
Pachmarhi Biosphere Reserve



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

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For more informations: Please visit our site or mail to

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Preface

The Biosphere Reserves (BRs) where human being is viewed as integral part of the ecosystem functions, is the most appropriate as means of protecting the landscape and its biodiversity. It is one of the significant testing ground for linking conservation with sustainable livelihood needs of local communities in the short term time frame and sustainable development of the region as part of long term strategy. As a part of Biosphere management strategies there is urgent need for converting traditional ecological knowledge into traditional technological technologies. Such a research orientation alone may enable to ensure community participation, whilst meeting sustainable needs of local communities and sustainable development of the landscape as a whole.

For developing new suitable technology for deciding management strategies and getting benefits of research already being carried out in the area, there is need for compilation of research based information available in various Biosphere Reserves so as to develop new researches in view of limited resources. Keeping this objective the Ministry of Environment and Forests, Govt. of India has initiated project for collection, compilation and dissemination of research based informations to various users /managers and also to find our gaps for taking suitable research projects. To carry out this job, the Ministry has identified Lead/ Coordinating Institution for various Biosphere Reserves.

EPCO is one of such Lead/Coordinating Institution for Pachmarhi BR. The informations collected by EPCO are being published in form of biannual Biosphere Reserve Information Service (BRIS) for Pachmarhi Biosphere Reserve. To bring this volume, informations have been collected from various published sources. The summary of these informations has been given. Attempt has also been made to give summary of the ongoing research projects being carried out in Pachmarhi BR. The critical problems and issues highlighted in newspapers have been also incorporated. It also includes compiled information on Pteridophytic flora of Pachmarhi BR. The research papers, books and reports available in EPCO and bibliography related to PBR have also been incorporated in this issue.

It is hoped that information would 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 these to larger users through our subsequent publications. This would also result in creation of data bank in EPCO. Interesting articles on PBR, successful case studies related to implementation of development projects for benefiting the local inhabitants.

Support of Ministry of Environment & Forests, New Delhi for the project is highly acknowledged.

I appreciate Dr. R.P. Singh, Project Coordinator and Dr. Sujatha Jagdish, Research Associate who worked hard to bring out this publication. The secretarial assistance by Mr. Rajneesh Rai is also acknowledged.

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

Date :- October , 2002

Swadeep Singh
Executive Director

1. Pachmarhi Biosphere Reserve - General Information

Schemes Sanctioned for Management Action Plan of Pachmarhi Biosphere Reserve during 2001-2002

For conservation of biodiversity and socio-economic uplift of local people of Pachmarhi BR area, the Ministry of Environment & Forests, Government of India sanctioned Rs. 51.10 lakhs during 2001-2002. The break-up of funds for various schemes are as follows:

S.No.	Name of the Sub Project	Financial (Rs. Lakhs) in
1.0	Habitat Improvement	
1.1	Lantana Eradication at Pachmarhi Plateau	6.00
1.2	Catchment Area Treatment Works	5.00
2.0	Eco -Tourism	
2.1	Nature Trails and Trekking Routes	1.00
2.2	Interpretation Centre including Research Station	2.60
3.0	Eco- Development	
3.1	Eco-Development in Revenue Areas	7.00
3.2	Pilot Project of Fuel/Fodder in Degraded Forest Area	1.60
4.0	<i>In-situ and Ex-situ Conservation of Plant Species</i>	
4.1	<i>In-situ</i> Conservation of Genepool Reserve Areas	0.80
4.2	<i>Ex-situ</i> Conservation and Demonstration with Emphasis on Medicinal Plants	1.50
5.0	Promotion of Non-conventional Energy and Composting	
5.1	Promotion of Bio-gas Plants	3.00
5.2	Promotion of Smokeless Chulha	1.50
6.0	Promotion of activities for increasing Crop Production	
6.1	Micro-Irrigation Works	5.00
7.0	Socio-economic Upliftment	
7.1	Conservation of Indigenous Species of Fruit Plants	2.50
7.2	Promotion and Training for Honey Bee Rearing	2.00
7.3	Animal Health Care, Immunization and Improvement of Poultry	1.00
8.0	Social Welfare Activities	
8.1	Organisation of Human Health Camps	1.50

9.0	Awareness, Education and Training	
9.1	Awareness Campaign for General Public for Bio-diversity Conservation	1.50
9.2	Organisation of Nature Camp for School Children	1.20
9.3	Technical Training /Workshop for Implementing Agencies	0.50
9.4	Publication, Purchase of Books, Video-film, Pamphlets, Brochure etc	0.50
10.0	Techno-economic feasibility studies	
10.1	Solid waste Management Pachmarhi Town	1.00
10.2	Management of Natural Springs near Anhoni	1.00
10.3	Carrying Capacity of Ground water Resources at Tamia	2.00
10.4	Development of Alternative Project for Fuelwood Bricketing	1.40
	Total	51.10

These management action plans are prepared based on the feedback given by various online Departments of Implementaing agencies, NGO's, local people, planner administraters etc. and sent to Government of India, Ministry of Environment and Forests after due approval of the Districtwise Field Level Implementing Committee constituted under Chairmanship of respective District Collector and State level Coordination Committee constituted under Chairmanship of Principal Secretary, Department of Housing & Environment. The suggestions /feedback on various asopects 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 utilisable resources and dependency (earning sources) on Forest of local inhabitants (villagers)

Social organisation and their occupational pattern of people residing in the project site.

Population Dynamic of some Endangered Species (Mammalian Rodent Species) around Falls in the Pachmarhi Biosphere Reserve

Dr. Vinoy Kumar Shrivastava

Reader, Deptt 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 species in Pachmarhi Biosphere Reserve.

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,
Araera 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 Planing & Coordination Organisation
(EPCO), Paryavaran Parishar, E-5 Araera Colony, Bhopal

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

Objectives: More specifically the study will 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 legitimise their traditional knowledge
- To explain the inhibiting/facilitating factors experienced by the tribals to conserve, monopolise 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.

Review Articles

Pteridophytic Flora of Pachmarhi - A compilation

Dr. Jagdish Sujatha

Environmental Planning & Coordination Organization, Bhopal

The pteridophytic flora of Pachmarhi is very rich, as various gorges provide ideal habitat for the growth of such plants. This place has one of the richest floras of India representing north and south India floras.

During past years extensive survey of different remote areas of Pachmarhi in different directions and at different altitudinal ranges have been explored by various researcher in connection with pteridophytic biodiversity. These study reveals occurrence of 107 species, belonging to 18 families and 52 genera.

In the present article an attempt has been made to compile these available informations.

The family-wise distribution is as follows:

S.No.	Families	No. of Genera	No. of Species
1.	Psilotaceae	1	1
2.	Lycopodiaceae	1	2
3.	Selaginellaceae	1	3
4.	Isoetaceae	1	3
5.	Equisitaceae	1	3
6.	Ophioglossaceae	2	6
7.	Merattiaceae	1	1
8.	Osmundaceae	1	2
9.	Lygodiaceae	1	1
10.	Gleicheniaceae	1	1
11.	Cyathaceae	1	3
12.	Davalliaceae	4	10
13.	Aspidiaceae	13	26
14.	Pteridaceae	11	25
15.	Blachianaceae	1	2
16.	Asplanaceae	2	7
17.	Polypodiaceae	8	11
18.	Marsileaceae	1	1
	Total	52	107

The details of species and their distribution are as follows:

S.No	Family	Name of the Genus/species	Distribution
I	Psilotaceae	<i>Psilotum nudum</i>	Found in the crevices of rocks but rarely also occur as an epiphytes
II	Lycopodiaceae	<i>Lycopodium clavatum</i> <i>Lycopodium volubile</i>	Rare in the way of Reechgharh, Panarpani, Jalgali
III	Selaginellaceae	<i>Selaginella agna</i> <i>Selaginella chrysocaulos</i> <i>Selaginella involvens</i>	Found on the surface of the soil or over logs and marshy and shady places of rocks.
IV	Isoetaceae	<i>Isoetes panchanani</i> <i>Isoetes butleri</i> <i>Isoetes coromandelina</i>	Found on the way to Sunderkund, also found in Nallah on the way to Mahadeo from Matkuli.
V	Equisetaceae	<i>Equisetum debiee</i> Roxb. <i>Equisetum diffusum</i> Des <i>Equisetum arvens</i> L.	Many places as indicated above.
VI	Ophioglossaceae	<i>Ophioglossum nudicaule</i> Linn. <i>Ophioglossum reticulatum</i> L. <i>Ophioglossum fibrosum</i> Schum. <i>Ophioglossum vulgatum</i> L.	In all marshy places where organic matter is rich. Bari Aam, Reechgarh & Jambodweep
		<i>Botrychium daucifolium</i> Wall <i>Botrychium lanuginosum</i> Wall {Syn. <i>B. virginianum</i> (L.) Sw.}	In many places where moisture is available throughout the year. Besides the Nallahs, it is also found in places like Jalgali, Jambodweep, Dhupgarh & Dutches Fall.
VII	Merattiaceae	<i>Angiopteris evecta</i> (Froster) Hottm.	Found in places like Jalgali, Dutches Fall, Jambodweep, Sunderkund.
VIII	Osmundaceae	<i>Osmunda regalis</i> L. <i>O. japonicus</i> Thumbs <i>Osmunda gracilus</i> Link (Syn <i>O. humalis</i> Sweet)	Very commonly found in both sides of Nallahs of Patharchatta, Vanashree Vihar, Jalgali, Jambodweep, Panar Pani.
IX	Lygodiaceae	<i>Lygodium flaxuosum</i> {Syn. <i>japonicum</i> (Thbg) Sw.}	In way to Dhoopgarh, Dutches Fall and Richgarh, Big fall, Chintamani

X	Gleicheniaceae	<i>Dicranopteris linearis</i> Syn <i>Gleichenia linearis</i> Auct.	In Pachmarhi this is very common in places where soil moisture is very high and exposed to light. Found in places like Panar Pani, Dhoopgarh, Cahuragarh, Jalgali, Reechgarh area. Twynam Pool, Chitra shala, Pancy Pool
XI	Cyatheaceae	<i>Cyathea gigantea</i> (Wall) Holtt. <i>Alsophila glabra</i> Hook <i>Cyathea latebrosa</i> (Wall) Copel. <i>Alsophila latebrosa</i> Hook <i>Cyathea pinolosa</i> (Wall) ex.hook	Deep Nallas and streams of Pachmarhi, very common in Jalgali, Dutches Fall and Jambo Dweep.
XII	Davalliaceae	<i>Davallia bullata</i> Wall	Very common in all places.
		<i>Araiostegia pulchra</i>	Bada Mahadeo & surrounding places, These ferns colonize moist shaded rocks between 900-1100 m
		<i>Nephrolepis acuta</i> Presl. <i>Nephrolepis cordifolia</i> <i>Nephrolepis</i> (L.) Schott. <i>Nephrolepis volubilis</i> J.Sm <i>Nephrolepis undulata</i> J.Sm.	Many places in forest garden, Panar Pani. Found in marshy places commonly.
		<i>Leucosteriga</i> Presl. <i>Leucosteriga pulchra</i> Don-Humata pulchra Dicts <i>Leucosteriga umersa</i> Wall	In marshy places associated with mosses and Bryophytes
XIII	Aspidiaceae	<i>Athyrium</i> sp	Found in places like Jalgali, Sunderkund, and Patharchatta.
		<i>Diplazium esculentum</i> Syn. <i>Anisogium esculentum</i> <i>D.Cochleata</i> <i>D.Sparsa</i>	Jamboo dweep & Tynam valley
		<i>Amelopteris prolifera</i> Presl. Syn. <i>Goniopteris prolifera</i> <i>Nephorium proliferum</i> .	Commonest ferns along the streams and rivers on lower elevation

<p><i>Athyrium hohenackerianum</i> Bedd. <i>Athyrium macrocarpum</i> Bedd. <i>Athyrium falcatum</i> Bedd. <i>Athyrium felixfoemina</i> <i>Athyrium japonicum</i> <i>Athyrium schimperii</i></p>	<p>In marshy places where water is dripping, Jalgali, Dutches Fall, Patharchatta, Vanashree Vihar, Reechhgarh, Sunderkund.</p>
<p><i>Cyclosorus contiguus</i> (Rosaust) Copel (Syn. <i>Christella quadrangulans</i> Feu. <i>Cyclosorus subpubescens</i> (Bl) Chuj.Syn – <i>Christella subpubescens</i> (Blume) Holttum</p>	<p>In Sal forests (1000-3000 feet) elevation Jalgali, Jambodweep, in the way of Sunderkund.</p>
<p><i>Dryopteris cochleata</i> (Don. C)Syn. <i>Nephrodium cochleata</i> Don <i>Dryopteris sparsa</i> (Don.) Ktze</p>	<p>In route of Jambodweep at 1000 m deep, and also found in Tynam valley.</p>
<p><i>Lastrea criocarpa</i> Decuine <i>Lastrea falciloba</i> Hooker <i>Lastrea odorata</i> Bony <i>Lastrea flaccida</i> Moore</p>	<p>Found in places like Jalgali, Vanashree Vihar, Patharchatta, Tridhara, Hemian Khund, Dhupgarh, and in Jambodweep, on the way to Dutches Fall.</p>
<p><i>Pleonema leucaena</i> (Faud.) Presl.</p>	<p>At higher altitude 1000-1200m, like Bari-Aam, Panarpani.</p>
<p><i>Polybotrea appendiculata</i> Bedd.</p>	<p>In all marshy & shady places- Reechhgarh & Dutches Fall</p>
<p><i>Polysticum auriculatum</i> Linn.</p>	<p>At every marshy palce- Jalgali, Jambodweep</p>
<p><i>Tecteria macrodonta</i> (Gav.) Syn <i>Aspidium circuitaria</i></p>	<p>Found in Jatashanker, Mahadeo, Jalgali</p>
<p><i>Abacopteris multineatum</i> (Wall) Chiag <i>A. urophylla</i> (Wall) Chiag-syn. <i>Dryopteris urophylla</i> <i>Nephridium urophylla</i></p>	<p>Near flowing water marshy places, Bari-Aam, Dutches Fall & Pathar Chatta.</p>
<p><i>Anisogonium esculentum</i> Presl.</p>	<p>Found mostly in Partharchatta, Jalgali, Sunderkund</p>

XIV	Pteridaceae	<i>Actinopteris dichotoma</i> Bedd	In many rocky places specially on sand stone formation
		<i>Adiantum capillus veneris</i> Linn. Syn. <i>Adiantum fontannum</i> <i>Adiantum repandum</i> <i>Adiantum coriandrifolium</i>	Found in all marshy and Dry places
		<i>Adiantum caudatum</i> Forsk. Syn. <i>Adiantum hirsutum</i> <i>Adiantum incis</i> <i>Adiantum cilianum</i>	Found throughout Pachmarhi.
		<i>Adiantum philippense</i> Linn. Syn. <i>Pteris lunata</i> Retz <i>Adiantum lunatum</i> Cav. <i>Adiantum lunulatum</i> Barm	In marshy places as the rocks of Mahadeo, Patharchatta, Jalgali, Richgarh.
		<i>Aleuritopteris</i> Forsk <i>Aleuritopteris farinosa</i> (Forsk) Fec.	In all places of Pachmarhi, one of the commonest ferns can be easily recognized out by its purple black strips and white under side of the fronds.
		<i>Cheilanthes tenuifolia</i> SW.	In all dry places of Pachmrhi, especially associated with ground flora of mixed dry forest.
		<i>Pteris erecta</i> L. <i>Pteris pellucida</i> Presl. <i>Pteris quadriaurita</i> Retz. <i>Pteris longifolia</i> L. <i>Pteris biaurita</i> Linn.	Found in mostly marshy & shady places like –Mahadeo, Jatashankar, Jalgali, Dutches Fall, Bee Fall.
		<i>Gymnopteris contaminans</i> Bedd.	Very common in evergreen forest.
		<i>Hemionitisarifolia</i> Bedd.	It grows in dry localities, also cultivated in garden
		<i>Lindsaya Dryand</i> Syn. <i>Lindsaya pectinata</i>	It grows in shady places.
		<i>Microlepis platyphylla</i> J. Sm. <i>Microlepis speluncae</i> Bedd.	Mostly found at height of 1000 m in deep ravine in shady places & constant flow of water is available.
		<i>Pteridium seopoli</i> Syn. <i>Pteris aquilina</i> (L.) <i>Sphenomeris Maxon</i> Syn. <i>Stemolena chinensis</i> Bedd.	In lower part of hills where shady & marshy places are existing

XV	<i>Blachinaceae</i>	<i>Blachinum occidentale</i> <i>Blachinum orientale</i>	Near shady places like - Jatashankar, Dutches fall, Jalgali, also found in the base of hills where water is flowing like - Patharchatta, Tridhara, Sunderkund.
XVI	<i>Asplanaceae</i>	<i>Thamnopteris</i> Persl. Syn. <i>Asplenium nedus</i>	Cultivated in many places.
		<i>Asplenium lacinatum</i> Don. <i>Asplenium lunulatum</i> SW. <i>Asplenium planicaule</i> Wall. <i>Asplenium trichomonas</i> Linn <i>Asplenium unilaterali</i> L. <i>Asplenium cheilosorum</i> Kuntze	In marshy and shady places, Jalgali, Dutches Fall and also at lower levels / elevation dense shady places.
XVII	<i>Polypodiaceae</i>	<i>Drynaria quaerifolia</i> Bory	Found throughout Pachamrhi
		<i>Leptochilous axillaris</i> (Cai.) Kaulf. Syn. <i>Cymnopteris</i> <i>variabilin</i> Bedd. <i>Leptochilus decurrens</i>	Found throughout Pachmarhi
		<i>Loxogramme involata</i>	Very common at higher places, Dhupgarh, Chauragarh, Richgarh.
		<i>Pleopeltislan ceolata</i> Presl. <i>Pleopeltis membranacea</i> Bedd. <i>Pleopeltis punetata</i> Bedd.	Found on trees in many area -Mahadeo, Bee fall, Jatashankar. Epiphytes are mostly found in shady places.
		<i>Pyrrrosia mirbel</i> Syn. <i>Niphobolus</i> Kauf. <i>Pyrrrosia adnascens</i>	Found throughout Pachmarhi as Epiphytic fern
		<i>Polypodium gracilis</i> Syn. <i>Goniopteris gracilis</i>	Rare in shady places.
		<i>Microsorium membranaceum</i>	On the basal portion of Shorea robusta Brindavan and Jambu Dweep
XVIII	<i>Marsileaceae</i>	<i>Marsilea minuta</i> L.	In small ditches, Bari-Aam ponds, Pachmarhi ponds and near Pachmarhi lake.

Endangered plants requiring Urgent Protection Measures for their *In Situ* Conservation

S.No.	Name of the Species
1.	<i>Psilotum nudum</i>
2.	<i>Polybotrya appendiculata</i>
3.	<i>Cyathea spinulosa</i>
4.	<i>Polystichum ambile</i>
5.	<i>Equisetum sp.</i>
6.	<i>Osmunda regalis</i>
7.	<i>Adiantum lunulatum</i>
8.	<i>Lycopodium cerenum</i>
9.	<i>Lygodium flexuosum</i>
10.	<i>Selaginella exigua</i>
11.	<i>Cyathea gigantea</i>
12.	<i>Isoetes panchananii</i>
13.	<i>Ophioglossum nudicaule</i>
14.	<i>Cheilanthes farinosa</i>

Plants Species, to be banned for Collection from Pachmarhi

S.No.	Name of the Species	Name of the Families
1.	<i>Cyathea gigantea</i> (Tree Fern)	Cyatheaceae
2.	<i>C. spinulosum</i>	Lygodiaceae
3.	<i>Lycopodium flexuosum</i>	Lycopodiaceae
4.	<i>Equisetum species</i>	Equisetaceae
5.	<i>Ophioglossum nudicauli</i>	Ophioglosaceae
6.	<i>Osmunda regalis</i>	Osmundaceae
7.	<i>Psilotum nudum</i>	Psilotaceae
8.	<i>Isoetes panchananii</i>	Isoetaceae

Classification of Important Pteridophytes based on Ecological considerations

From Ecological point of view Pteridophytes inhabiting the area may be classified into the following categories depending upon their growth habits and various habitats they occupy.

Name of Species	Habitat
EPIPHYTES	
<i>Microsorium membranaceum</i>	On the basal portion of Shorea robusta Brindavan and Jambu Dweep ravines the plant receive rain washings from the tree trunks.
<i>Pleopeltis macrocarpa</i> (Bory ex Willd.) Kauf	grows near Bara Mahadeo on the upper portion of the tree trunks and branches of Mangifera indica

TERRESTRIAL SPECIES	
(a) Climbers	
<i>Lygodium flexuosum</i> (L) Sw.	On forest floor near Jambu Dweep, Big fall and Chinta Mani
(b)Thicket forming species	
<i>Dicranopteris linearis</i>	Grows in almost pure formation on exposed ravines & open rocky hillside near Twynam pool, Chota Mahadeo pancy pool, fairy pool, Panar pani, Chitra shala.
(c) Ravine forms	
<i>Cyathea gigantea</i> <i>C.spinulosa</i> <i>Angiopteris erecta</i>	Along water courses deep into ravines and gorges between about 7 to 900 mts. near Dutches Fall, Saunder pool, Pancy pool, Patherchatta, sangam, Handikhoh Tridhara, Mahadeo, Pacham dwar, Chinta Mani
<i>Osmunda Regalis</i> <i>Polybotrya appendiculata</i> <i>Abacopteris multilineata</i>	Grows along water channels of Dutches Fall, Saunder pool, Pancy pool, Patherchatta, sangam, Handikhoh Tridhara, Mahadeo, Pacham dwar, Chinta Mani
<i>Cylosorus cylindrothrix</i>	Being frequently bathed by water currents in above mentioned localities .
<i>Equisetum debile</i> <i>E.ramosissimum</i> <i>Microlepia speluncae</i> <i>Diplazium esculentum</i>	Grows on calcareous soil along water channels around Jambu Dweep and Bara Mahadeo.
(d)Species inhabiting forest floor and forest borders	
<i>Ampelopteris prolifera</i>	flourishes on moist situation or near stream , shade or open
<i>Blechnum orientale</i>	At higher elevation on gravelly soil in open and dry places
<i>Dryopteris sparsa</i> <i>D. cochleata</i> <i>Abacopteris multilineata</i> <i>Athyrium pectinatum</i> <i>A.schimperi</i> <i>A.japonicum</i>	On well lighted and exposed situations along road sides or forest paths around Pachmarhi
<i>Cyclosorus dentatus</i> <i>C.parasiticus</i>	Grows where soil is rich in humus
<i>Pteris quadriaurita</i> <i>Nephrolepis exaltata</i>	Forms dense clumps in the moist situations
<i>Pteris cretica</i>	Grows in bushy formation on the stony walls
<i>Asplenium unilaterale</i>	Grows in varying degree of shade afforded by trees and shrubby growth
<i>Selaginella exigua</i>	Is often found in the dark shady crevices of dripping caves at about 900 m.

<i>Lycopodium cernum</i>	Grows on the calcareous soil of the hilly slopes beyond sangam khud.
LITHOPHYTES	
(a) Xerophytes species	
<i>Cheilanthes farinosa</i> <i>C.tenifolia</i> <i>Athyrium falcatum</i>	It thrives well along forest margins in exposed dry situations between 600-900 m along bridle paths.
(b) True rock species	
<i>Psilotum triquetrum</i>	Grows lithophytically and isolated individuals are seen drooping from shaded rocks
<i>Selaginella radicata</i> <i>S.ciliaris</i> <i>Adiantum capillus-veneris</i> <i>Sphenomeris chinensis</i> , <i>Leucostegia immersa</i> <i>Araiostegia pulchra</i> <i>Asplenium Cheilosorum</i> <i>A.normale</i> , <i>A.inaequilaterale</i> , <i>Polystichum amabile</i> , <i>Microsorium membranaceum</i> , <i>Pleopeltis macrocarpa</i>	These ferns colonize moist shaded rocks between 900-1100 m
(c) Ferns growing in the crevices of stony walls and embankment s	
<i>Adiantum lunulatum</i> <i>A.incisum</i>	They thickly carpet the stny walls on account of their capacity for prolific vegetative multiplication
SPECIES MET WITH IN GRASSY AREAS	
<i>Isoetes panchananii</i>	Grows mixed with grasses along with the banks of the lake near the town and some other muddy pools .
<i>Ophioglossum nudicaule</i>	Flourishes well in shaded grass - lands enroute Twynam pool near old hotel block and enroute Dhoop garh .
<i>Selaginella rupestris</i>	Grows in grassy areas at about 950m .
HYDROPHYTIC SPECIES	
<i>Marsilea quadrifolia</i>	The only water fern grows in the local lake which covers the surface of water.

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Status of Fauna in Protected Areas of Madhya Pradesh - The Case Studies of Satpuda, Bandhavgarh, Indravati and Madhav National Parks**R B S Kushwah* and V Kumar****

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Biodiversity means the variability among living organisms from all sources and the ecological systems of which they are a part, includes diversity within species, between species and of ecosystems. Human depends on biological resources for food energy, construction materials, medicine, inspiration etc. Further the biological resources have the critical character of being renewable, so that with proper management they can be used sustainably, ensuring their use for future generation. In order to define biodiversity in mathematical terms, the Shannon Weiner Biodiversity Index, based on the proportional abundance of the species was adopted.

Attempt has been made for the first time in the State of Madhya Pradesh to work out the biodiversity indices for fauna in the four PAs, i.e, the Bandhavgarh (BNP), Indravati (INP), Madhav (MNP) and Satpuda (SNP) National Parks of Madhya Pradesh following standard sampling techniques and formulae. The values of Shannon Wiener biodiversity Indices were computed and found to be 1.998, 1.963, 1.651 and 1.631, respectively for SNP, INP, MNP and BNP. The values of the index of evenness has also been computed and found to be 0.634, 0.626, 0.534 and 0.520, 63, respectively for SNP, INP, MNP and BNP. The above faunal diversity has been supplemented by studying the RDB status and abundance of the faunal species in the PA with the help of secondary and primary information. Secondary information was taken from the data bank of Wildlife Institute of India (WII), Dehradun, which was further, confirmed by the observation in the field (i. e, the primary data). This study is not only of academic interest, but also relevant for PAs managers.

(**Source:** Cheetal- Vol.38 (No.1) P 21- 35)

Ethnobotanical Observations on Some Ferns of Pachmarhi Hills

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In recent years, a lot of information about different uses of plants prevalent along the various tribes and natives in India have attracted many ethnobotanists. About 58 species of ferns and fern allies are already reported from Pachmarhi hills out of which the medicinal uses of 12 species viz. *Abacopteris multilineata*, *Adiantum capillus- veneris*, *A. philippense*, *Cheilanthes farinosa*, *C. tenuifolia*, *Cyathea gigantea*, *Dicranopteris liniaris*, *Deplazium esulentum*, *Dryopteris cochleata*, *Hypodematium crenatum*, *Nephrole cordifolia* and *Tectaria macrodonta*. Prevalent amongst the tribes like Brahma, Bhil, Gond, Korku, Mavasi and others have been described. This paper also compares the present information with that of earlier ethnobotanical observations about these plants from other parts of the country as well as from abroad.

(Source: J.Econ.Tax. Bot. Addl. Ser.10, 1992)

Less Known Medicinal Uses of Plants Among Some Tribal and Rural Communities of Pachmarhi Forest (MP)

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In the present study a thorough ethnobotanical information with special reference to medicinal importance of plants are recorded.

For the study of all kinds of vegetation field tours were conducted to different localities around the Pachmarhi Biosphere Reserve covering places like Numbingly Mahadeo, Chauragarh, Sangam Points, Vanushree Vihar, Dhupgarh, Jamboodweep, Bee Fall, Dutches Fall, Rorighat, Bori, Beldhandar, Panarpani and Matkuli during various seasons. The assistance of local informants and medicine men, plants were collected. Their local areas, traditional uses, folklore and other taxonomic and economic uses were recorded. Only 38 species were found to be used differently.

(Source: Ethnobotany, Vol. 13,2001.pp.96-100)

Ground Water Conservation and Management with Special Reference to Madhya Pradesh

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The Pachmarhi Biosphere Reserve located at Satpura hill ranges in Central India lies in between lat. 22⁰11' to 22⁰56' N and 77⁰52' E longitude and covers 4987.38 sq.km. area of Hoshangabad, Betul and Chhindwara districts of Madhya Pradesh. The area is rich in natural resources and about 51 natural springs are located in the area. Out of them two are hot springs. One hot water spring is situated at lat. 22⁰42'42" N and long. 78⁰11" and is known as "Chhoti Anhoni" The other one is located at lat. 22⁰35'1"N and long. 78⁰36'19" near dyke ridges known as "Badi Anhoni" The area is affected by the Narmada-Son tectonic activity. A number of igneous intrusions are also seen in this area. The hot water is coming not only from one point source but also at several places along the main point source. The hot water, containing highly inflammable gas bubbles, may be sources of geothermal energy. In these springs hot water resistance species *Chlorococcus* and *Oscillatoria* algae are also found.

(Source: National Workshop Organised by Water Resources Department Govt. of M.P. 16-17 June 2002)

Influence of Mineral Salts on Spore Germination in *Plagiochasma appendiculatum* L.et L

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In the present study an attempt was made to investigate influences of various mineral salts on spore germination in *P.appendiculatum*. Mature sporophytes were collected and air dried and finally stored at ordinary conditions. Spore germination was tested in the solutions of various mineral salts and simultaneously control was with distilled water. It was observed that *P.appendiculatum* could germinate even in water. but inorganic salts influence germination upto a certain extent. Germination was better in half strength solution as compared to full strength, which reveals that concentration also plays a significant role.

In the present study the germination of spores was enhanced upto a certain extent and nitrate lies next to magnesium in the category of stimulators.

Inhibition of germination of spores takes place by sodium chloride and potassium dihydrogen orthophosphate.

A significant importance of magnesium salt is seen in the germination of spores. At lowest concentration the germination accelerates and its absence from medium decreases germination. High tolerance towards calcium is responsible for its success on the walls and tolerance to various mineral salts indicates perpetuation of species over a variety of substrates viz rocks, soils and walls. Tolerance of salts provides an additional insurance for the perpetuation of this taxon in different environments.

(Source: Geobios 8:116 – 118, 1981)

Chlorophyll Concentration and a/b Ratios in Response to Habitats in Three Species of *Riccia*

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In the present study, chlorophyll concentration was analysed for three species of *Riccia* grown at three different habitats of Pachmarhi. Bryophytes as a group, tends to be shade adapted with many of them having a low chlorophyll a/b ratio. Three species of *Riccia*, mainly *R. discolor*, *R. gangetica* and *R. fluitans* for chlorophyll concentration and a/b ratios, grown in shady, exposed and aquatic habitats, respectively, were taken for this study. The shady adapted species *R. discolor* had higher average chlorophyll a (0.517 mg/l) and b (0.358mg/l) because sunlight not penetrate directly on surface view of thalli at Jatashankar locality locality.

In *R. gangetica* average chlorophyll a (0.476 mg/l) and b(0.343 mg/l) because red pigmentation developed due to high light intensity because it grows in exposed condition at this locality and received direct sunrays. Production of red pigment in many species of bryophytes is a characteristic and taxonomically important production is a response to ecological condition. The chlorophyll a & b is lesser in *R. fluitans* than above two species, the usual colouration is green.

Based on these observations, *R. discolor* responds to low light intensity by broad thalli, cover more areas by propagation and increased chlorophyll due to shady habitat. *R.*

gangetica responds to high light intensity by red colouration, found in small patches with narrow thalli and less chlorophyll, because grown in exposed and moist condition. and *R.fluitans* an aquatic species, have very narrow thin thalli and lesser chlorophyll.

R. discolor species show higher chlorophyll a & b because at Jatashankar locality there is no sunlight penetration directly on the surface of the thalli.

Since *R. gangetica* is from the locality of Jamboodweep, there is a development of red pigmentation due to high light intensity as it grows in exposed condition at this locality and received sunrays.

(**Source:** Yushania, Vol. 3 No.4. 1986)

Summary of Project Reports

Conservation Strategy for Sustenance of Threatened Bioresources of Pachmarhi Forest Division (MP)

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The present work was carried out to measure the conservation strategies after a thorough study of various aspects. The objectives of the present work was as follows:

- To make extensive survey of various localities of Pachmarhi forest for the study of biodiversity.
- To collect information regarding the multifarious uses of plants for various purposes.
- To study the quantitative characters like density , frequency and abundance of the vegetation.
- To find out the rare, threatened and endangered plant species of the Biosphere Reserve.
- To study the conservational practices of plants by local people.
- To propagate rare plants with low reproductive capacities through standard techniques.
- To study the factors (biotic, natural etc.) affecting the survival of threatened species
- To study the pattern of the herbivory amongst different animals species and its impact on survival of plants.
- To prepare computer simulations of the species diversity model.

Observations

A total of 18 sites were covered in the study area. The observations were made at and around the following localities:

1. Jatashankar 2. Bee Fall 3. Mahadev Hill 4. Dutches Fall 5. Sangam Point 6. Dhupgarh 7. Apsara Vihar 8. Bawadi 9. Bori 10. Rorighat 11. Little Fall 12. Down Fall 13. Vanshree Vihar 14. Jambodeep 15. Kajri 16. Panarpani 17. Bari Am 18. Dhaibori.

Vegetational Analysis

After field survey and plant collection from different localities a total of 789 species belonging to 471 genera and 109 families have been collected. During the present study the emphasis was laid on angiospermic species only. It has been observed that the vegetation consists of a mixture of temperate and tropical elements. The region is remarkable, forming a meeting ground for species characteristic to the Himalayan and South Indian hills for e.g. *Berberis asiatica* (Berberidae), *Thlinctrum foliolosum* (Ranunculaceae), *Eriocaulon xeranthenum* are the characteristic to Himalayan region while *Utricularia graminifolia* (Lentibulariaceae), *Pogostemon purpuascens* (Lamiaceae), *Smithia pycnantha* (Papilionaceae) and *Curcuma pseudomontana* (Zingiberaceae) are species of South-West India. Amongst the pteridophytes, 17 species and amongst bryophytes 7 species were observed because of their predominance in many localities and deep association with various angiospermic taxa.

Distribution of Plant Communities

In the present study it was observed that Pachmarhi forests exhibits a mosaic of vegetation comprising different plant communities at different altitude and localities which is as follows:

- i) **Tropical Dry Deciduous Forest:** These reserve forests are the protected forests of Sohagpur, Pipariya and Bankhedi ranges in the catchment of Denwa river occupying the northern part of the Sanctuary. The most characteristic tree of this type is *Tectona grandis* and its most typical associates are Dhaora (*Anogeissus latifolia*) and Saja (*Terminalia alata*). The only trees associated are Saja (*Terminalia alata*), Bija (*Pterocarpus marsupium*), Sal (*Shorea robusta*), Aonla (*Embllica officinalis*), Lendia (*Lagerstromia parviflora*), Tendu (*Diospyros melanoxylon*), Haldu (*Adina cordifolia*), Kullu (*Sterculia urens*), Achar (*Buchnanian lanzan*), Palas (*Butea monosperma*), Kakai (*Flacourtia indica*), Kari (*Saccopetalum tomentosum*), Bel (*Aegle marmelos*), Semal (*Bombax ceiba*) etc.
- ii) **Southern Dry Mixed Deciduous Forests:** This type is different from previous type mainly floristically though some typical species (notably Salai) are more conspicuous. Bamboos are usually absent. Grass is conspicuous till it is grazed down or burnt. Climbers are generally few but heavy in moist locality, fire is more common in this type. The most characteristic tree species is *Anogeissus latifolia*, while *Terminalia alata* is a very typical associate. *Diospyros melanoxylon* is also common.

Chloroxylon swietenia, *Hardwickia binata*, *Boswellia serrata*, and *Soyimida febrifuga* are very wide spread and useful indicators, as they are from the moist deciduous forest. The top canopy consists of Saja (*Terminalia alata*), Dhaora (*Anogeissus latifolia*), Mahua (*Madhuca longifolia*), Tendu (*Diospyros melanoxylon*), etc. The understory consists of Khair (*Acacia catechu*), Aonla (*Emblica officinalis*) etc. Undershrub consists of Ber (*Zizyphus rugosa*), Seharu (*Nyctanthes arbortristis*) etc. Common climbers are Mahul (*Bauhinia vahlii*), Palasbel (*Butea superba*), Amarbel (*Cuscuta reflexa*) etc.

iii) **Dry Peninsular Sal Forests:** The preponderance plants belong to *Shorea robusta*, *Chloroxylon swietenia*, *Terminalia alata*, *Boswellia serrata*, *Lannea coromondalica*, *Lagerstroemia parviflora*, *Anogeissus latifolia*, *Buchnanania lanzan*, *Madhuca indica*, etc. Some rare pteridophytes like species of *Psilotum*, *Cyathea*, *Osmunda*, *Lycopodium*, *Lygodium* etc. are also found in this area.

iv) **Tropical Hill Forest:** In the vegetation there is preponderance of *Syzygium cumini*, *Manilkara hexandra*, *Ficus spp.*, *Mallotus philippenseis* etc., and a shrubby undergrowth including *Strobilanthes*, *Ixora*, *Indigofera cassioides* etc. and often climbers are like species of *Bauhinia*, *Ampelocissus*, *Clematis* etc. Bamboos occur only in a few compartments on the north-western part of the sanctuary. *Dendrocalamus strictus* is the only species.

Quantitative Analysis of vegetation

Various quantitative parameters were studied to find out density, frequency and abundance of plant species. Twenty line transects of 10 meters each were laid randomly in 10 selected localities. Quantitative analysis of vegetation was calculated by standard formulae and a major difference in plant communities were observed in different localities. Marked seasonal difference in herbs and grasses were also observed. The quantitative analysis e.g. density, frequency and abundance indicates that hardly any rare species occurred in the transects. Further the number of such species is very less, Therefore, they did not appear in random sampling. The habitat of many rare species is of different type, either in deep gorges, high rock crevices or on tree trunks. The study reveals the occurrence of over eighty rare species of plants in pachmarhi Biosphere Reserve.

Use Pattern of Plants

- (a) Medicinal Plants: About 50 plant species have been reported medicinally important in Pachmarhi Biosphere Reserve area. The information regarding the uses of species was gathered from the local villagers as well as some tribal people. For e.g. *Abrus precatorius* (Gunja) Leaves are used in cough and cold, *Aegle marmelos* (Bel) Fruit is used in fever, cough and cold , leaf juice in jaundice, *Andrographis paniculata* (Kadava chirayata) Decoction of plant is used in fever, *Bauhinia variegata* (Kachnar) leaves and flowers are used as vegetable, roots in snake bite etc.
- (b) Plants Used for Other Purposes: In the present study list of plant species having edible and commercial importance in various parts of India and those occur in Pachmarhi forest has been depicted. Such plants are collected from various forest localities of Pachmarhi and sold either in local weekly market or other adjacent town-markets. The list has been divided under specific heads—the edible part and the commercial part.

Some of the plants used for miscellaneous purposes are as below-

S.No.	Purposes	Name of the plant species used
1.	Sticks & poles	<i>Bambusa polymorpha</i> , <i>Dendrocalamus strictus</i> etc.
2.	Baskets,hats & mats	<i>Cyperuspangorei</i> , <i>Dendrocalamus strictus</i> , <i>Diospyros melanoxylon</i> , <i>Indigofera cassioides</i> , <i>Phoenix acaulis</i> , <i>P. sylestris</i> , <i>Phragmites karka</i> etc.
3.	Beverages and drinks	<i>Cassia occidentalis</i> , <i>Madhuca longifolia</i> , <i>Phoenix sylvestris</i> , <i>Tamarindus indica</i> etc.
4.	Bidi rolling from leaves	<i>Bauhinia vahlii</i> , <i>Diospyros melanoxylon</i> etc.
5.	Brooms	<i>Dendrocalamus strictus</i> , <i>Phoenix acaulis</i> , <i>Sida acuta</i> , <i>Thysanoldaena maxima</i>
6.	Dye	<i>Acacia catechu</i> , <i>Butea monosperma</i> , <i>Curcuma pseudomontana</i> , <i>Mallotus philippensis</i> , <i>Nyctanthes arbortristis</i> , <i>Pterocarpus marsupium</i> , <i>Woodfordia fruticosa</i> , <i>Wrightia tinctoria</i> etc.
7.	Fibre	<i>Abutilon persicum</i> , <i>Bauhinia purpurea</i> , <i>B. vahlii</i> , <i>Butea monosperma</i> , <i>Calotropis gigantea</i> , <i>C. procera</i> , <i>Corchorus aestuens</i> ,

		<i>Eulaliopsis binata, Grewia tiliaefolia, Helicteris isora, Hibiscus subdariffa, Sida acuta, Soymida febrifuga, Triumphetta rhomboidea, Urena lobata etc.</i>
8.	Fish poison	Fruit pulp of <i>Casearia elliptica, Gardenia turgida, Xeromphis spinoisa</i> and roots of <i>Milletia extensa</i>
9.	Floss	<i>Bombax ceiba, Calotropis gigantea, C. procera, Cochlospermum religiosum etc.</i>
10	Gum	<i>Anogeissus latifolia, Boswellia serrata, Cochlospermum religiosum, Lannea coromandelica, Sterculia urens, Woodfordia fruticosa etc.</i>
11.	Insect repellent oil	<i>Azadirachta indica, Cymbopogon martini etc.</i>
12.	Jaggery	<i>From stem sap of Phoenix sylvestris</i>
13.	Kattha	<i>From wood of Acacia catechu</i>
14.	Oil (for paints , varnishes, lubrication, tanning, soap etc.)	<i>Argemone mexicana, Boswellia serrata, Buchanania lanzan, Casearia graveolens, Celastrus paniculata, Cochlospermum religiosum, Madhuca longifolia, Mallotus philippensis, Pongamia pinnata, Putranjiva roxburghii, Riccinus communis, Schleicheria oleosa, Semicarpus anacardium, Shorea robusta , Sterculia urens , Tamarindus indica, Ventilago denticulate etc.</i>
15.	Paper pulp	<i>Boswellia serrata, Dendrocalamus strictus, Eucalyptus spp. Kydia calcina, Pterocarpus marsupium etc.</i>
16.	Perfume	<i>Cymbopogon martini, Jausminum spp. Michelia champaca, Vetiveria zizynoides etc.</i>
17.	Platters and bowls	<i>Leaves of bauhinia vahlii, butea monosperma, madhuca latifolia, Musa spp. Shorea robusta etc.</i>

Herbivory Pattern

The herbivory pattern of different species and its impact on the plant life was also studied. The vegetation of any area happens to be the prime component of the food chain and food web of its ecosystem. Different types of herbivorous animals feed on different or common types of plants species. Possessing a vast variety of vegetation, Pachmarhi shelters a large number of herbivorous

animals. The wild animals particularly herbivores have to depend entirely on the edible materials in the area, which in addition to fruits and flowers consists of grasses and leaves of various, herbs, shrubs and trees. During summer when grass dries up, animals used alternate food. Fortunately Mahua flowers are available in early summer. In summer sprouting of young leaves takes place in many species, which provide very good food for the herbivorous animals. Fruits, though available round the year, are produced in maximum quantity by most of the trees in summer. Thus animals with flexible food habits get food material round the year. For e.g. Langur depends mainly on *Bauhinia vahlii*, *Ficus* spp., *Terminalia chebula*, *Cassia fistula*, *Emblica officinalis*. Sahi depends on grasses and herbs, *Dioscorea bulbifera*, *Cyperus* spp., Squirrel depends on *Bauhinia racemosa*, *Gardenia latifolia*, *Falcourtia indica*, *Gymnema sylvestris*, *Madhuca longifolia*, while Chital depends on *Zizyphus* spp. Sambhar depends on *Bauhinia racemosa*, Deer on *Soymida febrifuga*, Four horned antelope depends on *Acacia leucophloea*. Chinkara depends on *Terminalia alata*.

The present work also deals with some threatened species of plants in Pachmarhi due to specific climate and geographical conditions. There are approximately 76 species under angiospermic trees and shrubs, 10 among the pteridophytes which are threatened. The number of rare species in various families were also observed. There are about 38 families wherein maximum number of rare species is 12 in Poaceae each in 27 families and rest of the families the count of rare species lies between the range of 2-7.

A comparative status of plants of Pachmarhi with other states of India was also carried out. There are 166 plants in Pachmarhi, some of which are rare in Pachmarhi are but commonly found in other states and vice versa. For e.g. *Manilkara hexandra* is rare in southeast Rajasthan and common plant in Pachmarhi as well as rare in south India. Likewise is the condition of *Cyathea gigantea*, *C. spinulosa*, *Dimeria connivens*, rare both at Pachmarhi as well south India. *Coolbrookea oppositifolia* is rare in south Gujrat, threatened in Tirupathi (AP) and common in Pachmarhi, *Berberis lyosium* is threatened in Kashmir to Garhwal and rare in Pachmarhi. *Dioscorea wightii* is threatened in Courtallum, Kerala and rare in Pachmarhi. *Pimpinella bracyteata* is thrteated in Orissa and common in Pachmarhi. *Melasoma thomsonii* is threatened in Orissa and common in Pachmarhi. *Tylophora fasciculate* is threatened in Orissa, south and central Gujrat and rare in Pachmarhi.

Under the study, the propagation of some threatened species was done with seeds, rhizomes, tubers and the germination and mortality percentage were observed. It was observed that there was 100 % germination in *Zingiber roseum* (rhizome) while the mortality rate was zero. Many of the species did not exhibit satisfactory results. It is well known fact that several wild species do not grow successfully when cultivated because several other environmental conditions are altogether required.

Endangered mammals & Reptiles

The study reveals that atleast 14 species of mammals and reptiles are endangered including Tiger, Gaur and Indian Bison.

Factors responsible for disappearance of species

In Pachmarhi certain biotic and natural factors are found responsible for the disappearance of many species from the forest. But still the condition in Pachmarhi is far better. Some important and common factors are as follows:

- (i) **Grazing:** As per the data of forest department over 10000 cattle belonging to the villagers inside the BR exerts great pressure on the northern part of BR. Apart from this, additional cattle from nearby areas also come to graze. The steep slopes of Pachmarhi hills being remote and inaccessible do not suffer from many grazing incidences. But the forestland around Denwa tract is heavily grazed, and due to excessive grazing a good number of plants has been destroyed.
- (ii) **Fuel wood:** Free head load (fuel wood) is collected every day. Fuel stacks are also supplied to the villagers from the departmentally worked coupes. Illegal cutting of fuel wood is also fulfilled for the brick kilns situated around the Biosphere Reserve.
- (iii) **Tourism:** Pachmarhi is known for its hilly scenic beauty. Thousands of tourists visit every year to this beautiful place. They mainly enjoy and visit certain fixed sites like Jatashankar, Chouragarh, Dhoopgarh, Bee Fall etc. Tourists unnecessarily disturb or uproot plants. The polythene bags and other used items are also thrown at these places which directly or indirectly get disturbed in various ways. Trees are cut for warming water and

heating during winters. Construction of roads and other facilities for tourists further affect the biota adversely.

- (iv) **Festivals:** Every year thousands of people visit Pachmarhi during Nagpanchami and Mahashivaratri festivals. Many pilgrims collect medicinal plants or their parts and disturb the vegetation.
- (v) **Trading of plants:** Mainly the following plants are excessively collected for various purposes:-
- *Gymnema sylvestris* – Known for its antidiabetic properties.
 - *Bauhinia vahlii* - Bark is used for making ropes and its seeds are edible
 - *Eulopia herbacea* - The rhizome is used for edible and medicinal purposes.
 - *Manilkara hexandra* - Walking sticks are made.
 - *Securinega leucopyrus* - Used for Making sticks
 - *Thysanolaena maxima* – Broom making.
 - *Shorea robusta* – Trees are used for collecting resins.
 - *Litsea glutinosa* - Entire plant is destroyed for obtaining bark
 - *Dioscorea bulbifera* - Rhizome is edible.
 - *Semicarpus nacardium* – The twigs are destroyed for collection of fruits.
- (vi) **Botanical excursions and other collection:** During the course of excursion, students collect plants in unscientific manner without knowing the importance and rarity of plants. Scientific material suppliers also collect a huge quantity of plants.
- (vii) **Exotic plants:** - A total of 37 species of exotic plants have been listed during the present study. The invasion of some weeds has resulted in the replacement of many indigenous species. Several plants have become an intricate part of Indian flora and grown for various purposes like roadside plantation, ornamentation, hedging etc. Some are cultivated and several of these plants are also used for trade purposes. *Lantana camara*, *Parthenium hysterophorus*,

Duranta repens, *Ageratum conyzoides*, *Elephantopus scaber* etc. have encroached upon many localities of the forest and eradicated other local species. *Lantana camara* can be seen growing everywhere at all sites and altitudes. Even some species are cultivated for and also used for trade purposes. *Acacia auriculiformis* is the native of Australia, similarly *Hibiscus rosasinensis* and *Prunus persica* both are the native of China and have become an intricate part of Indian flora.

- (viii) **Collection of minor forest produce:** Villagers, workers of pharmaceuticals from localities of BR collect minor forest produce like bark, seeds, fruits, leaves, rhizomes entire herbaceous plants etc. These plants or parts are not collected in proper manner and result in complete destruction of surrounding vegetation. Tribal people also collect 'honey' and Mahua flowers.

Conservation Strategies

Forests are the lifelines of majority of the Indian societies particularly those living around the villages. The management system of any forest actually maintains the resources of that area.

A total ban on grazing may not be beneficial for the wildlife. Complete stoppage of grazing increases the grass growth to such a stage that it becomes a fire hazard.

A strict vigil on tourists is necessary to prevent them from doing eco-unfriendly activities. Eco-friendly and conservational slogans should be displayed at tourist sites and roads.

The area is under dry deciduous forest, hence maximum emphasis should be given to the species which provide fruits, fodder, shade, shelter and cover to wild animals, specially during the dry summer months. The secondary importance should be given to valuable timber species and also those species which will meet the demand of local people for small timber and fuel.

The data on herbivory pattern indicates the dependency of herbivores on a large number of plants. It would be worthwhile to know the nutrient contents of leaves and other parts of such plants on which the herbivores are dependent.

Plant Species to be Banned for Collection from Pachmarhi

S.No.	Name of the plant	Local name	Family
1.	<i>Gymnema sylvestre</i>	Merasingi	Asclepediaceae
2.	<i>Eulophia herbacea</i>	Ban singhara	Orchidaceae
3.	<i>Berberis asiatica</i>	Daruhaldi	Berberidaceae
4.	<i>B.lysium</i>	-	Berberidaceae
5.	<i>Drosera indica</i>	-	Droseraceae
6.	<i>D.burmanii</i>	-	Droseraceae
7	<i>Begonia malabarica</i>	-	Begoniaceae
8.	<i>Litsea glutinosa</i>	Mendachal	Lauraceae
9.	<i>Utricularia exoleta</i>	-	Lentibulariaceae
10	<i>Andrographis paniculata</i>	Kadua chirayata	Acanthaceae
11.	<i>Nervillia aragoana</i>	Ban batasha	Orchidaceae
12.	<i>N.prainiana</i>	-	Orchidaceae
13	<i>Cyathea gigantea</i>	Tree fern	Cyatheaceae
14.	<i>C.spinulosa</i>	Tree fern	Cyatheaceae
15.	<i>Lygodium flexuosum</i>	-	Lygodiaceae
16.	<i>Lycopodium cernuum</i>		Lycopodiaceae
17.	<i>Equisetum sp.</i>		
18.	<i>Ophioglossum nudicaule</i>		Ophioglossaceae
19.	<i>Osmunda regalis</i>		Osmundaceae
20.	<i>Psilotum nudum</i>		Psilotaceae
21.	<i>Isoetes panchananii</i>		Isoetaceae

Suggestions for Further Studies

For sustenance of bio-resources and fulfill the objectives for which Pachmarhi has been declared as the 'Biosphere Reserve', the following studies may be conducted:

1. Regeneration behaviour of all rare and threatened plant species, as described in the present work, must be studied. It will help in adopting proper methods of their propagation and conservation.
2. The carrying capacity of all the three zones i.e. 'core', 'buffer' and 'transition' must be analysed. It can be done by observing animals, their interrelationship and dependency on vegetation of respective zones.
3. Work may be carried out on the growth pattern of different types of forest trees like 'Sal', 'teak', 'Saja', 'Mahua', 'Dhobin' etc.
4. The impact of exotic species on indigenous plants must be studied. The behaviour of weeds specifically lantana and parthenium must be observed with reference to eradication rate of other species, which have become out of the system. The quality and quantity of medicinal plants and their parts collected from the BR should be estimated.
5. The grazing pattern in terms of number of cattle, types of vegetation on which they feed and the vegetation destroyed must be studied

6. The herbivory pattern may be studied by observing the nutritional value of plants and their parts upon which the cattle and other wild animals like monkeys etc., are dependent.
7. The carrying capacity of various tourist spots should also be studied. It will help in providing the data related to the actual pressure lying on various such points. It will also help in deciding the number of tourists, which can be accommodated at on place for a particular period.
8. The actual dependency of the local and other people on flora and fauna of BR in terms of quantity and quality must be studied. The turn over of the local market with refernce to the forest produce and other items should also be estimated.

(**Source:** Final Technical Report submitted to Ministry of Environment & Forests, Government of India 2002,New Delhi)

Water Pollution Control at Pachmarhi Plateau

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Under Mananagement Action Plan of Pachmarhi Biosphere Reserve programme, the Techno-economic feasibility study of water pollution problem at Pachmarhi plateau was carried. The main objective of the study was to assess status of the surface water quality of different water resources, identification, characterisation of pollution causing factors and preparation of mitigative measures by considering techno-economic option for its management.

The study has been envisaged to mainly two problems:

To assess the techno-economic feasibility for restoring the water quality of

(i) Old lake (ii) Down Fall & Little Fall (iii) Bari Am lake

To control the water pollution in Banganga and Jata Shankar drains

The study reveals that environmental issue for restoration of water quality of the old Pachmarhi Lake and the Down Fall can be tackled in two phases-

Phase- I

Water quality restoration of Old Pachmarhi lake, New Pachmarhi lake and

Bari- Aam Lake.

Phase-II

Water quality restoration of Down Falls, Little Falls and Bainganga drain in the down stream of Old Pachmarhi Lake.

The main environmental issues and remedial measures for the individual problems are as follows:

Old Pachmarhi Lake: This lake is receiving untreated sewage from the neighbouring settlements that accumulate round the year and degrading water quality of the lake. The inflow of untreated sewage in the lake need to be checked for maintaing of lake water quality.

The main problems identified are:

Reduction in storage capacity due to sedimentation, eutrophication on account of anthropogenic activities

Weed infestation

Sewage intrusion from inlet and Cantonment area

Remedial measures:

Desilting & deweeding

- Provision of cascading arrangement all along the main feeder channel
- Construction of septic tank on both sides of the lake
- Creation of buffer zone in the periphery of the lake
- Removal of hypo-limnetic water through existing sluice gate

New Pachmarhi lake: It is a man made reservoir for storing water for recreational purposes like boating etc. The decreasing depth of water body due to sedimentation of the lake is major concern for the lake.

The main problems identified are:

- Inflow of silt in the lake & sedimentation
- Erosion due to deforestation in the catchment area of the lake

Remedial measures:

- Soil Erosion treatment
- Plantation of appropriate plant species for erosion control
- Desilting of the lake in phase manner as may be necessary

Bainganga: The outflow of the Old Pachmarhi lake forms the Bainganga drain passing the storm water from the plateau but sewage inflow and solid waste dumping in the drain are main cause of pollution. The surrounding area has no organized sewer system. Apart from sewage treatment and disposal it is also essential to clean bed of Nalla for reducing of contaminants of cascades.

The main problems identified are:

- Direct discharge of untreated sewage and waste water from the Cantonment and Civil area into Bainganga
- Degradation of aesthetic and hygienic conditions in the drain and Down Fall
- solid waste intrusion in the drain
- Discharge of slaughter house and dairy waste into Bainganga drain

Remedial measures:

- Construction of garland drains along both sides for collection of untreated sewage and its treatment
- Construction of cascading structures
- Treatment of sewage and Wastewater collected through garland drains.
- Collection of solid waste and its secured disposal for land fill
- Nalla bed cleaning & public awareness campaign

Bari Aam Lake: It is a small water impoundment formed after construction of road leading to Pachmarhi Plateau. The lake is receiving wastewater from southern end.

The main problems identified are:

- Inflow of untreated sewage to the lake

- Accrual of nutrients in the lake accumulated with sewage and solid waste

- Anthropogenic activities & infestation of macrophytes

Remedial measures:

- The treatment of sewage before it enters the lake

- The outflow of the silt trap should be passed through roughening filter made of boulders and gravels.

- Plantation of appropriate plant species.

Jatashankar Sewage Drain: The new settlement coming up in close vicinity of nalla leading to Jatashankar, receiving pollution load in form of sewage are the main cause of concern.

The main problems identified are:

- Inflow of untreated sewage in the drain leading to Jatashankar

- Unplanned settlements in the catchment area of the drain

- solid waste disposal in the drain leading to Jatashankar

- The joining of sewage and wastewater to the source of water leading to Kund of Jatashankar temple.

Remedial measures:

- The sewage reaching the main stream should be passed through cascades, boulders and gravel.

- Land available at both sides of Nalla should be planted with water loving plant species

- Sewage drains should be diverted to new pipelines.

Conclusion

New Pachmarhi lake is free of pollution and does not require any molestation except desilting

Old Pachmehi lake is eutrophic, weed infested and silted

Bainganga Nallah passing through the New lake, Old lake, Bus stand, Sadar Bazar area and Ranikund carry contaminated water, thereby polluting Little and Down Fall

Little and Down Falls receive contaminated water from Bainanga Nala, which is the only source of water for both the falls.

Contaminated water from Down Fall joins the Denwa River, thereby, polluting it too.

(Source: Techno-Economic Feasibility Study- "Water Pollution Control at Pachmarhi Plateau" published by Environmental Planning & Coordination Organization, 2001 under the management Action Plan of Pachmarhi Biosphere Reserve)

News Items/Samachar

No Record of Births-Deaths in Bori Sanctuary

There is no written record for the last two and a half years at the Bori animal sanctuary as far as how many animals were borned and how many died.

The reason attributed for the same is that no census was taken during the year 2000 and 2001. The authorities on their part give record of the years up to 1999. It is learnt that due to some VIP work the census work was not completed.

Thus the number of animals killed by poachers is also difficult to find.

It is surprising how the census of the animals at the sanctuary was not carried out for the last two years. As a result, at the national level also, old figures had to be relied upon for animal census.

Even though ordinary census was not carryout at the sanctuary. However, the figures of tiger and leopard have been shown for the year 2,000 and 2001. There is no mention of the other 19 animals. According to information from the above sanctuary there are 14 tigers and 16 leopards in the current year.

Five years back the number for tigers were given as six and leopards as 16. There is a rise in the number of tigers but the figure for leopards remains the same. In the year 1998 the number of leopards had increased by one. In the year 1999-2000, the figure became 14. In the year 2001 it went up to 16. Going by the figure of year 99 the species of wolf and jackal has almost ceased. Also number of Sambhar, Neel Gai, bear, Langoor, Chinkara and alligator is constantly on decline. However, there is increase in the number Sonkutta , Siyar and wild pig.

The census of the wild animals is done as per the hoof marks. It is a tough job. Now the authorities will carry out census work every day as being followed at Kanha and Bandhwagarh sanctuaries. Sub Divisional Officer, Mr. Tiwari said that now census of the animals would be calculated. This will help in achieving the right figure of the animals.

(Source: Central Chronicle, Dated: 28/05/2002)

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I rik uskuy ikdzejm vyV

Hkks ky@bVkj l h] 27 ebA ckjh vH; kj.; ea [krjukd l Oked chekj , fkdI QSyus vks ikp taxy HkS ka dh eksr ds ckn ijs l ri/le uskuy ikdZ ea jM vyVZ ?kks'kr dj fn; k x; k gA jfookj dks ftl taxy HkS ds [ku ds ueus fy, x, Fks ml dh Hkh l keokj dks eksr gks xBA vHkh rd taxy tkuojka dks pi/v ea ys jgh bl chekj l seu; ka ea Hkh QSyus dk [krjk cuk gprk gA MkDvjka dh Vhe us vH; kj.; ds l Hkh xkoka ea Ng gtkj eof'k; ka ds Vhdkdj.k dk vHk; ku 'kq fd; k gsvks xteh.kka ds LokLF; ij Hkh utj j[kh tk jgh gA

l Oked jks ds y{k.k ds l kfk ftu taxy HkS ka dh eksr gpr muea l s , d ds fcl jk dh tkp ea, fkdI gksus dh i'V LVS/ os/vjh gkLiVy dh iz ks'kkyk us jfookj dks dj nh FkhA , d vU; chekj taxy HkS ds [ku ds ueus fy, x, Fks bl dh tkp fjik/ vHkh ugha vkbZ gsf yfdu HkS dh l keokj dks eksr gks xBA phQ okbYM ykbQ okMZu dk; ky; igph [kcjka ds emkfed vHkh rd ikp taxy HkS ka dh eksr gpr gA bl dh i'V djrs gq gskackckn ds dyDVj vk'kh" k mi k/; k; us crk; k fd xteh.kka ea chekj u QSys bl fy, muds LokLF; ij utj j[kh tk jgh gA , fkdI ds thok.kq ol; ik.f.k; ka ea ds s igp} bl dh tkp djkbZ tk jgh gA Jh mi k/; k; us crk; k fd ?kjsyweof'k; ka l s QSyus okyh ; g chekj vkl & ikl ds xkoka ea fd l h ckgjh eosh ds vkus l s QSyh gksrA bl ds ckjs ea ou foHkkx ds vf/kdkjh xteh.k l s iNrkn dj jgs gA gekjs bVkj l h dk; ky; ds vuq kj vH; kj.; ea rok tyk'k; ds fdukjs vkt l qg , d phry vks , d l kkkj dks ykxka us er ns'kka bl dh i'V ds fy, ftyk izkkl u dk , d ny Hkst k x; k gA

vk'kck 0; Dr dh tk jgh gsf d chekj l ri/le uskuy ikdZ ds vU; fgLI ka ea Hkh QSy l drh gA bl s ns'krs gq ou foHkkx ds ikdZ ea jM vyVZ ?kks'kr djrs gq vf/kdkfj; ka dks ijh l rZrk cjrus ds funk fn, x, gA vH; kj.; ea gkykr dk tk; tk ydj yks/s LVS/ os/vjh

gkLiVy dh Mh-vkbZ iz ksc'kkyk ds fMIVh Mk; jDVj MKW vkj- ds xkj [k us crk; k fd jk/ktkuh l sMkDVjka dk , d ny Hkst k x; k gS tks vxys vkns k rd vH; kj.; ea jgsckA bl ds vykok bVkj l h l s Hkh , d Vhe xbz gA mlgkaus crk; k fd vH; kj.; ea fLFkr l Hkh 17 xkoka ea ekStm yHkxHk Ng gtkj eof'k; ka dks Vhds yxkus dk vfHk; ku NMlt x; k gA bl ds fy, l k-s Ng gtkj oDI hu igpk nh xbz gA MKW xkj [k us crk; k fd xgu tkp ds ckn gh , fkdI ds l Oe.k dh otg dk irk py l dckA mlgkaus dgk fd i kuh ihus ds fy, ou; i k.kh xkoka l s yxs gq ty Jkrka rd tkrsgA l Hko gS ogha eof'k; ka ds l Ei dZ ea vkus l s mlga l Oe.k gks x; k gA , gfr; kr ds rkj ij {ks= ds l Hkh ty L=karks ea , a/h ck; kSDv nok, aMkyh xbz gA

jkt/kkuh ds ou fogkj ea Hkh ou; i k.kh fo'kSkK MKW vfuy 'kekZ ds usRo ea , d Vhe dks ckjh Hkst k x; k gA l #ka us crk; k fd ; g ny thfor ou; ikf.k; ka ds jDr ds ueus yus dh dks'k'k djsk ftl l smuea l Oe.k dk irk yxk; k tk l dA b/kj] insk ds izkku eq; ou l j {kd MKW jke id kn us crk; k fd ckjh vHj; k.; ea ou; ikf.k; ka vksj xkeh.kka ds LokLF; ij utj j [kus ds fy, i; kr veyk ekStm gA mlgkaus dgk fd l ri qMlt uskuy ikdZ ea Hkh vf/kdkjh l rdzrk cjr jgs gA {ks= ea ng'kr tS h dkbZ fLFkr ugha gA

cf l y , fkd l i 'kqvj vneh nksadstku yok thok.k

, fkdI ds fu'kku ij %xk;] HkMf cdjh] dfr} l wj o pkj iS okys vl; tkuojA

i'kys ea , fkdI ds y{k.k% vka [ka yky gksuk] cgr rst cd [kkj] ukd&dku] xink , oa ; ksu ea xgjs Hkjs jax dk [ku tks terk ugh] iS QnyukA

?krd vl j% cf l yl , fkdI thok.k dk l Oe.k vf/kd gksus o l e; ij bykt u feyus l s vkB l s ckjg ?k/s ea eksA ejs tkuoj dk iS vl kekl; : i l s cgr vf/kd Qnyuk , oafryh dk vkdkj rhu xpk c<ukA

eu; kads [krj%] , fkdI ea l Ofer i'kq dk eka [kkus okys HkMf l wj , oa vl; tkuojka ds cky , oa peMf fudkyus , oa cd k vksj dkj iS cukus okyka dks [krjka , fkdI dk l Oe.k gksus ij vkneh dh Ropk ij cM&cM-Nkys iMuk] rst cd [kkj] mYVh o iS nnZ tS sy{k.kA

l ko/kul% fdl h Hkh i'kq ea , fkdI ds y{k.k fn [kus ij ml s Qk] u fpdfRI d dks fn [kk, A vki & ikl ds nti js i'kq/ka dks Hkh , fkdI ekj oDI hu yxkuk t: jh gA bl ?krd jksx l sejs i'kq dk u rks i k VekVd fd; k tkuk pkfg, vksj u gh ml dk peMf fudkyuk pkfg, A jksx ds thok.k dks Qsyus l s jkadus ds fy, ml s tykus ds ctk; xMMk [kkndj ued o piuk Mkydj tehu ea xk<uk t: jh gA , d k u djus l s thok.k gok ds l Ei dZ ea vkrs gh L; kj ¼ Qn i koMj tS seghu d.k½ cuk yrs gS tks Qj okrkoj.k ea l kyka ekStm jgrs gA

(l kr: nfud HkkLdj] 28@05@2002)

**ckjh eaxlš ½ck; l u½ ij eMjkrk , fkdI dk [krjk
pkj txyh xlš dh eš% l Øe.k xteokfI ; aealh Qsyusdh vt'kdk**

Hkš ky 29 ebZ ¼ ÅA l riMk uškuy ikdZ ds ckjh vH; kj.; ea pkj txyh xlš ¼oM; j
ck; l u½ dh ekš l Øed jks , fkdI l s gkus dh vt'kdk ds ckn l eps uškuy ikdZ ea
jMvyVZ ?kkš"kr dj fn; k x; k gÅ fi Nysjfookj dksftI , d xlš ds jDr ds ueusfy, x,
Fks mudh tkp ea eaxyokj dks , fkdI dh iŕV gks xBÅ txyh tkudjka dks viuh ?kkrd
piV ea yus okyh bl chekjh ea euŕ; ka dks Hkh [krjk i šk gks x; k gÅ i 'kqfpdRI k foHkx us
vH; kj.; ds ikp fdeh dh ifjf/k ds l Hkh xkoka ea djhc Ng gtkj eoš'k; ka ds Vhdkdj.k dk
dk; Z'kq dj fn; k gÅ l kFk gh {ks= dh xteh.kka ds LokLF; ij Hkh utj j [kh tk jgh gÅ

ftu txyh xlš ½ck; l u½ dh ekš l Øed jks dh piV ea vkus l s gPZ gÅ muea l s , d ds
fcljk dh tkp ds ckn jkt dh; i 'kqfpdRI ky; dh iz ks'kkyk us ml s , fkdI jks gkus dh
iŕV dj nh gÅ ftI xlš ½ck; l u½ ds jDr ds ueusfy, x, Fks ml dh jfookj dks ekš gks
xbZ gÅ eŕ; ou; tho l j {kd dk; kš; dks feyh l pukvka ds vuŕ kj vc rd pkj txyh
xlš ½ck; l u½ bl chekjh dk f'kdkj cu pps gÅ bl dh iŕV gks kxkckn ds ftyk dyDVj
vt'kh'k mi k/; k; us Hkh dh gÅ nks xlš ½ck; l u½ dh ekš nyny ea Qd us ds dkj.k gPZ gÅ

, fkdI ds thok.kq ou; i kf.k; ka ea dš s igps bl dh Hkh tkpa djkbZ tk jgh gÅ vuŕku gšfd
?kšyw eoš'k; ka es gkus okyh ; g chekjh xkø ds fdl h eoš'kh ds vH; kj.; ea HkVd tkus l s
Qsyh gÅ ou foHkx ds vf/kdkjh bl ckjs ea Hkh xteh.kka l s iNrkn dj jgs gÅ ftyk iz kkl u
bl ckjs ea Hkh l PpkbZ dk irk yxk jgk gšfd vH; kj.; ea rok tyk'k; ds fudV , d phry
vkš , d l kkkj ejs i M+ns [ks x, gÅ bl vt'kdk dks ns [krs gq fd ; g chekjh l riMk uškuy
ikdZ ds vU; fgLI ka ea Hkh Qsy l drh gš uškuy ikdZ ea jM vyVZ ?kkš"kr dj fn; k x; k gš
vkš vf/kdkfj; ka dks ijh l rdZk cjrus ds funžk fn, x, gÅ vH; kj.; dk tk; tk ydž
yKs/jkt dh; i 'kqfpdRI ky; dh Mh- vkbZ iz ks'kkyk ds ml l pkyd MKW vkj- ds xlš [ks us
crk; k gšfd jkt/kkuh l s MKDVjka dk , d ny Hkstk x; k gš tks vxkeh vkns'k rd vH; kj.;
ea gh jgs kA xkoka ds eoš'k; ka ds Vhdkdj.k ds fy, Ng gtkj Vhds fhktok fn; s x; s gÅ

, fkdI ds l Øe.k dk irk xgu tkp ds ckn gh pšy kA ou; i k.kh ikuh i hus ds fy, xkoka
l s yxs tu Jks'ka rd vkrs gÅ vkš l Hko gšfd ogha eoš'k; ka ds l ä dz ea vkus l s mUga ; g
l Øe.k gšvk gÅ jktekkh ds ou fogkj dk , d ny Hkh MKW vfuy 'keZ ds us'Ro ea ckjh
vH; kj.; x; k gš tgka og vU; thoka ds jDr ds ueus yskA jkT; ds iekku ou; i k.kh
l j {kd} MKW jkeiž kn ds vuŕ kj ckjh vH; kj.; ea ou; i kf.k; ka o xteh.kka ds LokLF; dh
ns [kHky ds fy, i ;žr veyk ekš m gš vkš ng'kr tš h fLFkr ugha gÅ iekku eŕ; ou
l j {kd} ou; i k.kh , - ih- f}onh ds vuŕ kj tcyij l s Hkh , d fo'kš k MKW JhokLro dks
veys ds l kFk ckjh Hkstk x; k gÅ ij s ou ea pšdl h dh tk jgh gÅ fdl h ou; i k.kh dh
vkdflEd ekš s gkus ij ml dh ijh rjg tkp djus ds ckn er 'kjhj dks ; k rks tyk nsuk
pkfg, vFkok tehu ea xkM+nšuk pkfg, rkfd ml ds l Øe.k ds dkj.k nš js ij Hkfk; ka ij jksx
u QsyA eŕ; [krjk ck?kka ij Hkh gks l drk gš tks eka Hk{kh i k.kh gkus ds dkj.k er tkuojka
dks [kdkj , fkdI tš s ?kkrd jksx dk f'kdkj gks l drs gÅ

ckjh vH; kj.; ea ck?kka dh l a; k 37 gA rnyka ds Hkh l Øfer gkus dh vk'kadk gA ogka rnyka
dh l a; k 50 gA l kkhj vH; kj.; ka ea gtkj l smij gA l kudrs 254 gA xkS ½ck; l u½ dh
l a; k Hkh gtkj l s Åij gh gA buds vrfjDr uhyxk;] fl ; kj] Hkkyw txyh l vj o
ydMEX?kk dh iztkfr Hkh vH; kj.; ea [krjs ea gA oudfez; ka dks ijh l koekkuh cjrus ds
vknsk fn, x, gSD; kkd bl ?kkrd jksx l s l a dZ gkus ij jksx ds dhVh.k qeut; ka ea Hkh QSy
l drs gA vkt fQj pkj gtkj , fkdI Vhds vks ckjh i gpp x, gA mlga feykj nl gtkj
Vhds ogka i gpp ppls gA vH; kj.; l s yxs gq xkoks ds fuokl ; ka dk LokLF; ijh{k.k Hkh 'kq
dj fn; k x; k gS vks mlga Hkh bl ?kkrd jksx l s cpkus ds fy, vko'; d funsk fn, tk jgs
gA è; ku jgs vLl h ds n'kd ea n- Hkkjrh; cknhi g vks emeykbZ ds vH; kj.; ka ea gtkj ka xkS
½ck; l ukk dh , fkdI l s eks gks xbZ FkhA gky gh ds o"kkà ea nf{k.k vQhdk ds ckj uskuy
i kdZ ea Hkh dbZ fl gks dh eks , fkdI i hfMf txyh HkS ka ds er 'kjhj dks [kkus l s gks xbZ FkhA

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