

Project No: AFRI-09/FE/Ext (SFD: Raj.)/2013-14)

**DOCUMENTATION OF SACRED GROVES OF RAJASTHAN AND
ASSESSMENT OF BIOLOGICAL DIVERSITY IN SOME OF THEM
FOR IMPROVED MANAGEMENT AND PEOPLE LIVELIHOODS**

FEBRUARY 2013 TO JULY 2014



By

Dr. G. Singh, Scientist F

Division of Forest Ecology

Arid Forest Research Institute, Jodhpur-342005

(Indian Council of Forestry Research & Education, Dehradun-248006)

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Submitted to

RAJASTHAN FOREST DEPARTMENT
(Government of Rajasthan)



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2014



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निदेशक

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शुष्क वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद्,
पर्यावरण एवं वन मंत्रालय, भारत सरकार की स्वायत्तशासी संस्था)
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FOREWORD

Existing sacred groves are based on ancestral worship and focus on the conservation of forest patches globally. By distribution over a wide ecosystem, sacred groves help in the conservation of rare and endemic species. Well preserved sites are store houses of biological, ecological, medicinal, ethno-cultural and religious values. Sacred groves have existed in India from time immemorial as patches of densely wooded areas and venerated on religious grounds. The preserved rare and endemic wild plant species hold potential benefit to man in medicine, agriculture and industry. In fact, sacred groves represent the ancient Indian way of *in situ* conservation of genetic diversity and reported earlier from the Himalayas, North-east India, highlands of Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala. Studies on floristic and ethnobotanical aspects of sacred groves provide detail scientific account of these sacred groves in India. Despite scattered all over the country sacred groves do not enjoy protection via federal legislation, while increased pressure from modernization and market linked economy is resulting in degradation in sacred groves and the associated traditional management cultures.

In Rajasthan, projected number of sacred groves is about 25000, but numbers of documented sacred groves are hardly 10% of this. Each grove is associated with a presiding deity and the groves are referred to by different names like: Oran, Devbani, Kakarbani or Baag in Rajasthan, where hunting, logging or removal of green trees is strictly prohibited. In the project '**Documentation of Sacred Groves of Rajasthan and Assessment of Biological Diversity in some of them for Improved Management and People Livelihoods**' funded by State Forest

Department, Rajasthan, Arid Forest Research Institute, Jodhpur (AFRI) has highlighted the importance of sacred grove in Rajasthan context by documenting 123 sacred groves selected minimum two to three sacred groves from each district distributed throughout Rajasthan. A focus was given to study the biological diversity, soil characteristics, tree dominance and their regeneration status, invasion of exotic species. Benefits accrued from the sacred groves to the villagers and types of disturbance/threats have also been studied and focused upon.

The present study reinforces the notion that the sacred groves, though small in size, are important repositories of endemic flora and fauna. However, it is clear that tradition and way of life associated with the sacred groves which used to follow strictly earlier are now under degradation. Various types of overexploitation, encroachment and uses were seen during the study, where these sacred patches of forest are degrading at faster rate in most of the sacred groves. Accommodation of the desire in devising strategies in management and restoration of sacred groves may help conserve these valuable resources in benefits of society as well as environment.

I hope the report prepared on this project would be useful tool for the planners, foresters, non-government organizations and society as whole engaged in protecting, restoring and conserving this ancient treasure of our civilization.

(Dr. T.S. Rathore)

Director

PREFACE

Traditionally protected forest fragments, commonly known as sacred groves are often relics of original forests that covered the region before. These preserved forest patches are usually close to human settlement and are the abodes of gods/goddess, as their remains with rare/endangered species and unique ecological functions still exist. Shift in developmental paradigm and consequent changes in socio-economy and land use practices have transformed the sacred groves leading into various stages of degradation.

Sacred groves are often part of the heterogeneous landscape intermingled with agricultural land, plantation, barren land, water bodies and the villages. It supports a significant number of rare and endemic species, which are extra-sensitive, compared to common species, and persist only in favourable niches provided by the sacred groves. However, there are gaps in knowledge about the endemic and endangered species, population, regeneration status, ecology, etc. Most studies on sacred groves focussed around floral and faunal diversity and maintenance of rare threatened and endemic species with sketchy descriptions. In Rajasthan, where the groves are relatively larger in size, faith in the deities is still strong and the groves harbour a significant number of floral and faunal species, the availability of literature is very scarce. Even the 10% of the protected sacred grove in Rajasthan have not been documented. Very few studies have adopted a wider range of approach with varying edaphic and climatic condition.

The study '**Documentation of Sacred Groves of Rajasthan and Assessment of Biological Diversity in some of them for Improved Management and People Livelihoods**' assigned to Arid Forest Research Institute, Jodhpur (AFRI) by the State Forest Department, Government of Rajasthan has presented biological, social and economic status of the sacred groves of Rajasthan through a concerted and determined attempt. By documenting the status of 123 sacred groves distributed throughout Rajasthan, and biological diversity, soil carbon density, dominant and subdominant tree and shrub species, regeneration and *Prosopis juliflora* and *Lantana camara* invasion status; this report also focus on the benefits accrued from the sacred groves to the villagers and various threats arise out of overexploitation, developmental and mining activities and encroachments of various types. It has also been tried to accommodate the desire and level of participation of the local villager in protecting and conserving these sacred groves. Subsequently management strategies have been suggested focussing people participation and adopting landscape approach dovetailing the probable needs of the grove dependent communities of the society.

This work has only been possible with financial support of forest department, Government of Rajasthan, for this we are grateful. We would also like to thanks staff of forest department for their field support. For successful completion of field survey, data compilation and report preparation the staff of the Forest Ecology Division, AFRI, Jodhpur is gratefully acknowledged. We shall not justify, if not mentioned the name of Sh. S.K. Srivastava, the then Addl. PCCF (Dev), Jaipur, Sh. N. Bala, Scientist E, Dr. Bilas Singh, R.O., Sh Deepak Mishra, Senior Project Fellow, Sh Kaushal Singh, JRF, Mrs. Ritu Sharma, Project Fellow, Km Priyanka Garhwal, Research Scholar and the project staff Dr. Smita Shukla, Research Associate, Sh Jalaj Saxena, JRF and Km Versha Saxena, JRF for their contribution of varying kinds.

Thus I hope that this study report will help in effective planning and transferring the knowledge in protecting and conserving this ancient institution, restoring it back with effective participation of village folk and promoting grove ecological value and rural livelihood.

(Dr. G. Singh)

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Acronyms

AFRI	:	Arid Forest Research Institute
ANOVA	:	Analysis of Variance
BD	:	Bulk density
BSI	:	Botanical Survey of India
cm	:	Centimeter
D	:	Species dominance
DMRT	:	Duncan Multiple Range Tests
<i>e'</i>	:	Species evenness
ENS	:	Effective number of species
FAO	:	Food Agriculture Organization
g	:	gram
G	:	Gravel fraction
GOI	:	Government of India
<i>H'</i>	:	Shanon:Weiner index of diversity
ha	:	Hectare
ICAR	:	Indian Council of Agriculture Research
IPCC	:	Intergovernmental Panel on Climate Change
IVI	:	Importance value index
IUCN	:	International Union for Conservation of Nature
JBF	:	Jal Bhagirathi Foundation
km	:	Kilometer
M	:	Molarity
m	:	Meter
Mg	:	Mega gram
mm	:	Millimeter
NH ₄ -N	:	Ammonium nitrogen
NO ₃ -N	:	Nitrate nitrogen
NGO	:	Non Governmental organization
NTFP	:	Non Timber Forest Produces

PO ₄ -P	:	Phosphate phosphorus
RD	:	Relative density
RF	:	Relative frequency
RDom	:	Relative dominance
Sj	:	Jaccard similarity index
SOC	:	Soil Organic Carbon
Sq	:	Square
SOC	:	Soil organic carbon
SIC	:	Soil inorganic carbon
TGA	:	Total geographical area
UNCBD	:	United Nations Convention on Biological Diversity
UNFCCC	:	United Nations Framework Convention on Climate Change
V	:	Volume
WWF	:	World Wild Fund

EXECUTIVE SUMMARY

Sacred groves are distinct patches of vegetation ranging in size from a cluster, a few trees to a large forest stand spanning several hundred acres and are consecrated in the name of local deities or ancestral spirits. Removal of any living material from the sacred groves is a taboo. However, dead logs and leaves are sometimes collected from some sacred groves. Sacred groves are known as 'Oran', 'Devabani', 'Kakerbani' or 'Baag' in Rajasthan and are the best example of indigenous traditional resource use practices promoting conservation of biodiversity and source of livelihood. Sacred groves are often part of the heterogeneous landscape intermingled with agricultural field, plantation, barren land, water bodies as well as villages. However, increased uncertainties in rural livelihoods and market expansions has resulted in the abandonment of associated traditional management practices, which has enhanced vulnerability to depletion of the many biological resources connected with this culture. At the same time the Convention on Biological Diversity (1992) (Article 10) acknowledges the protection and encouragement of customary biological resources use in accordance with traditional cultural practices compatible with conservation.

Available literature on documentation and inventorisation of the sacred groves of Rajasthan is relatively deficient, scanty and sporadic as compared to the rest parts of India, whereas projected numbers of sacred groves appears highest in Rajasthan. In view of the limited literature and data deficiency on sacred groves of Rajasthan, need of documentation and inventorisation of sacred groves was felt. As a result a project entitled '**Documentation of Sacred Groves of Rajasthan and Assessment of Biological Diversity in some of them for Improved Management and People Livelihoods**' was sanctioned by the State Forest Department, Government of Rajasthan with total outlay of Rs. 9.99 Lakhs. The objectives are: (i) to document and assess floral diversity of the important 'sacred groves' in different districts of Rajasthan; (ii) to identify and record faunal diversity countered in the above-mention 'sacred groves'; and (iii) to suggest suitable management strategies to increase diversity and productivity for improved local benefits and climate change adaptation.

A total 123 sacred groves were identified based on the interactions with the local people as well as the forest field staff working in different localities. Observations were made of the general geo-morphological factors related to the groves and status of soil erosion and soil conditions. Data on weed infestation, invasion by species from nearby plantations, protection measures, cattle grazing etc. were collected. Likewise types and extent of encroachment was also captured. To determine local attitudes toward the sacred groves, elements of sacred grove management including restrictions on resource use, as well as ceremonies associated with sacred groves a total number of 615 people were interacted. For vegetation survey and data collection a cluster design was followed in which 5 plots of 0.25 ha (50 m x 50 m) were laid to cover 1.25 ha area of the sacred grove. All tree species having girth at breast height (at 1.37 m height) >10 cm were measured for girth and total height. Shrubs and tree saplings were counted and measured in plots of 5 m x 5 m size, whereas herbaceous vegetation and grasses were counted in plots of 1 m x 1m size nested in the main plots. Soil samples in 0-30 cm soil layer were collected for estimation of soil bulk density, soil physic-chemical and nutritional properties. Based on laboratory analysis of soil organic carbon, soil carbon density was calculated. Likewise diversity variables like number of species, Shannon-Weiner diversity index, effective number of species, reciprocal of Simpson's dominance index and importance value index (IVI) were calculated for the trees of >30 cm and 10-30 cm girth, tree saplings and shrub species.

Though described as remnants of pristine forests in climax formation, our survey of sacred groves in Rajasthan indicates that along with the indigenous flora, non-native trees like Israili Babul (*Acacia tortilis*), *Eucalyptus camaldulensis*, *Prosopis juliflora*, *Lantana camara* etc also occur in the sacred groves. This indicates that these trees are either planted or invaded the sacred groves and therefore the biotic composition of sacred groves is not necessarily pristine, but is a result of continuous human intervention and management.

Sacred groves of Rajasthan vary widely in their floral and faunal diversity. Our inventory of 123 sacred groves selected from all districts of Rajasthan has recorded 131 woody species belonging to 48 families. These sacred groves were dominated by 26 types of tree species depending upon their adaptability to edaphic and climatic conditions. Dominant species with decreasing number of sacred groves are in order *A. pendula*>*P. juliflora*>*Salvadora oleoides*> *Capparis decidua*>*P.*

cineraria>*Tectona grandis*>*Acacia leucophloea*>*Acacia nilotica*>*Butea monosperma*>*Zizyphus rotundifolia*.

Number of tree species in >30 cm and 10-30 cm girth class in different sacred groves varied from 5.5 to 16.0 and 2.6 to 10.0, respectively, whereas number of shrub species ranged between 1.0 and 10.0 species. Number of tree species in sapling ranged from 1 to 6 species but in most of the sacred groves it was 1 to 2 species only. Effective number of species varied from 1.0 to 10.47 for trees of >30 cm girth, 1.05 to 8.02 for trees of 10-30 cm girth, 1.14 to 5.77 for shrub species and 1.40 to 4.77 for the tree saplings between different sacred groves throughout Rajasthan. Reciprocal of Simpson's dominance ranged between 0.55 and 10.77 with highest value in Shri Parbatেশ्वर Mahadeo ji ki Bani in Bundi district for tree >30, 1.00 to 6.66 for trees of 10-30 cm girth, 1.0 to 5.11 for shrubs and 1.0 to 4.01 for tree saplings. Sacred groves dominated by *P. roxburghii*, *W. tinctoria*, *E. officinalis*, *B. monosperma*, *M. parviflora*, *A. indica*, *A. catechu* and *Tectona grandis* indicated higher vitality in terms of diversity and regeneration status in the sacred groves and can be promoted under restoration of the groves. In arid region *P. cineraria* and *Salvadora* spp. found effective in maintaining diversity of the groves. Likewise sacred groves of IB, IIB, IIIB and IVB agro-climatic zone showed better floral diversity and thus ecological status.

These sacred groves function as important refugia for many plants and animal species. At least 19 birds, 25 mammals and 10 reptiles including the Alexandrine parakeet were observed or said to be visited these sacred groves. For example Kalu Das ji Ki Dungari, Dausa is full of Alexandrine parakeet and could be a bird watching place, where almost each tree of *Anogeissus pendula* had 1-3 numbers of holes as residence of these parakeets.

The increase in diversity and quantity of SOC, NH₄-N, NO₃-N and PO₄-P and soil carbon density with increased rainfall indicated favourable conditions of the sacred groves available in east of the Aravalli, where most of the sacred groves showed better soil conditions. However, almost 50% sacred groves showed medium to severe erosion and low in soil depth. The sacred groves dominated by *A. indica*, *A. senegal*, *A. nilotica*, *E. officinalis*, *T. grandis* and *T. arjuna* appeared

best in accumulating soil organic carbon. Sacred groves in agro-climatic zone IB and IV showed greater soil carbon density as compared to the other zones.

Significantly low values of diversity and the basal area associated with trees of 10-30 cm girth or even lower than the tree saplings indicate less natural regeneration and further recruitment to higher plants. Availability of *P. juliflora* of >30 cm girth, 10-30 cm girth and saplings in varying density were observed in about 47.2%, 46.3% and 30.9% sacred groves, whereas availability of *L. camara* was observed in 8.9% sacred groves of Rajasthan. Further, in most of the sacred groves the climax species particularly *Anogeissus pendula* is degenerating with very poor regeneration and seedling recruitment.

Sacred groves are place of water availability, grazing, fuel wood and fodder collection and work as communally shared commons for the villagers. People used to observe important social ceremonies in indigenous societies. Several cultural festivals are performed in these sacred groves, which also provide a meeting place on various occasions including social gatherings, marriage, after death rituals etc.

Despite of several benefits provided to the local people these ancient institutions are under degradation. Modern age of liberalization, privatization and globalization make communities deviate from the customs. Sanctity of life has no place in this market-linked livelihood system and modern education has no respect for local traditions. As a result this ancient and widespread institution is now weakening in terms of both cultural and biological integrity. Developmental activities, agricultural encroachment, increased resource use, cattle trampling and renovations of temples lead to damage of these valuable habitats. Moreover, lack of policy and any legal status to the sacred groves also promote degradation and extinction of these sacred groves. Most common threats to the sacred groves can be categorized as: (i) loss of traditional beliefs; (ii) rapid urbanization and developmental interventions); (iii) plantation of exotics; (iv) transformation of the primitive forms of nature worship into formal temple worship; (v) invasion by exotic species like *Lantana camara* and *Prosopis juliflora*; (vi) increasing livestock and fuel wood collection; and (vii) fragmentation and perforation of sacred groves.

The desire of the respondents categorized into 15 points and can be narrated as documentation of available sacred groves, delineation and erection of boundary, restoration through plantation, developing water body, construction of Dharmashala, government intervention for effective control of encroachments, effective protection, irradiation of *P. juliflora* and ban on mining activities.

Since sacred groves are associated by a range of oral narratives and belief systems, which are unique social means to prevent intra-group conflicts and violation of the traditional ethos participatory involvement of all members of the user community in protection of the sacred groves appeared more effective. Indeed, customary edicts to protect sacred groves are more acceptable to preindustrial communities than the externally imposed laws restricting traditional land use practices. Voluntary participation of villagers in protecting the sacred groves makes it a true commons, toward which the community responsibility is reflected in sentiments of affinity. Thus success of sacred grove conservation will be more effective when all members of the community have the ownership of, and accountability for, the resource in question. Rebuilding the community traditions in resource management is the most effective means to discourage free-riding based short-term economic gains and ensure long term welfare of the community.

Effective management strategies for protection and conservation of sacred groves would be strengthening the existing conservation system of the villagers and restoring the degraded once following landscape level approach. Various steps in managing the sacred groves would be: (i) People participation and awareness generation; (ii) Effective government policy and planning; (iii) Documentation and delineation of the sacred groves; (iv) People mobilization and management; (v) Restoration of sacred groves; (vi) Control of over grazing and over exploitation; and (vii) Control of invasive species like *P. juliflora* and *Lantana camara* through applying physical, chemical and biological approaches.