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# Van Sangyan

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**Tropical Forest Research Institute**
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PO RFRC, Mandla Road, Jabalpur – 482021. India

# Van Sangyan

## Editorial Board



## Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

**Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve**
**Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)**

# From the Editor's desk

*The rich biodiversity of India has always played an important role for the benefit of human, animals and the environment. Biodiversity generally refers to the variation in the species (Species Diversity). However, it also includes Eco-system and Genetic variations. Such richness is attributed to the vast variation in physio-graphic and climatic conditions in India. India is a agricultural country and produces wide variety of food products such as wheat, rice, maize, fruits, vegetables, etc. The crop diversity of India has got lots of economic and other benefits. The Ayurvedic and other medicines are the results of rare herbs found in Himalayas and other areas. India is a major preserver of varieties of plant species. More than 45,000 plants species have been estimated to be present in India, accounting for nearly 7 percent of the flora in the world. Of these 15,000 are estimated to be the flowering plants. The other important plant groups we find are gymnosperms, bryophytes, pteridophytes, lichens, algae and fungi. The faunal wealth is no less diverse. The animal species are estimated to be around 81000. This accounts for 6.4 percent of the world's fauna. Of the invertebrates more than 5000 are mollusks and 57000 insects.*

*Just 17 of the world's 190 or so countries contain 70 percent of its biodiversity, earning them the title "megadiverse." India is one of these megadiverse countries with 2.4% of the land area, accounting for 7-8% of the species of the world, including about 91,000 species of animals and 45,500 species of plants, that have been documented in its ten bio-geographic regions. Of these 12.6% of mammals, 4.5% of birds, 45.8% of reptiles, 55.8% of amphibians and 33% of Indian plants are endemic, being found nowhere else in the world. It is further estimated that about 4, 00, 000 more species may exist in India which need to be recorded and described. The baseline data on existing species and their macro-and micro-habitats, is also inadequate. This biodiversity has arisen over the last 3.5 billion years of evolutionary history and its sustainable use has always been a part of the Indian culture. India home to nearly one-fifth of the world's human population and is rapidly seeing a change in its economy from a predominantly agrarian society into a diversified one resulting in mounting pressures on land use. A consequence of this has been the loss and fragmentation of natural habitats, which has been identified as the primary threat to biodiversity.*

*India also has three of 34 "global biodiversity hotspots" - unique, biologically rich areas which are facing severe conservation threats. The rapid rate of hotspot degradation makes it imperative that conservation science be pursued immediately and vigorously in these habitats, to devise effective measures which curtail the rapidly diminishing biodiversity, and to protect its unique biota. The value of this biodiversity for sustaining and nourishing human communities is immense. To take an example, the ecosystem services from the forested watersheds of two great mountain chains, the Himalayas and the Western Ghats, indirectly support several million people in India. Open and free access to biodiversity information is essential to promote conservation, management and sustainable use of biodiversity and has immense potential to increase the current and future value of the country's biodiversity for a sustainable society.*

*This issue of Van Sangyan contains an article on Achanakmar-Amarkantak biosphere reserve, India: a diverse tropical forest ecosystem, Angiosperm phylogeny grouping, Documentation and conservation of medicinal plants in Barnawapara wildlife sanctuary, Chhattisgarh, Indigenous medicinal plants used in the healing of urinary tract infections and kidney stones, Technological impacts in forestry, Mango tree, Joint forest management: a program to conserve forest and environment, Mahogany (Swietenia macrophylla) - a promising tree for agroforestry and biodiversity of Hystrix indica and Chrysopogon zizanioides.*

*I hope that readers would find all information in this issue relevant and valuable. Van Sangyan welcomes articles, views and queries on various issues in the field of forest science.*

*Looking forward to meet you all through forthcoming issues.*

**Dr. N. Roychoudhary**
Scientist G & Chief Editor

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# Achanakmar-Amarkantak biosphere reserve, India: A diverse tropical forest ecosystem

**Dr. N. Roychoudhury[1], Dr. Ruby Sharma[2] and Dheeraj Kumar Gupta[1]**
[1]Tropical Forest Research Institute,
Jabalpur – 482021, Madhya Pradesh, India
[2]Formerly Woman Scientist 'B' under Department of Science and Technology Project on Achanakmar-Amarkantak biosphere Reserve, Tropical Forest Research Institute,
Jabalpur – 482021, Madhya Pradesh, India

**Abstract**
Achanakmar-Amarkantak Biosphere Reserve is the only interstate biosphere reserve in central India, located in an ecologically diverse and least disturbed landscape representing Tropical Dry and Moist Deciduous forests on Deccan Peninsular biogeographic region of the country, covering the states of Chhattisgarh and Madhya Pradesh. This is the first biosphere reserve for the state of Chhattisgarh and 14th for the Indian Union. The expanse of Achanakmar-Amarkantak biosphere reserve covers 3835.51 $km^2$ of which 551.55 $km^2$ forms the core zone. The situation of biosphere reserve on trijunction of major mountain ranges of central India is advantageous in formation of hilly terrain throughout interspersed with perennial streams, rivulets and origin of three sacred rivers, the Narmada, Johilla and Son. The core area of Achanakmar-Amarkantak consists of the protected forest land while the buffer zone and the transition area are characterized by forests, agricultural and rehabilitated land and small suburban clusters. Twenty seven tribal and non-tribal communities inhabit 418 villages living on agriculture (including production of medicinal plants) and non-timber products produced in the buffer zone and transition areas.

The biosphere reserve harbours a rich biodiversity of great conservation value. Moist deciduous forests constituting 63% of the area dominate the biosphere reserve and provide diverse habitat to various flora and fauna. So far 1,527 species of flora and 324 species of fauna have been recorded from the site. The flora includes more than 324 species of thallophytes (algae fungi and lichen), 44 species of bryophytes, 40 species of ferns, 16 species of gymnosperms and more than 1,111 species of angiosperms. The total number of fauna recorded so far in biosphere reserve is 327 species. The biosphere reserve supports animals like tiger, bison, beer, spotted deer, barking deer, panther, wild cat, fox, wild dog, sambhar, four horned antelope, mouse deer etc. Recently, the International Council of UNESCO's Man and the Biosphere Programme (MAB) meeting in Paris from 9-13 July 2012 has declared Achanakmar-Amarkantak Biosphere Reserve under the World Network of Biosphere Reserves (WNBR).

**Keywords:** Achanakmar-Amarkantak biosphere reserve, bio-resource, flora, fauna

## Introduction

The idea of Biosphere Reserves was mooted by United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1973 under its Man and Biosphere (MAB)

programme for "building scientific and technical capacity for effective management and sustainable use of biodiversity" (UNESCO - MAB, 1973, http: // www. fao. org/docrep /x0963e/x0963 e0 8. htm # Top Of Page). MAB was launched in 1971 to catalyse a greater understanding and provision of knowledge and skills to support sustainable relationship between people and their environment (http://en.wikipedia.org /wiki /Man_ and_ the_ Biosphere_ Programme). Biosphere reserve (BR) is an international designation coined by UNESCO for representative parts of natural and cultural landscapes extending over terrestrial or coastal/marine ecosystems. It consists of areas of terrestrial or marine ecosystems, which are internationally recognized within UNESCO's Man and Biosphere programme for promoting and demonstrating a balanced relationship between people and nature (http://www.unesco.org.uk/uploads/biopsher e% 20reserves%20faq.pdf). Biosphere reserve is a unique concept that includes one or more protected areas and surrounding lands that manage to combine both conservation, and sustainable use of natural resources. The purpose of formation of a biosphere reserve is to conserve *in situ* all forms of life, along with its support system, in its totality, so that it could serve as referral system for monitoring and evaluating changes in natural ecosystems. Biosphere reserve acts as a keystone of MAB by providing a global network of sites for cooperative research toward this end and demonstrates the sustainable use goals of the world conservation strategy. The first biosphere reserve of the world was established in 1979 (http://www2.wii.gov.in/ nwdc/biosphere.htm), since then the network of biosphere reserves has increased to 580 in 114 countries across the world (UNESCO, 2012; http://www.unesco.org/new/en/natural-sciences/environment/ecological – sciences biosphere - reserves / world- network - wnbr/ wnbr/).

India launched National Biosphere Reserve Programme in 1979 under Indian MAB (http://envfor.nic.in/ divisions/ csurv/ BR_ Guidelines.pdf). The Ministry of Environment and Forest, Government of India, is implementing this programme in the country. Currently, there are 18 biosphere reserves operating in India (Table 1) (http://en.wikipedia.org/wiki/ Biosphere_ reserves_of_India). Of these, "Achanakmar-Amarkanatak Biosphere Reserve" is located in the States of Chhattisgarh and Madhya Pradesh (Fig. 1), under the jurisdiction of Tropical Forest Research Institute, Jabalpur, a National Institute of Indian Council of Forestry Research and Education (ICFRE) under Ministry of Environment, Forests and Climate Change, Government of India.

**Achanakmar - Amarkantak biosphere reserve**

Achanakmar-Amarkantak biosphere reserve is named after Achanakmar forest village and Amarkantak, a holy place from where the rivers Narmada, Johilla and Sone emerge. Achanakmar-Amarkantak Biosphere Reserve was declared as Biosphere Reserve (BR) by Government of India vide notification no. 9/16/99 CS/BR dated 30th March 2005. It lies between lat. $22^0$ 15' to $20^0$ 58' N and long. $81^0$ 25'N to $82^0$ 5'E and is spread from Maikal hill ranges to the junction of Vindhyan and Satpura hill ranges in a triangular shape. Bilaspur and Marwahi forest divisions of the Chhattisgarh state and

Dindori and Anuppur forest divisions of Madhya Pradesh state surround the core zone of BR. The total geographical area of BR is 3835.51 sq. km (Anon, 2007). The core area of the BR is 551.55 sq. km., falls in Chhattisgarh state. It

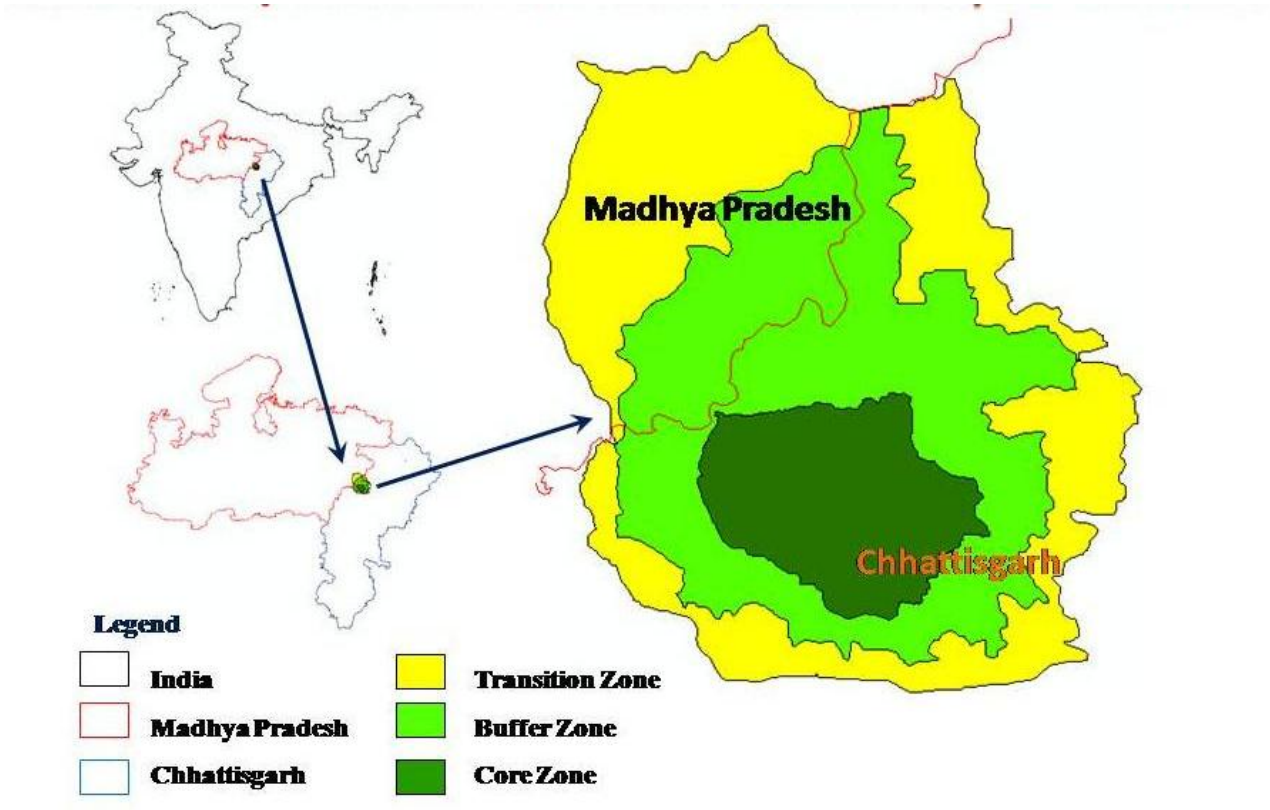


**Fig 1: Location map of Achanakmar-Amarkantak biosphere reserve**

is surrounded by buffer and transition zone area of 1955.875 sq. km. and 1328.09 sq. km. sq. km. Out of this, 2058.98 sq. km. falls in Bilaspur and Marwahi forest divisions of Chhattisgarh and 1,224.98 sq. km in Dindori and Anuppur forest divisions of Madhya Pradesh.

Its topography is varied from crop fields in Bilaspur and Anuppur district and Dindori district to the hills of Maikal ranges of Satpura. The topography, in combination with perennial streams and valleys has created varied micro-climatic conditions in the area to provide diverse environmental conditions, encouraging luxuriant growth for several species of thallophytes, bryophytes, pteriodophytes (ferns), gymnosperms, angiosperms and many species of wild fauna of economic importance.

The geology of the area is unique, varied from schists and gneisses with granite intrusion rocks, sand stones, shales, limestone, basaltic lava and bauxite. The soils of the Achanakmar - Amarkantak BR vary in composition and texture from sandy to loamy-clays, generally light brown to brownish yellow in colour. An olive green clay zone up to 5 mm sometimes exists at some places where marshy conditions develop due to poor seepage in these areas. Red soils (due to presence of iron oxide), which is porous and fertile, also occur in

some places. Deposits of alluvial soils are also seen on the banks of numerous streams in the tract. The black cotton soil exists in many areas of Achanakmar - Amarkantak Biosphere Reserve.

The BR has typical monsoon climate with three distinctly defined seasons and a short post rainy season. The summer season begins from April and lasts up to the middle of June. The rains commence from middle of June and continue till the end of the September. Post rainy season remains during the month of October. The winter or cold season begins from November and lasts up to March. The mean daily maximum temperature ranges from $24^0$ to $39^0$ C and mean daily minimum temperature ranges from $10^0$ to $25^0$ C depending upon season. The lowest and highest temperatures are touching extremes in recent years as a consequence of climatic changes occurring throughout the country and globe. A few showers of rain generally occur in every season throughout the year. The average rainfall is 1322 mm to 1624.3 mm. The relative humidity is fairly high due to thick vegetation of sal forest at higher elevations and frequent showers of rain are between June-October. The rainfall decreases to the lowest of 12.98 mm in the month of December. Frost between December-January is often observed to damage *Anogeissus latifolia, Diospyros melanoxylon, Kydia calycina, Lagerstroemia parviflora, Litsea glutinosa, Ougenia oojeinensis, Terminalia tomentosa,* etc. in Achanakmar and Lamni forest ranges in core zone and *Buchnania lanzan, Emblica officinalis, Shorea robusta,* etc. at Khandoli in buffer zone.

Achanakmar - Amarkantak BR is blessed with many seasonal monsoon dependent and permanent streams, is a place of origin of rivers like the Narmada, the Johilla and the Sone, many rivulets and two dams. Not many efforts have been made to increase infiltration into soil, control excess runoff and to manage and utilize runoff for useful purposes. Old Khudia dam situated in the south-western boundary on Maniary river in the core zone and Malhaniya dam built on Malhaniya river in the buffer zone are the main constituents of the water bodies. These dams are very useful for men and wild animals living in BR particularly during summers when the seasonal *nallah*s and streams dry up. The water bodies comprise of 33.61 sq. km. areas. The average annual rainfall is about 1624.3 mm distributed on an average over 71 to 118 rainy days in a year, providing ample scope for the watershed management.

The BR constitutes a total of 418 revenue and forest villages inhabited by tribal and non-tribal communities within Chhattisgarh areas. Of these, 22 villages having a population of 7617 persons are located in core zone and the remaining is situated in buffer and transition zones of the BR. The major occupation of the inhabitants is agriculture besides collection of medicinal plants and other non - wood forest products. They are also engaged sometime as labours by the forest department. The major tribes residing in BR are Baiga, Kol, Kanwar, Pradhan and Gond.

**Zonation and forest types of Achanakmar-Amarkantak biosphere reserve**

The core, buffer and transition zones of the BR are divided into following eleven ranges in Chhattisgarh and three ranges in Madhya Pradesh. The entire core zone lies in Chhattisgarh state comprising of Lamni, Achanakmar and Game range. The buffer and transition zone partly lies in both states

of Chhattisgarh and Madhya Pradesh, the major portion falling in Chhattisgarh state. The forests of ranges Lormi Range, Kota Range, Khudia Range, Belgahana Range, Khodri Range, Marwahi Range, Gorela Range, Lamni Range (General) of Chhattisgarh and Amarkantak, Rajendragram and East Karanjiya in Madhya Pradesh.

The forests of BR constitutes of North Indian Tropical Moist forests and North Indian Moist Deciduous forests with subtypes in the likes of Moist Peninsular sal forests, Moist Mixed deciduous forests, Northern Dry Mixed Deciduous forests interspersed with rainfed fields and inhabited areas (Figs 2-5).

**Floral attributes**

The BR is very rich with high diversity and density of flora. It comprises of 1527 species of identified flora (Anon, 2010). It has more than 317 species of thallophytes that includes 7 species of algae, 179 species of fungi and 130 species of lichen, 44 species of bryophytes, 40 species of ferns, 16 species of gymnosperms and more than 1, 111 species of angiosperms. They provide produce for subsistence as well as substitute their livelihood through sale of NTFP's. In Northern Tropical Moist Deciduous Forests, sal is the dominant species occurring in hilly tracts and low level areas of Lamni, Game, Marwahi and Achanakmar ranges as well as in the valley in Khudia range. Sal and its associates like *saja, bija, dhaora, kasai, lendia,* etc. and many species of shrubs, climbers and herbs exist in this type. The dry mixed deciduous forest consists of dry sal with associates in the top storey like *saja, bija, dhaora, kusum, kasai, lendia, jamun, mahua, aonla, achar, baranga, amla, bel, garari, kari, khamer, salai, tendu, tilwan,* and a few other thorny species in the middle storey, *banrahar, chhind, dhawai, harsingar, kurdai* and *kalabansa* in the undergrowth; *chhira, kusum, bhurbhusi,* and *mushel* as grasses and *mahul,* etc. as common climbers. Plant species like the lichen *Caloplaca amarkantakana* (Fam: Teloschistaceae), fern

**Fig 2: Moist sal forest**

**Fig 3: Dry peninsular sal forest**

**Fig 4: Moist mixed deciduous forest**

**Fig 5: Northern dry mixed deciduous forest**

*Isoetes bilaspurensis* (Fam. Isoetaceae) and an angiosperm *Bothrichloa grahamii* (Fam:

Poaceae) are endemic to this region. Twenty eight threatened species of flora and 55 threatened species of fauna belonging to various groups have been identified and observed to different threat categories regionally as well as globally as per IUCN criteria ver.2001. Some species of ferns like *Adiantum capillus veneris* and *Lygodium flexuosum* are endangered. Among angiosperms, *Rauvolfia serpentina* is critically endangered in the BR whereas *Clerodendrum serratum*, *Acorus calamus*, and *Eulophia herbacea* are endangered locally as well as at regional level. Remaining 22 species are, however, found vulnerable.

The pteridophyte *Ceratopteris thalictroides* (syn. *Acrostichum thalictroides*), *Cheilanthes rufa* (syn. *Aleuritopteris rufa*), *Dryoathyrium boryanum* (syn. *Aspidium boryanum, Lastrea boryana, Phegopteris kingie*), *Marginaria macrocarpa*, *Microsorium membranaceum* (syn. *Polypodium membranaceum, Pleopeltis membranaceum*), *Polystichum auriculatum* (syn. *P. harpohyllum*), *Pteris quadriaurita* (syn. *Polypodium membranaceum, Pleopeltis membranacea*) were sampled in 1970 and thereafter some of the taxa recorded once or twice in 30 years whereas others could not be recorded and probably have become extinct from the wild. Besides this, there are 518 floral species of food and medicinal value. Seven of them are pteridophytes whereas remaining 511 species are flowering plants of dicotyledons and monocotyledons.

**Faunal attributes**

The faunal resources of BR are very rich and varied. It comprises of 324 species of identified fauna, out of which 117 species belong to invertebrate and 210 species belong to vertebrate. Among the invertebrates, 5 species belong to Chilopoda, 84 species belong to Lepidoptera (49 butterflies and 35 moths), 24 species belong to Coleoptera and only one species belongs to Orthoptera. Among the vertebrates, 16 species belong to Pisces, 10 species belong to Amphibia, 15 species belong to Reptilia, 142 species belong to Aves and 27 species belong to Mammalia. Among fauna, there are 2 critically endangered species, viz. *Philautus sanctisilvaticus* (Amphibia: Hylidae), *Gyps bengalensis* (Aves: Accipitridae) and 2 endangered fauna, viz. *Notopterus chitala* (Pisces: Notopteridae), *Panthera tigris* (Mammalia: Felidae) besides, 51 low risk to vulnerable species as per IUCN categorization. The area of the BR has a known habitat for animals like tiger, bison, bear, spotted deer, barking deer, panther, wild cat, fox, wild dog, sambhar, four horned antelope, mouse deer, etc. It has rugged terrain as well as grasslands giving shelter to wildlife in all seasons. Rich dense forests dominated by sal and its associates give way to high precipitation further enhancing and promoting moist habitat and supported plant diversity.

**Achanakmar - Amarkantak biosphere reserve under world network of biosphere reserves**

The International Council of UNESCO's Man and the Biosphere Programme (MAB) meeting in Paris from 9-13 July 2012 declared Achanakmar-Amarkantak Biosphere Reserve under the World Network of Biosphere Reserves (WNBR) (www. unesco. org/ new /en/ media-services/ multimedia / mab -2012). The World Network of Biosphere Reserves of the Man and Biosphere Programme consists of a dynamic and interactive net work of sites

**Table 1: Biosphere Reserves of India**

| S. No. | Year | Name | Location | State | Type | Key Fauna | Area ($km^2$) |
|---|---|---|---|---|---|---|---|
| **1** | 1986 | Nilgiri Biosphere Reserve* | Part of Waynad, Nagarhole, Bandipur and Mudumalai, Nilambur, Silent Valley and Siruvani Hills | Tamil Nadu, Kerala and Karnataka | Western Ghats | Nilgiri Tahr, Lion-tailed macaque | 5520 |
| **2** | 1988 | Nandadevi* | Parts of Chamoli District, Pithoragarh District & Bageshwar District | Uttarakhand | Western Himalayas | | 5860 |
| **3** | 1988 | Nokrek* | Part of Garo Hills | Meghalaya | East Himalayas | Red Panda | 820 |
| **4** | 1989 | Gulf of Mannar* | Indian part of Gulf of Mannar extending from Rameswaram island in the North to Kanyakumari in the South of Tamil Nadu and Sri Lanka | Tamil Nadu | Coasts | Dugong or Sea Cow | 10500 |
| **5** | 1989 | Sunderbans* | Part of delta of Ganges and Barahamaputra river system | West Bengal | Gangetic Delta | Royal Bengal Tiger | 9630 |
| **6** | 1989 | Manas | Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamrup and Darrang Districts | Assam | East Himalayas | Golden Langur, Red Panda | 2837 |
| **7** | 1989 | Great Nicobar Biosphere Reserve | Southern most islands of Andaman and Nicobar Islands | Andaman and Nicobar Islands | Islands | Saltwater Crocodile | 885 |
| **8** | 1994 | Simlipal* | Part of Mayurbhanj district | Orissa | Deccan Peninsula | Gaur | 4374 |
| **9** | 1997 | Dibru-Saikhowa | Part of Dibrugarh and Tinsukia districts | Assam | East Himalayas | Golden Langur | 765 |
| **10** | 1998 | Dihang-Dibang | Part of Siang and Dibang Valley | Arunachal Pradesh | Eastern Himalaya | | 5112 |
| **11** | 1999 | Pachmarhi Biosphere Reserve* | Parts of Betul District, Hoshangabad District and Chhindwara District | Madhya Pradesh | Semi-Arid | Giant Squirrel, Flying Squirrel | 4981.72 |
| **12** | 2000 | Khangchendzonga | Parts of Kanchanjunga Hills | Sikkim | East Himalayas | Snow Leopard, Red Panda | 2620 |
| **13** | 2001 | Agasthyamalai | Neyyar, Peppara and | Kerala, | Western | Nilgiri | 1828 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Biosphere Reserve | Shenduruny Wildlife Sanctuary and their adjoining areas | Tamil Nadu | ghats | Tahr, Elephants | |
| **14** | 2005 | Achanakamar - Amarkantak Biosphere Reserve* | Part of Annupur, Dindori and Bilaspur districts | Madhya Pradesh, Chattisgarh | Maikala Range | Tiger Bison | 3835 |
| **15** | 2008 | Great Rann of Kutch | Part of Kutch, Rajkot, Surendranagar and Patan Districts | Gujarat | Desert | Indian Wild Ass | 12454 |
| **16** | 2009 | Cold Desert | Pin Valley National Park and surroundings; Chandratal and Sarchu & Kibber Wildlife Sancturary | Himachal Pradesh | Western Himalayas | Snow Leopard | 7770 |
| **17** | 2010 | Seshachalam Hills | Seshachalam Hill Ranges covering parts of Chittoor and Kadapa districts | Andhra Pradesh | Eastern Ghats | | 4755 |
| **18** | 2011 | Panna | Part of Panna and Chattarpur Districts | Madhya pradesh | | Tiger Leopard | |

*** Included under World Network of Biosphere Reserve (Source:http://en.wikipedia.org)**

of excellence. It fosters integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty reduction and human well-being improvements, respect for cultural values and society's ability to cope with change, thus contributing to the Millennium Development Goals (MDGs). With this recognition from UNESCO, the Achanakmar-Amarkantak Biosphere Reserve enters into new realm of developmental activities which will usher in biodiversity conservation and socio-economic improvement of nearby tribal and provide opportunities for international scientific cooperation and funding.

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# Angiosperm phylogeny grouping

**Dr. Sanjay Singh and Dr. P. K. Khatri**
Tropical Forest Research Institute,
Jabalpur – 482021, Madhya Pradesh, India

We have been classifying plants since ancient time in one form or another. Before botanical classification was proposed, people classified plants according to their economic uses. The scientific classification aims to classify plants according to their evolutionary history, phylogeny. The system gives us an insight to the sequence of even that led to current diversity of life-form on earth. With the knowledge of phylogeny we can understand the diversification, regularities in pattern of evolution (i.e. favoured characters) and evolutionary changes within a clade.

The understanding of evolutionary history also adds to our knowledge about the evolution of life on earth. Recently an attempt has been made by a group of scientist to use our current advances in field of genetics and molecular biology to trace the evolutionary history in plant kingdom. During the 1990, the rapidly accumulating DNA sequences from plastid gene *rbcL* enabled the reconstruction of flowering plants phylogeny. Cladistic analysis of larger data sets coupled with various methods (Flsenstein, 1985; Farris, *et al.* 1996) for estimating phylogenetic relation between different taxa provided an elaborate phylogenetic tree. However the new knowledge of phylogeny is not similar to the traditional popular phylogenetic systems of Cronquist (1981), Takhtajan (1997), and Thorne,(1992) whose systems were based largely upon the morphology. The new system of phylogenetic classification rests on a larger database, using cladistic analysis including DNA sequences along with other form of systemic data. The new acquired information about phylogeny and evolution of higher plants don't fit in the existing understanding of phylogeny.

Our current knowledge about the phylogeny of major clades of seed plants and the relationship within and between them is still in state of flux. A group of plant systematists (popularly called as Angiosperm Phylogeny Group) thus came up with a new system of classification of higher plants APG, (1998). Which was further revised in 2003 (APG-II, 2003) and 2009 (APG-III, 2009).

**Angiosperm phylogeny group (1998)**

The initial system (APG, 1998) compromised 462 families arranged in 40 putatively monophyletic order and a few monophyletic higher groups, that were known as Monocots, Commelinoids, Eudicots, Core-eudicots, Rosids (further divided in Eurosids I and II) and Euasterids I and II.

The classification proposed was more focused on order. In comparison to the system proposed by Takthjan (1997) the orders in the proposed classification were clearly circumscribed based upon the large jackknife analyses of molecular data.

Three Monofamilial orders Ceratophyllales, Acorales and Arecales, were recognized, these families were apparently sister groups

of larger groups including several orders. However many families were not classified to order because their position were unknown. These families were listed under the supraordinal groups (eudicots of uncertain position).

APG system assumed that there will be minor changes in the circumscription of the order, some minor correction of transfer of some misplaced families, and of-course they still have a list of families for which the clades were to be identified. The APG system strictly involved in recognisation of monophyletic groups at all level, however it was duly acknowledged that there were families like Euphorbiaceae and Scrophulariaceae which are non monophyletic.

Further research was required for reclassification of these families into monophyletic units. It was felt that changes in family circumscription were required to reflect the improved understanding of phylogeny.

**Angiosperm phylogeny grouping II (2003)**

An updated version of APG classification was proposed in 2003. After 1998 five other systems of angiosperm classification were published. Judd *et al.* (1999) and Stevens, (2001) published there system of classification using APG1998 as the basis of classification. Classification proposed by Thorne, (2001) was contribution towards the APG 2003 while classification proposed by Wu, Tang, & Li, (2002) and Doweld, (2001) follow the system proposed by Takhtajan, (1997).

The APG-II adopted conservative approach making changes in the system proposed in APG (1998). Five additional orders were recognized namely Austrobaileyales, Canellales, Celastrales, Crossosomatales and Gunnerales, which represented well, supported monophyletic groups of families which were previously unclassified in APG, (1998). The number of orders has increased from 40 to 45 and the number of families decreased from 462 to 457. Of this number, 55 families are listed in brackets

Some APG orders were more widely circumscribed to include their sister groups. Except in case of Canellaceae and Winteraceae, which were established as order Canellales rather then including in their sister group Piperales. No APG orders were merged or split and no families were transferred from one order to another, except the case where Oncothecaceae was removed from Garryales and assigned a new position the beginning of Euasterids-I without classifying in any order because recent analyses have not supported any clear ordinal position for the family.

The APG II proposed formal starting date of nomenclature of spermatophytes (if not all vascular plant) family name as of 4$^{th}$ august 1789 to achieve nomenclature stability

**Angiosperm phylogeny grouping III (2009)**

Backlund and Bremer (1998) provide a useful discussion on the principles of phylogenetic classification that is applicable at all levels apart from species. Most importantly, taxa that are recognised formally should be monophyletic, that is, they should include all and only the descendants of a hypothesized common ancestor.

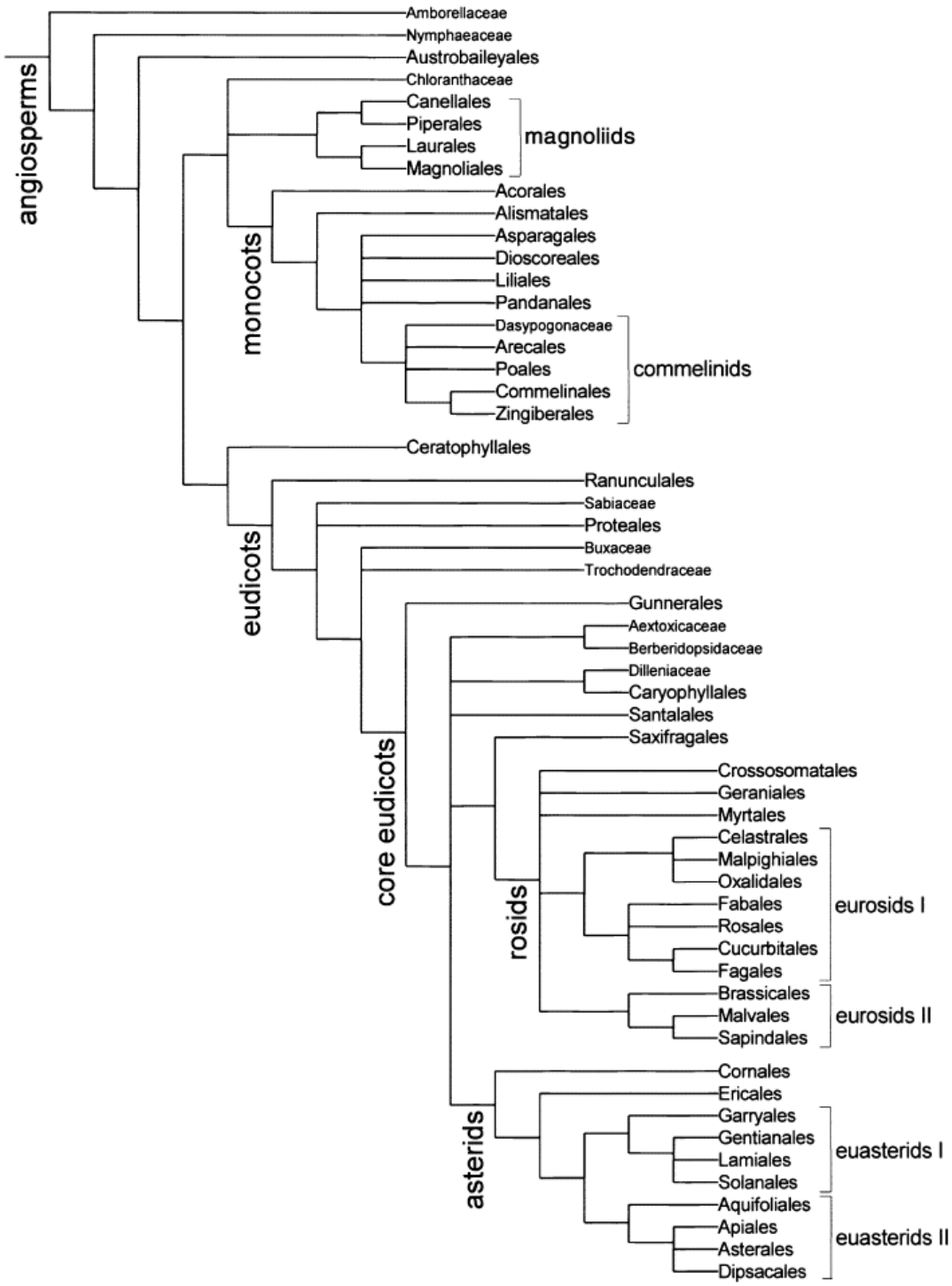


**Figure 1: Outline of phylogenetic classification of orders and families as per in APG II (2003)**

However, this does not indicate which particular clades we might wish to name as families, genera, etc., and talk about in general conversation: If a well-supported hypothesis of monophyly is a necessary prerequisite for a group to be named, it is

not a sufficient prerequisite. The principles of Backlund & Bremer, (1998) states that a taxa to be recognized formally should be monophyletic, however he does not indicates which particular clades should be named as families, orders etc. It is helpful if

1. Taxa formally recognized are easily recognizable
2. Groups that are well established in the literature are preserved
3. The size of group should be taken into account (particularly small ones, which should be combined with others whenever possible)
4. Nomenclature changes are minimized

Following changes were suggested in APG – II bearing the Buckland and Bermer (1998) Principle and guidelines in mind.

Circumscription proposed for some families in APG II was removed as it appeared to create more confusion than clarity. As an alternative, use of circumscription adopted by textbooks like that of Judd *et al*. (2007) and Mabberley, (2008) was suggested. It was brought in to light that most of the European Herbarium (*eg.* K, E, BM, P, G) are in process of reorganizing their collections along the APG lines. Agreeing to adopt APG III as their standard and linear order as propose by Haston, *et al.* (2009) which in general adopt the broader circumscriptions.

With clarification of position of isolated families new orders were added to the APG

Families which were wrongly placed due to unavailability of sequence or submission of chimaeras sequences were placed correctly with the new supporting evidence like the Hydatelaceae was moved from Poales to Nymphaeales (Saarela, et al., 2007)

Few family circumscriptions suggested by APG II did not reflect general usage were modified like the Brassicaceae was split into 3 families in APG-III

**About the classification**

The APG system mostly talks in terms of orders and families for convenience, families are simply monophyletic units useful in communication, major units learned by biologists and others world-wide. Clades are mainly determined by the clues from the DNA sequences extracted from mitochondria and chloroplasts. Events like hybridization, endo-symbiosis and lateral-gene transfer may cause problem when we emphasize on monophyly as criteria for circumscription. Also many genera are not monophyletic like members of Poaceae and Tritiaceae, (Dewey, 1984; Love, 1984; Petersen *et al.*, 2006) circumscription of the allopolyploids genera thus cannot be monoplyletic owing to the origin of the origin of genera. Takhtajan, (1997) suggested that smaller families are more "natural". He also suggested that narrowly defined taxa are more useful for phylogenetic studies; this may be true as a smaller group gives a comprehensive account of the synapomorphies which distinguish the taxa from the other taxa of crown group. However a group or any size may have apomorphies, larger taxa having large apomorphies represent diversification of the character during the course of evolution. Hence with suitable reason (and as per convienence) several smaller monophyletic group (having similar characters) can be merged to produce a

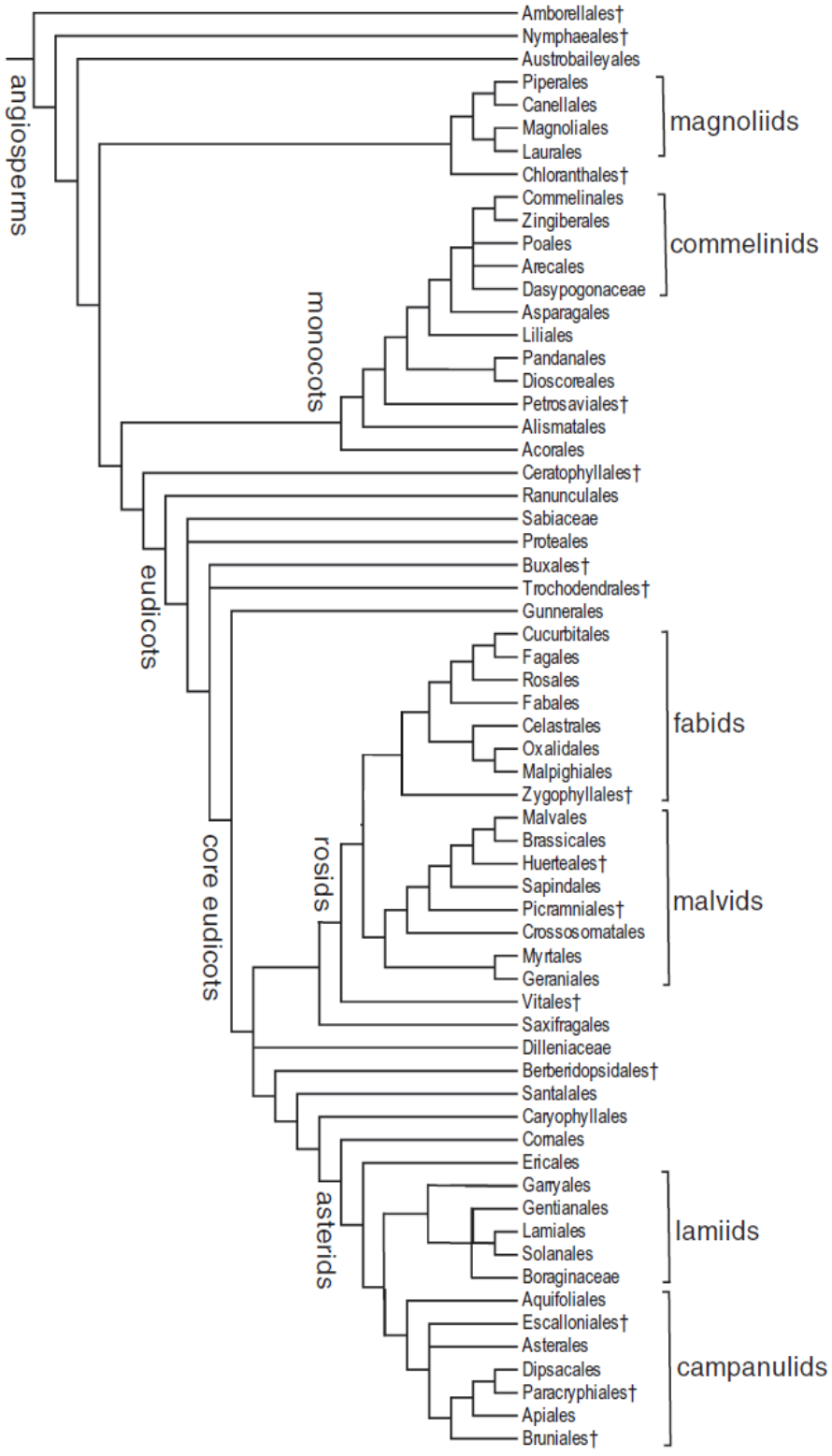


**Figure 2: Outline of the classification of Angiosperms proposed in APG-III**

larger unit based on shared apomorphies, or a larger unit can be distinguished in several smaller groups on similar grounds. APG-II (2003) broadened the circumscription of Malvaceae on account of para/polyphyly of some families that were historically associated (Judd and Manchester, 1997; Baum *et al.* 2004; Alverson *et al.* 1999) Families like Tiliaceae, Bombacaceae and Sterculiaceae are now merged into the larger family Malvaceae. Humphreys and Linder (2009) in their studies noted that generic limits have oscillated historically, current studies recognise broader taxa.

But, circumscription of the clades (a group of taxa sharing common ancestry) is not enough, we also need to identify the similarity that makes clades unique, the shared and derived characters of the clades that first appeared in their immediate ancestor and is represented by the entire lineage. Our knowledge of similarities associated with taxa however remains poor, as the modern system of analysis certainly help us in finding out composition of clades, but cannot help us in finding out the similarities through which the clade can be distinguished. Phylogeny based classification represent our knowledge about the phylogenetic relationships. Thus a monophyletic family can have several genera, but then genus can never include families. Genera Families etc. are name we use to denote appropriate parts of phylogenies and convey information about the relationship between the taxa.

As we know that we have circumscribed the orders to be monophyletic, distinction can be made between crown groups and stem groups. The crown groups are the monopyletic groups that include the extant members of a clade and the others sharing the common lineage. Stem groups include all the members of the lineage below the crown group to the point where it splits from its sister groups and all the branches of its lineage. However the most of the organisms which were links between the two crown groups or represented the stem group are unknown, our knowledge from the paleobotany in this regard is also incomplete, only a few fossil organism can be placed here. In case of angiosperms, it is possible that most of the organisms to be placed in the stems groups are gymnospermous (Stevens, 2001).

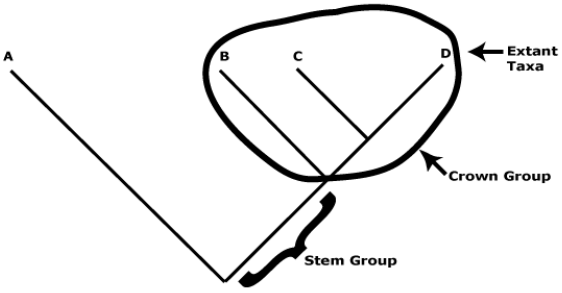


**Figure 3: Stem group, branch group and extant taxa**

However, when we talk about phylogenetic classification it is not imperative that two taxa of similar rank have emerged at the same time during the course of evolution. Taxa at the same rank are equivalent only by designation and have nothing necessarily in common other than there monophyly. Thus Ranks has no meaning other than signifying that the taxa have another set of monophyletic group of taxa at lower hierarchy. It was suggested that the rank of taxa should be adjusted so that rank somehow reflects the degree of morphological differences among the taxa, however fascinating it may sound but, it is not practically possible when our classification is phylogenetic.

Most of the popular systems like that of "Bentham and Hooker (1862-1883)" and "Engler and Prantl (1887-1915)" were

constructed in the manner that was easy to perceive and memorize. It was also helpful as all the groups in their classification were relatively small (each taxa containing three to eight immediate subordinate taxa). The classification proposed by the Angiosperm Phylogeny Group is yet to find acceptability among the field taxonomist. It is recognized that the names of the taxa that are learned by the students and used in herbaria will be needed, as they are harder to replace, replacing them will also impede the communication. The systematists want to have a robust and clear understanding of the evolution of the life form but 'Nature' does not identify classification, in fact many times it appears it doesn't like the idea of classification at all. All the classifications are constructed by us, for our ease for better understanding of living world around us.

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# Documentation and conservation of medicinal plants in Barnawapara wildlife sanctuary, Chhattisgarh

**Abhishek Raj[1], Pratap Toppo[1] and M.K. Jhariya[2]**
[1]Department of Forestry, College of Agriculture, I.G.K.V., Raipur- 492012 (C.G.)
[2]Department of Farm Forestry, Sarguja University, Ambikapur-497001 (C.G.)

**Abstract**
The central India constitute Barnawapara Wildlife Sanctuary which known for its lush green vegetations and unique wildlife. This comprises flora of varied characteristics and importance in term of medicinal value. Need to assess and conserve this diversity of floras should be prime concern and which helps to reduce exploitation and fragmentation of these natural resources that is harbor of many wild animals. The present paper gives an account of assessing the diversity of flora and their medicinal value in Barnawapara Wildlife Sanctuary. Survey of the plants and its medicinal use by the rural community is also in corporate. In the present study 7 climbers, 3 shrubs, 11 herbs and 21 trees species are reported as medicinal purpose.

**Keywords:** Conservation, diversity, forest, flora, medicinal value, wildlife.

## Introduction

India constitutes varied ecosystems of central India which symbolize diversified flora and fauna (Toppo *et al.*, 2014), conserve plant diversity and source of timber and non-timber products like commercially important gums (Raj *et al.*, 2015; Das *et al.*, 2014; Raj, 2015a; Raj, 2015b). Assessment and documentation of plant diversity leads to next and prime step of conservation for maintaining biodiversity (Raj and Toppo, 2014). These good biodiversity balance the food chain, food web, $CO_2$ sequestration, nutrient cycling and livelihood of human being (Jhariya and Raj, 2014). Forest is very diverse natural resource combating negative impacts of climate change (Singh *et al*., 2013) and a part of social forestry, agroforestry, reforestation and rehabilitating the waste lands and degraded industrial lands (Jhariya *et al.*, 2013 and Raj and Jhariya, 2016). Agroforestry is the new name for an ancient land use practice and just a compromise between agriculture and forestry (Raj *et al.*, 2014; Jhariya *et al.*, 2015; Raj *et al.*, 2016).

The state Chhattisgarh having 44% of forest covers of the total geographical area and forest type is tropical moist and tropical dry deciduous forest which bears many valuable nutritious wild floras (Toppo et al., 2016) performs medicinal value. As per Jhariya and Raj (2014) conservation of these all forest types is important as they harbor high biodiversity of not only plant species, but are also a preferred habitat for several wild animals. Therefore, it is needful aspect of conserving these biological resources for sustainable ecosystem (Pinker *et al.*, 2015).

## Material and method

The present study was conducted in Barnawapara Wildlife Sanctuary (BWS) of Chhattisgarh. Barnawapara Wildlife Sanctuary is one of the finest and important wildlife sanctuaries in the region. The sanctuary is relatively a small one covering an area of only 245 sq km.

the topography of the region comprises of flat and hilly terrain with altitudes ranging between 265-400 mts. The flora of Barnawapara Wildlife Sanctuary chiefly comprises of tropical dry deciduous forest with Teak, Sal, Bamboo and Terminalia being the prominent trees. Other major plants found in the sanctuary include Semal, Mahua, Ber and Tendu. The rich and lush vegetation cover supports a wide variety of wildlife in the sanctuary.

The extensive field visit was conducted in the wildlife sanctuary to document the medicinal plants. The plants and trees species were identified and documented with the help of local people residing in and around forest area, forest dwellers, and ethical community and forest guards. Finally, plants were documented by following their botanical name, local name, family habits and medicinal use.

**Results**

The study area conceives many type of vegetation; it includes trees, shrubs, climbers and herbs and did not show uniform distribution. In the study area 42 plants were identified among them 21 trees, 3 shrubs, 11 herbs and 7 climber's species. The climbers of 7 species yield tuber which is eaten and has medicinal value. The documented of trees, shrubs, herbs and climbers are listed in a scientific manner as follows (Table 1).

**Table 1: Documentation of medicinal plants of study sites**

| Local Name | Botanical Name | Family | Habit | Medicinal use |
|---|---|---|---|---|
| Lal gunja | *Abrus precatorius* | Fabaceae | Herb | Cure asthma, gonorrhea and eye disease |
| Buch | *Acorus calamus* | Acoraceae | Herb | Used in fever and antispasmodic |
| Bakain | *Melia azedarach L.* | Meliaceae | Tree | Cure piles and skin disease |
| Lajjawanti | *Mimosa pudica* | Fabaceae | Herb | used in treatment of asthmas, fever and cough |
| Tulsi | *Ocimum sanctum* | Lamiaceae | Herb | cure scabies and other Cutaneous diseases. |
| Kumarika | *Smilax zeylanica* | Smilacaceae | Climber | Used in Urinary complaints and dysentery |
| Imli | *Tamarindus indica* | Fabaceae | Tree | Remedy for paralysis, ulcers and inflammations |
| Sarpgandha | *Rauwalfia serpentina* | Apocynaceae | Shrub | Cure snake bite, insomnia and high blood pressure |
| Satawari | *Asparagus racemosus* | Asparagaceae | Climber | Remedy for diabetes, jaundice and urinary disorder |
| Sahijan | *Moringa oleifera* | Moringaceae | Tree | Used in piles and asthma |
| Harra | *Terminalia chebula* | Combretaceae | Tree | Useful in bronchitis, asthma and respiratory trouble |
| Kharpat | *Garuga pinnata* | Burseraceae | Tree | Remedy for skin disease |
| Climbing lily | *Gloriosa superba* | Colchicaceae | Herb | Cure constipation |

| | | | | |
|---|---|---|---|---|
| Aonla | *Emblica officinalis* | Euphorbiaceae | Tree | Cure stomach disorder |
| Baichadi | *Dioscorea hispida* | Dioscoreaceae | Climber | Used in contraceptive pills. |
| Ghartarul | *Dioscorea alata* | Dioscoreaceae | Climber | Used in fever, constipation. leprosy, piles and gonorrhea |
| Dang Kanda | *Dioscerea bulbifora* | Dioscoreaceae | Climber | Used in Aphrodisiac, stomachic, Improves appetite. |
| Neem | *Azadirachta indica* | Meliaceae | Tree | Treatment of small fox |
| Aloe | *Aloe barbadensis* | Liliaceae | Shrub | For burns and purgative |
| Chiwan | *Alstonia scholaris* | Apocynaceae | Tree | Used in fever, skin disease in treatment of leucoderma |
| Keu | *Costus speciosus* | Zingiberaceae | Herb | Useful in fever, bronchitis, anemia and diabetic. |
| Semal | *Bombax ceiba* | Malvaceae | Tree | Used for curing diarrhea and dysentery |
| Bael | *Aegle mormelos* (L.) Correa | Rutaceae | Tree | Used in stomach disorder |
| Adhatoda | *Adatoda vasica* | Acanthaceae | Herb | Remedy for asthma, cough, fever, gonorrhea leprosy |
| Mahul | *Bauhinia vahlii* | Caesalpiniaceae | Climber | used as tonic, aphrodisiac, skin disease, diarrhea |
| Tanki | *Bauhinia purpurea* | Caesalpiniaceae | Tree | To control diarrhea and animal bite |
| Dhawai | *Woodfordia fruticosa* | Lythraceae | Shrub | For piles and liver complaints |
| Ber | *Zizyphus sp.* | Rhamnaceae | Tree | To cure thirst and in blood diseases |
| Baheda | *Terminalia belerica* | Combretaceae | Tree | Cure stomach disorder |
| Aurjun | *Terminalia aurjuna* | Combretaceae | Tree | Cure cardiac disorder |
| Ram phale | *Annona squamosa* L. | Annonaceae | Tree | Used in cancer |
| Amaltas | *Cassia fistula* L. | Caesalpiniaceae | Tree | Used in constipation |
| Kewanch | *Mucuna pruriens* | Fabaceae | Climber | Treatment for neurological disease |
| Safed musli | *Chlorophytum borivilianum* | Liliaceae | Herb | Treatment for diabetes and health |
| Musli | *Chlorophytum arundinaceum* | Liliaceae | Herb | Treatment for diabetes |
| Kali musli | *Curuliogo orchioides* | Liliaceae | Herb | Used as nutritive tonic for strength, vigour and vitality. |
| Kalmegh | *Andrographis paniculata* | Acanthaceae | Herb | Treatment of anti-inflammatory, antibacterial |

| | | | | |
|---|---|---|---|---|
| | | | | and antioxidant |
| Jamun | *Syzygium cumini* (L.) Skeels | Myrtaceae | Tree | Used in diabetes and stomach disorder |
| Khamhar | *Gmelina arborea* Roxb. | Verbenaceae | Tree | Cure piles, abdominal pains, burning sensations and fevers |
| Rohini | *Soymida febrifuga* | Meliaceae | Tree | Treating leucorrhoea and menorrhagia |
| Karanj | *Pongamia pinnata* | Leguminosae | Tree | Cure skin disease |
| Maida | *Litsea glutinosa* | Lauraceae | Tree | Cure stomach disease |

Assessment of medicinal flora and their documentation are key steps to generate the information related to their availability/abundance, distribution, utilization pattern and for the conservation need according to their status. The information gathered from the BWS showed very diverse nature of medicinal flora which underlines the potential source of the ethno botanical research, need for the documentation and will attract the attention of ethno botanists, phytochemists and pharmacologists for further investigation of medicinal plants present in the BWS. The conservation of these resources along with the traditional information should be given utmost importance to prevent the rapid loss of medicinal plants.

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# Indigenous medicinal plants used in the healing of urinary tract infections and kidney stones

**Dr. P. Shivakumar Singh[1] and Dr. D.S.R. Rajender Singh[2]**
[1]Department of Botany, Palamuru University, Mahabubnagr-509001, Telangana State, India.
[2]SV Government UG and PG College, Palem, Mahabubnagr Dist, Telangana State, India.

## Abstract

The current report is rigorous on the ethnic knowledge of medicinal plants curing in kidney disorders by pastoral people of Telangana, India. A total of 14 species were recorded as natural therapeutic plants treating in kidney disorders. Out of these individual's species, representing 10 families. The utmost, herbs were in the information are considered. In the present results the importance of the wild leafy vegetables plants wisdom has been observed. Except efforts are ended to educate the further generations about their importance, it may be vanished in future. This variety of information might contribute comprehensively in modern drug designing or in government policies to progress modern innovative drug design systems in rural, folkloric areas, and in the improvement of advance formulas with reference to feral medicinal pants.

**Introduction**

The importance of indigenous medicinal plants in treating urinary infections has not been documented perfectly from rural, folkloric background of Indian society. India has been considered a rich in biodiversity of medicinal plants and their aboriginal intelligence (Piermattei *et al.*, 2006). Kidney disorders like stone formation are very common in around the Mahabubnagar. Due to high concentrated calcium oxalate, pH of soil is different than other areas of the same district. The prevalence of Kidney stones and urinary disorders are 1-5%. Many modern medicinal therapies like surgical techniques, shock waves and medicines are available for the treatment of this disease but they are very expensive and having many side effects. So there is no suitable medical therapy is available for such stone disorder, it is very important to show an interest in indigenous system of medicine and traditional herbal remedies which are regarded as quite safe with no side effects and should be cost effective, readily available and easily affordable. Kidney stones and urinary disorders are most painful conditions and have been affected people for several centuries. Ancient Vedic literature describes stones as Ashmari. A large population of India suffers from urinary tract and Kidney stones, formed due to deposition of Calcium, Phosphate and oxalates. These stones may persist for indefinite time, lead to secondary complications causing serious consequences to patient life. It is very painful and proper cure is needed to get rid of the problem (Mishra and Kumar, 2000). Appropriate and timely treatment of kidney stones can prevent severe complications such as kidney failure. Stone in the urinary tract are common disorders because urine is a chemical solution that contains a large number of chemical substances. These substances can crystallize easily and then grow in size to form stones (Ramaiah, 2005). Though treatment of urinary tract and kidney stone is revolutionized by the development of non invasive methods of stone disruption

but the patients always try to refrain from surgical procedures. Moreover, it also carries the factors like high cost, availability, side effects etc: the recurrence rate is approximately 50-80% (Zaidi *et al*., 2006). As no suitable medical therapy is available for such stone disorders, it is imperative to search for some new or less known medicinal plants, which are potential source for new bioactive compounds of theraptic value.

The current work is an effort to document and analyze the ethnic facts concerning the custom and exploit of indigenous medicinal plants in healing in treating urinary infections. So that the present work carried out Mahabubnagar district head quarter villages of Telangana.

**Methodology**

A digit of countryside trips were undertaken in south districts of study area (Fig. 1). At each one time of trip, diverse folkloric and forest or rural people's information was collected in different seasons. The information was accrued after discussions with several users like village head, elder women and other local informants. Repeated interviews through questionnaires were made in diverse villages to substantiate the information. Plant specimens were collected and identified with regional floras (Gamble, 1928; Pullaiah and Chennaiah, 1997; Pullaiah and Moulali, 1997; Pullaiah, 2015).

The study area Telangana is one of the southern states of India. This region is situated in the central stretch of the eastern seaboard of the Indian Peninsula. Telangana has an area of 114,840 square kilometers (44,300 sq mi). The area is divided into two main regions, the Eastern Ghats and the plains. Telangana lies between 15 50' – 19 55' North latitudes and 77 14' – 78 50' East longitudes. Telangana is bordered by the states of Maharashtra to the north and north-west, Karnataka to the west, Chattisgarh to the north-east and Odisha to the east and Andhra Pradesh to the south. The state is drained by two major rivers, with about 79% of the Godavari river catchment area and about 69% of the Krishna catchment area, but most of the land is arid. It is an extensive plateau with an average elevation of about 400 m above sea level. This plateau consists mainly of the ranges of erosion surface: (i) above 600 mt, (ii) from 300 – 450 mt and (iii) from 150 – 300 mt. The State Telangana has the monsoon type of tropical climate. On the whole State enjoys warm climate. In northern Telangana tropical rainy type of climate prevails. Hot Steppe type of climate is noticed in the southern parts of the State. In Tropical Rainy type, the mean daily 0 temperature is above 20C with an annual rainfall of 150 to 200 cms, mostly in summer and South-West monsoon. In the Hot Steppe type, the mean daily temperature is 18C and less. In the state of Telangana Maximum temperature in the summer season varies between 37C and 44C and minimum temperature in the winter season ranging between 14C and 19C. The State has a wide variety of soils and they form into three broad categories - red, black and laterite. The type of forests met within Telangana, as per the classification of Champion and Seth are Tropical moist deciduous forests, Southern dry deciduous forests, Northern mixed dry deciduous forests, Dry savannah forests and Tropical dry evergreen scrub. In the Telangana there is about more than 20

**Table-1: The important wild plants list in the healing of urinary tract infections and kidney stones.**

| Botanical name | Family | Habitat | Local name | Part Used |
|---|---|---|---|---|
| *Abutilon indicum* (Linn.) Sweet. | Malvaceae | Climber | Thuthura benda (Telugu), Athibala (Hindi). | Root tips |
| *Aegle marmelos* L. Corr. | Rutaceae | Tree | Maaredu (Telugu), Beel patr (Hindi). | Fresh bark peel |
| *Amaranthus spinosa* L. | Amaranthaceae | Herb | Nalleru (Telugu), Adak dathura (Hindi). | Arial part |
| *Argemone mexicana* L. | Papaveraceae | Shrub | Zeeripothu Allamu (Telugu), Bharbandh (Hindi). | Roots |
| *Cassia fistula* L. | Caesalpinioideae | Herb | Nela Thangedu (Telugu), Amalthas (Hindi). | Bark peel |
| *Celosia argentea* L. | Amaranthaceae | Herb | Gunugu (Telugu), | Leaves |
| *Cocculus hirsutus* (L.) Diels | Menispermaceae | Herb | Cheepuru theega (Telugu), Bajar bele (Hindi). | Un-ripened Fruit |
| *Phyllanthus emblica* L. | Euphorbiaceae | Shrub | Usiri (Telugu), Amla (Hindi). | Leaves Fruit |
| *Phyllanthus fraternus* Webster, | Euphorbiaceae | Herb | Neela Usiri (Telugu), Avla (Hindi). | Young leaves, Green stem |
| *Sesamum indicum* L. | Pedaliaceae | Herb | Nuvvulu (Telugu), Thil (Hindi). | Roots, Stem bark |
| *Tinospora cordifolia* (Willd.L). | Menispermeaceae | Climber | Thippa theega (Telugu), Guloye (Hindi). | Olden leaves, Seeds |
| *Ricinus communis* | Euphorbiaceae | Shrub | Aamudmu (Telugu), Irandi (Hindi). | Roots, Stem Bark |

tribes were recorded. Commonly they are located hilly and interior forest areas (Singh and Singh, 2016). The research report focusing on a number of the important wild medicinal plants, which need to be documented for diverse usages in future.

**Results**

Sums of 7 species were recorded as wild medicinal plants. Of these species, 7 species belongs to the 7 families representing single species from each of them. The maximum, herbs were in the information are considered. In the present results the importance of the wild medicinal plants wisdom has been observed. Except efforts are ended to educate the further generations about their importance, it may be vanished in future. This kind of reports could donate extensively in Government policies to progress medicinal

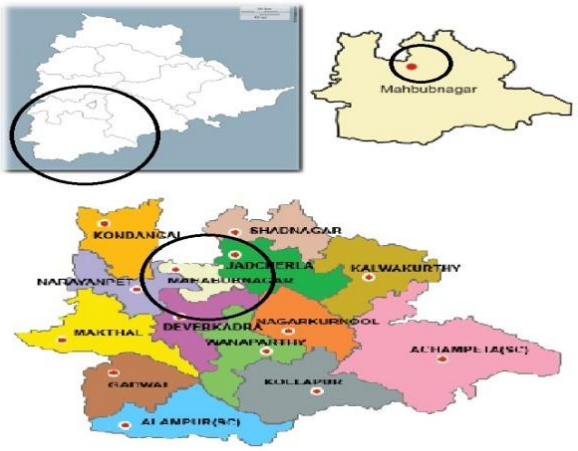


**Figure 1: The study area: Around the Mahabubnagar head quarter**

Plants knowledge conservation schemes in rural, folkloric areas and in the improvement of ancestors wisdom protecting and its importance in innovative drugs system.

A number of 14 species were recorded as natural therapeutic plants treating in kidney disorders. Out of these individual's species, representing 10 families. The utmost, herbs were in the information are considered. In the present results the importance of the wild leafy vegetables plants wisdom has been observed. Except efforts are ended to educate the further generations about their importance, it may be vanished in future. This variety of information might contribute comprehensively in modern drug designing or in government policies to progress modern innovative drug design systems in rural, folkloric areas, and in the improvement of advance formulas with reference to feral medicinal plants.

***Abutilon indicum* (Linn.) Sweet.**

***Aegle marmelos* L. Corr.**

***Amaranthus spinosa* L.**

*Argemone Mexicana L.*

***Cassia fistula* L.**

***Celosia argentea* L**

***Cocculus hirsutus***

***Phyllanthus emblica L.***

***Phyllanthus fraternus***

***Sesamum indicum* L.**

***Tinospora cordifolia* (Willd.L).**

***Ricinus communis***

**Conclusion**

In the instantaneous the population is increasing profusely, at the same time people are forgetting their traditional information. This will be possessions on future health care. Consequently, steps are needed to undertake extensive education about their importance as a medicinally importance and as a direct and indirect source of maintenance in health care system for the poor families. A very few of the wild plants are available in the treating of treating urinary infections. So, efforts must be affianced to safeguard indigenous medicinal plants and also the rural intelligence for expectations health care systems.

**Acknowledgement**

Authors are grateful to rural, folkloric; ethnic peoples of around the villages of Mahabubnagar head quarter of Telangana for contribution their secret information.

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# Technological impacts in forestry

**S. Suresh Ramanan[1] and R. Deepak Kumar[2]**

[1]Department of Silviculture and Agroforestry, College of Forestry, Kerala Agricultural University.
[2]Department of Forest Management and Utilization, College of Forestry, Kerala Agricultural University.

**Abstract**

Technological development creates new opportunities and structures and increases efficiency. Despite the importance of technological development, it has rarely been the focus of research in the forestry. It is often taken as a given, like an "externality" that falls from heaven. This is probably partly due to the difficulties related to the phenomenon itself. The scope of technological development and its impacts are often dauntingly large. Technological changes may alter forest industries, as well as forest management, utilization, and growth. Yet there are many inclusion of technology in the forestry sector i.e. field of nursery management, monitoring of the forest area, protection wing, etc.

This paper is comparison of production efficiency achieved by the adoption technologies in certain instances with the area where the technology is yet to be adopted. This paper on the whole gives as a detail picture about the various technology available, its adoption and nature of usage in India and an elaborative picture about the failure of adoption of technology by the stakeholders and a solution for it.

**Introduction**

Human are the most oddment creature in the process of Evolution who never stopped questioning. The basic nature of question leads him to find answers, somewhere answered by science. Ultimately the humans used it, the scientific reason for their betterment of life-Technology. In the era of Technology, Forestry sector has too evolved itself. Yet, the reach of technology in the various sector of the forestry is in Stone Age. The various stake holders in the forestry sectors can be categorized into Farmers, Industries and Government Institutions (Parthiban, 2011).

Among the three sectors each sector is heavily impacted with the intervention of technology leading to the production efficiency will be depicted in this paper with few examples. In the producer sectors we will take the case studies in paper products and nursery production

**Dynamic forestry sector**

Nature is always in dynamic equilibrium. Forest are not an exceptional to it, they are not static. Similarly the forestry sector has highly adapted to technologies throughout the changes in time. Wooden ships were affected by timber decay that led to timber preservation but with the advent of the iron steel majority of demand for wood for ship building got reduced gradually. This has not limited the forestry sector, due to increased trade and communication the demand for pulp and paper soared like anything. Yet again, a challenge for the forest sector to find new ways to utilize wood and fibre. This is a typical example forestry is integrated into the consumption and livelihood cycle.

Interesting feature in the process of the technology development is the different phase involved in it. They are invention or discovery, implementation and diffusion for wide usage- Extension (Grubler, 1998).

As per Frenken and Faber (2009), technological development is mainly due to the interaction between technology and technological innovation system. This has led to the establishment of well-developed heuristic framework for science and innovation (Hekkert and Negro, 2009). The transition management theory developed by Dutch Social researchers is one good example for it (Kemp *et al*, 2007)

**Case studies**

**Farmers as stakeholders**

According to Arnold and Dewees (1997) has classified the pattern of tree management among farmers as those who maintained trees on non-arable or fallow land, Trees grown around the house Trees growing along boundaries and in other interstitial sites, Intercropping on arable land, Mono-cropping on arable land (farm woodlots).

Among them various management pattern Intercropping on arable land and mono-cropping on arable land has proved to be more beneficial due to the present day monsoon variation and acute labour shortage problem (Sekar and Karunakaran, 1992).

As per National Forest Policy 1984, no more felling in Natural forest for industrial purpose. These wood based industries have to meet out their raw material. Upon implementation many forest based industries has either to import the raw material that lead to loss of many industries (Rathakrishnan, 1993).

The above said condition prevailed in Tamil Nadu but due to intervention of the technologies from Forest College and Research Institute there has significant increase in number of tree growers which automatically enhanced the performance of wood industries (Parthiban, 2011) A Value Chain on Industrial Agroforestry in Tamil Nadu" has been implemented in a consortium mode involving two paper industries (Tamil Nadu Newsprints and Papers Limited, Kagithapuram, Karur and Seshasayee Paper and Boards Ltd, Erode) and one match industry (Vasan Match Works, Vellore). The project has designed bi-partite, tri-partite and quad-partite model contract farming system involving farmers, research institutes, wood based industries and financial institution as stake holders. Among the various intervention listed in the project report the main success for the project is the farm out reach that led to the improvement of Live of the beneficiaries about 6300 farmers. (NAIP, 2014)

**Industries and government institutions**

**Paper and pulp industry**

The paper industry has an important role to play on the Indian economy. The overall paper consumption in India reached 4.2 million tons in 2000, making India a large market from any perspective. The potential for per capita consumption increase, originated on economic growth, increasing purchasing power and emerging export-led industries, attracts companies to invest and modernize. The increasing demand for paper puts pressure into supply of papermaking fibres, including efficient recovery of recycled paper, use of non-wood raw materials and the need to develop and expand sustainable use of wood

The Indian paper industry ranks 15$^{th}$ globally in terms of size, but accounts for only 2% of the world's production. Paper consumption in India has reached 9 million tons per annum (m tpa). However, the industry is highly fragmented with a capacity range from 2 to 800 tons per day (tpd). Paper consumption in India is

expected to grow to 14m tpa by 2015 (Thapar, 2009).

As per National Forest Policy the industry has to meet its own raw material from any other sources (Lal, 2000) but not from the natural Forest, so the industries have launched a massive social / agro forestry scheme which increased planted area from 19,000 ha planted in 2001 to 250,000 ha in 2009. The industry will need 1.2 – 1.5 m ha of Plantation area in the future.

**View in Tamil Nadu paper and pulp industries**

There are about 600 paper mills in India and about 39 paper industries in the state of Tamil Nadu and in which two industries are wood based and the remaining industries are based on agricultural waste or other sources of fibre. The two industries viz., Tamil Nadu News Prints and Papers Limited (TNPL), Karur and Seshasayee Paper and Boards (SPB), Erode use predominantly hardwoods like Eucalyptus and *Casuarina* as a raw material.

Constraints for any Industry

1. Raw Material
2. Labour
3. Capital

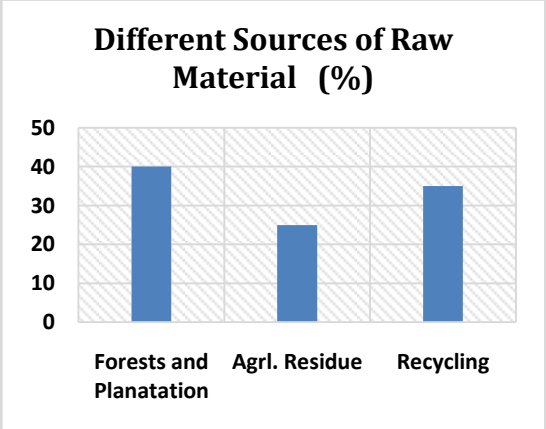
**Among these first one threatens the industry to greater extent**

These two paper industries required nearly 4.0 lakh tonnes of wood pulp and most of the raw material requirement is met from the Forest Department and partly from farm lands. Currently, both the industries have expanded their paper production capacity, which ultimately resulted in the wood pulp demand of nearly 8.0 lakh tonnes per annum against the actual availability of around 3.5 to 4.0 lakh tonnes of wood pulp and if we take in Indian scenario the view will be terrific.

This issue was sorted due to intervention of Technology and Extension program by Forest College and Research Institute, Mettupalayam, Tamil Nadu. As farmers prefer short rotation fast growing species for obvious reasons like market uncertainties and need for early returns, paper industry promoted mainly eucalypts and to some extent Acacia spp; Casuarina (*Casuarina equisetifolia*) (Saigal *et al.*, 2002). Combined with farmers interest incorporating agroforestry and contract model has led to the success of the programme (Lal, 2004)

**Conclusion**

New technologies and innovations applied to the forest sector are increasingly needed to enhance sustainability. Since the early 1990s and the Rio Conference, there has been a re-orientation of economic and social activities towards sustainability. This trend has been labeled in the technological change literature as a process of sustainable socio-technical change, industrial transformation, and technological transitions (Hekkert and




Negro, 2009). In this literature, the emphasis is on the development of new policies, institutional changes, and wide-reaching system changes that transform societies away from unsustainable patterns to sustainable ones.

In the forest sector, the above line of thinking has materialised in new

technology-driven innovation programs. In India, forest sector-related technology programs have been started in recent years. The background and motivation for these programs stems from the structural change taking place in the forest sectors in these countries. Given this state of things, the forest sectors in our countries seek to innovate and re-direct their businesses in ways that provide new benefits for various stake holders.

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# आम (मेन्जीफेरा इंडिका): खास है

डॉ. ममता पुरोहित एवं डॉ. राजेश कुमार मिश्र
उष्णकटिबंधीय वन अनुसंधान संस्थान, जबलपुर (म.प्र.)

भारत में आम एक विशिष्ट फल माना जाता है क्योंकि यह अपने रंग एवं स्वाद की विविधता, सर्वत्र उपलब्धता एवं गुणों के कारण सभी वर्गों की विशेष पसंद है। आम की उत्पत्ति भारत में हुई, यहीं से यह आम के प्रेमियों के माध्यम से विश्व के बहुत से उष्ण कटिबंधीय देशों तक पहुँचा। ऋग्वेद और यजुर्वेद मे कई जगहों पर आम का उल्लेख मिलता है। प्राचीन मूर्तियों में आम और उसकी पत्तियों के चित्र मिलते है। हमारे प्राचीन ग्रंथो एवं लोककथाओं में आम के दृष्टांत वर्णित है। महाकवि कालिदास ने अभिज्ञान शंकुलतम नाटक में आम वृक्ष और मालती लता का विवाह शकुंतला और उसकी सखियों से संपन्न करवाया है। 7 वीं शताब्दी में भारत भ्रमण पर आये चीनी यात्री ह्वेन सांग ने अपनी यात्रा वृतांत में आम का वर्णन किया है। बादशाह अकबर ने बिहार में दरभंगा के पास आम के एक लाख पेड़ लगवाये थे। जिसे लक्खी बाग कहा गया। यह लक्खी बाग आज भी मौजूद है।

आम को क्षेत्रीय भाषाओं में अलग-अलग नामों से जाना जाता है। इन सभी नामों की उत्पत्ति संस्कृत के आम्र शब्द से हुई है। आम का वानस्पतिक नाम *मेन्जीफेरा इंडिका* है। भारतवासी आम से लगभग चार हजार वर्षों से परिचित है। वर्तमान में यह भारत के अतिरिक्त थाईलैण्ड, चीन, मलेशिया, मैक्सिको, फिलीपिंस, इंडोनेशिया, आस्ट्रेलिया, दक्षिणी अमेरिका तथा वेस्ट इंडीज में रोपित किया जा रहा है। आम का उत्पादन उन क्षेत्रों में अधिक होता है जहां चार महीने की वर्षा के पश्चात साल भर शुष्कता बनी रहती है। आम के वृक्ष की उम्र लगभग सौ वर्ष की मानी जाती है। अनुकूल परिस्थितियाँ होने पर आम प्रतिवर्ष फल देता है परन्तु चार- पाँच वर्षो में एक बार आम के वृक्ष में सामान्य से अधिक फल लगते हैं। बसंत ऋतु में आम के बौर (फूल) आना प्रारंभ हो जाते हैं तथा ग्रीष्म ऋतु तक फल लगने की प्रक्रिया सम्पन्न हो जाती है। बौर लगते समय यदि वातावरण में नमी रहे तो कीट संक्रमण का भय रहता है तथा पैदावार भी कम होती है।

**आम की प्रजातियाँ**

भारत में आम की एक हजार से भी अधिक प्रजातियाँ हैं लेकिन व्यावसायिक दृष्टि से 30 से 40 प्रजातियों को ही विशेष रूप से रोपित किया जाता है। कुछ प्रजातियाँ जैसे फजली, दशहरी, लंगडा, चौसा आदि बहुत प्रसिद्ध हैं। भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली द्वारा विकसित प्रजातियाँ आम्रपाली और मल्लिका इस समय लोकप्रियता के शिखर पर हैं।

इन्हें उत्तरी भारत की तथा दक्षिण भारत की मशहूर प्रजाति नीलम के संकरण से बनाया गया है। इसी तरह फल अनुसंधान केन्द्र, गरेला में नीलम और

अल्फांसों के संकरण से रत्ना प्रजाति विकसित की गई है । फल अनुसंधान केंद्र, सेनगरेडी में रूपानी और नीलम के संकरण से मंजारा प्रजाति विकसित की गई है । महाराष्ट्र कृषि विश्वविद्यालय, परभनी द्वारा सन् 1985 में निरंजन प्रजाति जारी की गई । इस प्रजाति में फूल जून - जुलाई माह तथा फल अक्टूबर माह में तैयार होते हैं । गुजरात कृषि विश्वविद्यालय, पारिया द्वारा नीलफांसों, नीलशान तथा नीलाखरी प्रजातियाँ विकसित की गई हैं । नीलफासों प्रजाति नीलम और अल्फांसों के संकरण से, नीलशान प्रजाति नीलम व बानेशान के संकरण से तथा नीलाखरी प्रजाति नीलम व दशहरी के संकरण से तैयार की गई है । इसी तरह तोतापरी, बंबईया, सफेदा, लखनवी, कजरी, शाही, जहांगीरी, बगनापल्ली आदि लोकप्रिय प्रजातियाँ हैं । बगनापल्ली प्रजाति का गूदा मीठा तथा हल्का सफेद होता है ।

अंतर्राष्ट्रीय बाजार में आम की लोकप्रियता को देखते हुए सन् 1972 में लखनऊ में आम अनुसंधान केंद्र स्थापित किया गया । सन् 1984 में इसका नाम बदलकर केंद्रीय उत्तर मैदानीय उद्यान अनुसंधान संस्थान, लखनऊ कर दिया गया । संस्थान का मुख्य काम आम के प्रजनन, उन्नत किस्मों का उत्पादन, सुरक्षा, रखरखाव आदि विषयों पर अनुसंधान करना है । यहाँ आम की लगभग 500 प्रजातियों के जननद्रव्य (जर्मप्लास्म) संग्रहित किये गये है । भारतीय उद्यान अनुसंधान संस्थान, बैंगलूर द्वारा आम की आई.आई.एच.आर. 10, आई.आई.एच.आर. 13, तथा आई.आई.एच.आर.17 प्रजातियाँ विकसित की गई हैं ।

**पौध तैयार करना**

आम की पौध निम्नलिखित विधियों द्वारा तैयार की जाती है:

**बीजों द्वारा**

साधारणतः आम के पौधों को गुठलियों (बीज) से तैयार किया जाता है । मई-जून माह में इसकी गुठलियाँ (बीज) प्राप्त हो जाती है । पर्याप्तरूप से सुखाई गई गुठलियों (बीज) को 15 X 20 से.मी. माप की पोलीथीन की थैलियों में मृदा मिश्रण (खादःरेतःमिट्टी :: 1:1:1) भरकर 1 से 3 से. मी. की गहराई में बोकर मृदा मिश्रण से ढक दिया जाता है । इन गुठलियों (बीज) में 10 से 15 दिनों में अंकुरण हो जाता है । जुलाई माह के अंतिम सप्ताह तक आम की 30 से 40 से .मी. लंबाई की रोपित करने योग्य पौध प्राप्त हो जाती है ।

**वर्धी प्रजनन द्वारा**

मातृ वृक्ष के वृद्धि भागों से पौध बनाने की विधि वर्धी प्रजनन कहलाती है । आम में निम्नलिखित वर्धी प्रजनन विधियों द्वारा पौध तैयार की जाती है:

**ग्राफ्टींग द्वारा**

इस कार्य के लिए सितम्बर-अक्टूबर माह में डेढ़ से दो

वर्ष पुराना आम का स्वस्थ्य पौधा लेते हैं । इस पौधे पर जिस प्रजाति के आम का पौधा ग्राफ्ट करना होता

है उसकी शाखा को एक सप्ताह पहले पत्ते विहीन कर वृक्ष पर ही लगी रहने देते है। एक सप्ताह बाद शाखा को काटकर, इन्डोल ब्यूटरिक एसिड (आई. बी. ए.) 200 पी.पी.एम. के घोल में डुबाकर या रूटेक्स पावडर लगा कर पोषित पौधे पर तेज धार वाले चाकू आदि से खांचा बनाकर फिट कर देते हैं। तत्पश्चात ग्राफ्ट किये गये भाग को पोलीथीन की पट्टी से इस तरह से बांध देते है कि जोड़े गये भाग से पानी एवं वायु प्रवेश न कर सके। इस विधि से 2 से $2_{1/2}$ माह में शाखाओं युक्त पौधा प्राप्त हो जाता है।

**एयर लेयरिंग द्वारा**

सितम्बर-अक्टूबर माह में लगभग एक वर्ष पुरानी ओजपूर्ण, स्वस्थ्य शाखा को छीलकर, छिले हुए भाग पर सोलराइट और रूटेक्स पावडर से बने मिश्रण को पोलीथीन की सहायता से बाँधकर छोड़ देते हैं। इस भाग को पोलीथीन की पट्टी से इस तरह से बांध देते है कि छिले हुए भाग से पानी व वायु प्रवेश न कर सके। तत्पश्चात 1 से $1_{1/2}$ माह में इस छिले हुए उपचारित भाग से जड़ें निकल आती हैं। अब जड़ों वाली शाखा को मातृ वृक्ष से काटकर मृदा मिश्रण (मिट्टीः गोबर खादः रेत :: 1:1:1) से भरी 15x20 से. मी. माप की पोलीथीन थैलियों में लगा देते है। इस तरह तैयार की गई पौध को चार माह तक रोपणी में रखकर वृक्षारोपण स्थल पर रोपित कर देते हैं।

**लाभ**

वर्धी प्रजनन के निम्न लिखित लाभ हैं:

1. मातृ वृक्ष के समान गुणों वाली पौध प्राप्त होती है।
2. जल्दी फल देने वाली सन्तती प्राप्त होती है।
3. लागत तथा समय की बचत होती है।

**वृक्षारोपण स्थल का चयन एवं वृक्षारोपण**

रोपण स्थल का चयन करते समय निम्नलिखित सावधानियाँ अमल में लाना चाहिए:

1. पानी के निकास की उत्तम व्यवस्था हो।
2. भूमि चट्टानी नहीं होना चाहिये।
3. पौध स्थापित होने तक पशुओं से सुरक्षा हो सके।

**गड्ढे तैयार करना**

आम का सघन वृक्षारोपण करना हो तो 7 x 7 मीटर की दूरी पर अप्रेल-मई माह में 90x 90 x 90 से.मी. माप के गड्ढे तैयार कर लेना चाहिए। इस समय खोदे गये ग़ड्ढों से निकली हुई मिट्टी सूर्य के तेज प्रकाश व गर्म हवाओं से भुरभुरी, वायवीय तथा हानिकारक जीवाणुओं से रहित हो जाती है। गड्ढा खुदाई करते समय मिट्टी यदि उपजाऊ नहीं लगे तो गड्ढे से निकाली हुई मिट्टी में 1:1:1 के अनुपात में गोबर खाद, रेत व मिट्टी मिलाकर मृदा मिश्रण तैयार कर लेना चाहिए। आवश्यकता होने पर 20 से 30 किलोग्राम अतिरिक्त गोबर खाद एवं 500 ग्राम बी.एच.सी. पावडर भी मृदा मिश्रण में मिला देना चाहिए। ध्यान रहे कि गोबर खाद पका हुआ हो, नहीं तो दीमक लगने का खतरा अधिक रहता है। खेतों की मेढ़ या सड़क के किनारों पर आम के पौधे रोपित करना हो तो ग़ड्ढों की दूरी कम से कम 10 मीटर होनी चाहिए।

**पौध रोपण**

जुलाई से अगस्त माह के प्रथम सप्ताह में कम से कम 60 से. मी. लम्बाई के पौधों को खोदे गए गड्ढों में रोपित करके गड्ढों को मृदा मिश्रण से भरकर, मृदा

मिश्रण को पौधों के चारों तरफ़ अच्छी तरह दबा देना चाहिए तथा जमीन की सतह से 15 से 20 से. मी. ऊपर 60 से. मी. व्यास का थाला बनाना चाहिए। थालों में पानी नहीं भरना चाहिए अन्यथा पौधों के सड़ने का खतरा रहता है।

**आम के वृक्षों की सुरक्षा**

- यदि वृक्षों में शाखाऐं टूटी, सूखी एवं उलझी हुई हो तो शाखाओं को छटाई - कटाई के द्वारा अलग कर दें। इससे वृक्ष हवादार बनेगे एवं उसके सभी हिस्सों में सूर्य प्रकाश पर्याप्त मात्रा में पहुँचेगा।
- आम के वृक्ष में फूल एवं फल पुरानी शाखाओं में बहुतायत से आते है। अतः यह आवश्यक है कि वृक्ष की आवश्यकतानुसार छटाई की जाये। जिससे वृक्षों को सही आकार, वृद्धि एवं फैलाव मिलेगा।
- समस्त कटे एवं घाव वाले हिस्सों पर डामर भरने से पेड़ के सड़ने का खतरा नहीं रहता है।
- चीटियों, रसचूसक (टिड्डी) आदि कीटों से सुरक्षा के लिये कीटनाशकों जैसे इण्डोसल्फान, मैलाथियान आदि का 0.05 से 0.1 प्रतिशत का घोल बनाकर छिड़काव करना चाहिए।
- वृक्षों के नीचे से कूड़ा-करकट, सड़े एवं सूखे फल आदि को एकत्रित करके वृक्ष से दूर ले जाकर जला देना चाहिये।
- वृक्षों के नीचे बी.एच.सी. पावडर का घोल बनाकर प्रतिवर्ष छिड़कना चाहिये जिससे हानिकारक कीटाणु आदि नष्ट हो जायें।
- वृक्ष के तने की जमीन से 3-4 फीट की ऊँचाई तक चूने से पुताई प्रत्येक मौसम में करना चाहिये।
- आम के वृक्षों में आकार के अनुसार प्रतिवर्ष आवश्यकतानुसार गोबर की खाद, स्फूर एवं पोटाश के अलावा नाइटोजन भी थाले में डालकर हल्की गुड़ाई करके सिंचाई करना चाहिए।
- यदि कीट-पंतगों का प्रकोप हो तो नीम की खली बारीक पीसकर आवश्यकतानुसार थालों में डालना चाहिए।
- वृक्षों के आसपास पानी के निकास की उचित व्यवस्था होनी चाहिए ।

**उपयोग**

आम का पूरा वृक्ष उपयोगी होता है। आम की पत्तियों, छाल तथा तने में जीवाणु प्रतिरोधक गुण पाये जाते हैं। पका हुआ आम विटामिन ए तथा विटामिन सी का उत्तम स्रोत होता है। यह

विभिन्न खनिज लवणों तथा पाटेशियम का भी एक अच्छा स्रोत है। प्रोटीन व वसा इसमें नहीं के बराबर में पाये जाते है। आम के प्रचलित उपयोग इस प्रकार हैं:

- आम एक उर्जादायक फल है। सौ ग्राम आम खाने से लगभग 6 किलो केलोरी उर्जा प्राप्त होती है।
- कच्चे आम से अचार, चटनी , अमचूर आदि बनाया जाता है तथा पके हुये आम का प्रयोग आईसक्रीम, मैंगो शैक, जैम, जैली, मुरब्बा, आम पापड़, आमरस आदि बनाने के लिये किया जाता है।
- लू लगने पर कच्चे आम से तैयार किये गये पेय (पनहा) को पिलाने का प्रचलन भारत वर्ष के सभी क्षेत्रों में है।
- सामान्यतः भारत के गामीण क्षेत्रों के बच्चों में पाये जाने वाले नेत्र संक्रमण, रतौधी तथा अंधेपन से बचाव में आम की अहम भूमिका रहती है क्योंकि पके आम में विटामिन ए व सी भरपूर मात्रा में होता है। विटामिन ए त्वचा व नेत्रों के स्वास्थ के लिये अनिवार्य पोषक तत्व है।
- आम में पाया जानेवाला विटामिन सी दांतों को मजबूती प्रदान करता है एवं हड्डीयों को लचीला बनाता है।
- आम की गोंद पौष्टिक व शक्तिवर्द्धक होने से औषधियों में उपयोग की जाती है।
- आम की गोंद चिपकाने (एढेसिव) के काम आती है।
- आम की लकड़ी का उपयोग दरवाजे तथा खिड़कियों के पलड़े बनाने में किया जाता है।
- बैठने हेतु पटा, तखत व बेलन-चौकी आदि बनाने में आम की लकड़ी उपयोग की जाती है।
- फर्नीचर बनाने में आम की लकड़ी उपयोग की जाती है।
- आम की लकड़ी का उपयोग हवन की समिधा के रुप में किया जाता है।
- आम की पत्तियों से बंदनवार व कलश को सजाया जाता है।
- आम की पत्तियों से पातल बनायी जाती है।

**उपसहांर**

आम हमारी संस्कृति और सभ्यता का प्रतीक है। सरकार को चाहिए कि आम के प्रचार और प्रसार के लिए आम उत्पादकों की कठिनाइयों का निराकरण करें तथा आम के विभिन्न किस्मों के वृक्षों के वृक्षारोपण हेतु ग्राम पंचायत, समाज सेवी संगठनों, गैर शासकीय संगठनों, कृषि विभाग तथा वन विभाग के माध्यम से जनमानस को जागरुक करें। निजी भूमि, खाली पड़ी शासकीय भूमि, सड़क के किनारे, शाला परिसर, मंदिर परिसर, सार्वजनिक बाग-बगीचों आदि स्थानों पर वृक्षारोपण करवाने से फल उत्पादन द्वारा आर्थिक लाभ बढ़ने के साथ-साथ पर्यावरण सुधार एवं नैसर्गिक सौदर्य भी बढ़ेगा। अतः हम सभी का कर्तव्य बनता है कि हम आम के गुणधर्मो का हर संभव प्रचार कर आम के वृक्षारोपण को प्रोत्साहित व संरक्षित करें।

# Joint forest management: A program to conserve forest and environment

**Abhishek Raj[1] and M. K. Jhariya[2]**

[1]Department of Forestry, College of Agriculture, I.G.K.V., Raipur- 492012 (C.G.), INDIA

[2]Department of Farm Forestry, Sarguja University, Ambikapur-497001 (C.G.), INDIA

**Abstract**

Joint forest management (JFM) is a participatory process and two-way partnership between forest department and local inhabitant people inside or around the forest, helps to rehabilitate the degraded forests of the country and conserving the natural resources. The levels and degree of participation in this process is an important factor which are critical for the successful outcome of the process. Apart from livelihood support by forest, people also benefited in tangible and intangible way. Tangible benefits include timber for construction, fuel wood, pole; NTFPs like gum, Katha, catechu, Tendu patta etc but intangible benefits work as local ecosystem services i.e. amelioration of environment through closed and sustained nutrient cycling, watershed management and dwelling place of wild animals. Thus involvement of communities in conservation of forests and wildlife is of paramount interest. Thanks to JFM program for strengthening the two way partnership between people and state forest department which is working and based on managing these natural resources including forest treasure and maintain environment with biodiversity conservation.

**Introduction**

The increasing rate of forest depletion for fulfilling feed, fibre and fuel would necessitate the conservation of that natural precious resource. The inherent potential of traditional local communities to protect and manage the forest has emerged as a dominant paradigm. This envisaged an evolution of Joint Forest Management. The JFM is a system to plan that a willing and active partnership between the state and local communities to promote conservation through managing forest resources sustainably. It is a concept of developing partnerships between extreme forest user groups and the forest department (Chavan, 2013). Therefore, it is a successful participation by local community in managing forests in the country. Participatory management regime involving the government and local communities for regeneration of degraded forests through effective protection, sharing of produce and improving the livelihood opportunities of forest dependent communities. Legal backup to the JFM committees, participation of women in the JFM programme, extension of JFM in good forest areas, preparation of micro-plan in JFM areas, conflict resolution, and recognition of self initiated groups, contribution for regeneration of resources and monitoring and evaluation are major factor which contributes strengthening of JFM.

Raising plantations on degraded forest areas and regeneration of less degraded forests is a dominant activity under JFM in many states. In Uttara Kannada district of Karnataka, where JFM was implemented during 1993 - 2000. 12,050 ha of plantations have been raised on degraded forests till 1998-1999 and this accounts for

1.5% of the total forest and 28% of the open forest in the district (Bhat, *et al*., 2000). Therefore, this increased in area of forest helps to maintain the forest cover up to 33% given by National Forest Policy.

**Origin**

The origin of JFM is very clear. It's originated in west Bengal accidentally at the Arabari Forest Range in West Midnapore, near Midnapore town in 1971. A few years later, JFM was employed in the state of Haryana to prevent soil erosion and deforestation. The progress of JFM has been started with desire contribution of local communities through involvement in various activities related to forest development and protection that is envisaged by national forest policy, 1988. The policy also highlighted that the first charge of the benefits accruing from the forests will vest with the local communities. This radical shift provided a new dimension to forestry and the forest management in the country (Anon, 2008). Subsequently, JFM as a process of change involving local people in forest protection, regeneration and sustainable resource use emerged as inclusive and participatory mode of forest management. The immediate past system of forest management- Traditional forest management, also referred to as an 'Old Paradigm' or orthodox forest management where people were considered as outside, biotic-interference, anthropogenic pressures on forests with changed philosophy, the new paradigm, the JFM started recognizing the symbiotic relationship of people and forests and treating people as partners and stakeholders (Annamalai, 1997).

**Status**

In the year 1990 Indian National JFM guidelines were issued. 22 States are now implementing the programme. Joint Forest Management Committees (JFMC) covers more than 22 million hectors of forests spread across 28 States of India and union territories. JFM cover more than 18% of the total forest (Chavan, 2013). As per Bahuguna (2004) around 8.3 million families and 62 million people were managing the forests under JFM streams and only around 4 million ha of forests in 17 states were under JFM until 1998. The quality of forests, the socio-economic and cultural profile of local people, and role of grass root level political workers, the local economy, the market forces and attitude of the local foresters had a bearing on the success of JFM (Bahuguna, 2001). .

**Potential**

JFM has the potential to meet local subsistence needs, of fuel wood, fodder, other non-timber forest produce, small timber and timber etc., to provide livelihood through sale of produce, while at the same time, preventing degradation of the forests that provide local, national and global environmental benefits. Moreover, JFM helped to reduce illegal cutting of trees, reduce area under illegal encroachments, forest fire prevention and control by community involvement and to enhance the forest cover through a forestation program (Chavan, 2013).

**Promotion of agroforestry in JFM**

Promotion of agroforestry in JFM area can reduce the dependency of people on natural forest for their need of timber, fuel wood, firewood etc. Moreover, tree component of agroforestry produce tangible products in sustainable way. For example, incorporation of babul trees for gum production in agroforestry and babul based traditional agroforestry systems helps farmers to strengthen their socioeconomic conditions as well as to

help conserve environment and biodiversity too (Raj, 2015a). The central India forms one of the major ecosystems of the Indian subcontinent (Raj and Toppo, 2014; Toppo *et al*., 2014) and having store house of gum producing states (Raj *et al*., 2015; Das *et al*., 2014; Raj, 2015b). Likewise, due to importance of Neem in social forestry, agroforestry, reforestation and rehabilitation of the wasteland and degraded industrial lands it helps to combat desertification, deforestation and soil erosion and to reduce excessive global temperature (Jhariya *et al*., 2013). Therefore, Agroforestry contributes a vital role in Indian economy and has potential to satisfy three objectives, viz. to protect and ameliorate the environment, enhance sustainable production of economic goods on a long-term basis and improve socioeconomic condition of rural people (Jhariya *et al.*, 2015; Raj *et al.*, 2014). The poor, particularly the rural poor, depend on nature for many elements of their livelihoods, including food, fuel, shelter and medicines (Jhariya and Raj, 2014). In the present scenario of climate change, agro-forestry practices, emerging as a viable option for combating negative impacts of climate change (Singh *et al*., 2013). Apart from maintaining higher local species diversity, agroforestry practices also aid in meeting various biomass needs of the community and reducing the reliance on forests (Shastri *et al*., 2002).

**Socioeconomic upliftment and environmental amelioration**

Indeed JFM plays an important role in protection and management of forest and this forest biome has multifarious benefits for conservation and amelioration of environment. JFM is associated with its diverse economic, ecological, social and environmental benefits. Its impact is supposed to be felt in promoting environmental sustainability, economic betterment and sociopolitical empowerment of the poor rural masses inhabiting in forest fringe areas (Datta and Sarkar, 2010). A JFM institution, if intended to be implemented sincerely, needs be preceded by nurturing community participation with a proper reckoning of the socio-economic, political, cultural and ecological variables that influence the JFM (Mukherjee, 1998). Empirical findings in the context of Ludhi-Damgade district in Nepal reveal that participation in community forest management is influenced by socio-economic factors, which in turn determine the level of benefits obtained from forest resources (Maskey *et al.*, 2005). By the participation of local people, protection of forest becomes easier and effective in return tribal get benefited as valuable timber for construction, fuel wood, firewood, valuable NTFPs for their daily subsistence need in sustainable way. Therefore, JFM is environmentally viable, socially acceptable and plays an enviable role in upliftment of living standard of rural peoples/tribal. Government should make effective and updated policy in favour of successful JFM programme and this can be achieved through active participation of local people.

**Conclusion**

JFM is a new evolutionary idea for managing the exiting forests with a good partnership between village communities and state government. Both are benefited each other in the way of generation of employment to local communities and generation of revenue to state government. People should be aware about making a

great contribution for better management of forest by involving in JFM programme.

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# Mahogany (S*wietenia macrophylla*) - A promising tree for agroforestry

**R. Deepak Kumar and S. Suresh Ramanan**
College of Forestry, Kerala Agricultural University, Thrissur, Kerala – 680 656

## Introduction

Farmers of India have long tradition of maintaining trees along the annual crops. It by enhancing livelihood security of the farmers by various means i.e., food, fodder, medicine, fuel, income etc., It also helps the nation to protect the environment, supply of raw material to the industries and additional employment generation in rural areas. These efforts are most commonly successful but they are often lack adequate technical assistance and knowledge regarding overall management. Thus there is need enhancing knowledge on ecology, Silviculture and post-harvest technology for trees. Mahogany (*Swietenia macrophylla King.*) is native to the tropical regions of America which is imported to India and cultivated almost throughout of India (Luna, 1996). It is known for its superior-quality wood used for furniture and cabinet making.

## Ecology

Mahogany can able to adopt wide range of environmental conditions (Wightman et al., 2008). But it will perform better on deep, fertile well trained alluvial soils with neutral pH. It requires an optimum of 800-1500 mm annual rainfall with a dry period of four months (Luna, 1996).

## Description

*Swietenia macrophylla* is a very large deciduous tree which can reaches up to 30-40 m of height and 3-4 m of girth. *Swietenia macrophylla* has an umbrella-shaped crown. It has straight, cylindrical trunk with a buttressed at base. The bark is rough and flaking off in small patches.

## Biology

Leaves are paripinnate with 6-16 leaflets. Leaves are lanceolate, ovate and slightly oblique, up to 20 cm long when mature. Flowering and fruiting are distinctly seasonal; most commonly starts flowers in February. It has male and female flowers in single tree. In mixed inflorescences, male flowers open first, but self-pollination may occur. This tree may produce fruits once a year which woody capsule resembling a large inverted club. When it mature it dispersed by wind.

## Seed collection and nursery establishment

*Swietenia macrophylla* is propagated from seeds. Light coffee coloured pods are collected either from crown or ground. The pods are dried under the sunlight for four days. Pods are gently shaken and seeds are collected. It has 800 – 1500 seeds per kg. Viability lasts for only up to 7 months. The seeds are sown in a light sand bed in 3–7 cm deep and maintaining under adequate moisture and shade. Healthy seedlings are lifted and transferred to the containers.

## Field planting technique

Field is cleared from weeds and ploughed. Pit is taken 30 feet$^3$ with wider spacing of 4.5 x 4.5 m because it requires large amounts of light. Planting is done during June – July at start of monsoon when they are about 4-5 months old. Gap filling may be requiring in case of mortality of seedling. During the initial 2 years after field planting, weeding should at least once in six months. Removal of lower

branches, pest and disease infected parts were removed for first three years after planting.

**Pests and diseases**

The most serious pest of *S. macrophylla* is the shoot borer (*Hypsipyla robusta*), which is occurred in a plantation as well as nursery stage also (Orwa *et al*., 2009; Krisnawati *et al*., 2014). It results in poor bole form and a severe reduction in timber quality. *Orthene*, a systematic insecticide, has proved an effective chemical control of this pest (Mohandas, 2000). Throughout the Greater Antilles, the mahogany web worm, *Macallathyrsisalis*, causes defoliation and webbing.

**Uses**

The heartwood of mahogany is red-brown in colour. The wood is suitable for furniture, interior paneling, flooring; turnery, musical instruments, plywood (veneer) and construction work (Anoop *et al*., 2014). A gum is produced from cuts in the bark for markets in Bombay, India, it is marketed either in both pure form and also mixed with other gums. The bark of mahogany is used for dyeing and tanning leather. Oil can be extracted from the seed kernels which may have some commercial value.

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# Know Your Biodiversity

**Dr. Swaran Lata and Pradeep Bhardwaj**
Himalayan Forest Research Institute, Shimla (H.P.)

***Hystrix indica***

*Hystrix indica* is a large herbivore rodent. It is commonly known as Indian crested porcupine or Indian porcupine. It belongs to order Rodentia and family Hystricidae. It is found in southwest and throughout southeast and central Asia and in parts of Middle East. In India it is found in all the states in different habitats viz. tropical and subtropical dry deciduous forests, scrub, grasslands, dry montane forests, semi-deserts, caves, subterrenean habitats and agricultural lands. It is considered as a serious economic pest of crops and forest plantations but it also plays important role in pollination and dispersal of seeds.

It is large rodent with multiple layers of modified hairs (quills). The quills are brown or black with alternating white or black bands made of protein Keratin. Each quill is connected to muscle at it base which allows the porcupine to raise its quills when it feels threatened. The longest quills are found on neck and shoulder and the most rigid quills are found on the back and rump. Base of the tail contains short white quills with long hollow quills to produce sharp warning sound when threatened. It has broad hand and feet with long claws for burrowing. Sometimes we can see those chewing bones. Bones provide minerals (Ca, Mg etc.) for the growth of the spines.

It is nocturnal, semi fossorial and monogamous animal. Breeding period of Indian porcupine is February-March. Female gives birth to 2-4 offspring per year and the gestation period is 240 days. Young ones are born with their eye open and their body is covered with short soft spines. Its life expectancy is about 20 years. Main predators are large cats, caracals, wolves, striped hyenas and humans. It feeds on roots, bulbs, fruits, grains, succulent tubers and insects. *Allium cepa, Bombax ceiba, Brassica campestris, Dalbergia sissoo, Hordeum vulgare, Mangifera indica, Pinus roxburghii, Melia azedarach, Ziziphus mauritiana, Triticum aestivum* and *Zea mays* are the some of the examples of food plants of Indian porcupine.

Porcupines are serious pest of the traditional as well as non-traditional crops, including fruit orchards, vegetables, flowering plants, forages etc and for its proper management, burrow fumigation should be done through aluminum phosphide (3g) followed by second generation anticoagulant bait. In some parts of the country its meat is also eaten for its medicinal value. In Gujarat quills are fumigated for the respiratory problems in children and to cure mouth diseases of cattle. Dung of the porcupine is also used to cure skin problems in some parts of India.

It is given status Least Concern in IUCN Red List category because of its adaptability to wide range of habitats and food types. In India it is protected under schedule IV of the Indian Wildlife Protection Act 1972. Although its population seems stable but changing habitat quality due to construction of hydro power projects, grazing, overexploitation, pest control practices and other human induced disturbances may affect their population in near future. Hence conservation of its habitat is the only solution for maintaining its population stable in future.

***Chrysopogon zizanioides***

*Chrysopogon zizanioides* is native to India and commonly known as Vetiver or Khas-khas grass. *Vetiveria zizanioides* is its synonym. It belongs to order Poales and family Gramineae. The plant tolerates prolonged drought, survive under long seasonal flooding and grows over a wide range of soil pH. It is well known plant in South India and widely distributed in India, Bangladesh, Sri Lanka, Myanmar and spread from Southwest Asia to Tropical Africa. In India it grows wild in Haryana, Uttar Pradesh, Rajasthan, Gujarat, Bihar, Orissa, Madhya Pradesh and throughout South India. In Himachal Pradesh it is found in Kangra, Una, Hamirpur, Mandi, Paonta-Nahan and Nalagarh.

It is tall, stout, densely tufted, aromatic, perennial herb. The plant has rhizomatous stolen which gives rise to spongy, fibrous, dense root system and erect clums. The leaves are linear, narrow, erect, grassy, and glabrous with scabrid margins. Inflorescence is a panicle upto 15 to 45 cm long, narrow acute, appressed, awnless, sessile and somewhat flattened laterally with short, sharp spines. Spikelets are pale or reddish brown or purplish with 3 stamens and 2 plumose stigmas. Flowering and fruiting period is August-October.

It grows luxuriantly in areas with an annual rainfall of 800 -2000 mm and temperature ranging from 22 to 43 $^{0}$C. Marshy riverbeds with sandy loam are best suited for this grass. It is widely cultivated in the tropical regions of the world and in India it is cultivated in Rajasthan, Uttar Pradesh, Punjab, Kerala, Tamil Nadu, Karnataka and Andhra Pradesh for its scented oil as well as its ability to retain soil and prevent erosion. As the root system is fine structured, very strong and grows 3 m or 4 m deep within one year. These properties make it highly drought tolerant and helps to protect soil erosion.

Vetiver oil the most valuable and important raw materials in perfumery, soap, cosmetic and soft drink industries. Pure vetiver oil is known as '*Ruh-khus'* in market and it is obtained by steam distillation of roots. Vetivone, Zinanal and Epizizizanal are the major constituents in oil. In South Indian states it is cultivated mainly for vetiver oil. Roots are harvested at the age of 10-12 months. Because of its stimulant, diaphoretic, refrigerant, antimicrobial and anti-fungal properties it is extensively used in cosmetics and aromatherapy for relieving stress, anxiety, nervous tension and insomnia.

It contains active chemical constituents e.g Vetiverol, Vetivone, Khusimone, Khusimol, Vetivene, Khositone, Terpenes,

Benzoic acid,Tripene-4-ol, ß- Humulene, Epizizianal, vetivenyl vetivenate, iso khusimol, ß-vetivone, vetivazulene and used in traditional medicine as well as pesticides. In India Various ethnic tribes use it to treat various diseases viz. boils, burns, anemia epilepsy, fever, scorpion sting, snakebite, sores in the mouth, headache, toothache, weakness, lumbago, sprain, skin disorders, indigestion, loss of appetite, rheumatism, urinary tract infection, malarial fever, acidity relief and as an anti-helmintic. It is excellent in the treatment of depression, nervous tension, debility, insomnia and many stress related diseases and also act as aphrodiasiac where the reason for impotence is stress.

The Santhal tribes of Bihar and West Bengal use the paste of fresh roots for burn, snakebite and scorpion sting, and a decoction of the roots as a tonic for weakness. Tribes of Mandla (M.P) and Bastar (Maharashtra) use the leaf juice as anthelmintic. Besides these medicinal properties of the plant, the dried culms of the plant are used as brooms and to thatch roofs. In India, since ancient times, the roots have been used for making screens, mats, hand fans, and baskets. In Northern India roots are generally used in electric room coolers, screens, mats, hand fans, and baskets and major supply of raw material comes from collection of Khas by villagers or rural folk from wild. These Khas root traders are commonly seen in the roadside in Lucknow, Delhi and Kanpur etc.

Market demand for Khas-khas in flavour, pharmaceutical and cosmetic industries is very high due to its unique properties. Vetiver System (VS), which is based on the application of vetiver grass (*Vetiveria zizanioides* L.), has huge potential in soil and water conservation was first developed by the World Bank in India in the mid 1980s. Hence it must be used for the rehabilitation of the regions devoid of biodiversity, controlling soil erosion in steep slopes, phytoremediation, water purification, leachate and effluent disposal, removal of nitrogen and phosphorus etc and to improve the economic conditions of local people.

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**P.O. RFRC, Mandla Road**
**Jabalpur – 482021 M.P. India**
**Phone: 91-761-2840484**
**Fax: 91-761-2840484**
**E-mail: vansangyan_tfri@icfre.org**
**Visit us at: http://tfri.icfre.org or http://tfri.icfre.gov.in**