

**ECOLOGY AND PRODUCTIVITY STUDIES  
ON SOME NON-TIMBER FOREST PRODUCTS  
OF BILIGIRI RANGASWAMY TEMPLE  
WILDLIFE SANCTUARY**

**REFERENCE ONLY**

A Thesis  
submitted to the University of Mysore  
for the degree of

**DOCTOR OF PHILOSOPHY  
IN  
BOTANY**

**UNIVERSITY LIBRARY  
MANASA GANGOTRI  
MYSORE**

*R. Siddappa Setty*

By

**R. SIDDAPPA SETTY, M.Sc.,**

Under the guidance of

**Dr. SHANKAR P. HOSMANI, Ph.D**

Professor



**DEPARTMENT OF STUDIES IN BOTANY  
UNIVERSITY OF MYSORE, MANASAGANGOTRI  
MYSORE - 570 006, INDIA**

**JUNE - 2004**

**Dedicated to**  
**My Parents**  
**&**  
**Professor. Kamal Bawa**

Founder Trustee and President of Ashoka Trust  
for Research in Ecology and Environment  
(ATREE), Bangalore, India  
and also Distinguished Professor of Biology,  
University of Massachusetts, Boston,  
United States of America.

**Dr. Shankar P. Hosmani**, M.Sc., Ph.D.,  
Professor



Department of Studies in Botany  
University of Mysore,  
Manasagangotri  
Mysore-570 006  
Phone : 0821-515525 (Extn. -42)

## CERTIFICATE

This is to certify that the thesis entitled "**Ecology and Productivity Studies on Some Non-timber Forest Products of Biligiri Rangaswamy Temple Wildlife Sanctuary**" submitted by **Mr. R. Siddappa Setty** for the award of the degree of Doctor of Philosophy in Botany **has been revised** on the basis of the evaluation report of the examiner, and all necessary corrections have been incorporated.

The thesis is fit for resubmission.

Place: Mysore  
Date: 21-02-2005


  
**Dr. SHANKAR P. HOSMANI**

Research Supervisor  
**Dr. SHANKAR P. HOSMANI**,  
M.Sc., Ph.D.  
PROFESSOR  
Dept. of Studies in Botany  
University of Mysore, Manasagangotri  
MYSORE-570 006, INDIA

## DECLARATION

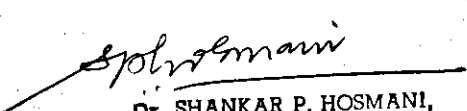
I, **R. Siddappa Setty** hereby declare that the thesis I am presenting entitled "**Ecology and Productivity Studies on Some Non-timber Forest Products of Biligiri Rangaswamy Temple Wildlife Sanctuary**" for the award of the degree of Doctor of Philosophy in Botany, to the university of Mysore **has been revised** on the basis of the evaluation report of the examiner and the revised thesis is fit for resubmission.

Place: Mysore  
Date: 21-02-2005



**R. Siddappa Setty**

Research Fellow  
Department of Studies in Botany  
University of Mysore  
Manasagangothri, Mysore, India



**Dr. SHANKAR P. HOSMANI,**  
M.Sc., Ph.D.

PROFESSOR  
Dept. of Studies in Botany  
University of Mysore, Manasagangothri  
MYSORE-570 006, INDIA

**Dr. Shankar P. Hosmani**, M.Sc., Ph.D.,  
Professor



Department of Studies in Botany  
University of Mysore,  
Manasagangotri  
Mysore-570 006  
Phone : 0821-515525 (Extn. -42)

## CERTIFICATE

This is to certify that the thesis entitled “**Ecology and Productivity Studies on Some Non-timber Forest Products of Biligiri Rangaswamy Temple Wildlife Sanctuary**” is the original research work carried out by **Mr. R. Siddappa Setty** during the period of his studies at Biligiri Rangaswamy Temple Wildlife Sanctuary, Chamarajanagara district, Karnataka. This research work has not previously formed the basis for the award of any degree, diploma, associateship or fellowship or any other title. This work was done under late **Dr. Vijay Gopalraj Urs** during the period of 1999 to 2002 and under my guidance during the period of 2002 to 2004.

Place: Mysore  
Date: 26-06-2004

  
**Dr. SHANKAR P. HOSMANI**

Research Supervisor

**Dr. SHANKAR P. HOSMANI,**  
M.Sc., Ph.D.

PROFESSOR

Dept. of Studies in Botany  
University of Mysore, Manasagangotri  
MYSORE-570 006, INDIA

## DECLARATION

I, **R. Siddappa Setty** hereby declare that the thesis entitled “**Ecology and Productivity Studies on Some Non-timber Forest Products of Biligiri Rangaswamy Temple Wildlife Sanctuary**” embodies the results of bonafide research work done by me under the guidance of late **Dr. Vijay Gopalraj Urs**, Reader and **Dr. Shankar P. Hosmani**, Professor, Department of Studies in Botany, University of Mysore, Manasagangothri, Mysore, India.

I further declare that this or a part thereof has not been the basis for the award of any other degree, diploma or associateship or any other similar titles previously.

Place: Mysore  
Date: 26-06-2004



**R. Siddappa Setty**

Research Fellow  
Department of Studies in Botany  
University of Mysore  
Manasagangothri, Mysore, India

## ABSTRACT

Non-timber forest products (NTFP) have been shown to play an important role in the economy of local communities. Several studies have documented the social and economic benefits of NTFPs. Yet, little is known about the biological consequences of harvesting these products. Four important NTFP species, Nelli (Gooseberry; *Phyllanthus emblica* and *P. indofischeri*); Antuwala (Soapberry: *Sapindus luarifolia*) and Sige (Soapnut: *Acacia sinuata*) were studied over a period of 5 years in order to understand aspects of their ecology and fruit productivity. The specific objectives were to study the (a) annual and inter annual variation in fruit productivity, extraction and regeneration of four NTFP species in different vegetation types, (b) impact of factors such as harvest intensity, infestation of mistletoes and forest fire on fruit productivity, and (c) the flowering and fruiting phenology of four NTFP species.

Overall fruit productivity and number of fruiting individuals of *Phyllanthus emblica* showed biannual peaks and overall harvest intensity was relatively low (29%) across all years and sites. An inverse 'J' shaped population structure was not observed. This was probably due to high mortality, as a result of biotic and abiotic factors such as weeds, excessive growth of mistletoes and fire.

*P. indofischeri* showed an alternative fruit productivity for the first three years, but it declined during the last two years which may be due to drought. Although harvest intensity was high on individual trees, it was low at the population

level. The population structure followed the typical inverse ' J ' shaped curve and mortality was low, indicating that the population could sustain harvesting.

Cutting of entire branches during fruit harvest had a deleterious effects on fruit productivity. The method of branch cutting for harvesting fruits is therefore not a prudent method of fruit harvest. Mistletoes have showed a negative impact on fruit productivity, fruit and seed weight and mortality of trees. Removal of mistletoes can increase the productivity and survival of *P. emblica*. However, Mistletoes support bird populations and hence their complete removal should be discouraged.

There was no significant impact of harvest on regeneration of Antuwala (*Sapindus laurifolia*), but the cutting of primary branches had a negative impact on fruiting potential. Overall harvest intensity was relatively low (32%) across all years and sites. The density of seedlings was high which is a clear indication that regeneration of plants was not hampered by extraction.

Sige (*Acacia sinuata*) is restricted to a few pockets of the dry deciduous forests. Mortality rates of reproductive adults were high due to debarking by elephants. Since the plant is a giant liana, lack of host trees and the drying of the habitat affected their growth. The percent of harvest depended on the quantity of fruit production and number of Soligas involved in harvesting.

Based on my studies I recommend that reducing mortality of *P. emblica* and *P. indofischeri* is only possible through manual removal of mistletoes. Given that mistletoes support bird-life the effect of eradication of mistletoes on bird population should be assessed before resorting to the complete eradication of mistletoes. As the overall collection of Nelli and Antuwala fruits in BRT is low and harvest does not have a negative effect on regeneration, the government should permit controlled harvest by tribals. Decentralized NTFP micro-enterprises should be encouraged. It is essential to encourage domestication and cultivation of NTFPs under different agro-forestry systems in nearby villages and farms. This will enable the survival and conservation of wild species.

## ACKNOWLEDGMENTS

I extend my deepest thanks to late **Dr. Vijay Gopalraj Urs**, Reader, Department of Studies in Botany, University of Mysore, who initiated me into the Ph.D. His death deeply saddened me as I lost an able mentor. He guided me through the rigours of the Ph.D. for three and half years. I thank him posthumously and profusely for his invaluable guidance and help.

I would also like to give my special thanks to **Dr. Shankar P. Hosmani**, Professor, Department of Studies in Botany, University of Mysore for his willingness to guide me after the demise of Dr. Vijay Gopalraj Urs. Dr. Hosmani's kindness and constructive comments was the key for me to finish this thesis.

**Prof. Kamaljit S. Bawa** has been a source of constant guidance during my tenure of ten years at ATREE (Ashoka Trust for Research in Ecology and the Environment). I have learnt much from him on the issues of forest conservation and livelihoods. I have long admired his hard work and outstanding contributions to the scientific field and civil society. I do not have words to express my gratitude for his support, encouragement and I dedicate this thesis to him and to my beloved parents.

I express my sincere gratitude to the people who helped, cared and kept me happy in the field. First of all I would like to thank **Kumbhe Gowda**, a brilliant and hard working field assistant whose help in the field was indispensable. Secondly I thank everybody in the ATREE field station at B.R.Hills, who accepted me and worked with me. Among them were **M. Kethe Gowda**, **D. Kethe Gowda**, **Jadeya**,

Nanje Gowda, Jade Swamy, R. Madeva. D. Rajanna, Renuka and Mada and the Soliga tribal community at BRT.

I am unable to adequately express my feelings of gratitude to Dr. K. S. Murali, Director of Research, Department of Ecology, French Institute, Pondicherry for his outstanding help in analyzing, interpreting data, and for his comments. This work would not have been possible without his help. I would like to thank him again and his family for their warm hospitality during my stay in Pondicherry.

A special thanks to R. Ganesan, Fellow, ATREE, for his brotherly affection and he is an extraordinary person to me. I have learned a lot from him when I was in the field. He freely shared his knowledge, photographs and helped me in planning my fieldwork and thesis. I am very lucky to have Nitin Rai, my friend who joined ATREE during the compilation of this thesis. His comments, help and advice to improve my thesis are deeply appreciated. I wish to express my sincere thanks to my friend Satish Murthy for his valuable comments on my thesis.

My sincere thanks to Gladwin Joseph Director of ATREE for his encouragement to complete my Ph.D. as a researcher at ATREE. His friendly encouragement, support and advice are deeply appreciated. I owe him a big thanks for gently nudging me to complete my thesis. I express my gratitude to Chiranjeev Bedi, Ex-executive Director of ATREE for his encouragement and permission to register for a Ph.D.

I wish to express my sincere gratitude to the outreach team members C. Madegowda, Ramamani, A. Kavitha, Ramesh Kanan and Mahesh Murthy for their moral support. I would like to thank Ankila Hiremath, T. Ganesh and Sharachchandra Lele for their encouragement and suggestions during my study. Special thanks to my colleagues of ATREE, N.A. Arvind for fruitful discussions. Jagdish Krishnaswamy, Mohammed Irfan, Arundhati Das, Kiran, Narayani, Bipin and GIS division for sharing BRT vegetation maps. I thank Vanaraj and Raghunandan for their encouragement.

I deeply express my feeling of gratitude to Dr. Shivamurthy, Chairman and other staff members of Department of Studies in Botany, University of Mysore for their kind encouragement. I wish to thank Poornima and Reeth, research fellows of the same department for their friendliness and making my visit to the lab truly purposeful and enjoyable. I thank Dr. Rajendran my neighbour and Reader in Department of Economics, University of Mysore for his encouragement.

I am grateful for the encouragement of Dr. H. Sudarshan, Venkat and Mallesh at Vivekananda Girijana Kalyana Kendra (VGKK) and Taluka Soliga Abirudhi Sangha in BRT. The Karnataka Forest Department (KFD) rendered an enthusiastic support to this work throughout, and I greatly thank Mr. Narananaswamy, Mr. Vijay Kumar Gogi and Mr. Dixit, Deputy Conservators of Forest. I thank the secretaries of B.R.Hills, Hanur and Chamarajanagara LAMPS (Large Scale Adivasi Multipurpose Societies) for providing NTFPs collection data.

I am grateful to The Ford Foundation and Ashoka Trust for Research in Ecology and the Environment for funding this research and providing all the logistical support.

I express my gratitude to my dedicated and supportive parents, Racha Setty and Rajamma, whose constant support and unconditional love make my life wonderful and meaningful one. I wish to thank my in-laws Ramaiah and Manjula for their encouragement.

Special thanks to my wife Reshma, for her support, encouragement, assistance and her stay with me in BRT during my peak data collection time. My special love to my dearest daughter Rachana and a month old daughter Harshika. Many heartfelt thanks to my dearest brother R. Mahadeva and his wife Swarna Latha, sisters Shantha Nagaraj, Umavathi Venkatachala and my innovative brother-in-law Mahesh Babu, co-brother Puttamalliah and his wife Vijayalakshmi for all their support and encouragement.

Last but not the least, my very special thanks and cheers to my special friends; Seena, Neelam, Ravi, Viji, Vishwa, Mukund, Nagaraj, Shivkumar and Subash for their love and gentle pressure to complete my thesis.

**SIDDAPPA SETTY.R**

# CONTENTS

Chapters		Page No.
1.	<b>INTRODUCTION</b>	1
	Objectives	4
	Organization of the thesis	4
2.	<b>REVIEW OF LITERATURE</b>	5
	Importance of non-timber forest products	5
	International importance	6
	National importance	7
	Importance of NTFPS at BRT wildlife sanctuary	8
	Productivity studies	9
	Extraction studies	10
	Regeneration studies	11
	Impact studies	12
	Fire	14
	Weeds	14
	Market forces	14
	Sustainability of NTFP extractions	15
	Phenology	15
3.	<b>STUDY AREA</b>	17
4.	<b>NELLI (<i>Phyllanthus emblica</i> and <i>Phyllanthus indofischeri</i>)</b>	22
	Natural history	22
	Contribution of Nelli to the cash income of Soligas	24
	<b>Methods</b>	<b>25</b>
	Phenology	25
	Estimation of fruit productivity	25
	Extraction	26
	Regeneration	27
	Data analysis	27
	Experimental studies on effect of mistletoes on fruit productivity in <i>P. emblica</i>	28
	Branch cut experiments	28
	Effect of forest fire on fruit productivity	29
	Fruit weight variation	29

Statistical analysis	29
<b>Results</b>	<b>30</b>
Phenological studies	30
Size class distribution	32
Fruit production	34
Fruit productivity and extraction	37
Effect of branch pruning on fruit productivity	40
Harvesting efforts and fruit collection by the community	45
Fruit productivity and fire	47
Mistletoes removal experiments	49
Tree mortality and mistletoes infestation	50
DBH and mistletoes response	51
Vulnerability of tree size to mistletoes	52
Effect of mistletoes on fruit size and weight	52
Effect of mistletoes on seed size and weight	53
Fruits selected by the community people	54
Variation in fruit weight	55
Regeneration study	56
<b>Discussions</b>	<b>61</b>
Phenological studies	61
Fruit productivity	61
Fruit extraction	63
Pruning experiments	66
Harvesting efforts and fruit collection by the community	68
Fruit productivity and fire	68
Experiments on mistletoes	69
Fruits selected by the community people	71
Variation in fruit weight	72
Regeneration	72
<b>Conclusions</b>	<b>75</b>
<b>Recommendations</b>	<b>77</b>
<b>5. ANTUWALA (<i>Sapindus laurifolia</i>)</b>	<b>78</b>
Natural history	78
Contribution of Antuwala to the cash income of Soligas	79
<b>Methods</b>	<b>80</b>
Phenology	80
Estimation of fruit productivity	80

Extraction	81
Population structure and regeneration studies	81
Branch cut experiments	82
Statistical analysis	82
<b>Results</b>	<b>82</b>
Phenology of flowering and fruiting	82
Fruit productivity across different years and sites	83
Difference in fruit productivity among sites and years	84
DBH and yield	86
Fruit productivity and harvest intensity	87
Harvest intensity in different sites	88
Effect of branch pruning on fruit productivity	90
Time taken and number of fruits harvested	93
Fruit weight of different seeded fruits	94
Regeneration	95
<b>Discussion</b>	<b>98</b>
Phenology of flowering and fruiting	98
Fruit productivity across different years and sites	98
Difference in fruit productivity among sites and years	99
Relationship between tree size and yield	100
Fruit productivity and harvest intensity	100
Effect of pruning on fruit productivity	102
Time taken and number of fruits harvested	103
Regeneration	103
<b>Conclusions</b>	<b>105</b>
<b>Recommendation</b>	<b>106</b>
<b>6. SIGE (<i>Acacia sinuata</i>)</b>	<b>107</b>
Natural history	107
Contribution of Sige to the cash income of Soligas	108
<b>Methods</b>	<b>109</b>
Phenology	109
Population distribution and size class	109
Fruit production	109
Fruit extraction	110
Regeneration	110
Statistical analysis	111

<b>Results</b>	111
Population structure	111
Flowering and fruiting phenology	112
Fruit productivity in Sige across sites	112
Fruit production and harvest intensity	114
Mortality	117
Number of lianas with different years of fruiting over 5 years	118
Number of fruits borne by lianas with different history of fruiting	119
Regeneration	120
<b>Discussions</b>	121
Population structure	122
Flowering and fruiting phenology	123
Fruit productivity in Sige across sites	123
Fruit production and harvest intensity	125
Mortality	126
Number of lianas with different years of fruiting over 5 years	127
Regeneration	128
<b>Conclusions</b>	129
<b>Recommendations</b>	130
7. <b>SUMMARY</b>	131
<b>BIBLIOGRAPHY</b>	139

## LIST OF TABLES

Table No.		Page No.
<b>CHAPTER - 4</b>		
1.	Mean and standard deviation of fruit number counted across the year from dry deciduous forest ( <i>Phyllanthus emblica</i> )	35
2.	Mean and standard deviation of fruit number counted across the year from scrub forest ( <i>Phyllanthus indofischeri</i> )	36
3.	Fruit productivity and extraction in <i>P. emblica</i> and <i>P. indofischeri</i> (1000 X 10 meter transects)	39
4.	Fruit yield in different years after pruning primary, secondary and tertiary branches in dry deciduous forest of <i>P. emblica</i>	41
5.	Statistical significance values t and p values (in parenthesis) for number of fruit per tree in different treatment of branch cutting experiments for <i>P. emblica</i>	41
6.	Fruit yield in different years after pruning primary, secondary and tertiary branches in scrub forest of <i>P. indofischeri</i>	44
7.	Statistical significance values t and p values (in parentheses) for number of fruit per tree in different treatment of branch cutting experiments for <i>P. indofischeri</i>	44
8.	Nelli harvest techniques followed by the community people	46
9.	Statistical significance values t and p values (in parenthesis) for number of fruit per tree in different treatment of branch cutting experiments for Nelli harvest	46
10.	Number of fruits in burnt and unburnt plots in Biligiri rangan hills in <i>P. emblica</i> (Deciduous forests) and <i>P. indofischeri</i> (Scrub forests) different sites	48
11.	Average fruit productivity of <i>P. emblica</i> infested with mistletoes, non mistletoes and mistletoes removed trees	50
12.	Dead and live trees due to mistletoes infection	51

13.	DBH and mistletoes response	51
14.	Vulnerability of tree size due to presence of mistletoes, mistletoes removed and in non mistletoes	52
15.	Fruit size and weight patterns in trees of with mistletoes, without mistletoes and mistletoes removed trees	52
16.	Seed weight (in gram) patterns in trees with mistletoes, non mistletoes and trees with mistletoes removed	53
17.	Statistical comparison of seed weights between trees with mistletoes, non mistletoes and mistletoes removed among sites	53
18.	Fruits size selected by the community people for harvest	55
19.	Variation of <i>P. emblica</i> fruit weight during 2000 and 2001	55
20.	Variation of <i>P. indofischeri</i> fruit weight during 2000 and 2001	56

#### CHAPTER-5

21.	Mean and standard deviation of fruit numbers per tree across year and among sites	84
22.	Statistical significant values t and p (in parenthesis) for fruit productivity comparison across the year and among sites	85
23.	Comparison of fruit productivity and size of the tree	86
24.	Fruit productivity and harvest intensity in different sites in Antuwala	87
25.	Size of the trees that were harvested in Gummane and Sigeguli sites	88
26.	Fruit productivity and extraction in Antuwala across year and among sites in BRT	89
27.	Mean and standard deviation of fruit yield in different years after pruning primary, secondary and tertiary branches in Antuwala	91
28.	Statistical significance values t and p values (in parenthesis) for number of fruit per tree in different treatment of branch cutting experiments for Antuwala	92
29.	Time taken to harvest fruits at different branch level and number of fruits harvested	93

30. T and p values (in parenthesis) for time taken for cutting primary and secondary branches 93
31. T and p values for fruits harvested for cutting primary and secondary branches 94
32. Fruit weight of different seeds of Antuwala 94
33. Regeneration of Antuwala seedlings, Juveniles and Trees in different sites in BRT sanctuary 97

#### **CHAPTER-6**

34. Fruit production of Sige in different years in different locations of BRT 113
35. Fruit productivity and extraction of Sige at different sites 116

## LIST OF FIGURES

Figure No.		Page No.
<b>CHAPTER - 4</b>		
1.	Fruiting and flowering phenology of <i>P. emblica</i>	31
2.	Fruiting and flowering phenology of <i>P. indofischeri</i>	32
3.	Adult population structure and mortality of <i>Phyllanthus emblica</i>	33
4.	Adult population structure and mortality of <i>Phyllanthus indofischeri</i>	34
5.	Average fruit yield of <i>Phyllanthus emblica</i> in dry deciduous forest during the period 1999-2003	35
6.	Average fruit yield of <i>P. indofischeri</i> in scrub forest during the period 1999-2003	37
7.	Graph indicating the percentage change in fruit production of differentially treated branches ( <i>Phyllanthus emblica</i> )	42
8.	Graph indicating the percentage change in fruit production of differentially treated branches ( <i>P. indofischeri</i> )	45
9.	Overall patterns of Nelli fruit production in deciduous and scrub forests	48
10.	Seed weight variation in trees with mistletoes, non mistletoes and mistletoes removed	54
11.	Population of seedlings, saplings and adults in <i>P. emblica</i> and <i>P. indofischeri</i>	58
12a.	Size class distribution of stems of <i>P. emblica</i>	59
12b.	Size class distribution of stems of <i>P. indofischeri</i>	59
13.	The annual rate of recruitment and mortality of trees, saplings and seedlings of <i>P. emblica</i> and <i>P. indofischeri</i>	60

## **CHAPTER-5**

- |     |  |    |
|-----|--|----|
| 14. | Flowering and fruiting patterns of Antuwala in BRT sanctuary over 5 years                                  | 83 |
| 15. | Fruit production from 1999 to 2003 among all the sites   | 84 |
| 16. | Fruit yield in different years after pruning primary, secondary, tertiary and control branches in Antuwala | 92 |
| 17. | Size class distribution in Antuwala  | 96 |
| 18. | Density of seedlings, juveniles and trees in Antuwala  | 96 |

## **CHAPTER -6**

- |     |   |     |
|-----|---|-----|
| 19. | Size class distribution of Sige in the shola and dry deciduous forest | 111 |
| 20. | Flowering and fruiting phenology of Sige liana in BRT                 | 112 |
| 21. | Average fruit yield across the different year and sites in Sige       | 114 |
| 22. | Rate of tree mortality in Sige from the period of 2000 to 2004        | 118 |
| 23. | Number of trees with different years of fruiting over 5 years         | 119 |
| 24. | Number of fruits borne by trees with different history of fruiting    | 120 |
| 25. | Regeneration levels at different sites during 2001 and 2004           | 121 |

## LIST OF PLATES

- Plate-1. **Locator map of study site and tribal settlements.**
- Plate-2. **Vegetation map of BRT**
- Plate-3. **View of study site**
- Plate-4. **Habit and habitat of Nelli (Goosberry: *Phyllanthus emblica* Linn and *Phyllanthus indofischeri* Bennet)**
- Plate-5. **Flowering and fruiting of Nelli (Goosberry: *Phyllanthus emblica* Linn and *Phyllanthus indofischeri* Bennet)**
- Plate-6. **Mistletoe (Uppilu: *Taxillus tomentosus* Auct.) and its effect.**
- Plate-7. **Antuwala (Soapberry: *Sapindus laurifolia* Vahl).**
- Plate-8. **Sige (Soapnut: *Acacia sinuata* Lour.)**

## **ABBREVIATIONS USED**

1	<b>ATREE</b>	<b>Ashoka Trust for Research in Ecology and the Environment</b>
2	<b>AG</b>	<b>Agasagittikanu</b>
3	<b>B.R.Hills</b>	<b>Biligiri Rangaswamy Hills</b>
4	<b>BRT</b>	<b>Biligiri Rangaswamy Temple Wildlife Sanctuary</b>
5	<b>DBH</b>	<b>Diameter at Breast Height</b>
6	<b>DDF</b>	<b>Dry deciduous forest</b>
7	<b>GK</b>	<b>Gummanekanu</b>
8	<b>KB</b>	<b>Karadisiddana betta</b>
9	<b>KFD</b>	<b>Kanataka Forest Department</b>
10	<b>LAMPS</b>	<b>Large Scale Adivasi Multipurpose Society</b>
11	<b>NTFPs</b>	<b>Non-timber Forest Products</b>
12	<b>NWFP</b>	<b>Non Wood Forest Products</b>
13	<b>SD</b>	<b>Standard Deviation</b>
14	<b>TB</b>	<b>Temple</b>
15	<b>TERI</b>	<b>Tata Energy Research Institute</b>
16	<b>VGKK</b>	<b>Vivekananda Girijana Kalyana Kendra</b>
17	<b>YF</b>	<b>Yadani</b>