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Quantitative plant diversity evaluation of sagadara and navalachi raimonotypic sacred groves in pune district of Maharashtra state, India

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ABSTRACT

Forest preserved on religious grounds is known as Deorai or Deo rahati or Sacred grove. It is a traditional heritage of nature conservation in Indian culture and civilization. Generally, sacred groves are classified into different forest types and they preserve climax vegetation. Monotypic sacred groves are unique in their vegetation pattern. Sagdara and Navalaichi rai are two distinct groves situated in Pune district. Sagdara is located near Shirdale village in Ambegaon Taluka. It lies between 74° 03' E and 18° 82' N having 400 mm rainfall in monsoon season. It has 2.04 ha area and major population is of sag/teak (Tectona grandis L.). Due to sag trees it is known as Sagdara. Navalaichi rai is situated in Sinhagad-Bhuleshwar range near village Thopatewadi. It lies between 73° 77 to 73° 84' E and 18° 33' to 18° 41'N having 7000- 8000 mm rainfall in monsoon season. It has 0.5 ha area and major population is of Saigiri (Miliusa tomentosa (Roxb.) Sinclair). The present paper deals with evaluation of these two monotypic sacred groves for their habitat conservation, population richness of species, quantitative assessment of tree diversity and comparative floristic account.

Key words : Quantitative analysis, monotypic sacred groves, Maharashtra.

INTRODUCTION

A religiously preserved forest is known as Deorai or Deo rahati or Sacred grove. In Vedic literature the term *Aranyakas* or forest means a place where life of the hermits is in the peaceful set up. The *tapovana* was a special place in the forest used for meditation. Both *aranya* and *tapovana* are known as *abhayaranya* or sanctuaries. Kings and common people visited these places to seek the wisdom, blessing and guidance of the sages. The ancient Indian civilization was cradled in our forests and abodes of saints and sages were epitomes of man's inherent concern for other forms of life. The groves, pools and ponds were sanctified in ancient time and are still revered and venerated as religious symbols of the past (7,17).

The term "remnant vegetation" is broadly used to traditional conservation of native vegetation that occurs within fragmented landscapes. Remnants are generally small to medium sized patches of vegetation surrounded by highly modified land, such as cropping or grazing lands. Remnants are patches of trees, shrubs and huge climbers (1). However, remnants may also be used to describe any fragmented native ecosystem preserved on religious aspect.

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The flora and fauna in sacred groves are protected under sanctions and taboos which provide limits to overexploitation (14,6).

An assessment of biological diversity is a widely accepted new trend in life sciences. Exploring the biodiversity consists of surveying, sorting, cataloguing and quantifying resources which is an essential part for conservation. In this respect, Shirkai sacred grove in Pune district was evaluated for their plant diversity (5). Kulkarni and Nipunage (4) recorded floristic diversity and ecological studies of Dhup-Rahat from Bhor region in Pune district.

An environmental impact of sacred groves on flora and fauna as well as conservation of water streams are reported from Western ghats (8, 10). The tree species in the sacred groves will improve the soil physical properties through elimination of surface soil disturbance. Presence of leaf litter encourages activity of soil organic carbon (SOC). There is an appreciable influence of trees on carbon pool and effect of soil physical properties on carbon sequestration (22). Nipunage, *et al.* (19) carried out ecological survey of sacred groves from Malshej ghat, Pune district and recorded floristic diversity, soil analysis and myco-flora from five sacred groves. In general forest vegetation profiles with more organic matter in forest soil will manage water runoff, soil erosion and nutrient loss (12,13).

Leaf litter in same peace of land decomposes at faster rate and natural re-generation increases. In this connection, Nipunge and Kulkarni (16) carried out survey in 19 sacred groves of Ambegaon Taluka for natural regeneration. Most of the plants regenerate due to micro-climate available in sacred groves.

Present attempt was made for comparative floristic account of monotypic sacred groves in Sagdara and Navalaichi rai.

MATERIALS AND METHODS

Indian vegetation and forest types were first classified and described by Champion, later on revised by Champion and Seth (2). The detailed analysis of Geography, Climate, Temperature and Flora of Maharashtra especially Deccan region was prepared by Mahabale (15).

Sagdara is located near Shirdale village in Ambegaon Taluka. It lies between 74° 03' E and 18° 82' N having 400 mm rainfall in monsoon season. It has 2.04 ha area and major population of sag/teak (*Tectona grandis* L.). Due to sag trees it is known as Sagdara. This religious forest is abode of village deity '*Khandoba*'. The older villagers are unable to predict the precise age of the grove. Only they could say that it is being preserved for generations without any disturbance. The deity '*Khandoba*' has been established by a monk which is present in the ravine under two 'Sag'' (*Tectona grandis* L.) trees growing side by side. Gradually the sacred congenial environment in the ravine made other seedlings of 'sag' to grow and now it has become a forest pocket predominantly consisting of more than 200 trees of Sag.

Navalaichi rai is situated in Sinhagad-Bhuleshwar range near village Thopatewadi. It lies between 73° 77 to 73° 84' E and 18° 33' to 18° 41'N having 7000- 8000 mm rainfall in monsoon season. It has 0.5 ha area and harbours major population of **Saigiri** (*Miliusa tomentosa* (Roxb.) Sinclair). *Rai* has a female deity Navalai and it consists of 31 trees of Saigiri and other deciduous tree species. The older people gave information regarding Saigiri trees that old trees were fallen down and now regeneration of same trees is seen in the grove.

Methodology: In the methodology emphasis was given on following points.

- § To collect the botanical specimens and identification from two sacred grove.
- **§** To note the habit of the individual species and common plant in both sacred grove.
- § To study the general appearance and abundance of the individual species.
- **§** To record comparative plant diversity from earlier work.

Observations and Findings

Sr. no	Plant name	Sagdara (1988)	Sagdara (2005)	Navlai (1993)	Navlai (2005)	Type of plant
1	Abrus precatorius L.	v v v v v v v v v v v v v v v v v v v	v v v v v v v v v v v v v v v v v v v		, í	Tree
2	Acacia caesia (L.) Willd.		\checkmark			Tree
3	Acacia leucophloea (Roxb.) Willd.		\checkmark			Tree
4	Acacia polyacantha Willd.	\checkmark	\checkmark			Tree
5	Achyranthes aspera Linn		\checkmark			Shrub
6	Agave sisalana Perrine.		\checkmark			Shrub
7	Albizia lebek Linn				✓	Tree
8	Alternanthera sessilis R Br		\checkmark			Herb
9	Arisaema murravi Grah				✓	Herb
10	Artemisia iaponica Thunb				✓	Herb
11	Arthraxon lanceolatus (Roxb.) Hochst.				✓	Herb
12	Atylosia scarabaeoides(L.) Benth		\checkmark		•	Tree
13	Asparagus racemosus Willd	\checkmark	\checkmark		✓	Herb
14	Azadirachta indica A.Juss	\checkmark	\checkmark			Tree
15	Bambusa arundinacea Retz			\checkmark	✓	Shrub
16	Bauhinia racemosa Lam	\checkmark	\checkmark		✓	Tree
17	Blumea lacera (Burm.f.) DC.		\checkmark		•	Herb
18	Boerhavia diffusa Linn				\checkmark	Herb
19	Bombax ceiba Linn			\checkmark	\checkmark	Tree
20	Bridelia retusa Linn		\checkmark		\checkmark	Tree
21	Capparis sepiaria L		\checkmark			Shrub
22	Capparis deciduas (Forssk) Edg	\checkmark				Shrub
23	Capparis revlanica Linn	✓				Shrub
24	Carissa carandas Linn	✓	\checkmark		✓	Shrub
25	Cassia auriculata Linn	✓	\checkmark			Tree
26	Cassia fistula Linn	✓	✓	✓	✓	Tree
20	Cassia tora Linn	✓			✓	Herb
28	Catunaregam spinosa Thunh				✓	Shrub
29	Celastrus paniculatus Willd	✓	✓		✓	Tree
30	Cinadessa baccifera Roth				✓ ✓	Herb
31	Cissampelos pareira var hirsuta Linn				 ✓	Climber
32	Cissus pallida Wt and Arn	✓	\checkmark			Shruh
33	Clerodendron serratum Moon		-		✓	Shrub
34	Cocculus hirsutus Linn	✓	✓			Shrub
35	Cocculus pendulous I R & G Frost				✓	Herb
36	Commeling benghalensis Linn				✓ ✓	Herb
37	Cordia dichotoma Forst				· · · · · · · · · · · · · · · · · · ·	Tree
38	Cryptostegia grandiflora R Br		\checkmark		•	Shruh
30	Cymbonogon martinii I F Watson		•			Herb
40	Cynarus rotundus I					Herb
40	Desmodium laxiflorum DC				· ·	Herb
41	Dioscorag allata Linn				· ·	Herb
42	Dioscorea anatana Poxh			<u> </u>	· ·	Climber
43	Diospyros monana Roxo			•	•	Climber
44	Euphorbia acrigulata Ortog		•			Uarh
43	Euphorbia nivulia Buch Hem				, v	Harb
40	Euphorota hivuua Buch-Halli	•	*			Herb Tree
47	Ficus benghulensis Linn				•	Tree
40	Ficus racemosa Linn Elacourtia latifolia Hook E & Thomas		*		•	Tree
49 50	Flacourtia latifolia (Hook f & Thoms) Cooke				*	Tree
50	Chairman and a Linn		v			I ree
51	Guoriosa superoa Linn Cmelina arborea Poxb	×	×	./		nero Trac
52				v		
55	Grewia aslatica Linn		/		v	SHFUD
55	Heteropagon contextus (L) D. Decuy, Ex. D. C.		• ./	<u> </u>		Horb
55	Heieropogon contortus (L.) P. Beauv. Ex K.& S.		v /			nero Shaab
56	Hildiscus rosa-sinensis L.	/	v /	/	/	Snrub
57	Holoptelea integrifolia Koxb	✓ ✓	✓ ✓	✓	~	1 ree
58	Jairopha curcas Linn	~	~		/	Snrub
59	Lannea coromandalica Houtt.	/	/		×	Herb
60	Lantana camara Linn	✓ /	~		~	Snrub
61	martynia annua Linn	✓ /				Herb
62	Maytenus rothiana (Walp.) L. Callen.	√				Shrub

63	Miliusa tomentosa (Roxb.) Sinclair.		\checkmark	\checkmark	\checkmark	Tree
64	Jasminum malabaricum Wt.				\checkmark	Climber
65	<i>Mirabilis jalapa</i> Linn			\checkmark	\checkmark	Herb
66	Nyctanthes arbor-tristis Linn				\checkmark	Tree
67	Oxalis corniculata L.				\checkmark	Herb
68	Peristrophe paniculata Forsk		\checkmark			Herb
69	Phoenix sylvestris Linn	√	\checkmark			Tree
70	Phyllanthus reticulatus				\checkmark	Shrub
71	Plumbago zeylanica Linn	√				Herb
72	Plumeria alba Linn	√	\checkmark	\checkmark	\checkmark	Tree
73	Pongamia pinnata Linn	\checkmark				Tree
74	Rhus mysorensis G.Don	√	\checkmark			Shrub
75	Secrinega leucopyrus Willd	√				Herb
76	Sida rhombifolia Linn				\checkmark	Tree
77	Spondias pinnata Linn				\checkmark	Tree
78	Sporobolus indicus (L.) R.Br.				\checkmark	Herb
79	Syzigium cumini Linn			\checkmark		Tree
80	Tacca leontopetaloides Linn			\checkmark	\checkmark	Herb
81	Tamarindus indica Linn		\checkmark			Tree
82	Tectona grandis Linn	√	\checkmark		\checkmark	Tree
83	Tinospora sinensis Lour	\checkmark				Climber
84	Trewia nudiflora Linn			\checkmark	\checkmark	Tree
85	Triumfetta rhomboidea		\checkmark		\checkmark	Shrub
86	Urena lobata Linn				\checkmark	Shrub
87	Vernonia anthelminitica Linn				\checkmark	Herb
88	Vernonia cineria Linn				\checkmark	Herb
89	Xanthium strumarium Linn	\checkmark	\checkmark			Herb
- 90	Zizyphus mauritiana Lamk	\checkmark	\checkmark			Tree
91	Ziziphus nummularia (Burm.f.) Wt.& Arn.		\checkmark		\checkmark	Tree



Common plants in both sacred groves

Sr. no	Plant name	Sagdara	Navlai	Type of plant
1	Carissa carandas Linn	\checkmark	✓	Shrub
2	Cassia fistula Linn	\checkmark	✓	Tree
3	Celastrus paniculatus Willd	\checkmark	\checkmark	Shrub
4	Ficus racemosa Linn	\checkmark	\checkmark	Tree
5	Holoptelea integrifolia Roxb	\checkmark	\checkmark	Tree
6	Plumeria alba Linn	\checkmark	\checkmark	Tree
7	Miliusa tomentosa (Roxb.) Sinclair.	\checkmark	\checkmark	Tree

8	Tectona grandis Linn	\checkmark	\checkmark	Tree
	0			

Observations and calculations:

Sr.No	Observed values of Sagdara trees	Radius in cms	Diameter in cms	Basal Area in sq. cm	Average diameter	Average Basal area
1	206	32.77273	65.54545	3375.591		
2	110	17.5	35	962.5		
3	56	8.909091	17.81818	249.4545		
4	105	16.70455	33.40909	876.9886		
5	69	10.97727	21.95455	378.7159		
6	50	7.954545	15.90909	198.8636		
7	65	10.34091	20.68182	336.0795		
8	192	30.54545	61.09091	2932.364		
9	94	14.95455	29.90909	702.8636		
10	17	2.704545	5.409091	22.98864		
11	43	6.840909	13.68182	147.0795		
12	51	8.113636	16.22727	206.8977		
13	58	9.227273	18.45455	267.5909		
14	43	6.840909	13.68182	147.0795		
15	102	16.22727	32.45455	827.5909		
16	32	5.090909	10.18182	81.45455		
17	22	3.5	7	38.5		
18	31	4.931818	9.863636	76.44318		
19	26	4.136364	8.272727	53.77273		
20	33	5.25	10.5	86.625	16 70546	520 2018
21	96	15.27273	30.54545	733.0909	10./0340	550.2918
22	25	3.977273	7.954545	49.71591		
23	58	9.227273	18.45455	267.5909		
24	43	6.840909	13.68182	147.0795		
25	22	3.5	7	38.5		
26	153	24.34091	48.68182	1862.08		
27	35	5.568182	11.13636	97.44318		
28	15	2.386364	4.772727	17.89773		
29	38	6.045455	12.09091	114.8636		
30	53	8.431818	16.86364	223.4432		
31	48	7.636364	15.27273	183.2727		
32	170	27.04545	54.09091	2298.864		
33	13	2.068182	4.136364	13.44318		
34	15	2.386364	4.772727	17.89773		
35	87	13.84091	27.68182	602.0795		
36	25	3.977273	7.954545	49.71591		
37	16	2.545455	5.090909	20.36364		
38	115	18.29545	36.59091	1051.989		
39	99	15.75	31.5	779.625		
40	92	14.63636	29.27273	673.2727		

RESULTS AND DISCUSSION

In India the deities to whom the groves are dedicated to, are of ferocious nature and their names being something like Bapujiboova, Kalubai, Navlaidevi, Mariai, Andharidevi, Kadjai, Dongraidevi, Jakuradevi, Kalkai, Kalbhairi, Vanghrunjai, Gulumbai, Chiraidevi are just to name a few. However there are sacred groves, which are dedicated to deities that are not thought to be of ferocious nature such as Maruti, Ganpati and Khandoba, etc. (21).

The sacred groves have presently attracted attention of the environmentalists, geneticists, botanists for their undisturbed natural conditions, which enable them to become repositories of valuable germplasm of medicinal plants, endangered and endemic plant species. The groves create microclimate which permits regeneration and sustenance of biotic species not usually found in the surroundings (10,11). The need for such studies has been felt for quite some time. The studies from Maharashtra in the form of floristic checklists are available. However, the vegetation composition and quantification is seldom mentioned in the literature.

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The phenomenon of monotypic sacred groves in Maharashtra is very rarely documented. Nipunage *et al.* (20) reported 200 plants of *Tectona grandis* L. from Sagdara Sacred grove. It is worth mentioned here that Nipunage *et al.* (18) surveyed Sinhagad since 1985-86 for plant collection and reported seven sacred groves from the area. Recently, Kulkarni et al (9) reported wild bamboo diversity in sacred groves from Maharashtra. Monotypic sacred groves dominated by one or two species, which are rare and unique in their vegetation pattern. The present study reports evaluation of two such sacred groves with varying bioclimatic conditions from Pune district. Teak dominated Sagdara (Shirdale village, Ambegaon Taluka) and Saigiri (*Miliusa tomentosa* Roxb.) dominated Navlaichi rai (Thoptewadi, Haveli Taluka) are evaluated for their quantitative assessment, comparative floristic account and habitat conservation.

These two sacred groves were previously studied for their floristic wealth in different years in 1988 and 1993 respectively and present attempt was made in 2005. In both the sacred groves total 91 plants were recorded out of which 7 plants are common. Present survey carried out in Sagadara in 2005 shows trees shrubs, herbs and climbers in lower number in comparison with previous survey in 1988. The ratio of shrubs and herbs is changed due to seasonal variation. Navalichi rai was surveyed in 1993 and secondly in 2005. In both the studies trees are in constant number while herbs, shrubs and climbers are lower in number. There is no major difference in quantitative survey. During the present survey 40 trees from Sagdara sacred groves are evaluated for diameter and basal area analysis. The average diameter and basal area is 16.70546 and 530.2918 Sq. cm. respectively.

CONCLUSION

The most important justification for nature conservation is that it provides an insurance policy for the future. It preserves a reservoir of continually evolving genetic material, representative of natural ecosystem being protected. It preserves a reservoir of wild animal and plants, which may enable them to be cropped in the surrounding area. These groves are viewed as traditional method of *in situ* conservation. Nevertheless, the sacred groves are threatened due to the developmental activities and changing socio-economic values. Hence there is a constant need for their systematic inventorization and assessment in all disciplines. (3,23).

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REFERENCES

[1] B. Carle and Y. Mike. Research report-I. CSIRO, Division of wildlife and ecology, environment, Department of the environment and Heritage, Australia **1997**, 1-4

[2] H.G. Champion and S.K.Seth. A *Revised Survey of the Forest Types of India*. Govt. of India Press, New Delhi, **1968.**

[3] D.K.Kulkarni. In Proceeding of National Workshop on Strategy for Conservation of Sacred groves organized by Institute of Forest Genetic Tree Breeding (IFGTB), Coimbatore May 2004, **2005**, 155-165.

[4] D. K. Kulkarni and D. S.Nipunage, *Geobios* **2009**,36:298-302.

[5] D. K.Kulkarni and M. Shindikar, *Indian J. of Forestry*, 2005, 28:127-131.

[6] D.K. Kulkarni and A. S. Upadhye. In Ecological traditions of Maharashtra. Pub. C.P.R. Environmental Education Centre, Chennai. **2006**.60-70.

[7] D.K. Kulkarni, In Ecological traditions of Maharashtra. Pub. C.P.R. Environmental Education Centre, Chennai . **2006**, 47-59.

[8] D.K. Kulkarni and M. S. Kumbhojkar, The Deccan Geographer, 1999, 37: 65-72.

[9] D.K. Kulkarni, R.B. Bhagat and A.S. Upadhye, In Proceeding of National Seminar on Conservation and management of Bamboo resources on 29-30 Nov. 2007. Published by Institute of Forest Productivity, Ranchi. (Eds. S.Nath, S. Singh, A. Sinha, R. Das and R. Krishnamurthy) **2010**, 41-44.

[10] M. S. Kumbhojkar and D. K.Kulkarni, Sci. & Cult. 1998 64: 205-207.

[11] M.S. Kumbhojkar, A. S. Upadhye and D. K. Kulkarni, In, *Ethnobiology in Human welfare* Jain S.K. (Ed). Deep Publication, New Delhi, India, **1996**, 349-351.

[12] R. Lal, Science, **1987**, 236: 1069-1076

[13] R. Lal, Agroforestry Systems, 1989. 8: 97-111.

[14] A. R. Lebbie and R.P. Guries, Econ Bot. 1995, 49(3): 297-308.

[15] T.S. Mahabale, The Journal of Indian Botanical Society, 1979,58(3):197-207.

[16] D.S. Nipunage and D.K. Kulkarni, Indian Journal of Forestry, 2011, 34(4): 457-464.

[17] D.S. Nipunage, and D. K. Kulkarni, J. Asian Agri-History. 2010, 14(2):185-196

[18] D.S. Nipunage, D.K.Kulkarni and V.D. Vartak, Indian J. Forestry (Addl.Ser.), 1993, 6: 153-159.

[19] D.S. Nipunage, D.K. Kulkarni, K.G. Karndikar and D.P. Haridas, *Indian J. Trop. Biodiversity*, **2009**, 17(2): 39-44.

[20] D.S. Nipunage, M.S. Kumbhojkar and V.D. Vartak, Indian J. of Forestry, 1988, 11: 282-286.

[21] D.S. Nipunage, M. S. Kumbhojkar and V.D. Vartak, Proceeding of *Ninth Annual Conference on South Indian History Congress*, Pune, **1991**, 170-176.

[22] L.M. Hangarge, D.K. Kulkarni, V.B. Gaikwad, D.M. Mahajan and Nisha Chaudhari Annals of Biological Research 2012,3(7): 3426-3429.

[23] A. S. Upadhye, D.K.Kulkarni and M.S. Kumbhojkar, *Focus on Sacred groves and Ethnobotany* (Eds. Ghate, V.; Sane, H.& Ranade, S.S.) **2004**. Published by *Prism Publications, A Division of Timely Management Consl. Servs. Pvt. Ltd.* Mumbai, **2004**, 150-154.