Tada	6.	Tekapar
7.	Singoda	8.	Chillod
9.	Aliwada*	10.	Mohgaon
11.	Bans kheda*	12.	Pathai thekedari
13.	Kheri khurd	14.	Pathai mal
15.	Thuta Dahelwada	16.	Pisua
17.	Budhni*	18.	Piparia chandan
19.	Pali	20.	Mongra
21.	Mokalwada	22.	Binda kheda
23.	Banwari	24.	Meli
25.	Kumhabad	26.	Matkuli
27.	Naharwada	28.	Mehdi kheda
29.	Bamhori kalan	30.	Chhirrai
31.	Taron kala	32.	Ghana
33.	Taron khurd	34.	Jaman dhonga
35.	Kallu khapa	36.	Chakar
37.	Umariya	38.	Singanama
39.	Bodna thakur	40.	Ghogri
41.	Bijanwada	42.	Muar
43.	Raikhedi	44.	Kham khedi
45.	Sarra	46.	Pagara
47.	Buchal	48.	Bari Aam
49.	Lanjhi	50.	Badkachhar
51.	Nandwada	52.	Kanji ghat
53.	Bori	54.	Jambu deep
55.	Amadeh mal	56.	Kajri
57.	Amadeh ryt	58.	Rori ghat
59.	Madho	60.	Binora
61.	Rechheda	62.	Nandiya
63.	Panari	64.	Supdonagar
65.	Ghogri	66.	Sankari
67.	Samnapur	68.	Churni
69.	Bari devi	70.	Pipria (M) (UA) *
71.	Dokri kheda	72.	Pachmarhi (U.A.)
73.	Chauka	74.	Jhiria F.V
75.	Kheri kalan	76.	Paraspani F.V
77.	Simara	78.	Birji khapa F.V
79.	Dabka	80.	Raikheda F.V
81.	Anhoni	82.	Naya kheda F.V
83.	Churka	84.	Anjan dhana F.V
85.	Suakhapa	86.	Dhargaon F.V
87.	Sangai	88.	Nankot F.V
89.	Muhari kalan	90.	Nimghon F.V
91.	Hathni Khapa	92.	Ghodanar F.V
93.	Muhari khurd		

Block Bankhedhi		Tehsil- Bankhedhi	
1.	Piparia Palia*	2.	Chhater
3.	Khapa Khurd*	4.	Deori
5.	Junheta*	6.	Khabara
7.	Kharsali	8.	Junawani
9.	Bachawani*	10.	Dahalwada Khurd
11.	Baghedhi	12.	Dahalwada Kalan
13.	AndhyarBabdi	14.	Ban Khedi*
15.	Nayagaon	16.	Theni*
17.	Kodapdarai	18.	Lamta
19.	Ghoghari Mattha	20.	Rahatwada*
21.	Bargondi	22.	Nagwada
23.	Fatehpur Nadipura	24.	Jogiwada
25.	Khapa 1	26.	Pathar Kuhi
27.	Fatehpur Bichpura	28.	Khapa Kalan*
29.	Fatehpur Tekripura	30.	Kamthi Randhir*
31.	Hanotia	32.	Murgi Dhana*
33.	Mahua Kheda	34.	Bijanhai
35.	Menda Kheda	36.	Dangarahai*
37.	Kemdhana	38.	Pipar pani
39.	Panjra	40.	Kothri
41.	Kalkuhi	42.	Chhirpani
43.	Bichhua	44.	Khod
45.	Berkhedhi	46.	Jhiriya
47.	Singhpur	48.	Dhadao Padao*
49.	Padrai Thakur	50.	Dolni
51.	Baghraj		
District – Betul			
Block- Ghora Dongri		Tehsil - Betul	
1.	Khapa (Sataldehi)	2.	Punji
3.	Banjari Dhal-Ryt	4.	Chikhal Pati
5.	Sataldehi	6.	Hiran Ghati (Hirawghati)*
7.	Kaili Ryt (Puriji)	8.	Nutandanga (Nutanganga)
9.	Malwar	10.	Nishchintpur
11.	Chichdol Ryt	12.	Kothi (Viran) F.V
13.	Temrumol	14.	Sital Khedi (Viran) F.V
15.	Temru Ryt	16.	Bhatodi (Viran) F.V
17.	Rajegaon Khapa-Ryt	18.	Ghoghari F.V
19.	Hirapur(2)	20.	Rampur F.V
21.	Hirapur(1)	22.	Punji F.V
23.	Bishnupur	24.	Kohalya F.V
25.	Batkidoh	26.	Hirapur* F.V
27.	Narayanpur	28.	Silapati Viran F.V
29.	Dharampur	30.	Sakmandi Viran F.V
31.	Kolhiya	32.	Chopna* F.V
33.	Amdoh	34.	Bhanpur Viran F.V
35.	Lakkipur (Lakhipur)	36.	Bhandwa Viran F.V
37.	Jholi (2)	38.	Imlikheda Viran* F.V
39.	Jholi (1)	40.	Martal Guddi Viran F.V
41.	Chopna(2)	42.	Suyaguddi Viran F.V

43.	Chopna(1)	44.	Nishana Viran F.V
45.	Chopna(3)		
Block Shahpur		Tehsil - Shahpur	
1.	Dhodaramohar alias Bhoura	2.	Kundi*
3.	Dhasai Mal	4.	Kamthi
5.	Dhasai Ryt	6.	Bankakhodri
7.	Bhatna	8.	Kusmari
9.	Ranapura*	10.	Mardanpur
11.	Dhapada Mal	12.	Daudi
13.	Dendupura	14.	Kotmi*
15.	Guwadi*	16.	Sohagpur Dhana*
17.	Dhapda Ryt	18.	Chikhalda Khurd
19.	Chakdhpada	20.	Shahpur
21.	Chhimdi Ryt	22.	Barbatpur
23.	Gurgunda*	24.	Dhar F.V
District Chhindwara			
Block Tamia		Tehsil - Tamia	
1.	Sawarvani	2.	Pratapgarh Badla
3.	Sahawan	4.	Umariya
5.	Tapervani	6.	Khapa Khurd
7.	Deokhoh	8.	Sahradhana
9.	Mahuljhir	10.	Shrijhot
11.	Manakwada	12.	Jamundhonga
13.	Purtla	14.	Nishan
15.	Karer	16.	Belkhedi
17.	Khanchari	18.	Kursidhana
19.	Jhirpa	20.	Bhandi
21.	Panjora	22.	Mugasiya
23.	Kohpani	24.	Bangai
25.	Vasanghati	26.	Harasdiwari
27.	Kararkheda	28.	Markadhana
29.	jamunghati	30.	Kankhedi*
31.	Raini Kheda	32.	Dhagdiya
33.	Nazarpur Kamthi*	34.	Muttor
35.	Bhimkhedi	36.	Dhobiwada*
37.	Kheri Regadhana	38.	Gonawadi*
39.	Bamahori Khurd	40.	Khutti Alias Kua
41.	Khuniya	42.	Bijadhana*
43.	Bandh Bodal Kachhar	44.	Dhusawani*
45.	Anhoni	46.	Itawa*
47.	Jamuniya*	48.	Dundisikhar
49.	Tekapar	50.	Tamia*
51.	Pathai	52.	Jamuniya Khurd
53.	Podikheda	54.	Jaitpur
55.	Dharakpani	56.	Khadua
57.	Mirakota	58.	Gudhichhatri
59.	Kurangla	60.	Ghatlinga
61.	Dehgaon Kalan*	62.	Bhodiyaipani
63.	Keolari	64.	Bakhari
65.	Khapasani*	66.	Bijori

67.	Chawalpani	68.	Bans Dongri*
69.	Pipariya Sani	70.	Bamhori Kalan*
71.	Dehgaon Khurd	72.	Amdhana*
73.	Dholpur	74.	Satalba*
75.	Manegaon	76.	Karrapani
77.	Khamtra	78.	Palanigel Dubba
79.	Paundi*	80.	Ghanasal Dhana Kodia
81.	Jhamar*	82.	Dhurni Malni Domni
83.	Chargaon Khurd	84.	Sehrapachgol Khamarpur*
85.	Pindra	86.	Jadmadal Harra Kachhar
87.	Bamhni*	88.	Dorli Khamarpani
89.	Koshmi*	90.	Supli
91.	Kapoornala	92.	Supdongar*
93.	Godalpani Urf Pipardar*	94.	Jhira*
95.	Goikheda*	96.	Dhodramau
97.	Dundi Bhajipani	98.	Supdongari
99.	Chopna Bhajipani	100.	Palani Sani
101.	Kiraimau	102.	Chuntipur Sani
103.	Nawalgaon	104.	Dabak Kundi
105.	Jamun Kheda	106.	Chimtipur
107.	Karaghati	108.	Sukhabhand Harmau
109.	Piperpani	110.	Ghogharigunja Dongari
111.	Piper Jhela	112.	Kare Amrated*
113.	Pukhara Ghoghari	114.	Sidauli
115.	Khuna Jhiri	116.	Bijadhana
117.	Sitadongri	118.	Dhana Khede
119.	Delakhari	120.	Kathotiya
121.	Dhoukheda	122.	Batra*
123.	Mugaria	124.	Dongra*
125.	Dauriya Kheda		
Block Jamai (Junnardeo)		Tehsil - Jamai	
1.	Barud	2.	Chhawada
3.	Chhatiam	4.	Bhardi*
5.	Kharsi Adewas	6.	Bijori
7.	Gangwani	8.	Mali
9.	Almod	10.	Sagoniya
11.	Bijori	12.	Ghodawadi Kalan
13.	Charkhda	14.	Bhakra
15.	Sangakheda	16.	Ghodawadi Khurd
17.	Jhapiya	18.	Damua
19.	Bichbehari	20.	Chabdi Bhutaha
21.	Seonighat	22.	Khapa Sdwami
23.	Pilhawadi	24.	Dugriya*
25.	Dhannor*	26.	Bichuwa Mal
27.	Patre	28.	Kekda Nimdhana
29.	Mohagaon	30.	Purena Kothideo
31.	Uchetemru	32.	Deduwada
33.	Kukarpani	34.	Bichhua Khurd
35.	Hardoo*	36.	Kohliya
37.	Tarai	38.	Panara
39.	Gop	40.	Patniya
41.	Barukheda	42.	Bilawar Khurd

43.	Khajri	44.	Umradi
45.	Bichhwacharanbhata	46.	Bilawar Kalan
47.	Mudni	48.	Muari*
49.	Jhot kalan	50.	Karan Pipariya
51.	Jhot khurd	52.	Garadei*
53.	Ghatiya	54.	Chikhalmou
55.	Suwa Am	56.	Junnor Bi.
57.	Kodakhuri	58.	Junnordawami*
59.	Gorakhghat*	60.	Datlawadi*
61.	Khapa	62.	Jamai (M) (UA)
63.	Kowajhiri	64.	Damua (N.M.) (UA)
65.	Junapani		

District	Total No of Revenue Villages	Total No of Forest Villages	Total No of Urban Agglomeration	Total Settlements
Hoshangabad	269	49	6	325
Betul	51	18	0	69
Chhindwara	188	0	2	190
Total	508	67	8	583

NB: -

NM – Non Nagar Nigam	UA – Urban Agglomeration
OG – Urban Outgrowth	M – Nagarpalika
FV- Forest Village	* - Boundary Village of PBR
**In census there is no mention against this. Therefore urban it has been excluded from urban agglomeration	