

Monitoring spatial distribution of commercial rattans and palms in the tropical forest of Baratang Islands (Andaman and Nicobar Islands)

*Nidhi Nagabhatla, **PS Roy & **Rajendra Jagdale

*International Water Management Institute, PO Box 2075, Colombo, Sri Lanka; **National Remote Sensing Agency, Hyderabad, Andhra Pradesh; **Science and Technology Park, Pune 248011, Maharashtra

Email: n.nagabhatla@cgiar.org; nidhi26@gmail.com

Received 28 November 2005; revised 12 February 2007

Tropical forests are diverse and highly productive of all existing ecosystems. The need of the hour is to protect them from the devastating effect of development. The initiative requires not only assessment of the change in vegetation pattern over years but continuous monitoring of associated diversity as well. Since, the extraction activities in the islands are under check in the existing management policies, the economic upliftment has switched over to the non-forest timber products (NNTP's) (mainly canes and bamboos). The study proposes to foreground the islands having maximum cane diversity and have spotlight a comparative account of distribution in different parts of Andaman & Nicobar Islands. The potential use of remote sensing is highly promising and the study is an approach for multidisciplinary assessments. The study is carried out in the tropical forests of Baratang Forest Division, Andaman Islands for the estimation of rattan and cane resources. The study has aimed to highlight the areas having dense growth of NTPF's using spatial analysis. Distribution pattern of *Licula peltata*, a palm of high commercial importance has also been analysed. It also attempts to prepare map for the region highlighting areas of high rattan diversity using IRS IC LISS-III data. The necessary set of attributes at a resolution sufficient for monitoring the distribution of rattan species in the islands is also described. A vegetation cover type map was prepared and the ground details were integrated to establish a correlation between the upper storey and the under storey forms.

Keywords: Rattans, Palms, Non Timber forest products, Remote sensing, Andaman and Nicobar Islands, Baratang Islands

IPC Int. Cl.⁸: A01, A61K36/00

Rattans are the most important Non-Timber Forest Products (NTFP,s) in India and has recently gained popularity because of increased awareness and their important role in socioeconomic and socio-ecological research issues. Basic introductory information about rattans (canes), their size and distribution belonging to family *Calamaceae* categorized as the old world climbing palms, predominantly belonging to primary rain forest have been described¹. Three centers of rattan diversity are mainly distributed in the evergreen, semi-evergreen and moist deciduous forests in southern-Peninsular India, Northeastern India and Andaman & Nicobar Islands². The states of Assam, Arunachal Pradesh, Andaman & Nicobar Islands, Karnataka and Kerala are the main zones of rattan production³. Research and detailed study on rattan taxonomy, ecology, silviculture and conservation has also been done⁴. Of the total 53

species of rattan under 4 genera, 19 species are reported from the Andaman and Nicobar Islands⁵. Another report studying the diversity and distribution of rattans in 3 major zones of India has quoted nearly 15 species from Andaman & Nicobar Islands⁶. Eleven species are confined to the Andaman group and 5 to the Nicobar group⁷. An analysis of distribution of rattans in three different major areas in India show that much change has taken place in their distribution over the years because of the shrinkage of the natural forest cover⁸. Rattans are trailing/climbing spiny-palms classified belonging to family Aracaceae (Palmae) and constitute an integral part of the tropical forest ecosystem⁹. The pinnate leaves shows great variation (extend 0.5-2.0 m in length). In the Islands, rattans are very important source of livelihood for the settlers. These are used as raw material for variety of products mainly for making ropes, furniture frames, walking sticks, baskets, sports goods, mat making, wicker work, packing. Apart from conventional uses,

*Corresponding author

these have beneficial medicinal use as well³. The tribals (*Jarawas*, *Onges*, *Sentinels*, *Nicobarese* and *Great Andamanese*) gather rattans for thatching and ornamental purposes; these are equally used by the settlers for thatching. In the Nicobar Islands, the spiny sheath of canes is used for scraping coconut and used by *Nicobarese* in tribal rituals and festivals¹⁰. *Jarawas* use rattan sticks for making their dwelling places. It was observed that red oil-palm (*Elaeis guinensis* Jacq.), has been popular in Little Andaman sector covering a good plantation area.

Canes are economically important group of forest plants driving focus while discussing the developing concern for biodiversity stress. The restriction on timber extraction has laid stress on non-timber forest products (NTFP) for economic upliftment. In Andaman Islands, the tropical evergreen and semi-evergreen forests along with deciduous formation are the major habitat of *Calamus* species though their distribution shows significant variation. Cane species are regarded as forest protector as fearsome spines on their stems. Various cane species are noticed associated with semi-evergreen and moist deciduous formations in canopy gap areas where sunlight streams through. Many rattans grow to a height at which they are unable to support their weight and they collapse in a tangle to the forest floor resulting in thick under storey. The overall consumption pattern of cane in Baratang Islands is presented (Table 1). The cane diversity show resemblance with that of North East, Myanmar, Bangladesh and Sri Lanka suggesting some past connection between these places. The soil moisture has favoured rich growth of the under storey species. Increasing use by local settlers and commercialisation of rattan has significantly affected its density and distribution pattern. The development of the rattan resource in these Islands has recently gained momentum. The lack of basic knowledge about the species diversity and distribution, their ecological requirements and the social context of their utilization are the major issues responsible for hindering the promotion of rattan industry. The study is an approach to unite the available information for sustainable resource utilisation.

An assessment of NTFP resources by appropriate categories and detailed prospecting for specific products in the area is an essential part of the management process and also serve as a sound basis for planning. Map of rattan growing areas could be

developed using remote sensing data has been proposed¹². The map can be stratified, divided in zones of varied rattan diversity and forest types. During last few decades Andaman Islands has been experiencing modification and loss in biodiversity. Therefore, for preserving environmental integrity monitoring resources inventory has become substantial. The use of remote sensing technique in mapping and identifying forest resources has become an integral part of forest inventories. Its usefulness in the direct mapping of rattan resource however is hampered by a few limiting factors related to technology limitations and the pattern of distribution. The forest canopy and thick over storey vegetation of tropical forest make it difficult for sensors to detect the under storey rattan diversity. Thus, it is almost difficult to establish correlation between two storeys however remote sensing (use of high spatial resolution) is a valuable tool that has aided to capture more details on the ground identifying forest areas, where rattan occurs. The use of spatial technology have enabled to assess the probability of detecting small rattan patches growing under or in between tree crowns or in clumps have gained magnitude. To achieve the objective, detailed forest inventory and mapping was carried out in Baratang Forest Division, a territorial division of Andaman Islands. The ground data was prepared by counting and measuring of plant species. Landscape patterns and associated under storey shrub species and study of the ratio over storey: under story interactions is of extreme importance¹³. The findings highlight divergent successional stages in plant communities and show potential areas having high rattan diversity. These areas can be further divided into pockets of area with different levels of abundance.

Andaman & Nicobar Islands situated on the eastern coast of India in junction of Bay of Bengal, and Indian Ocean harbours lush green tropical rain forests. For management purpose, it is divided into five divisions comprising of South Andaman, Middle Andaman and North Andaman, Baratang Islands and Little Andaman. The forests are quite rich in endemic plant species harbouring several taxa of canes and rattans. The most popular species is the genus *Calamus*, the largest in the palm family and the

Table 1—Change in consumption pattern of canes

Party	1974-1975	1997-1998
Forest department	31,8601	1240066
Others (settlers, aboriginals)	11,3122	126175

Table 2—Rattan distribution in Andaman & Nicobar Islands

Species	North Andaman	Middle Andaman	Baratang Islands	South Andaman	Little Andaman	Nicobar Islands
<i>Calamus longisetus</i> Griff.	Poor	Average	Very good	Good	Average	Average
<i>Calamus andamanicus</i> Kurz.	Poor	Very good	Good	Average	Poor	Average
<i>Calamus palustris</i> Griff.	Average	Very good	Very good	Good	Poor	Good
<i>Calamus pseudorivalis</i> Becc.	Poor	-	Average	-	-	Average
<i>Calamus viminalis</i> Willd.	Average	Average	Very good	Good	Poor	-
<i>Korthalsia laciniosa</i> Mart	Average	Good	Very good	Good	-	-
<i>Licula peltata</i> Roxb	Average	Very good	Very good	Good	-	-
<i>Licula spinosa</i> Wurm.	-	Average	-	-	-	-
<i>Calamus acanthospathus</i> Griff.	-	Average	-	-	-	-
<i>Calamus indandamanicus</i>	-	-	-	-	Poor	-
<i>Areca triandra</i> Roxb.	Good	Good	Good	Very good	Good	Very good
<i>Phoenix paludosa</i> Roxb.	Average	Good	Good	Good	Average	Poor

Table 3—Distribution of forest–non-forest in Baratang Islands

Vegetation classes	Area (sq km)
Evergreen forest	155.26
Semi-evergreen forest	157.89
Moist deciduous forest	67.75
Bamboo	2.86
Mangrove	112.27
Littoral	1.99
Teak	13.91
Padauk	1.82
Non-forest	49.38

source of commercial rattan (canes). The species show unequal distribution in both the group of Islands. *Calamus andamanicus* Kurz. and *Korthalsia laciniosa* Mart. occur both in the Andaman & Nicobar Islands while most others including *Licula peltata* Roxb. have restricted distribution in certain islands only (Table 2).

Observation

Baratang division is one of 6 territorial divisions situated between Middle Andaman and South Andaman with its headquarter at Nilumbur. Geographically, the area lies between 11° 46' 10" and 12° 18' 35" North latitude and 92° 32' 35" and 92° 10' 40" East longitude. The mean annual temperature is 26.4°C and mean relative humidity percent varies from 65-89%. The major vegetation types in the islands includes evergreen, semi-evergreen, deciduous and forest plantation (Table 3). The cane species forms and important component of semi-evergreen and evergreen forest with intermediate diversity recorded from deciduous formations as well (Table 4). Areas under non forest were accounted to 49.38 sq km and bamboo coverage was 2.86 sq km.

To assess the regeneration status of the cane diversity in the island a ratio between mature and seedlings of the species was performed using the ground sample data¹⁴. From the derived values, it can be concluded that regeneration status in semi-evergreen formation was significant and comparatively high providing the conditions congenial for growth. The high regeneration capacity of the cane species (calculated in terms of seedling encountered) in semi-evergreen and deciduous formations is highlighted (Table 5). Canes are in high demand for small-scale industries being set up in the area. Substantial quantity is consumed for making furniture, walking sticks and baskets. At present only, seven of the 18 species recorded from these Islands have been exploited commercially. Besides commercial use, it is used by the settlers for thatching, hut construction, while bamboo is used extensively for fencing and house construction. The pattern of distribution is given in Tables 6 & 7. The habitat parameters of rattans and palms recorded during ground data collection from Baratang Islands is also presented (Table 8).

Licula peltata Roxb. commonly known as *silai patti* is a conspicuous and handsome palm species commonly distributed in Baratang Islands. It has fan shaped leaves and is economical species used by local community and aboriginal tribes (Fig. 1). The *Jarawas* and the *Onges* use it for making a kind of umbrella and their small houses. An attempt has been made to trace the distribution pattern of the species in different vegetation communities of Baratang Islands. They grew luxuriously associated with semi-evergreen and moist deciduous forest (Fig. 2). The field data collected was utilized to obtain a spatial

Table 4—Distribution of different cane species encountered in Baratang Island

Plant name	Common name	Forest types	Uses
<i>Calamus longisetus</i> Griff.	<i>Jungli Bet</i>	MD, PA, TK, TE	Used for making <i>lathis</i> and cane water is used by tribals (<i>Jarawas</i>) for drinking.
<i>Calamus andamanicus</i> Kurz.	<i>Mota Bet</i>	MD, TK, TE, TS	Used by <i>Jarawas</i> to make shafts of arrows. Stems are used making frames of cane furniture and baskets. Leaves are used for thatching.
<i>Calamus palustris</i> Griff.	<i>Malai Bet</i>	MD, TK, TE, TS	Used in weaving seats, timber rafts, baskets and handicrafts.
<i>Calamus pseudorivalis</i> Becc.	<i>Safed Bet</i>	MA, MD, TS	Cane is used for making furniture, boxes, baskets, rough cordage, matting and fibre trunks.
<i>Calamus viminalis</i> Willd.	<i>Hasali Bet</i>	MD, TE, TS	Used in making <i>lathis</i> (sticks used for walking).
<i>Korthalsia laciniosa</i> Mart.	<i>Lal Bet</i>	TE, TS	Used in making walking sticks and furniture.
<i>Licula peltata</i> Roxb.	<i>Silai Patti</i>	MA, MD, TK, TE, TS	Leaves used for thatching; wrapping, in roofs of huts, boats, making umbrellas and rain hats.
<i>Phoenix paludosa</i> Roxb.	<i>Khari Khajur</i>	MA	Leaves used for making ropes and thatching, source of Ayurvedic drug, <i>Kharjura</i> .
<i>Pinanga kuhlii</i> Blume.	<i>Kumbi</i>	TE, SE	Tender stem is eaten raw. Sticks are used as frame for huts.
<i>Caryota mitis</i> Loureiro.	<i>Mari patti</i>	TE, SE, MD	Fibre is obtained from stem; kernel of the fruit is edible.

TE: Evergreen; TS: Semi-evergreen; MD: Moist Deciduous; MA: Mangroves; BA: Bamboo; TK: Teak Plantation

Table 5—Growth pattern of palm and cane species

Vegetation type	Area (sq km)	No of species	No of plots	No of Individuals		Regeneration capacity (%)
				Mature	Seedlings	
Evergreen	155.26	11	27	183	81	30.68
Semi-evergreen	157.89	13	32	418	203	32.69
Moist deciduous	67.75	8	15	138	76	35.51
Mangrove	112.27	4	7	43	12	21.82
Littoral	1.99	1	2	14	3	17.65
Plantations	51.73	1	14	109	39	26.35

Table 6—Different vegetation communities in Baratang Islands

Forest type	No of species
Evergreen forest	11
Semi evergreen	13
Littoral	1
Mangrove	4
Moist deciduous	8

representation of probable occurrence of *Licula peltata* Roxb. in the region (Fig. 3). It was observed the fan palm grows well in the areas directly exposed to sunlight and therefore comfortably occurs associated with moist deciduous forest (54.41%) or the filling the gaps of forest plantation (51.25%) areas

Conclusion

In India, rattan has an important role in the rural economy serving as earning source for people in remote areas. In recent years, many small-scale rattan industries have come up in Bay Islands for economy support. Natural regeneration is not sufficient to meet the increasing demands. The forest in the Islands is



Fig.1—*Licula peltata* Roxb.

enriched with many species of canes regarded as locally significant and socially important serving as the preferred resource for basketry and binding. For resource conservation, study of threats to rattan needs to be understood as decreasing natural forest cover is leading habitat loss, exploitation of stems for the furniture industry and increased exploitation. During last few decades rattans have gained

Table 7—Distribution of cane species in Islands of Baratang forest division

Species	Baratang	Havelock	Neil	Peel	John Lawrence	Henry Lawrence
<i>Calamus longisetus</i> Griff.	+++	+	-	-	-	-
<i>Calamus andamanicus</i> Kurz.	+++++	++	+	+	++	++
<i>Calamus palustris</i> Griff.	++++	++	+	++	++	+
<i>Calamus pseudorivalis</i> Becc.	++	+	-	-	-	-
<i>Calamus viminalis</i> Willd.	+++	++	++	+	+	+
<i>Korthalsia laciniosa</i> Mart.	+++	++	-	-	+	+
<i>Licula peltata</i> Roxb.	+++++	-	-	-	-	-
<i>Phoenix paludosa</i> Roxb.	+++	+	+	-	-	-
<i>Pinanga kuhlii</i> Blume.	++++	+	++	-	-	-
<i>Caryota mitis</i> Loureiro.	+	++	+	-	+	+

+++++: Abundant; ++++: Very good; +++: Good; ++: Average; +: Poor

Table 8—Habitat parameters of rattans and palms

Parameters	Ever-green	Semi-ever-green	Moist deciduous	Man-grove	Plan-tations
Altitude	50-250	50-200	25-100	1-3	40-60
Accessibility	Low	Medium	High	Low	Very High
Slope	15-45	15-30	0-20	0-5	0-10
Aspect	SE	SW	SW	-	S
Canopy Density	> 60%	40-60%	30-60%	>60%	40-60%
Undergrowth	Average	Significant	High	Negligible	Observable
Water Source (drainage intensity)	High	Very High	Medium	High (due to creek formations)	Low

SW=Southwest, SE: Southeast, S=South

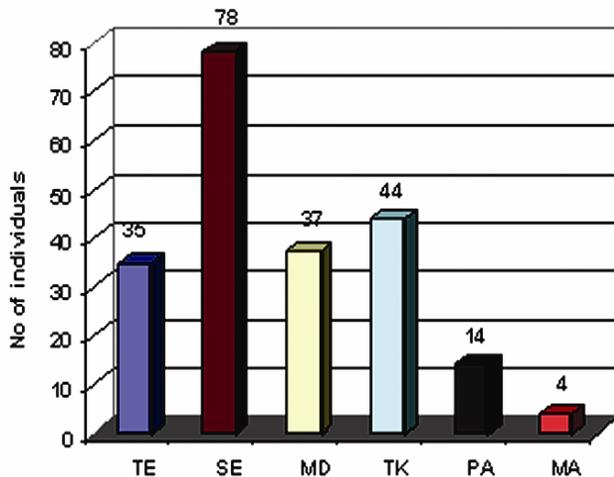


Fig. 2—Distribution pattern of *Licula peltata* Roxb

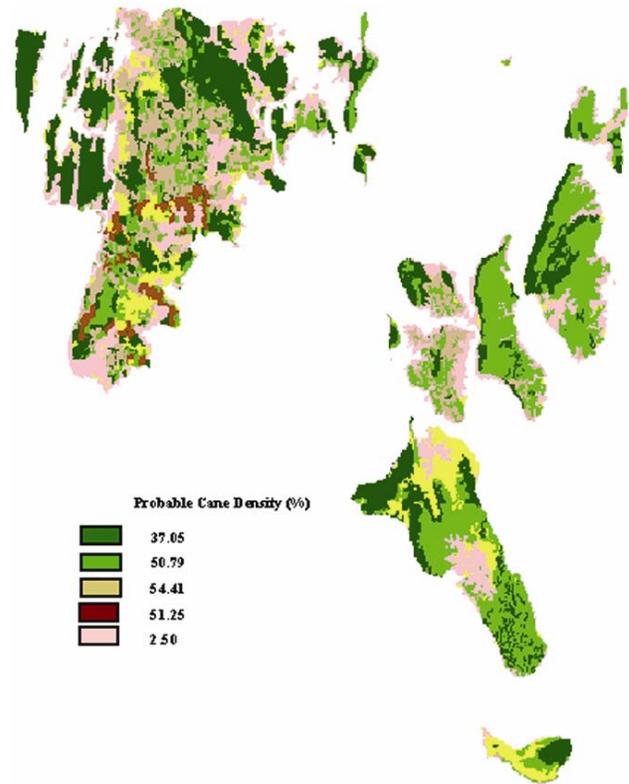


Fig. 3 Vegetation types in Baratang Island with occurrence of *Licula peltata* Roxb

significant importance. Rattan has to be harvested in environmentally sound way in equitable manner. The potential areas of cane distribution are Baratang, Rangat, Mayabunder, Diglipur, Hut Bay and Katchal. Quantitative information of these non-commercial species provides information about the ecological potential of the non-timber plant resources. The baseline information related to association of cane

species with different forest types is important for determining the actual pattern of their distribution. For this delineation of plant communities, based on the floristic composition is of vital importance; it provides information about the scattered species and also empathizes its sustainable use.

Acknowledgement

Authors are grateful to Director, NRSA for providing necessary support for the completion of the project. Thanks are due to Dr PK Hajra, ex-director Botanical Survey of India for identification of the specimen and for his constant support. Authors are also thankful to Shri Ravi Horo, DFO, Baratang Islands for his timely support.

References

- 1 Dransfield J, The Biology of Asiatic Rattans in Relation to the Rattan Trade and Conservation, In: *The Biological Aspects of Rare Plant Conservation*, by H Synge, (John Wiley & Sons Ltd, London), 1981, 179-186.
- 2 Rawat J K & Khanduri D C, *National Report on the State of Bamboo and Rattan in India*, INBAR, 1999, 31.
- 3 Bhatt K M, Changing Scenario of Rattan Trade in India, In: *Rattan Management and Utilization*, by S Chand Basha & K M Bhatt, Proc Seminar, Trichur, Kerala, Jan 1992, 335-339.
- 4 Rao A N & Rao V R, *Rattan Taxonomy, Ecology, Silviculture, Conservation, Genetic improvement and Biotechnology*, IPGRI -APO, Serdang, Malaysia, 1997, 61.
- 5 Basu S K, The Present Status of Rattan Palms in India – An Overview, In: K M Wong & N Manokaran, Proc Rattan Seminar, FRI, Kepong, Malaysia, 1985, 77-90.
- 6 Biswas S & Dayal R, Indian Rattans (Canes: Diversity, Distribution and Propagation, *Indian For*, 121 (7) (1995) 620-633.
- 7 Hajra P K, Rao P S & Mudgal V, *Flora of Andaman and Nicobar Islands*, (Botanical Survey of India, Calcutta), 1999, 35-61.
- 8 Renuka C, Rattan of Northeastern India – a cause for great concern, *Arunachal For News*, 14 (1996) 8.
- 9 Moore H E Jr, The Major Groups of Palms and their Distribution, *Genetes Herb*, 11 (2) (1973) 27-141.
- 10 Dagar R J C & Singh N T, *Plant Resources of the Andaman & Nicobar Islands*, (2) 987, ISBN 81-211-0165, 1999.
- 11 Anonymous, *Working Plan, Forest Management Plan* (1998-2004), *Baratang Forest Division*, Port Blair, ANI, 1995, 45-67.
- 12 Nandakumar U N & Menon A R R, Application of remote sensing in rattan resource survey: a case study from Kerala, India, *Int J Remote Sensing*, 14 (17) (1993 b) 3137-3147.
- 13 Austin M P, Meyers J A, Belbin L & Doherty M D, *Modelling of landscape patterns and processes using biological data: Sub-project 5, Simulated data case study*, (Division of Wildlife and Ecology, Commonwealth Scientific and Industrial Research Organization, Canberra), 1995, 31-38.
- 14 Chauhan N, Mapping, monitoring and modelling of landscape for biodiversity characterization in Baratang Forest Division in Andaman and Nicobar Islands, PhD Thesis, (University of Pune, Pune, India), 2004.