1) Long term monitoring

2) Action Research ——→ Socio-economic / biological

3) Biological Diversity ——→



Long term ~~monitoring~~ study:

Comprehensive listing

The ultimate objective of the scientific programme associated with biosphere reserves would be to generate an understanding necessary for humankind to maintain an environment supportive of the great diversity of life, while pursuing a path of sustainable development

such

to set up reserves representative of the different

terrestrial and coastal ecosystems, it is hoped,

gaining

with help in scientific knowledge of each

each of these ecosystems. We realize that each

A 3
F 20
F 27
A 12
F 25
A 2
F 23
A 13
F 22

FOCAL ANIMAL

ANIMAL NO.: 5 THE ANIMAL : VA---- NO. OF SESSION(5 MIN.)S, NASSN : 2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

Research Priorities and Research Activities in the Nilgiri Biosphere Reserve.

A 10
F 24
F 29
A 14
F 28
F 21
A 11
A 6
A 1
A 9
A 7
F 17
A 15
A 8
A 5
F 18
A 4
F 26
F 16
F 19
F 30
A 3
F 20
F 27
A 12
F 25
A 2
F 23
A 13
F 22

The objective of a scientific programme associated with the biosphere reserve should be to generate an understanding that would help maintain biological diversity, while pursuing a path of harmonious and sustainable development. This is possible only through a holistic view of the system taking man and his activities as an integral part of the system. The attempt to set up such reserves representative of the different terrestrial and costal ecosystems, it is hoped, will help in gaining scientific knowledge about each of these ecosystems. We realise that each

Stop 6

95° N

Sp	Dia	Height H	Height F.B.
Tectona	.72	8m	2m
Arogneses	.63	10m	4m
Arogneses	0.38	10m	3m
Schebera	0.40	5m	2m
Arogneses	0.39	10m	5m
"	0.44	10m	4m
"	0.32	7m	4m
"	0.30	7m	4m
Tectona	0.29	6m	4m
Arogneses	0.46	7m	5m
~~Arogneses~~			
Schebera	0.80	10m	2.5m
Tectona	0.49	7m	4m
Tectona	0.40	5m	3m
Mucocarpus	0.95	10m	4m
Arogneses	0.31	5m	2.5m

Q1 Open

Triandra	34
G. Sp (1)	4
Cambollina	9
Carcullago	2
H Sp (7)	1
Arogneses	1

Q2 25%

Triandra	27
G Sp (1)	4
Mucocarpus	1
Cambollina	3
H Sp (8)	1
Carcullago	7
H. Sp (1)	1

Q3 25%

Triandra	29
G Sp (1)	5
Desmodium	1
+ Ercolina	1
Ragi poll.	2
Cambollina	4
Carcullago	3
H Sp (1)	3
H Sp (8) Mosc	1

Q4 Open

Triandra	29
G Sp (1)	3
Grewia hirsuta	1
T. Chebula	1
Carcullago	3
H. Sp (3)	2
H Sp (1)	1
Cambollina	3

Q5 25%

T. Triandra	33
G. Sp (1)	4
H Sp (8)	1
? H Sp (1) Cordelena	1
Mucocarpus	1
L. Parviflora	2
H Sp.	

Q6 25%

T. Triandra	32
G Sp (1)	5
Carcullago	6
Cambollina	8
H Sp (9)	1
Nennari	3
H Sp (3)	1
L. Parviflora	3

Q7 X%

T. Triandra	13
G Sp (1)	11
Cambu pullu	1
Grewia hirsuta	4
H Sp (1)	2
Compound lead H (8)	1
Cambollina	4
H Sp (9)	2

Q8 25%

T. Triandra	21
G Sp (1)	9
H Sp (3)	3
Cambollina	9
Carcullago	5
Cyperacea	1
H Sp Cambifora	1

Q9 50%

T. Triandra	21
G Sp (1)	7
H Sp. Violet fl.	2
Nennari	2
H Sp. (2)	1

Q10 25% + Carcullago

T. Triandra	19
G Sp (1)	7
Arogneses	2
Herb (9)	1
Herb (Arona)	1
Cambollina	7
Cornucifora	1

A 15
F 28
A 4
F 30
A 10
A 14
F 24
A 3
F 19
F 27
A 7
F 23
A 9
F 17
F 25
A 8
F 22
F 21
A 2
A 1
F 26
F 16
F 20
F 18
A 5
A 6
A 12
A 11
F 29
A 13
FOCAL ANIMAL

of these biosphere reserves will be unique because of the ecological and cultural diversity that prevails. Thus scientific understanding of each biosphere reserve should evolve specific to the ecological and cultural situation in the reserve for it to be an effective conservation effort. Furthur, these reserves should also be sites for action research to formulate and test alternative strategies for a harmonious and sustainable survival of humankind as an integral part of the biosphere reserve. These strategies must be based on ecological principles.

Research for the above objectives must be carried out in the area of biological sciences, studying the characteristics

(Q2) 50-75%

Theyuda triandra	30
G. Sp (1)	4
Arogneses	2
Cambolina	9
Carcullago	7
H. Onion	1
Gotelleria	2
H. Sp (1)	2

(Q3) 50-70%

Triandra	34
Cambollina	9
Carcullago	4
T. Landea	2
T. Myllanthus	1
~~[illegible]~~ Bridellia	1
Creeper (Desmodium)?	1
Arogneses	1
H. (Compound leaf)	1
Gotelleria	5
H. Sp. (6)	2

(Q4) 0-25%

Triandra	27
G. Sp (1)	6
Carcullago	8
Cambollina	1
Gotelleria	1
Herb (1)	1

(Q5) 25%

Theyuda triandra	43
G. Sp (1)	6
Carcullago	9
Gotelleria	1
Arogneses	1
Cambollina	1
Herb (1) Sp.	1

(Q6) 25%

Triandra	34
Myllanthus	1
H. Sp. 1	13
G. Sp. 1	5
Gotelleria	1
Carcullago	7
Cambollina	7
H. Sp. (Gotelleria?)	1

(Q7) 25%

Triandra	17
Cambopull.	15
G. Sp (1)	12
G. Sp (6)	1
Gotelleria	2
Carcullago	4
H. Sp (1)	1
Greenia hirsuta?	1

(Q8) 25-50%

Triandra	7
G. Sp (1)	18
(Cambopulla)	3
Carcullago	13
H. Sp (1)	7

50 Cambollina 4

(Q9) 50-70%

Triandra	26
Landea	21
G. Sp (1)	6
H. Sp (1)	2
Carcullago	8

Cambollina 4

(Q10) 25%

Triandra	6
G. Sp (1)	1
Arogneses	1
Carcullago	8
H. Sp (1)	2
Cambollina	3
Gotelleria	4

A 15
F 28
A 12
F 30
F 24
A 2
F 29
A 7
F 19
A 11
F 27
F 18
F 22
A 13
A 9
F 17
A 6
A 3
F 23
F 21
F 25
A 8
A 1
A 4
A 5
A 14
F 20
F 26
A 10
F 16

FOCAL ANIMAL

~~and~~ responses and dynamics of ecosystems as well as in ~~the~~ social sciences ~~in~~ studying the nature and culture of ~~societies~~, their histories, their ~~and~~ aspirations, and their relationships with their environment. Under ~~this~~ previous, the ~~extremely~~ ~~Under~~ wide range of scientific studies could be broadly divided into three inter-linked groups.

1) long term monitoring of changes in the environment in relation to various kinds and forms of human impact.
2) Action Research evaluating alternative models of sustainable and harmonious development.
3) ~~Developing~~ an understanding of biological diversity and the evolutionary processes that maintain this diversity.

Strip 5 / 15° N

		Height T	Height FB
Anogeissus —	0.41	8m	4m
Teak —	1.13	12m	6m
Anogeissus —	0.52/0.10	8m	Base
Anogeissus —	0.64	8m	3m
Tectona —	0.51/0.57 Lead	7m	
Tectona —	0.48	8m	6m
Tectona —	0.55	7m	4m
Terminalia chebula —	0.88	10m	5m
Ereolina —	0.54	6m	2m
Ziziphus cylopeius —	0.92	10m	5m
Tectona —	0.58/0.41	8m	0.5m

Q1

Ereolina sap —	1.	Anogeissus	1
Phyllanthus —	1.	Crotolaria	1
Pterocarpus —	1	Randia	1
Themeda trianadra —	21		
G. sp (1) —	7		
Cambollina —	4		
H sp (1) —	4		

The Nilgiri Biosphere Reserve covering an area of 5520 sq km is one of the centres of rich biological diversity in peninsular India. The area forming a part of the Western Ghats covers different climatological regimes, with different soil characteristics and a wide altitude range resulting in a great diversity of living forms and ecosystems. It contains a large number of endemic and endangered species and is one of the centres of evolution of many of the cultivated plants like rice, pepper, cardamom, mango and jack. The area is also rich in timber and wood species that are economically valuable. It is also the habitat of many primitive and ~~ancient~~ indigenous societies

(Q7) 25%

Twandra	10
H Sp (1)	2
Zingerberaceae	1
Curcullago	8
Herb Sp (3)	3
+ Randia sap.	1
G. Sp (1)	6

(Q8) 25-50%

Themuda twandra	9
G. Sp (1)	3
Randia sap.	3
Cassia fistula	1
Anagnessus	1
Herb (1)	1
Cambolline	4
Ragipulla	2
Herb (3)	1

Q10 open

Themuda twandra	13	8	1	6	1	1	1
Curcullago							
Cambolline							
H Sp (1)							
Gaspar (3)							
Anagnessus sap							
Tuber (1)							

(Q9) 25-50%

Themuda twandra	20
Ragipulla	1
G Sp (1)	5
H Sp (1)	11
H Sp (Compost)	1
Curcullago	6
Zingerberaceae	2
Anagnessus	2

that have evolved sustainable and unique relationships with their environment over hundreds of years. The objective of the Nilgiri Biosphere Reserve is to ~~con~~ study and conserve the biological and cultural diversity of the area.

Long term Monitoring :

1. ~~Selection of Study Sites~~:

a). Benchmark Studies: The Biosphere Reserve provides ideal sites for benchmark studies of ~~ecosystems~~ the representative ecosystems of the biosphere reserve.

The NBR contains representative areas of the Malabar Rain forest and the Deccan Thorn Forest along with all

Q3

Themida Iwandra 8. 50-75%

H Sp (1) ~~2~~ 1.

Maluacea herb 1.

H Sp (5) 1.

Curcullogo ~~2~~ 2.

Creeper 1.

Grewia Sap 1. > 1cm

Q4

Themida Iwandra 6 50-75%

Creeper 1.

Curcullogo 1

Grewia hirsuta 1.

Herb Sp. (2) Gotollewa. 1.

Maluacea Herb 1.

Q5

Themida Iwandra 11

Grewia 1 50-75%

Curcullogo 4

H Sp (1) 1.

Creeper (2) 1.

Q6

Themida Iwandra 8. 50%-25%

Cambollona 4 Gotellewa 2.

Nennari 3 H Sp (1) 2

Thumba soppu 2 Arogueseus 1.

```
        TEST DATA
 015
 RT---,70101,70107
 RA---,70101,70107
 RTA--,70101,70107
 YT---,70101,70107
 YA---,70101,70107
 YTA--,70101,70107
 DBT--,70101,70107
 DBA--,70101,70107
 DBTA-,70101,70107
 LBT--,70101,70107
 LBA--,70101,70107
 LBTA-,70101,70107
 OT---,70101,70107
 OA---,70101,70107
      ,     ,
S0001TE1010170800RT---10  RA---10AFRTA--10ANYT---10ASYA---10AWYTA--10BBDBT--10BF
S0002TE1010170915DBA--10BJDBTA-10BLLBT--10BNLBA--10BPLBTA-10BUOT---10BWOA---10BX
S0003TE1010171000RT---10C1RA---10C2RTA--10C3YT---10CAYA---10CBYTA--10CDDBT--10CE
S0004TE1010171230DBA--10CLDBTA-10CMLBT--10CPLBA--10EELBTA-10ELOT---10EOOA---10EP
S0005TE1010171400RT---10FARA---10FERTA--10FLYT---10FOYA---10FSYTA--10FYDBT--10GR
S0006TE1010171600DBA--10IPDBTA-10MCLBT--10MHLBA--10MPLBTA-10MROT---10MSOA---10MW
S0007TE1020170800RT---10NBRA---10OPRTA--10PEYT---10PLYA---10PUYTA--10PXDBT--10RL
S0008TE1020170930DBA--10RMDBTA-10RPLBT--10SALBA--10SILBTA-10SROT---10SWOA---10WA
S0009TE1020171115RT---10WFRA---10WJRTA--10XXYT---10--YA---10AAYTA--10ABDBT--10AE
S0010TE1020171200DBA--10AGDBTA-10AMLBT--10APLBA--10ATLBTA-10AVOT---10BOOA---10CH
S0011TE1030171015RT---10CRRA---10FFRTA--10HMYT---10NIYA---10PKYTA--10S1DBT--10S2
S0012TE1030171530DBA--10S3DBTA-10SBLBT--10SCLBA--10SFLBTA-10SLOT---10SOOA---10SU
S0013TE1040170810RT---10AARA---10BIRTA--10BEYT---10GGYA---10AMYTA--10PPDBT--10BA
S0014TE1040171215DBA--10BVDBTA-10OFLBT--10BCLBA--10BRLBTA-10FFOT---10BHOA---10NN
S0015TE1040171350RT---10KKRA---10L1RTA--10L2YT---10L3YA---10LBYTA--10SSDBT--10LF
S0016TE1040171515DBA--10LLDBTA-10BSLBT--10LU
A0017TE1050170855RT---10AARA---10ABRTA--10AEYT---10AGYA---10AMYTA--10APDBT--10AT
X0017TE1050170855OA---OT---LBTA-LBA--LBT--
A0018TE1050171010DBA--10AVDBTA-10BOLBT--10CHLBA--10CRLBTA-10FFOT---10HMOA---10NI
X0018TE1050171010DBTA-DBA--DBT--YTA--YA---
A0019TE1060171430RT---10PKRA---10S1RTA--10S2YT---10S3YA---10SBYTA--10SCDBT--10SF
X0019TE1060171430YT---RTA--RA---RT---OA---
A0020TE1070171015DBA--10SLDBTA-10SOLBT--10SU
X0020TE1070171015OT---LBTA-LBA--LBT--DBTA-
```

Sharp

AF AFTRTA

Sharp

Inkpot

I shall use the Inkpot

Jump Jumbo

I am a teapot

Short and Stout.

Q1

Themeda	13
Cunculogo	6
Neumari	3
H. Sp (1)	1.
Elephant grass) G. Sp (4) –	1.
G. Sp (1) —	3

50% – 75%

Q2

Themeda –	6
Greenwa Herb	~~3~~ 7
Dalbergia Sp	1
Ercolina	1
Phillanthus ~~[illegible]~~ niruri	~~[illegible]~~ 12

G. Sp. Regipolla	~~2~~ 1
G. No 1.	2
T Garuga pinnata	1.
Gaspa	1.

and various biotic influences.

sts altitudinal, ~~and~~ successional variations. It also contains unique man-modified ecosystems that maintain their own dynamics. The reserve provides ideal sites for benchmark studies on these environments that are essential for any detailed understanding of the dynamics of the ecosystems. Two such ~~site~~ sites, one in the Evergreen forests of Silent Valley and another in the semi-deciduous tract of Mudumalai have been identified for such long term monitoring.

i) Topographical Surveys:

ii) Surveys and Inventories: The primary element of such surveys and inventories would be the topographical survey. These survey sheets are

Strip 4

Bearing : 150° N

Sp	Girth	Height B	Height T	Height PB
Tectona	125	0	12m	6m
"	122	0	13m	6m
Terminalia tom.	158	0	15m	6m
Tectona	180	0	13m	4m
"	169	0	12m	6m
"	184	0	15m	8m
Hardwickia	161/118	0	4m	0.0.
Terminalia	119	0	15m	5m
"	151	0	12m	~~4m~~ 5m
"	139	0	12m	10m
"	151	0	15m	5m

0	115	LF	1	0.6547E+0
0	116	LL	1	0.6547E+0
1	119	S-	3	0.1134E+0
1	120	LT	5	0.1464E+0

available in the 1:50,000 scale based on aerial ~~surv~~ photography and ground surveys conducted 10 to 20 years ago. A more detail map in 1:10,000 scale would be necessary immediately in priority areas where benchmark ~~studies~~ sites are identified or where human settlement pressure is high.

ii) Vegetational Survey: The French institute, Pondicherry has completed a vegetational (1:2,50,000) ~~map of the area~~ map based on satellite imagery and ground truth verification. There needs to be a constant updating of the vegetational map as changes occour because of biotic and other influences, as well as a finer vegetational types and in a more detailed scale.

113 LB 1 0.4286E+00 0.6547E+0
0

(iii) Geomorphological Survey: The NBR is a unique plateau geological formation of charnokites and peat bogs with steep slopes towards the east and the west. Fault lines and fractures run through the area making it a unique geological formation. A detailed geological and geomorphological map of the area would thus be helpful in land use planning, and other action research in the area.

iv) Survey of Human Settlements: The population census is conducted every ten years and data is available regarding populations, their and their main features for 1881 onwards. However detailed surveys on each of the tribal and indegenous communities inhabiting the area is not available. Thus their present

~~F~~ 28				
~~A~~ 13				
~~A~~ 6				
~~A~~ 10				
~~F~~ 22				
~~A~~ 9	Q7	Themoda Swandra	13	Open
~~A~~ 11		Cyperace	2	
~~A~~ 4		Nenmari	2	
C~~F~~ 17		Anogneses	1.	
~~A~~ 14		Curculago	4	
~~F~~ 21		Kambu pullu.	1.	
~~A~~ 3		G. Sp (1)	2	
~~F~~ 29		Cambollona	5	
~~A~~ 12		H Sp (3) Papilo!	2	
~~F~~ 26				
~~F~~ 27				
~~A~~ 7				
~~A~~ 8	Q8	Themoda Swandra	13	Open
~~F~~ 16		G. Sp. 1	1.	
~~A~~ 5		Kambu pullu.	1.	
~~F~~ 30		H Sp (3)	1.	
~~F~~ 25		H Sp (1)	3	
~~F~~ 18				
~~A~~ 1	Q9	Themoda Swandra	8	Open.
~~A~~ 15		G. Sp (1)	2.	
~~F~~ 23		Kambu pullu	2	
~~A~~ 2		Zingenberace	2	
F 20		Curculago	5	
F 24		H Sp (1)	3	
F 19		Cambollona	1.	
FOCAL ANIMAL		Bolle Mara.	1.	
		Asparagus.	1.	

Closed.

Themoda Swandra	13	4	8	3	1	2	2
G Sp (1)							
H Sp (1)							
Crotellaria							
Acanthacea							
Thunba Sapp							
Tamantea							

Q10

status of many of these communities need to be urgently studies by the Anthropological Survey of India. Their relationships with the environment and their ethnobiology needs to be studied in order ~~with attempts~~ to bring them into the main stream of the conservation attempt.

(iv) Floristic and Faunistic Surveys: Surveys have been conducted into particular areas like the Silent Valley and the Bandipur Tiger Reserve. There are many areas in the biosphere reserve that are terra incognita. Also these surveys have been biased towards certain groups, orders and families. The ~~undertaking~~ inventories of lower organisms is very poor. Reptiles, fresh water algae, fungi, and

F 23			
F 27			
A 5			
A 7			
A 6	Q6	Themida triandra	13
F 17			
A 10		G. Sp (1)	1
F 24			
F 28		H Sp (3)	2
F 25		Crotillaria	2
F 16		Zingiberaceae	1
A 3		Desmodium	1
A 2		Tectona Sup	2
A 14		Curculiago	3
F 18		Creeper	3
A 1		H. Sp (1)	2
A 15		Indigofera	1
A 13			
F 26	Q8	Themida triandra	13
F 29		H Sp (1)	5
F 30		H Sp (3)	1
A 9		Curculiago	4
A 4		Cambolliona	2
F 20		'Kamba pallu'	2
A 8			
A 12	Q7	Themida triandra	13
F 22		G. Sp (1)	4
A 11		Cambolliona	3
F 19		Curculiago	8
F 21		Zingiberaceae	2
		Nennari	1

25-50%

25-50%

Arogneum	1
Indigofera	1
H Sp (4)	1

25-50%

Zizyphus Xyloperaceae	2
Herb Sp (1)	6
'Thumba Sup'	1
G. Sp	1

FOCAL ANIMAL

soil annelids and anthropods are little studied.

(vi) Survey of Cultivars and Domesticated animals:

The area with its diversity of soil and climate has harboured large tribal populations that subsist on agriculture. Their form of agriculture and cultivars that they use ~~~~ have evolved over many generations and are unique and significant to warrant a detailed survey and in the preservation of these cultivars.

c) Monitoring:

Long term monitoring of a variety of environmental parameters and ecological processes is essential for research. Periodic remote sensed satellite images are necessary to monitor a wide range of ~~~~ vegetational, hydrological,

02	Themida Swandra	9	25%
	G. Sp. (1)	3	
	A. Sp. (3) Ragi pullei	1.	
	Curculago	7	
	Crotollerva	2.	
	Cambollona	2	
	H. Sp (3)	1.	
03	Themida Swandra	16	
	G. Sp (1)	3	
	H. Sp (3)	1.	
	Cambollona	5	
	H. Sp. (1)	2	
	~~H. Sp~~ Crotollerva	1.	
	H. Sp (4) (Thuma Sp)	1.	
	Creeper Sp.	1.	
04	Themida Swandra	7	Open
	H. Sp (1)	4	
	Tectona Sapling	1.	
	Gmenna Herb (Hirsuta)	2.	
	Zizyphus Zyloperace	1	
	G. Sp. (3)	1	

geological, land use and climatological data. Terrestrial monitoring at specified locations is also necessary to monitor a wide range of ecological parameters.

i a) Meteorological parameters such as rainfall, temperature, humidity, solar radiation, wind speeds and direction, air quality etc. need to be monitored. The area contains one IMD station and many private and state government ~~raingua~~ rain and temperature guages; and these ~~information~~ data are available for over 100 years. However detailed monitoring needs to be done in each of the ecological zones as well as in bench mark study sites.

ANIMAL NO.: 13 THE ANIMAL : OT--- NO. OF SESSION(S MIN.)S, NASSN :
2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
92	SU	1	0.6000E+01	0.2449E+01
98	GG	1	0.6000E+01	0.2449E+01

Strip 3

150° N

	Girth	Height B	Height T	Height PB
Tectona	0.85	0	10 m	5 m
Anogeissus	0.31	0	4 m	2 m
Tectona	0.74	0	10 m	2 m
Anogeissus	0.31	0	5 ~~6~~ m	4 m
Tectona	0.99	0	12 m	5 m
Anogeissus	0.58	0	12 m	4 m
Anogeissus	109	0	15 m	6 m
"	91	0	12 m	5 m
~~Tectona~~	~~.74~~	~~0~~		

(21) Open

Thermida triandra	11
Cambollona	3
Curculogo	8
H. Species (3)	2
Desmodium	1
H. Sp (1)	2

iii) Hydrological parameters, like surface run off, percolation, silt loads, water quality etc. The presence of reservoirs on the Nilgiri plateau for the past 40 years provide some data on these characteristics. Over the past decade, more information regarding hydrological parameters is available at 2 or 3 more sites. It is necessary to set up more monitoring stations in the bio sphere reserve

iii (a) ~~Vegetation Changes~~ Land Use Pattern need to be monitored by conducting surveys regarding human settlements, agricultural crops grown, grazing etc. These continuously changing phenomena needs to be monitored for effective action research.

iv (a) Sites must be chosen in each of the ecological zones to monitor primary production

ANIMAL NO.: 14 THE ANIMAL : UA--- NO. OF SESSION(5 MIN.)S, NASSN :
2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
96	BI	1	0.6000E+01	0.2449E+01
119	S-	1	0.6000E+01	0.2449E+01

07 , Thermida tuvandra 12 >75%
Curculago 5
~~H sp (2)~~ Acanthacea 3
H sp (2) 1.
Commolina 1.
Desmodium 1.
Crotelaria (2) 1.
Cyperacea 2.

08 Thermida tuvandra 12 50-75%
G sp. Vellipulla 1.
~~Desmodium~~ Crotollaria ~~2~~ 3
Cambolina 4
Curculago 4
Acanthacea 3
H sp. (1) 3
H sp (2) 6

09 Thermida tuvandra 12
Combollina ~~3~~ 4
H sp (1) 5
G. tel. 2
Ter. tomatosa 1.
Curcullago 3

and the cycling of nutrients such as nitrogen and phosphorous.

(v) Human needs on the biological production of the locality in term of fuel, fodder, construction material, green manure etc. need to be monitored.

(vi) Commercial activity in the area resulting in the export or import of raw materials and natural resources like biomass needs to be continuously monitored.

(vii) The extent and type of usage of the communication network in the biosphere reserve needs to be monitored to give some insights of the kind of activities of human communities in the area.

(viii) Indicator species in each habitat needs to be identified and monitored to indicate the overall health of each habitat.

ANIMAL NO.: 7 THE ANIMAL : DBT-- NO. OF SESSION(S MIN.)S, NASSN :
2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
69	PK	1	0.6000E+01	0.2449E+01
76	DB	1	0.6000E+01	0.2449E+01
85	LB	1	0.6000E+01	0.2449E+01
92	LT	1	0.6000E+01	0.2449E+01

Q4

G. Sp (1) 4 25%

G. Sp -

Cucullago 6

H Sp (1) ~~3~~ 4.

Grewia 1.

Anogeissus 2

Thunda Twanda 11

Q5

Twandra 9 50 - 75

Phyllanthus 1.

Zingerberaa 1.

Cotolleria 1.

Tomentosa 2.

H Sp (1) 1.

Q6

Twandra 9 50 - 70%.

Phyllanthus 1.

Zingerberaa 1. H Sp (1) — 1.

Grewia 2

'Jalpella' Grass 1.

(ix) Wildlife populations and their movements needs to be monitored to ~~a~~ afford ~~the~~ effective conservation and protection to these species.

Action Research

The second thrust of the scientific programme in the Nilgiri Biosphere Reserve should be to formulate and test sustainable alternate strategies. ~~for~~ A problem-oriented approach will adress itself to a whole range of issues ~~in~~ of resources use in the Nilgiri Biosphere Reserve. A model of development ~~should be tested~~ that is based on ecologically sustainable modes should be tested and adapted. It requires an innovative solution to many of the problems

ANIMAL NO.: 6 THE ANIMAL : DBA-- NO. OF SESSION(5 MIN.)S, NASSN :
2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
70	SB	1	0.6000E+01	0.2449E+01
77	ST	1	0.6000E+01	0.2449E+01
84	KK	1	0.6000E+01	0.2449E+01
91	S-	1	0.6000E+01	0.2449E+01

Q1

Themeda bimberoa 1 — Open 25%

G Sp. 6

Curculago 9

Zingiberaceae 1

Cambolona 1

H Sp (1) 2

Themeda triandra 4

Q2

Themeda triandra 20 — 50-70%

H Sp (1) 2

H Grewia sp 3

Dalbergia 1

Pleurocarpus M 1

Cambolona 1

Q3

Themeda triandra 13 — 50-70%

G. Sp. 3 — Carbon puller 4

H Sp (1) (1)

Phyllanthus Embolica 1

Crotellaria 1

Curculago 2

Cambolona 1

H Sp. 1

of resource use and restoration, that is critical to the success of the whole Nilgiri Biosphere Reserve Programme.

a) Land Use Planning is a major issue in a tract like the Western Ghats. Steep slopes and catchment areas have different land use capabilities than flatter terrains. Land use is the most significant issue ~~affecting~~ interrelated with every other aspect of conservation. Studies ~~b) Soil & Water Conservation is a signi~~ need to be conducted to assess land capabilities, and decide optimum land uses and restrict land use to the specified guidelines.

b) Soil and Water Conservation: is an important issue in the Nilgiri Biosphere Reserve because of ~~high~~ the occurrence of high siltation rates in the reservoirs decreasing the effective storage, and causing water shortages during monsoon failures. Methods of using

ANIMAL NO.: 9 THE ANIMAL : DBTA- NO. OF SESSION(S MIN.)S, NASSN :
2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
71	SC	1	0.6000E+01	0.2449E+01
83	NN	1	0.6000E+01	0.2449E+01
91	S-	1	0.6000E+01	0.2449E+01

$\frac{2 \times 20}{500 m^2} = \frac{240}{\times 20}$

$\frac{500}{\cancel{25,000}\ 50}$

Stop 2

62° N

Species	Girth	Height B	T	PB	
Arogueses	.32	0	4m	2.5m	
"	.58	0	12m	3.5m	
"	0.50	0	11m	10m	
Schebera	.52	0	10m	4m	
Terminalia	0.60	0	9m	5m	
Arogueses	0.67	0	10m	9m	4m
Tectona	0.97	0	12m	4m	
Arogueses	0.72	0	10m	4m ~~3.5m~~	
Tectona	0.60	0	~~8m~~ 10m	4m	
Terminalia t	0.83	0	8m	8m	
Arogueses	0.52	0	10m	2m	

H.A.

1

vegetation and live hedges for soil and water conservation need to be experimented with.

(c) Restoration: Huge areas in the biosphere reserve are in a degraded stage and concerted efforts are necessary to restore the ecological processes and natural balances by afforestation and other techniques. The question of designing an environment, and the vegetational successive stages, human utilities, ~~out of the exercise~~ and species composition have to be addressed.

(d) Forestry and Wildlife: A wide range of forestry practices need to be carefully monitored and new approaches to sustainable yield of forest raw materials for local use and industry needs to be evolved. With respect to wildlife, although the area harbours many large mammals, habitat ~~destru~~

2 ,AMOUNTING TO .... 0 HOURS 10 MINUTES

SERIAL NUMBER	BEHAVIOR	NO. OF OCCURENCES	FREQUENCY/HR	STD DEVIATION
72	SF	1	0.6000E+01	0.2449E+01
77	ST	1	0.6000E+01	0.2449E+01
82	BH	1	0.6000E+01	0.2449E+01
91	S-	1	0.6000E+01	0.2449E+01

Q8

Th. triandra	11	50-70%
G. Sp.	1	
H Sp (1)	5	
Lantana	1	
Randia Sapling	1/20	
Zingebenaa	~~3~~ 2	
Curculigo	3	

Q9

Themeda triandra	19	
G Sp	~~3~~ 5	50-70%
H Sp (1)	7	
Cambolina	7	
Curculigo	2	

Q10

Th. triandra	13	50-70%
G. Sp	1	
H. Sp (1)	4	
Cambolina	3	'Nennari' — 1.
Curculigo	6	
Desmodium. Herb	1.-10	

shrinking is causing a threat to their population. Migration routes and corridors to link areas of natural biota need to be identified and protected from human interference.

(e) Agriculture. The area contains unique cultivars that need to be provided with insitu ~~conser~~ protection. Cropping patterns have to be adjusted to and sustainable land use capabilities. Non-polluting agriculture with the use of green manure needs to be experimented with and encouraged. Another critical issue in protection of agriculture ~~from~~ against attack by wild animals which is responsible for considerable ~~apathy~~ antipathy of the local population towards conservation.

(f) Needs of human settlements ~~or~~ and local Welfare. It is important to involve the local communities in conservation

efforts for any degree of sucess of the programme. Methods to meet the ~~local~~ needs of local communities and ~~increasing~~ bettering their general well-being is an important issue in ~~for~~ the NBR area. Research ~~needs to be~~ ~~oriented~~ towards meeting the resource needs of local communities ~~and meeting these needs in~~ in a sustainable fashion is very necessary. Other recreational, educational and touristic interest in the NBR area has to be ~~regulated~~ carefully planned and regulated.

Understanding of the Biological Diversity

~~a) Conservation based studies~~ Concerning the entire spectrum of biological diversity including that of cultivated plants and domesticated animals

is ~~the most~~ an important purpose of the biosphere reserve. Our scientific understanding of ~~regarding to trends~~ processes governing trends of biological diversity and the evolutionary processes involved is very inadequate. ~~[illegible]~~

a) Community level studies.

~~species [illegible]~~. Our particular intrest will be how various environmental factors and human impact affect diversity. We need to ~~study~~ estimate levels of ecological species packing (alpha-diversity) and ecological species turn-over (beta-diversity) for each of the habitats constituting the NBR area. ~~They~~ These studies need long term monitoring to arrive at some understanding of the underlying processes. Questions regarding

~~b) Population~~

successions of vegetation, community structure, plant - animal interactions etc should be examined in detail.

b) Population Studies: Population studies on a few significant species ~~that~~ to understand in detail the population processes leading to evolution and extinctions need to be studied. Further studies on endangered and endemic species, as well as economically useful species will lead to a more efficient conservation of the species. For the selected species, population biology, levels of genetic variability, fertility, mortality, dispersals and interaction with other species need investigation. Some of the species that may be significant are the soil mycorrhizae,

dominant tree species, fresh water fishes endemic to the hill streams, ~~endemic~~ birds like the laughing thrushes, endangered species like the Nilgiri thar, elephants, tigers etc.

c) Genetic Resources: Special attention needs to be paid to looking at genetic resources of cultivated plants and ~~wi~~ domesticated animals. Bio-chemical techniques will have to be employed to look at genetic variability. Encouragement of insitu conservation of cultivars and protection to the wild relatives of cultivated plants have to be done.

Research Activities in the Nilgiri Biosphere Reserve.

a) Zoological Survey of India, Pune. They have taken up a detailed inventory of the fauna in the Bandipur and Mudumalai tracts with specific

reference to certain groups of invertebrates.

b) The Botanical Survey of India, Coimbatore. They have executed detailed studies of the flora of Silent Valley as well as general studies of the flora of Mukurthi and Bandipur. Detailed checklists of the flora of evergreen forests and their different stages is being executed.

c) Kerala Forest Research Institute Peechi. They have undertaken projects for long term monitoring of vegetational plots in the evergreen forests of Silent Valley. This would lead to studies on communities structure and population studies on wet evergreen ecosystems. They have also taken up action research for the eco development in Attappadi, a plateau of

tribal inhabitants.

d) Centre for Water Resources Development and Management, Calicut. They have initiated studies on select watersheds in the Nilgiri hills to monitor ~~water~~ hydrological parameters and suggest soil and water conservation ~~methods~~ techniques.

f) Indian Institute of Tropical Meteorology, Pune. They have set up raingauges to study rainfall and rain-water chemistry ~~studies~~ in the forest areas of Mudumalai.

g) Bombay Natural History Society, Bombay: Studies on the ecology and management of wild elephant populations in the Bandipur - Mudumalai tract has been

going on for the past 5 years. Range of habitats, foraging methods, population ~~[illegible]~~, migration routes etc are being monitored and studied.

h) ~~I~~ Centre for Ecological Sciences, Indian Institute of Science, Bangalore. Two projects are currently in progress in the Biosphere reserve area. A 50 hectare plot is being set out for long term ~~pr~~ monitoring and research into community structure, successions and population dynamics of vegetation in the transitions of moist to dry deciduous tracts of Mudumalai. In addition, vegetational dynamics, and plant-animal interactions are being studied only transects in different vegetation types of Mudumalai ——

A large mammal ecology project hopes to study the interactions and inter relations between the ~~large mammals like the elephant, the tiger, the deer deer, the wild dog~~ herbivores and carnivores in the Mudumalai - Bandipur tract.

In addition to the above a large number of ~~s~~ service and research and voluntary organizations are independently involved in ~~the~~ studies in the Nilgiri biosphere reserves. ~~There~~ There are other universities and organizations that could contribute ~~to~~ in specific areas of research. A coordinated effort among all these agencies towards the main objectives of research in the biosphere reserve will go a long way

A IS ✓

FOCAL ANIMAL ✓

in effective conservation of the area. This requires a massive and concerted effort given the diversity and uniqueness of the area. Indegenous ~~strategies~~ strategies need to be evolved specifically suited to the local conditions, which can only come about by interdisciplinary work between the biological sciences and the social sciences.

References:

1) Madhav Gadgil, S. Sathis Chandran Nair and R Sukumar, Scientific Programme for the Nilgiri Biosphere Reserve: Proposal for an Action Plan, IISc, Bangalore, Dec. 1986.

2) Madhav Gadgil and R. Sukumar, Research Priorities in the Nilgiri Biosphere Reserve - An Overview in Biosphere Reserves, Govt. of India, March 1987.

CCF

* State Govt Plan documents
* Current learners.

1) * Jan 6th meeting in Delhi for us
2) * Research Committee meeting
* IAS Training 2nd week of Feb.
* TN Govt to host Biosphere meeting.

Simulation and Modelling

1) Modelling of Ecosystems:
2) Recognition of Patterns: Spatial and Temporal.
3) Simulation of Ecosystems
4) Simulations in Evolutionary biology.
5)

⟶

Mathematics for Modelling and Simulation.

* Probabilistic and Stochastic Models.
* Differential Equations → Linear
  → Non linear.
* Functions and Curve fitting.

Tip #1 Adiabatic Lapse Rate:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$P_1 V_1 = P_2 V_2$$

Come to my room A-20.

~~$PV = RT$~~ $PV = nRT$

C_v : Specific heat at constant volume

C_p : Specific heat at constant pressure.

$c\,dT = -p\,dV$ HOW

$PV = nRT$

12:00 hrs

6/21/89

$\frac{5}{2}R$

$2.5R$

FIRST LAW OF THERMODYNAMICS.

$\{c\,dT = -p\,dV\}$ Adiabatic. No energy transfer. 'chk'

$w\,dh = g\frac{M}{V}\,dh$

$dp = -g\frac{M}{V}\,dh$ or $\Rightarrow V\,dp = -gM\,dh$

$p\,dV + V\,dp = nR\,dT$

$V\,dp = nR\,dT - p\,dV = (c+R)\,dT = -gM\,dh$

$$\frac{dT}{dh} = \frac{-gM}{c+R}.$$

Research Proposal

Recent Ecological History of the Nilgiri Plateau:

The diversity of the area:

- Topographical
- Latitudinal
- Longitudinal
- Climatological
- Altitudinal
- Flora
- Fauna
- Human Communities

Ecological & Vegetational zones

- Climatological + Altitudinal + Topographic + Edaphic.
- Vegetational types.

Characteristics and Pressures on each Vegetation type

Effects of Urbanization
Agriculture
Communication
Plantations
Population changes
et
on the Ecosystem.

Man and human societies is the greatest Ecological forces whether for Conservation or Destruction.

Man-Nature Interactions.

Is it time to sum up our historical & civilizational experience assess our ecological/environmental situation and then act and procede. Taking stock.

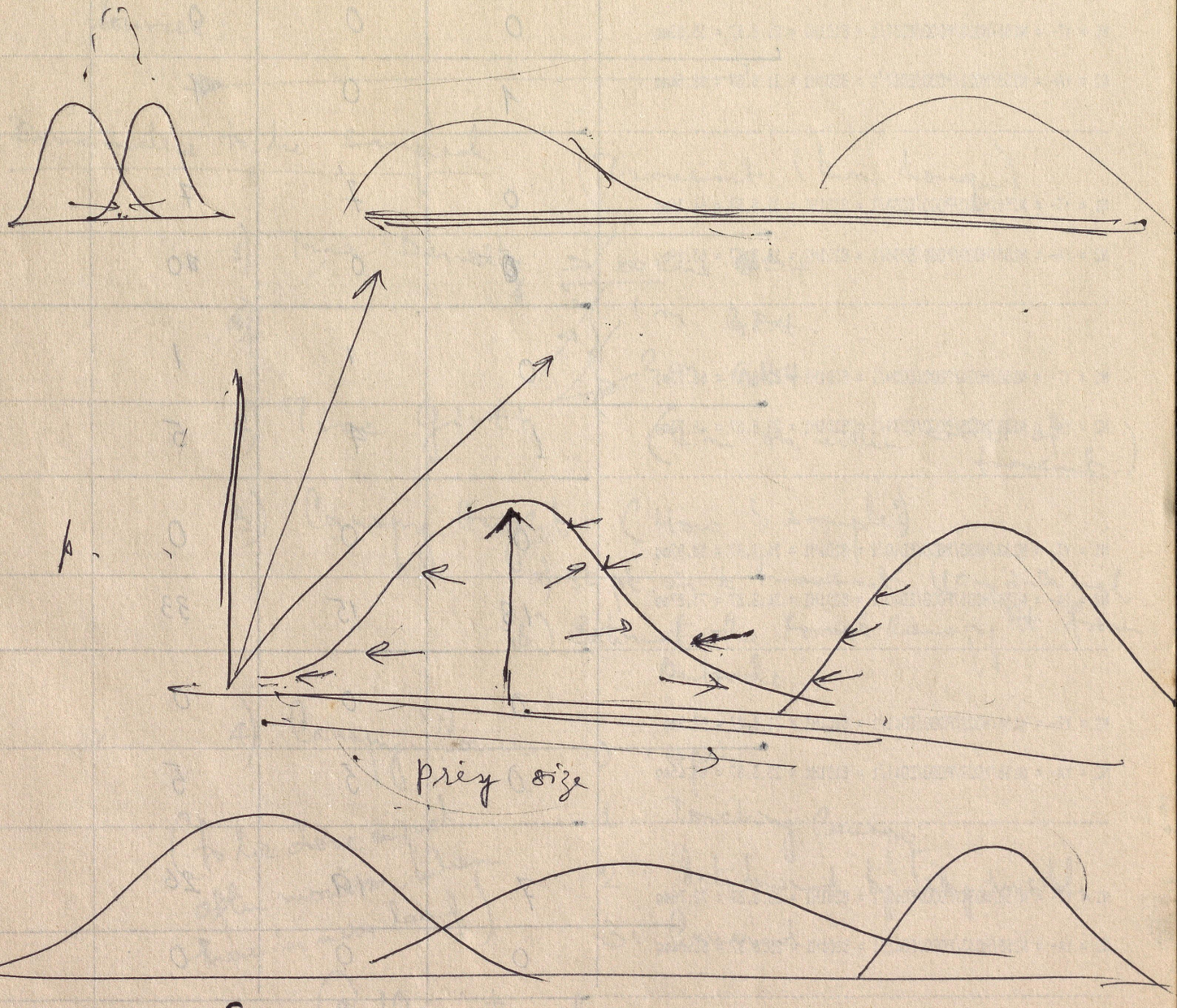
What is the response of the ecosystem? How have ecosystems altered with human interference?

N2 = YA- = N158/H033/P000/E042/2 = B1D1H1 = 25.8.87 = 61.34mg	0	2	2	2
N1 = YT- = N158/H039/P000/E043/1 = B1D1H1 = 26.8.87 = 55.71mg	8	2	10	
N2 = YA- = N158/H036/P000/E043/1 = B2D1H1 = 26.8.87 = 68.59mg	0	0	0	
N1 = YT- = N158/H040/P000/E044/1 = B1D1H1 = 27.8.87 = 67.54mg	3	1	4	
N2 = YA- = N158/H028/P000/E044/1 = B1D1H1 = 23.8.87 = 66.42mg	0	1	1	
N1 = YT- = N158/H042/P000/E045/1 = B1D1H1 = 27.8.87 = 53.7mg	0	0	0	
N2 = YA- = N158/H043/P000/E045/1 = B2D1H1 = 27.8.87 = 70.54mg	2	0	2	
N1 = YT- = N158/H046/P000/E046/1 = B2D1H1 = 29.8.87 = 70.0mg	7	2	9	
N2 = YA- = N158/H047/P000/E046/1 = B1D1H1 = 29.8.87 = 59.01mg	0	0	0	
N1 = YT- = N158/H045/P000/E047/1 = B1D1H1 = 28.8.87 = 62.7mg	0	0	0	
N2 = YA- = N158/H049/P000/E047/1 = B1D1H1 = 29.8.87 = 61.0mg	1	1	2	
N1 = YT- = N158/H055/P000/E048/1 = B1D1H1 = 31.8.87 = 53.96mg	0	0	0	0
N2 = YA- = N158/H044/P000/E048/1 = B2D1H1 = 31.8.87 = 63.26mg	3	0	3	5
N1 = YT- = N158/H053/P000/E049/1 = B1D1H1 = 31.8.87 = 61.67mg				
N2 = YA- = N158/H035/P000/E049/1 = B1D1H1 = 26.8.87 = 62.8mg				
N1 = YT- = N158/H053/P000/E049/2 = B1D1H1 = 31.8.87 = 61.67mg				
N2 = YA- = N158/H035/P000/E049/2 = B1D1H1 = 26.8.87 = 62.80mg				

Hypothesis. Result of theory of Competitions:

zzz... Competitor similarity.

(Map) zz Diffuse Competition



N2 = YA- = N158/H011/P000/E035/1 = B2D1H1 = 18.8.87 = 78.56mg	0	0	0	
N1 = YT- = N158/H019/P000/E036/1 = B1D1H1 = 21.8.87 = 60.77mg	0	0	0	
N2 = YA- = N158/H018/P000/E036/1 = B2D1H1 = 21.8.87 = 70.97mg	9	6	15	
N1 = YT- = N158/H019/P000/E036/2 = B1D1H1 = 21.8.87 = 60.77mg	0	0	0	0
N2 = YA- = N158/H018/P000/E036/2 = B2D1H1 = 21.8.87 = 70.97mg	0	0	0	15
N1 = YT- = N158/H023/P000/E037/1 = B1D1H1 = 21.8.87 = 55.00mg	0	0	0	
N2 = YA- = N158/H021/P000/E037/1 = B2D1H1 = 21.8.87 = 66.54mg	4	0	4	
N1 = YT- = N158/H020/P000/E038/1 = B1D1H1 = 21.8.87 = 64.36mg	0	7	7	
N2 = YA- = N158/H009/P000/E038/1 = B1D1H1 = 18.8.87 = 63.89mg	0	0	20	
N1 = YT- = N158/H024/P000/E039/1 = B2D1H1 = 22.8.87 = 68.73mg	0	1	1	
N2 = YA- = N158/H025/P000/E039/1 = B1D1H1 = 22.8.87 = 46.73mg	1	4	5	
N1 = YT- = N158/H030/P000/E040/1 = B1D1H1 = 24.8.87 = 58.97mg	0	0	0	
N2 = YA- = N158/H031/P000/E040/1 = B2D1H1 = 24.8.87 = 73.87mg	18	15	33	
N1 = YT- = N158/H022/P000/E041/1 = B1D1H1 = 21.8.87 = 67.9mg	0	0	0	
N2 = YA- = N158/H027/P000/E041/1 = B1D1H1 = 23.8.87 = 65.45mg	0	5	5	
N1 = YT- = N158/H034/P000/E042/1 = B2D1H1 = 25.8.87 = 72.76mg	7	19	26	
N2 = YA- = N158/H033/P000/E042/1 = B1D1H1 = 25.8.87 = 61.34mg	0	0	0	

	0	0	0

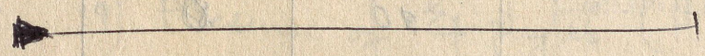
NZ = YA- = N158/H011/P000/E035/1 = 820IH1 = 18.8.87 = 78.56M9

Environmental / Ecological History

Introduction :

Outline :
Time Scale :
Details :

Oral Histories :
Sources :



Structure

Parameters to be sampled. (Transect 1 km long)

1) Tree Density. ≥ 30 cms @ BH
   1 m. GBH.
   2 m GBH
2) Tree Girth (2 m on either sides of transect.)
3) Canopy Height. (How to sample?)
   a) 50 pt. in a transect. (10 m interval
   b) Estimate the forest canopy Ht from Outside.
4) Canopy Cover : 0 : Open.
   1 : Touching Canopy
   2 : Intertwined by sky visible
   3 : Covered.

(To be done just after monsoon, when there is max leaf)

@ 10 m interval.

	20	4	20	
N1 = YT- = N158/H006/P000/E029/1 = B2D1H1 = 17.8.87 = 67.17mg	0	0	0	
N2 = YA- = N158/H004/P000/E029/1 = B1D1H1 = 17.8.87 = 57.29mg	1	4	5	
N1 = YT- = N158/H013/P000/E030/1 = B1D1H1 = 18.8.87 = 59.72mg	~~5~~	~~2~~	~~5~~	
N2 = YA- = N158/H003/P000/E030/1 = B2D1H1 = 17.8.87 = 69.33mg	~~0~~	~~0~~	~~0~~	
N1 = YT- = N158/H013/P000/E030/2 = B1D1H1 = 18.8.87 = 59.72mg	0	0	0	
N2 = YA- = N158/H003/P000/E030/2 = B2D1H1 = 17.8.87 = 69.33mg	~~10~~	~~0~~	~~10~~	
N1 = YT- = N158/H010/P000/E031/1 = B1D1H1 = 18.8.87 = 60.01mg	~~0~~ 3	~~0~~ 2	~~0~~ 5	
N2 = YA- = N158/H012/P000/E031/1 = B2D1H1 = 18.8.87 = 72.44mg	~~7~~ 0	~~2~~ 0	~~9~~ 0	
N1 = YT- = N158/H015/P000/E032/1 = B1D1H1 = 19.8.87 = 53.72mg	0	0	0	
N2 = YA- = N158/H007/P000/E032/1 = B2D1H1 = 17.8.87 = 72.26mg	10	8	18	
N1 = YT- = N158/H014/P000/E033/1 = B2D1H1 = 19.8.87 = 69.92mg	0	0	0	
N2 = YA- = N158/H008/P000/E033/1 = B1D1H1 = 18.8.87 = 59.73mg	7	2	9	
N1 = YT- = N158/H005/P000/E034/1 = B2D1H1 = 17.8.87 = 74.29mg				
N2 = YA- = N158/H017/P000/E034/1 = B1D1H1 = 20.8.87 = 47.32mg				

5) ~~Root Mo~~ ~~Butresses~~ / Tree Morphology - Butresses
Stilt Roots.
Others

6) — 30) —

6) Lianas & Woody Climbers reaching the canopy.

7) Bole Structure or Branching. (Coppiced growth)

8) Presence of Palms in the undergrowth.

9) Presence of Epiphytes (Hermacious or Woody) on trees.

10) Presence of Woody Stranglers.

11) Presence of Moss & Lichens.

12) No. of tree stumps.

13) Presence of Cycads.

14) Presence of Tree ferns.

15) Presence of Pepper (Piper spp.)

16) Meristica spp. } Humid tracts.

17) Canarium spp }

18) Mango trees (Large)

19) Ficus trees (not habitat specific)

20) Teak. (~~Secondary~~ Transition)

21) Anogeussis (Dry Habitat)

22) Terminalia (Dry & Moist) Secondary in order to Emergent

23) Gareinia

Indicator Species for Bio climates

Ind. Economic Species

Other Economic trees.

Commercial Plantations

Tea
Coffee
etc.

Indicator of Vegetational Dynamics.

24) Macaranga spp (Pioneer spp. in opened up Evergreen Forest)

25) Rubus (High Alt/end species)

26) Rhododendron (High Alt).

27) Wild Rose. (End species)

—

28) Presence of Tall grasses. (Fire Indicator)

29) Ferns. Ptredium. Braken

Structure

30) Ground Layer
Under Storey
Middle Storey
Canopy
Emergents.

31) Secondary Invaders.
Eupatorium (Dryer Areas) Annuals
Lantana (Perrinial)
Low Clumps of Bamboo (Overgrazing)
Strobilanthus (Wetter areas) Annuals or Perrinial
Parthenium.

32) Presence of Thorny Plants in the undergrowth (P. Selection for Overgrazing)

33) Presence of Poisonous Plants.

34) Presence of Cinnamon.

35) Presence of Cane at the ground level.

36) Availability of Fleshy fruits.

37) Riverine spp.
Oclandra.
Lagestromia speciosa.

38) Terminalia arjuna
Bassia neriifolia
Saracca Indica

Animals
Large Mammals.

28) Scrub.
Oppenaia.
Euphorbia
Cassia.
Borassus.
is it primary scrub or Secondary scrub.

Irrigation.

Check list of
Indicator Sp. Secondary Species.

Agriculture:
Soil treatment.
Bunds.
Cropping patterns.

Initial Condition
Final Condition

Fire / Cattle Sheep Grazing / Soil → Rocky, Lateritic, Hummy, Red, Black, Clayey, Sandy

Agricultural Species.
Grazing.

Population		
$\rightarrow X_1$	dx_1/dt	$1/x_1 \frac{dx_1}{dt}$
$\rightarrow X_2$	dx_2/dt	$1/x_2 \, dx_2/dt$

$$\frac{1}{x_1}\frac{dx_1}{dt} = f_1(x_1, x_2)$$

$$\frac{1}{x_2}\frac{dx_2}{dt} = f_2(x_1, x_2)$$

f_1 and f_2 are linear, then

$$\frac{1}{x_1}\frac{dx_1}{dt} = \frac{r_1}{K_1}\left[K_1 - x_1 - \alpha x_2\right]$$

$$\frac{1}{x_2}\frac{dx_2}{dt} = \frac{r_2}{K_2}\left[K_2 - x_2 - \alpha' x_1\right]$$

if $x_1 \to 0$, and for $\frac{1}{x_1}\frac{dx_1}{dt} > 0$; $x_2 \to K_2$

i.e $\frac{r_1}{K_1}\left[K_1 - \alpha K_2\right] > 0$

2 months

1) FORESTS
2) GRASSLANDS
3) FOREST PLANTATIONS
4) ARBORICULTURE
5) CULTIVATION

Cropping pattern
Irrigation

cultural practices

Preliminary List of Habitats.

1. Evergreen forests
2. Semi-evergreen forests
3. Deciduous forests
4. Thorny thickets
5. Grasslands.
6. Forest Plantations
7. Riverine Vegetation
8. Perrinneal Streams
9. Seasonal Streams
10. Water Bodies.

Hevea plantations
Manihot glazziovii

Grazing Lands.
~~Urban settlements~~
Large Mammals Lands

11. ~~[illegible]~~. Arboriculture.

12. Irrigated crops.

13. Dry crop cultivation

14. Fallows and Wastelands.

15. ~~Urban~~ Settlements.

Dams.
Cannals and Pipes.

16. Communication channels : Roads, Paths, Railways, telegraph lines

17. Power Stations.

18. Power transmission lines.

These may be called sensitive information?

A. STRUCTURE

1) Tree Density

2) Tree girth

3) Canopy Height

4) Canopy Cover

5) Tree Morphology - Buttresses
Stilt roots, etc.

6) No. of stumps.

7) Bole structure and Branching.

8) ~~Ground Layer~~ Tiers of Vegetation
~~Under Storey~~
Middle

Ground Layer
Under Storey
Middle Storey
Canopy
Emergents.

9) Number of species / Abundance.

B.

B. INDICATOR SPECIES FOR BIOCLIMATES.

9) Lianas & Woody climbers

10) Woody Stranglers

Epiphytes (Herbaceous or Woody)

12) Moss & Lichens

13) Palms in the undergrowth

14) Cycads

15) Tree Ferns

16) Pepper vines (Pipper spp)

17) Meristica spp.

18) Canarium spp.

19) Anoguessis spp

20) Rhododendron 21) Ferns. Braken.

Riverine spp.

Oelandra
Lagestromia.
Terminalia arjuna
Bassia nerifolia.
Saracca indica.

C. INDICATOR SPECIES OF VEGETATIONAL DYNAMICS.

~~20)~~ 22) Macaranga spp (Pioneer sp.)

23) Rubus (High Alt. edge sp.)

24) Wild rose (Edge spp)

~~25) Tall grasses~~ 25) Eupatorium

Oppenoa
Euphorbia
Cassica.

~~26)~~ Secondary Scrub.

26) Lantana

27) Strobilanthus

28) Presence of ~~Other~~ proliferating weeds

29) Parthenium

~~BIO~~

D. POSSIBLE INDICATORS OF BIOTIC INFLUENCE & INTREST

30) Mango Mangefera india

31) Ficus

32) Teak (Tectona grandis)

33) Matti (Terminalia spp.)

34) Rosewood (Dalbergia)

35) Vengai (Pterocarpus)

36) Venteak (Lagestromia)

37) Tadasil (Gremia)

Other Economic trees → Sandalwood (Santalum album)

Timber

MFPs.

38) Bamboo.

39) Cane.

40) Grasses for Grazing.

41) Fleshy fruits.

42) Presence of damage to vegetation by ~~mam~~ wild mammals.

43 Presence of large mammals.

44). Presence of Grazing. Cattle / Goats / Sheep.

45) Fuelwood Extraction.

No. of paths

5.0571 4.6667
5.6000 4.6333

44) Presence of Thorny Plants. (Herbivory)

45) Presence of Poisonous Plants

46) Susceptability & Occurance of Fire.

E. FOREST PLANTATIONS SPECIFIC.

1) Species. -



F. ARBORICULTURE SPECIFIC.

1) Species

2) Irrigation.

3) Land treatment. terracing etc.

G. AGRICULTURE Soil conservation etc.

Cropping pattern.

Irrigation.

Land treatment. terracing

H. SOILS : 1. Rocky Soil conservation.

2. Laterite.

3. Humus.

4. Red

5. Black

6. ~~Bot~~ Clayey

7. Sandy.

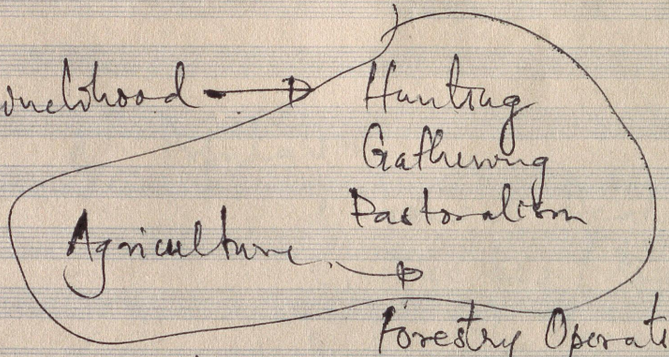
A. Population Changes / Synonyms.

Epidemics / Malaria.
General Health.
Immigration
Emmigration.

Population
~~Occupations~~
~~Disasters~~
Vegetation
Climate
Water Resources & quality
Communications
World life
~~Ethnobiology~~
Materials and Commodity Flows
~~Landscape features~~
Culture & Society

Note: A variability of resourceful people.
2. In each ~~town~~ catchment.
3. In each village.

Artifacts (Roads, Dams, Tanks)



Territory.

Government.

Culture & Society
Communications.
Commodities.
Artifacts?

Communications
Paths
Roads
Power.

ALL OCCURENCES SESSION NO. = 3

A T1128117

SCAN NO. = 2

S	T1128117	YO---	YS---	YG---	YD---	YW---	YX---	BR---
S	T1128117	OS---	OG---	OD---	OW---	OX---	SR---	SY---
S	T1128117	SB---	SL---	SO---	SG---	SD---	SW---	SX---
S	T1128117	GR---	GY---	GB---	GL---	GO---	GS---	GD---
S	T1128117	GW---	GX---	DR---	DY---	DB---	DL---	DO---
S	T1128117	DS---	DG---	DW---	DX---	WR---	WY---	WB---

ALL OCCURENCES SESSION NO. = 4

A T1128117

ALL OCCURENCES SESSION NO. = 5

A T1128117

ALL OCCURENCES SESSION NO. = 6

A T1128117

A. Population

1. General Health
2. Diseases / Epidemics / Malaria
3. Health Care
4. Immigration
5. Emmigration
6. Growth.

B. Territory

1. Range
2. Extant
3. Resources.
4. Change in –
5. ~~Origins of the Com~~ ~~Mig~~ Movements.
6. Landscape Features in the territory.

C. Livelihood & Economic Activity

1. Hunting
2. Gathering
3. Pastoralism
4. Agriculture.
5. Forestry Operations & MFPs
6. Plantations
7. Trade
8. Industry

D. Disasters

1. Flood
2. Famine
3. Diseases of Crops & Plants & Livestock & Wildlife
4. ~~Ac~~ Other disasters

E. Vegetation

1. Extant
2. Type

Species → 3. Resources. 1 (Grazing, Building, Food, Drugs, Agri.

4. Density & Size.

5. ~~Avail~~ &

5. ~~Availability~~ Abundances

6. Rights & Privileges / ~~Poaching dues~~ Smugglings.

7. Introduced species

8. Weeds.

9.

F. Climate

1. Rainfall.
2. Seasonality

G Water Resources.

1. ~~Seaso~~ Surface Water
2. Ground water
3. Seasonality
4. Water quality

H. Wildlife

1. Species
2. Abundance.
3. Hunting
4. Poaching
5. Conservation.
6. Conflict (Raids, Deaths etc).

I.

~~B. Commodities & Market~~

I. Culture & Society

1. Kin Groups.
2. Sacred Sites, Groves, Animals, Trees, Pools
3. Taboos.
4. Totems
5. Nature Worship.
6. ~~Their~~ Origins & History.
7. ~~Righ~~ Rites & Rituals & Celebrations.
8. Aspirations.
9. World view.

J. ~~Commodities~~ Communications

1. Paths
2. Roads
3. Power.
4. ~~Telegraph~~. P & T
5. ~~P~~

~~K~~

Government Records

A Records of the Forest Department

1. Reservation and Settlement
2. Working Plans
3. Forest Workings
4. Forest Inspection reports
5. Forest ~~crimes~~ offences.
6. Forest Maps
7. Resource Surveys
8. ~~Plantation Records~~ Plantation Records.

Forest Laws & Codes

B. Census Records.

1. Population
2. Occupations
3. Caste / Tribe.
4. Immigration.
5. Migrations.

C. Survey of India Maps.

1. Habitation ~~changes~~
2. ~~Habitat~~ Vegetation — Reserve Forests. Plantations
3. Land Use
4. Communications & Power
5. Water Bodies

D. Records of Public Works Departments:

1. Communication Networks: Roads / Bridges.
2. Dams / Reservoirs /

E. Records of the Revenue Department

1. Settlement
2. ~~Revenue~~ Annual Revenue
3. Yeilds
4. Cropping Patterns
5. Agricultural Seasons.

F. Miscellaneous Sources.

1. Newspapers.
2. Reports of Commissions on Famine
   Agriculture
   Forest.
3. Shikar ~~anecdote~~ anecdote
4. Travellogues
5. Tribal Studies.

E. Records of the Revenue Department

1. Settlement
2. ~~Revenue~~ Annual Revenue
3. Yeilds
4. Cropping Patterns
5. Agricultural Seasons.

F. Miscellaneous Sources.

1. Newspapers.
2. Reports of Commissions on Famine
   Agriculture
   Forest.
3. Shikar ~~anecdote~~ anecdote
4. Travellogues
5. Tribal Studies.

9 ✓
1 ✓
6 ✓
3 ✓
14 ✓
4 ✓
~~10~~
8 ✓
7 ✓
11 ✓
13 ✓
~~12~~

Field Equipment

1) Ropes 120 m
   1 Plastic
   2. ~~Cloth~~. Cotton.

2) Prismatic Compass
   Altimeter

3) Map Carrying and Drafting Kit
   (to be fabricated)

10) Data Sheets.

4) Tape Recorder

5) Camera

6) Films → Slides & Prints.

7) Tape ~~100 m~~ 50 m / 100 m

8) Binoculars.

9) Stationary:
   Tracing Sheets
   Butter paper.
   Rubber Pens / Inks
   Crayons
   Highlighters
   Scale ~~100~~ 1 m
   Pencils.

Scale
Pencils.

Analysis.

We commence
With this wealth of data, analysis to discern patterns of ecological changes both ~~in~~ ~~over~~ in time and space. From the current scenario picture, a set of ~~overlapping~~ ~~domains~~ spatial domains can be prepared for each of the parameters sampled ~~and~~ & ~~correlates and~~ Biogeographical zones and correlates between the various parameters for ~~would~~ need to be looked for, definite patterns of relationships. ~~Based~~ Based on this conservation priorities and strategies ~~we~~ could evolve.

* the interrelations

F 19

A. Vegetation.

1. What are the different vegetation types and what are their extents?

1. What has been the rate of deforestation in each of the different ~~zones~~ types.

2. What ~~has been the~~ is the extent of fragmentation of vegetation types. leading to genetic isolation of each type.

What have been the factors ~~reasons for deforestation~~ responsible for deforestation and by how much?

3. Would this extent of fragmentation hamper ecological processes?

4. Can we say something about their histories from ~~about~~ from the density and structure of vegetation, about their histories.

~~What is the historical~~ How has fragmentation proceeded in the last 200 years?

5. What have been the consequences of increases in communication networks on the vegetation?

6. What have been the consequence of increases in population?

~~2. What~~

N1 = YT- = N158/H044/P000/E056/1 = B1D1H1 = 28.8.87 = 65.64mg

N2 = YA- = N158/H064/P000/E056/1 = B1D1H1 = 2.9.87 = 63.51mg

N1 = YT- = N158/H048/P000/E057/1 = B1D1H1 = 29.8.87 = 66.34mg

N2 = YA- = N158/H037/P000/E057/1 = B1D1H1 = 26.8.87 = 70.34mg

---

N1 = YT- = N158/H048/P000/E057/2 = B1D1H1 = 29.8.87 = 66.34mg

N2 = YA- = N158/H037/P000/E057/2 = B1D1H1 = 26.8.87 = 70.34mg

---

N1 = YT- = N158/H066/P000/E058/1 = B1D1H1 = 2.9.87 = 57.53mg

N2 = YA- = N158/H056/P000/E058/1 = B1D1H1 = 31.8.87 = 56.19mg

---

N1 = YT- = N158/H066/P000/E058/1 = B1D1H1 = 2.9.87 = 57.53mg

N2 = YA- = N158/H056/P000/E058/1 = B1D1H1 = 31.8.87 = 56.19mg

---

Nov 1972

PRELIMINARY LIST OF HABITATS :

A. Forest Ecosystems . .

B. Agroforestry Ecosystems.

C. Agricultural Ecosystems.

Fuzzy { Original Ecosystems
Modified Ecosystems
Transformed Ecosystems.

N1 = YT- = N158/H059/P000/E050/2 = B1D1H1 = 1.9.87 = 56.70mg

N2 = YA- = N158/H060/P000/E050/2 = B2D1H1 = 1.9.87 = 66.48mg

N1 = YT- = N158/H063/P000/E051/1 = B1D1H1 = 2.9.87 = 66.54mg

N2 = YA- = N158/H062/P000/E051/1 = B2D1H1 = 2.9.87 = 55.84g

N1 = YT- = N158/H029/P000/E052/2 = B1D1H1 = 24.8.87 = 59.89mg

N2 = YA- = N158/H067/P000/E052/2 = B1D1H1 = 3.9.87 = 60.04mg

N1 = YT- = N158/H029/P000/E052/2 = B1D1H1 = 24.8.87 = 59.89mg

N2 = YA- = N158/H067/P000/E052/2 = B1D1H1 = 3.9.87 = 60.04mg

N1 = YT- = N158/H026/P000/E053/1 = B1D1H1 = 23.8.87 = 63.32mg

N2 = YA- = N158/H057/P000/E053/1 = B1D1H1 = 1.9.87 = 60.04mg

N1 = YT- = N158/H065/P000/E054/1 = B1D1H1 = 2.9.87 = 64.78mg

N2 = YA- = N158/H032/P000/E054/1 = B1D1H1 = 25.8.87 = 66.37mg

---

N1 = YT- = N158/H065/P000/E054/2 = B1D1H1 = 2.9.87 = 64.78mg

N1 = YA- = N158/H032/P000/E054/2 = B1D1H1 = 25.8.87 = 66.37mg

---

N1 = YT- = N158/H041/P000/E054/1 = B1D1H1 = 27.8.87 = 51.57mg

N2 = YA- = N158/H068/P000/E054/1 = B1D1H1 = 3.9.87 = 53.33mg

A. Forest Ecosystems

Evergreen

Most deciduous

Dry deciduous.

Tree Savannah

Scrub Savannah

Ants; Reproductive Behaviour; Observation
Reprint available
709
Herbers, J.M. 1979.

Landuse & Landscapes

A. Forest Ecosystems:

1. Evergreen forests ✓
2. Semi-Evergreen forests ✓
3. Moist deciduous forest. ✓
4. Dry deciduous forests ✓
5. Semi-
6. Grasslands
7. Riverine Vegetation.

B. ~~Agro-forestry Ecosystems~~ or Arboriculture

1. Forest plantations
2. Commercial plantation

C. Agriculture.

2.

D. Fallows & Wastelands (Perennial)

E. Water bodies.

1. ~~Semi~~ Seasonal Streams
2. Perennial Streams
3. Other water bodies.

perennial

Reprint available
843
Greenberg, L. 1983.

F. Artifacts

F. 1 Settlements

G. 2 Communication channels.

H. 3 Dams.

4 Canals & Ropes.

5 Power Stations.

6 Power transmission lines.

Psyche 16-19.
Social Wasp; Vespine Wasp; Hymenoptera; Vespidae; Dolichovespula grenaria; Dolic

There is an increasing pressure on land and other natural resources that raise serious question on the future subsistence of human societies. we talk about habitat destruction and endangering many living forms & the loss of genetic diversity, ... as hampering evolutionary processes.

To understand the current ecological scenaries

This study aims to pattern landscape changes over time and space. We intend to study the Nilgiri area as an ecological unit from the Moyar gorge in the north to the northern lip of the Palghat gap in the South, from the Coimbatore plains in the East to the Wynaad - Mysore plateau and the Nilambur plain in the West.

This study aims to understand the ~~col~~ ecology of the Nilgiri ~~troposphere~~ area

major gorge

↓

diversity

In order to understand the current ecological scenario of this area it is necessary ~~important~~ to understand ~~this~~ how it has been shaped by different forces in the last 200 years. For example, one important actor in the destiny of the Nilgiri is the Englishman searching for a terrain on which to recreate the landscape of his homeland. Several other forces have also made Nilgiris what they are now.

The historical shaping of the Nilgiri is recorded in documents left behind by the British and, in the memories of local inhabitants and more ~~than~~ visibly in the very geo-/landscape

Reprint available

633
Swaminathan, M.S. 1984.

~~created~~ In this study we will draw upon these complementary sources of information to ~~unde~~ understand the current ecological status & shaping of the Nilgiri area.

$$\left(\frac{K-N}{N}\right) \times r = \frac{dN}{dt}$$

~~$\left(\frac{K-1}{N}\right) \times r$~~

~~Ecological~~ Changes in the Nilgiri Biosphere Reserve and the current Ecological Status.

Nilgiri Biosphere Reserve:

Biotic pressure &
Habitat destruction
& Conservation priorities
Conservation strategies.

$$\left(\frac{K-N}{K}\right) r \times N = \frac{dN}{dt}$$

$$\left(1 - \frac{N}{K}\right) r N$$

Michener, C.D. 1981.
Classification of the Bee Family Melittidae with a Review of Species of Meganomi
inae
Contrib. Amer. Ent. Inst. 18, 1-135.
Hymenoptera; Apoidea; Melittinae; Dasypodinae; Classification; Taxonomy; Review

Spatial & Temporal characteristics of Landscapes

A. ~~Tree~~ Structure

1. Tree density.

typology: A study of types or a preclassification.

"Do we know enough about landscapes to propose a classification? The honest answer is no, and we wish to avoid the emergence of sterile dogmatism."

attributes

$\log_{10} 0 =$ $\log_2 2 = 1$

$\log_{10} 10 = 1.0$ 0.000

$\log_{10} 10 = 1.$

$10^0 = 1$ $10^1 = 10$

$10^0 = 1.$

$10^0 = 1$

$10^1 = 10$

$\log_b a = c$

$a = b^c$

$\boxed{\log_{10} 10 = 1.0}$

$A/P = \frac{\sqrt{A}}{P}$

$D_i = \frac{P}{2\sqrt{A\pi}} = \frac{2\pi r}{2\sqrt{\pi^2 r^2}} = 1$

756
Machado, V.L.L. 1977.
Estudos Biologicos de Polybia occidentalis occidentalis (Olivier, 1791) (Hym.-Ve
spidae)

Location : ?

~~Zone~~ ~~Catch~~ Catchment Area :

Zone

Main Floristics.

	Spp Sci. ‖ Local Name.	Tree/Shrub/Herb.	Che	~~[illegible]~~ Height	Regeneration	Distribution. C/U/L/P
1)						
2)						

The Biosphere Programme is a part of an UNESCO programme ~~launched~~ ~~in 1973~~ on Man and the Biosphere. It was launched in 1973 with the purpose of insitu preservation of the overall biological diversity of the world. It ~~has~~ hoped to ~~accecent was more on~~ identify and conserving two typical and contiguously large areas in each of the worlds biogeographic zones. Its accent was more on conserving the whole ~~biological~~ range of biological diversity rather than specific species conservation. In addition, it recognized man and his needs and development as an essential part of the ecosystem and tried to integrate human needs with biological conservation. In this sense it was a unique and new approach to conservation.

In this sense it was a unique and new approach to conservation.

Ecological Changes in the Nilgiri Biosphere Reserve

on biosphere reserves in gen.

Introduction

The Nilgiri Biosphere Reserve (NBR) covering an area of 5520 sq km is first biosphere reserve in the country. ~~in the form of an annular ring around the Nilgiri plateau~~. The ~~The Nilgiri biosphere~~ reserve (~~NBR~~) was constituted in 1986, covering the states of Karnataka, Kerala and Tamil Nadu*. ~~The NBR programme aims at the conservation of biological diversity, including the genetic diversity of cultivated cultivars and domesticated animals~~.

With the establishment of the NBR ~~NBR programme~~, it is hoped to conserve the ~~genetic~~ biological diversity of two of the twelve biogeographic zones of the Indian sub-continent, ie the Malabar Rain forest and the Deccan thorn forest. Infact the NBR area abounds in diversity of habitats from the lowlands Evergreen forests, to the high elevation evergreen shola forests, from the ~~heavy rainfall evergreen fore~~ tropical rainforests, to the dry scrub forests. The area also harbours ~~and~~, endemic and endangered flora and fauna ?, ~~with large mammals like elephants to many endemic amphibians and reptiles~~. It includes the ~~g~~ largest ~~known~~ populations of the Nilgiri ~~Thar~~ Tahr ~~and~~ the lion tailed macaque and Nilgiri langur; ~~two of the~~ endangered species, endemic to W. Ghats as well as ~~a healthy popopulation of the~~

* It includes the sanctuary complex of Wynaad, Nagarhole, Bandipur and Mudumalai; the forested hill slopes of Nilambur and Nilgiris, the upper Nilgiri plateau; and the Silent Valley, Attapadi plateau and Siruvani hills. The biosphere reserve programme of the UNESCO is an effort to preserve the rich biological heritage of the world for future generations.

Nilgiri langur

~~largest~~ ~~probably~~ the largest population of elephants, tiger, gaur, sambhar, and chital in Southern India. It is also ~~the habitat~~ home of to ~~a large number of~~ many tribal ~~groups~~ communities who have over time evolved a unique and harmonious relationships with their environment, growing a variety of cultivars and ~~&~~ domesticating ~~[illegible]~~ and breeding livestock.* The NBR programme aims at ~~such~~ conservation ~~of~~ of the ~~of biologi~~ ~~all the~~ biological diversity on such a scale and to evolve methods of sustainable development.

* In addition, the effect of tourism and industrial and mercantile development ~~have~~ are having their deleterious impact on the environment.

Scope of the Study: The current study aims to ~~pattern and study~~ pattern the ecological changes in the ~~Nilgiri~~ NBR ~~B~~area over the last 200 years. ~~upto the present~~. It aims to identify the current biotic pressures on the ecosystems and evolve conservation priorities and stratigies. ~~[illegible]~~.

δ not necessary

Right from the origins of man, about 3000 years bp human societies have be manipulating and modifying the environment for his own survival. Thus human societies have been a very strong ecological and evolutionary force. Especially over the last 200 years

Foraging and Morphology in Ants: The Role of Vertebrate Predators as Agents of N
atural Selection
In: Social Insects in the Tropics, (Ed.)P.Jaisson, Universite Paris-Nord, Vol.2,
pp. 87-101

Since the coming of the British, and with them, the industrial and mercantile mode of production, human societies have made very significant changes in the environment, to the effect of completly disrupting evolutionary and life processes. Simultaneously over the recent past, there has been an increasing awareness for conservation of natural resources.

The current ecological scenario in the NBR is a product of consequences of historical changes in the environment caused by man.

To understand the current ecological scenario in the NBR area, we have to study its changes over the a historical period. ~~It is the purpose~~ Before the coming of the British, the NBR area was sparsely populated with human societies. There were a few scattered tribal communities living by hunting, gathering, ~~pastoral~~ husbanding ~~the~~ livestock, and by some shifting cultivation. With the coming of the British, around 1800, the situation changed drastically. They found on the Nilgiri hills a salubrious climate, and a convenient retreat from the hot Tamil plains. Soon they established a sanatorium and tried to recreate their English home environment

not necessary

one or 2 sentences

summarize

with temperate fruits and vegetables and temperate forest trees. The plantation industry of Tea and Coffee plantations started around 1860s. This brought in waves of immigrant plantation labour from the famine stared Tamil plains. Consequetly the Nilgiris become a convenient hill resort with a lot of sport of shikar and hunting. Meanwhile the more accessible forests were worked for timber and other forest produce. All this had their toll on the forests and wildlife. A lot of habitats were modified or converted. ~~Infact the indo incidence of forest fire in the Mudumalai area increased with increased workings of the forests~~ there are definite indications that. After independence, the 'grow more food campaign', the development of forest based industries, the settlement of Srilankan repartriates, increased tourism etc, further hastened habitat modification and conversion. Simultaneously, the notification of wildlife sanctuaries and national parks, and the creation of the biosphere reserve itself has given an impetus to conservation of the rich biological diversity of the area. ~~Inspite~~ And, while such attempts have helped to restore depleted ecosystems, the ~~lack~~ lack of adequate zoning and the increasing pressure on land has brought the people living on the fringes of the forests in increasing confrontation with the objectives of

to 50% at least

775
Lenoir,A. 1981.
Brood Retrieving in the Ant, Lasius niger L.
Sociobiology 6, 153-178.
Hymenoptera; Formicidae; Foraging Behaviour; Recruitment Behaviour; Experiment

conservation. Critical habitat areas for wildlife are increasingly being threathaed by development projects.

In this study it is proposed to develop an accurate current scenario picture of the NBR area, and to reconstruct the ecological history of the area for the past 200 years. ~~This would~~ the study & would identify the extent of biological diversity, ~~the current pressures on the ecosystem, and~~ critical biogeographical areas for conservation.* It would assess the extent of habitat loss for each type of habitat and for wildlife, as well the prime reasons for such ~~loss of~~ habitat losses over the historical period. It would help understanding the ecosystem responses to man-induced ~~the~~ disturbance regimes. And finally it would question the patterns of progress and development and its impact on biological diversity, life processes and the quality of life for its inhabitants. The study would also generate scientific information that would be very essential to help evolve a management plan for the Nilgiri Biosphere Reserve.

* The study would assess habitat quality of each of the ecosystems in the NBR area, and identify current pressures on them. Help evolve a management plan.

Methodology:

Justification. expand give examples of how it will help management substantially

Le Moli,F., Parmigiani,S. 1982.
Intraspecific Combat in the Red Wood Ant (Formica lugubris, Zett.)
Aggressive Behaviour 8, 145-148.
Hymenoptera; Formicidae; Attack Behaviour; Aggressive Behaviour; Chemical ...

Methodology : The Nilgiri Biosphere Area (NBR) is to be ~~partitioned into twenty eight~~ on the basis of the drainage pattern into ~~six~~ major river catchments and minor sub-catchment areas. In each sub catchment, different homogenous habitats will be identified ~~and~~ ~~had~~ based upon the floristics and structure of the forests and land use patterns. Thus a detailed Vegetation and land use map will be prepared of the Nilgiri Biosphere Reserve. The field work and mapping would be done on ~~a~~ 1:50,000 scale maps and final vegetation map will be made on a 1:1,00,000 scale. Based on ecological principles of minimum area for conservation of biological diversity, the ~~presence of corri~~ presence or absence of migration routes for ~~swim~~ large mammals,

Reprint available

the appropriateness of ~~land~~ current land use patterns, etc, the landscape of the NBR area would be analysed. ~~Vegetational and other clues to the ecological history of each of the habitats of the area would be gathered.~~ Based on these the critical pressures on the ecosystem would be identified and critical areas for conservation identified.

The reconstruction of the past history of the ecosystem would be gleaned from three major ~~sour~~ ~~aspe~~ sources of information.

(a) Vegetational: Vegetational clues to the ecological history of each of the habitats would be gathered. The structure and floristics of the forests; the presence of weedy species; the presence of other indicator species that may denote typical microclimates or vegetational successional stages would be studied.

(b) Oral histories: Over the period of a 100 or 200 years oral histories and human

Observations on Mites of the Asian Honeybee Species (Apis cerana, Apis dorsata, Apis florea)
Apidologie 14, 197-204.

experience about the environment would be alive and rich. We would ~~collect and record~~ collect and record detailed oral histories for each of these areas regarding population, livelihood, modes of livelihood, vegetation, climate, water resources, wildlife, conflict with wildlife natural disasters etc. Obviously each social group's perception about the environment would be different depending up its occupation. Thus it is proposed to collect oral histories from articulate members of each of social groups in the NBR area. This would be done simultaneously with the Vegetational and land use mapping of the area.

shorten a little

(c) ~~Historical and~~ Archival records: Much of the ~~histori~~ archival records of the government are rich in information about the environment. The detailed records of the forest department would give details of the working of the forests, raising of forest plantations, details of water resources etc. The records of the agriculture and revenue department are rich in information regarding land use, agricultural yeilds, ~~irrigation etc~~. climate,

814
Knerer,G., Plateaux-Quenu,C. 1967.
Sur la production de males chez les Halictinae (Insectes, Hymenopteres) Sociaux
C.R.Acad.Sc.Paris 264, 1096-1099.

etc.. Older editions of the Survey of India maps and Census records would yield information of habitations, population changes, occupations etc. Shikar records, travelouges and newspaper reports would yield a lot of miscellaneous ecological ~~in~~ information. We would study these archival and historical records and cull out relevant ecological and environmental information to reconstruct the ecological history of the NBR area.

Justification:

Time schedule: ~~During the~~ Period Aug '89 to ~~Dec~~ ~~Jan~~ May '90 would be spent in field work in the Tamilnadu and Kerala portions of the NBR to ~~do~~ develop a detail current scenario ~~of~~ ~~the~~ of the Vegetation and land use. In addition during this period oral histories would be collected from all over the NBR area.

Period ~~Jan~~ May '91 to Dec '91 would be spent in Archival work at Ooty, Coimbatore, Madras, Calcutta, ~~an~~ Delhi and

806
Knerer, G. 1980.
Evolution of Halictine Castes
Naturwissenschaften 67, 133-135.

Facilities Available ; Fellowship. Dehra Dun.
Field Station.
Laboratory
PC
Satellite Imagery
Maps.

Budget

~~Financial Requirements~~ Partial funding for the project towards ~~funding for~~ ~~extra~~ travel during the extension field work is sought ~~in~~ ~~the form of~~ mainly ~~[illegible]~~ for ~~petrol and~~ fuel and maintenance charges for a jeep. ~~use~~

available support.

~~Approximate monthly costs~~

Approximate monthly costs for fuel and maintenances	Rs 2,000/= pm. 2500/-
No. of months of field work	~~18~~ ~~18~~ 20 ~~24~~ months.
Total	~~Rs 18,000~~ ~~Rs 32,000~~ Rs 50,000

no of km per month anticipated @ 1000 kms.

Rs 16/$

I page

Title of project
Principal Investigator
Address.

Duration of study
Budget.

Endorsements.
Summary.
~~Details~~ of proposal :

Holldobler, B., Moglich, M. 1980.
The Foraging System of Pheidole militicida (Hymenoptera: Formicidae)
Insectes Sociaux 27, 237-264.

Justification: ~~The study would generate~~ The study would generate scientific information that would be an essential input into ~~developing~~ evolving a management plan for the NBR. As such no integrated management plan exists because of the lack of scientific information about the ecosystem dynamic, ~~and the~~ ~~by~~ and the lack of political will of the society. In studying the changes in the ecosystem over a time period, ~~the~~ the patterns of change can be discerned, and the consequences of human activities as regards conservation of biological diversity can be inferred. ~~Critical~~ Areas rich in biological diversity could be identified ~~and~~ and effective conservation measures evolved. Critical areas like migration routes for wildlife, or refugias for wildlife during periods of resource scarcity, or catchement areas for streams could be identified ~~and~~ ~~nature of~~ ~~conflict~~ conserved Areas for ecorestoration and afforestation could be determined. ~~Critical~~ ~~Ecologically~~ ~~critical areas.~~ ~~The nature of~~ The study would yeild scientific information for more rational

Territorial Behavior in the Green Tree Ant (Oecophylla smaragdina)
Biotropica 15, 241-250.
Hymenoptera; Formicidae; Behavioural Communication; Interspecific Territoriality
; Observation

zoning into core and buffer zones in the NBR area. The nature of conflict between ~~xxxxxxxx~~ human activities and conservation need to be resolved for effective conservation. The study would identify the areas and resources of conflict ~~xxxxxxxx~~ and may suggest remedial measures to resolve some of these.

Control of mating preferences in mice by genes in the major histocompatibility c
omplex.
J-Exp-Med. 144, 1324-1335.
Mice; Behaviour; Kin Recognition; Mating Preferences

Facilities Available: Subsistance support is available from the ~~UG~~ University Grants Commission through the Centre for Ecological Sciences, Indian Institute of science. ~~for a post~~ The Centre has a full-fledged field station ~~is~~ at Masinagudi in the NBR area. The field station is equipped with a Personal Computer and other laboratory facilities needed for field work. In addition the centre has survey maps and satellite imagaries of the NBR area.

Budget :

Anim.Behav. 31, 978-984.
Acomys cahirinus; Spiny Mice; Behaviour; Kin Recognition; Phenotype Matching; Experiment.
Journal available.

Title of the project : Ecological Changes in the Nilgiri Biosphere Reserve.

Principal Investigator : R. Balakara, Research Scholar,
for
Address : Centre for Ecological Sciences,
Indian Institute of Science,
Bangalore 560012
India.

Summary of the proposal : This study attempts to pattern the ecological changes in the Nilgiri Biosphere Area over a 200 year period. The area is ~~one of the areas of~~ one of the richest in biological and cultural diversity in the peninsular India. Thus it has been proposed at India's first biosphere reserve in 1986. ~~The study would assess the habitat~~ The ~~quality,~~ identify current whole of the Nilgiri Biosphere Reserve area will be mapped on a 1:50,000 scale based on the vegetation and land use pattern ~~from~~ with the help of satellite imageries and field verifications.

64
Noonan,K.C.
Recognition Of Queen Larvae By Worker Honey Bees(Apis mellifera).
Unpublished Manuscript
Apis mellifera; Honey Bees; Behaviour; Kin Recognition; Recognition of Queen Lar
vae; Experiment.
Manuscript available.

65
Lacy,R.C. and Sherman,P.W. 1983.
Kin recognition by Phenotype Matching
Am.Nat. 121, 489-511.
Genetics; Kin Recognition; Phenotype Matching; Genetic Model; Theory.
Reprint available.

66
Waldman,B. 1981.
Sibling Recognition in Toad Tadpoles: The Role of Experience
Z.Tierpsychol. 56, 341-358.
Bufo americanus; American Toad Tadpoles; Behaviour; Kin Recognition; Sibling Rec
ognition; Experiment.
Reprint available
check. Kin Social Biol. or Social Biology.

67
Carter-Saltzman,L. and Scarr-Salapatek,S. 1975.
Blood Group, Behavioural, and Morphological Differences among Dizygotic Twins.
Soc.Biol. 22, 372-374. Social Biology, 22
Homo sapiens; Human Beings; Genetics; Kin Recognition; Blood Group; Behaviour; M
orphology; Dizygotic Twins; Experiment.
Reprint available.
check?

68
Pakstis,A., Scarr-Salapatek,S., Elston,R.C. and Siervogel,R. 1972.
Genetic Contributions to Morphological and Behavioural Similarities among Sibs a
nd Dizygotic Twins:Linkages and Allelic differences.
Soc.Biol. 19, 185-192. Social Biology 19,
Homo sapiens; Human Beings; Genetics; Kin Recognition; Linkages; Behaviour; Morp
hology; Dizygotic Twins; Experiment.
Reprint available.

69
Mintzer,A. 1982.
Nestmate Recognition and Incompatibility between colonies of the Acacia Ant Pseu
domyrmex ferruginea.
Behav.Ecol.Sociobiol. 10, 165-168.
Pseudomyrmex ferruginea; Acacia Ant; Behaviour; Kin Recognition; Incompatibility
Between Colonies; Experiment.
Reprint Available

70
Blaustein,A.R., O'Hara,R.K. and Olson,D.H. 1984.
Kin preference behaviour is present after metamorphosis in Rana cascadae frogs.
Anim.Behav. 32, 445-450.
Rana cascadae; Toad Tadpoles; Behaviour; Kin Recognition; Kin Preference; Experi
ments.
Journal available.

71
Gavish,L., Hafman,J.E. and Getz,L.L. 1984.

Journal available.

71
Gevish, I. -, Hafman, J-E- and Getz, L-L- 1984.

✓ Introduction to the Biosphere Reserves:

International.

✓ NBR. description.

Why biosphere reserves?

Objectives of NBR.

What is to be done in NBR by different departments? Integrated approach

Conservation Priorities & Strategies.

1. Conservation of biological & cultural diversity.
2. Sustainable resource use
3. Restoration.
4. Research & Monitoring & training.
5. Educational.
6. Model of ecologically sustainable development.

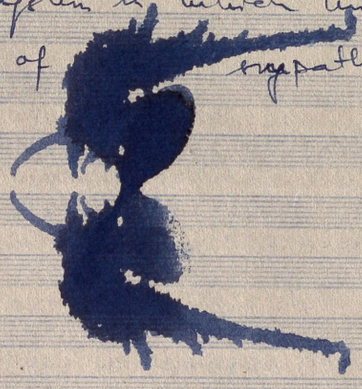
1) Coordination
2) Eco-development
3) Impact assessments.

In:Proc.X Internatl.Congr.IUSSI,Munich(In Press).
Social Insects; Kin Recognition; Labels; Templates; Review.

What are biosphere reserves?

Biosphere reserves are areas of terrestrial and coastal environments recognized for their value in conservation.

Till recently, conservation effort have been ~~directed~~ focussed on either one species, or a single habitat under human management in zoos, botanical gardens, arboretums, national parks and wild life sanctuaries. In 1971, the UNESCO, realizing the importance of ~~protecting~~ conservation the entire spectrum of representative terrestrial and coastal ecosystems ~~started the~~ initiated the idea of biosphere reserves. ~~Biosphere reserves are areas of be rich in biological~~ and cultural diversity ~~that are delineated for conservation and sustainable development~~. Instead of advocating that undisturbed natural ecosystems can be protected simply ~~of~~ by keeping all human influences out, it suggests that conservation must be an open system in which undisturbed natural areas can be surrounded by areas of sympathetic and compatable use. In view of the inclusion



Areas involved.

- River systems
- Habitat types. ← end./end. sp.
- Tribals.

Kinship And Incompatibility Between Colonies Of The Acacia Ant Pseudomyrmex ferr
uginea
Behav.Ecol.Sociobiol. 17, 75-78.
Pseudomyrmex ferruginea; Acacia Ant; Behaviour; Genetics; Kin Reconition; Incomp
atibility Between Colonies; Experiment.
Reprint available

49
Jaffe,K. and Sanchez,C. 1984.
On the Nestmate-Recognition system and Territorial marking behaviour in the ant.
Camponotus rufipes
Insectes Sociaux 31, 302-315.
Camponotus rufipes; Ants; Behaviour; Kin Recognition; Territorial Marking; Colon
y Odour; Pheromone; Mandibular Gland; Experiment.
Reprint available.

50
Russell,M.J., Mendelson,T. and Peeke,H.V.S. 1983.
Mothers' Identification of their Infant' Odors.
Ethol.Sociobiol. 4, 29-31.
Homo sapiens; Human Beings; Behaviour; Kin Recognition; Parent Offspring Recogni
tion; Infant Odour; Observation.
Reprint available.

51
Waldman,B. 1985.
Olfactory basis of Kin Recognition in Toad Tadpoles.
J.Comp.Physiol.A. 156, 565-577.
Bufo americanus; American Toad; Behaviour; Olfactory Basis of Kin Recognition; E
xperiment; Observation.
Reprint Available.

52
Getz,W.M. and Chapman,R.F. 1986.
An Odor Discrimination Model with Application to Kin Recognition in Social Insec
ts.
Internatl.J.Neurosci.(In Press).
Social Insects; Phenotype Matching; Template; Kin Recognition; Odour Discriminat
ion Model; Theory.
Reprint Available

53
Gadagkar,R., Swarnalatha,V.B., Padmini,N., Vinutha,C. and Arun,V. 1986.
Nestmate Discrimination in the Social Wasp Ropalidia marginata.
In: Proc.X Internatl.Congr.IUSSI, Munich (In Press).
Ropalidia marginata; Social Wasp; Behaviour; Kin Recognition; Experiment.

54
Jaffe,K. and Marcuse,M. 1983.
Nestmate Recognition and Territorial Behaviour in the Ant Odontomachus bauri Eme
ry(Formicidae:Ponerinae).
Insectes Sociaux 30, 466-481.
Odontomachus bauri; Ponerinae; Formicidae; Ant; Behaviour; Kin Recognition; Terr
itorial Behaviour; Experiment; Observation.
Reprint Available

This is a book. No abbreviation. Also give editors and publisher

55
Sherman,P.W. and Holmes,W.G. 1985.

55
Sherman, P.W. and Holmes, W.G. 1985. This is a book. editors and publisher

~~In 1971 UNESCO~~,

Species and population are becoming extinct at a rate faster than their natural attrition. Conservation efforts so far have attempted to preserve biological diversity of a species, or a habitat under human management in zoos, arboretums, botanical gardens, national parks and wildlife sanctuaries. In 1971, realizing the need to ~~protect~~ conserve the entire range of biological and cultural diversity, the UNESCO initiated the concept of biosphere reserve. Biosphere reserves are areas representative of terrestrial and coastal ecosystems. It recognizes the human element as an integral part of the ecosystem. It ~~and~~ envisages to incorporate the aspirations of the people for sustainable development and conservation of the biological diversity. ~~and sustainable use of resources~~.

The Government of India ~~set~~ up a core advisory committee of experts in 1979, to delineate biosphere reserves. ~~in~~ Accordingly the committee proposed 12 potential sites as per criteria laid down by UNESCO. The first one to come into being was the Nilgiri Biosphere Reserve (NBR) in the year 1986 under the auspices of the Ministry of Environment and Forests, Government of India.

The NBR covering an area of 5520 sq km is located at the trijunction of the Kerala, Karnataka and Tamilnadu states. It includes the sanctuary complex of Wynaad, Nagarhole, Bandipur and Mudumalai; the entire forested hill slopes of Nilambur and Nilgiris; the upper Nilgiri plateau; ~~the upper~~ the Silent Valley and Siruvani hills; and the Attappadi Sigur and Talamalai plateau. (Map). This contains a diversity of habitats ranging from dry scrub forests, dry and moist deciduous forests and semi-evergreen forests, high altitude evergreen sholas, grassy downs and swamps. ~~Numerous cultivation pockets also exist within these habitat~~. The area also supports ~~some~~ one of the largest populations of elephants, gaur, sambhar, deer, tigar, etc. in Southern India. It also supports populations of Nilgiri Thar and the lion tailed macque which are endangered species. Further several ~~endemic~~ species of plants and animals ~~are~~ endemic to the W. Ghats are also found

Enhanced Neural Response to Familiar Olfactory Cues.
Science 225. 849-851.

here. It is also the habitat for several tribal communities, ~~who have lived harmoniously with the environment with their indigenous~~ remarkable for their traditional mode of harmonious use of the environment. Numerous river systems drain the area both to the west and to the east. Swift flowing streams drain into the Chaliyar and Kunthipuza in the west; and tributaries of the Bhavani, Moyar and Kalpine ~~on~~ the east.

asp, Polistes fuscatus (Hymenoptera, Vespidae).
Can. Ent. 115, 655-658.

Location:

SOI No: 58A/10.

~~[illegible]~~ Sample No:

Altitude:

Sample Area:

Latitude:

~~Altitude~~: Date:

Longitude:

Time:

~~[illegible]~~ Landmarks: Circular Road / Moyan.

~~Characteristic features in the area~~

Line Bearing:

Terrain:

- Plateau / Plain / Hilly
- Gently ~~[illegible]~~ Undulating / ~~Flat~~ Flat
- Streams.

? Soils:

Vegetation.

Landscape/features:

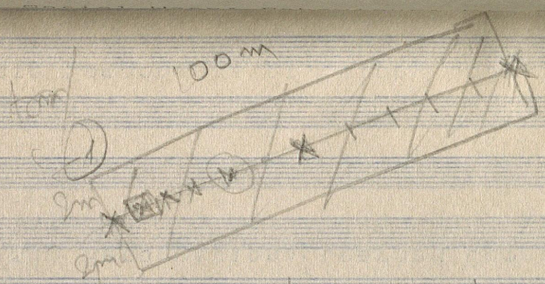
Remarks

Only wild life

Height Classes.	Woody		Herbaceous		
	Evergreen	Deciduous	Grasses	Bamb	
> 35m					
20 - 35m					
10 - 20m		50 - 75%			
5 - 10m					
2 - 5m					
0.5 - 2m			C	~~P~~	
0.1 - 0.5m				P	
< 0.1m.					
Coverage					

Ryan,R.E., Cornell,T.J. and Gamboa,G.J. 1985.
Nestmate Recognition in the Bald-faced Hornet, Dolichovespula maculata (Hymenoptera,Vespidae).
Z.Tierpsychol. 69, 19-26.

Profile Diagram



2,400

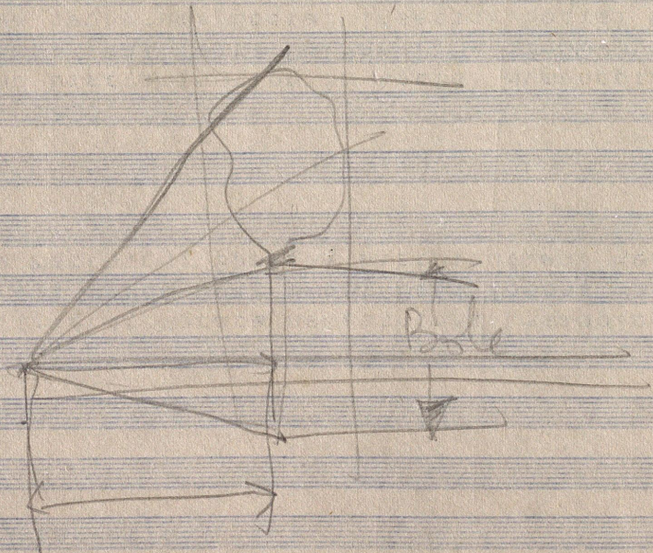
2,500

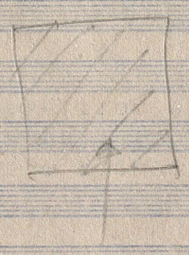
Strip Sampling.

Remarks	Strip No (Bearing)	Species Local name	Species Scientific Name	Family	Girth ~~Dia~~ Circumference	Height-measurements Dist	Angles B	T	FB
	1/25°N	~	~	~	✓		✓	✓	✓
							✓	✓	✓

2

Bold Colour/Texture





Grass

3

erences; Rearing; Experiment; Observation.
Reprint available

17
Holmes,W.G. and Sherman,P.W. 1983.
Kin Recognition in Animals.
Am.Sci. 71, 46-55.
Spermophilus beldingi; Apis mellifera; Macaca nemestrina; Lasioglossum zephyrum; Bufo americanus; Ground Squirrel; Honey Bee; Sweat Bee; Toads; Macaques; Behaviour; Kin Recognition; Phenotype Matching; Spatial Distribution; Recognition Alleles; Review
Reprint available.

Expand

give name & publisher

18
Holldobler,B. and Michener,C.D. 1980.
Mechanisms of Identification and Discrimination in Social Hymenoptera.
Evol.Soc.Behav.Hypotheses and Empirical Tests,Ed.Markl,H. 35-58.
Social Hymenoptera; Lasioglossum zephyrum; Social Insects; Social Wasp; Sweat Bee; Kin Recognition; Review.
Reprint available.

* In: Evolution of Social Behavior: Hypotheses and Empirical tests, ed. H. Markl, pp. 35-58; Dahlem Konferenzen 1980. Weinheim: Verlag Chemie Gm

19
Jutsum,A.R., Saunders,T.S. and Cherrett,J.M. 1979.
Intraspecific aggression in the leaf-cutting Ant Acromyrmex octospinosus.
Anim.Behav. 27, 839-844.
Acromyrmex octospinosus; Leaf Cutting Ants; Behaviour; Kin Recognition; Intraspecific Aggression; Experiment.
Reprint Available.

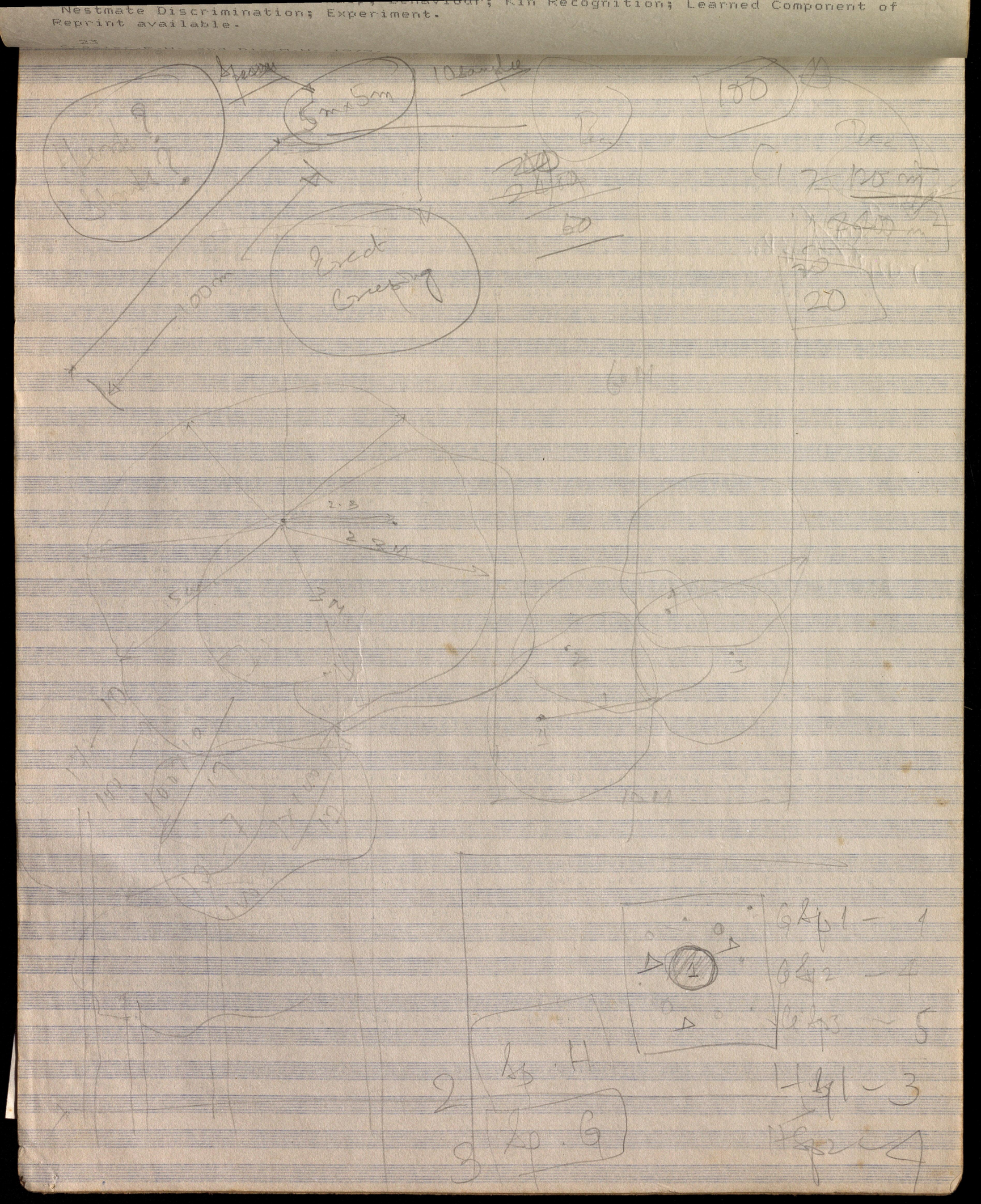
20
Kukuk,P.F., Breed,M.D., Sobti,A. and Bell,W.J. 1977.
The Contributions of Kinship and Conditioning to Nest Recognition and Colony Member Recognition in a Primitively Eusocial Bee, Lasioglossum zephyrum (Hymenoptera:Halictidae).
Behav.Ecol.Sociobiol. 2, 319-327.
Lasioglossum zephyrum; Halictidae; Hymenoptera; Sweat Bee; Behaviour; Kin Recognition; Colony Odour; Colony Member Recognition; Intraspecific Nest Defense; Experiment.
Reprint Available.

expand and check remaining part

21
Kalmus,H. and Ribbands,C.R. 1952.
The Origin of the Odours by which honeybees distinguish their companions.
Proc.R.Soc.(B). 140, 50-59.
Proc. Roy. Soc (B) 140, 50-59.
Apis; Honey Bees; Behaviour; Kin Recognition; Origin of Colony Odours; Experiment.
Reprint available.

22
Pfennig,D.W., Reeve,H.K. and Shellman,J.S. 1983.
Learned Component of Nestmate Discrimination in Workers of a Social Wasp, Polistes fuscatus (Hymenoptera: Vespidae).
Anim.Behav. 31, 412-416.
Polistes fuscatus; Social Wasp; Behaviour; Kin Recognition; Learned Component of Nestmate Discrimination; Experiment.
Reprint available.

Nestmate Discrimination; Experiment.
Reprint available.



9
Klahn,J.E. 1979.
Philopatric and Nonphilopatric Foundress Associations in the Social Wasp Polistes fuscatus.
Behav.Ecol.Sociobiol. 5, 417-424.
Polistes fuscatus; Social Wasp; Behaviour; Kin Recognition; Philopatric and Nonphilopatric Foundress Associations; Experiment; Observation.
Reprint Available.

10
Jones,J.S. and Partridge,L. 1983.
Tissue rejection: the price of sexual acceptance?
Nature 304, 484-485.
Drosophila; Lasioglossum zephyrum; Fruit Fly; Sweat Bee; Kin Recognition; Tissue Rejection; Mate Choice; Sexual Selection; Histocompatibility; Theory.
Reprint available.

11
Holmes,W.G. 1984.
Ontogeny of Dam-Young Recognition in Captive Belding's Ground Squirrels (Spermophilus beldingi).
J.Comp.Psychol. 98, 246-256.
Spermophilus beldingi; Ground squirrel; Behaviour; Kin Recognition; Ontogeny of Dam Young Recognition; Experiment.
Reprint available.

12
Klahn,J.E. and Gamboa,G.J. 1983.
Social Wasps:Discrimination between kin and nonkin brood.
Science 221, 482-484.
Polistes fuscatus; Social Wasp; Behaviour; Kin Recognition; Brood Discrimination; Experiment; Observation.
Reprint available

13
O'Hara,R.K. and Blaustein,A.R. 1981.
An Investigation of Sibling Recognition in Rana cascadae Tadpoles.
Anim.Behav. 29, 1121-1126.
Rana cascadae; Frog Tadpoles; Behaviour; Kin Recognition; Sibling Recognition; Experiment; Observation.
Reprint available.

14
Larch,C.M. and Gamboa,G.J. 1981.
Investigation of Mating Preference for Nestmates in the Paper Wasp Polistes fuscatus (Hymenoptera:Vespidae).
J.Kans.Entomol.Soc. 54, 811-814.
Polistes fuscatus; Polistes metricus; Vespidae; Hymenoptera; Social Wasp; Behaviour; Kin Recognition; Mating Preferences; Experiment; Observation.
Reprint available

15
Post,D.C. and Jeanne,R.L. 1982.
Recognition of Former Nestmates during Colony Founding by the Social Wasp Polistes fuscatus(Hymenoptera:Vespidae).
Behav.Ecol.Sociobiol. 11, 283-285.
Polistes fuscatus; Social Wasp; Behaviour; Kin Recognition; Nestmate Recognition; Experiment; Observation.

Behav.Ecol.Sociobiol. 11, 283-285.
Polistes fuscatus; Social Wasp; Behaviour; Kin Recognition; Nestmate Recognition
; Experiment; Observation.

Strip 1 / 30° N

Species	Dia	Height B	Height T	Height FB	Dead
Teak	.29	0 xx	4.5 m	2 m	
Terminalia tom	.43	0	8-10 m	xx	
Teak	.41	0	8-10 m	3 m	
Anogeissus	.54	0	7-8 m	3 m	
Anogeissus	.69	0	11 m ~~8-10 m~~	3 m	
Anogeissus	.48	8/10.5	+41.5	+9.5	
Teak	1.11	0	12 m	2.5 m	
Anogeissus	.88	0	12 m	~~2.5 m~~ 5 m	
Anogeissus	1.06	0	12 m	1.5 m	
Anogeissus	0.88	0	12 m	6.0 m	
Anogeissus	0.23	0	8 m	4 m	
Teak	0.58	0	9 m	5 m	
Anogeissus	0.88	0	13 m	6 m	
Teak	0.47	0	6 m	4 m	
Anogeissus	0.98	0	12 m	3 m	
Ari	0.48	0	8 m	6 m	2 m
Teak	0.47	0	12 m	6 m	5 m
Teak	0.80	0	10 m	3 m	4

Reprint available

Canopy

Open

① Q1 Thenoda triandra	24	
Pholantaus Em	1.	
~~Sp~~ H. Sp ①	6	
Curculigo / ~~H Sp ②~~	~~3~~ 4	
Commolina (H)	1	
Q2		
Th. triandra	22	Open.
G. Sp ①	4	
Ercolina	1.	
H Sp ①	6	
Curculigo	4	
Commolina	1	
Zingeberacea	1.	
Q3 Th. triandra	17	Open
Curculigo	3	
H. Sp ①	2	
Gremoa. sp. H.	~~1~~2	
Zingeberacea Indica	1.	
H. Sp. ②	1.	

Q4	Th. Twandra	9	~~Closed~~
	Cunculace	6	50 - 75%
	H. Sp (1)	6	
	Greuwa. H	5	
	Greuwa T.	1. - 126	
Q5	Th. twandra	8	Closed
	Greuwa H.	1 - 82	
	H Sp (1)	4	
	Cunculogo	6	
	G Cyperace.	2.	
Q6	Th. twandra	16	50% - 75%
	~~H Sp~~ H Sp (1)	~~1~~ 2	
	Acanthacea.	11	
	~~H Sp (2)~~	~~3~~	
	Commbolina	4	
	Cunculago	6	
	Creeper (1)	(2)	
Q7	Th. twandra	14	50 - 70%
	Cassia fistula	1 - 42	
	H Gurenwa.	5 - 104	
	Phyllanthus.	1 - 23	
	Combolina.	1.	
	~~H~~ G Sp.	2	

Kambu Grass — Setaria indica?

H sp (ppt.) — Caesalpinia ___ ?

H sp (purple) — Argeria cuneata

Creeper herb — Hemidesmus indicus

Grass — Themeda triandra

Herb (trifoliate leaves) — Crotalaria

Creeping herb with white flr. — Andrographis ~~Sep~~ Serpentiphylla

Aromatic herb — ___ labiate

Ultrosiphon?

triangular ~~Boat~~ shaped bract herb — ~~Commelina~~ Commelina

Lacchi Age 60 yrs 14/15th April

12 yrs ago: Poochapari timber loop

: Thondakulam / Cane -

3 types { Punua, : Callopy
Pale - Pale
Surli - Mesua ferrea. }

Planks made here & taken headload

to Karuvarakunda

Labour from Karuvarkundi / ~~Kalkundi~~

Kalkundu / Mannarkad

Dung father's time all this area was Coop area

All Dys was Mesna in my sample

Eleocarpus – butterwood
used for matchsticks

Thoo da

Animals

13 Resident elephants
Bison
Barking deer
Toglus
Wild dogs
Sambha

Eleocarpus - Emergents in this area
light green leaves

Koondal panai

Caryota urens. Bastard sago.

Used for making ploughs in the Wynaad by the Chettis

Parchi mara — Butressed tree, over 35 m in lib

1.7 L

50 L

88 L

1 L | NDP

30 x 20

600 Week

x 6

3600

x

4000

300

12 L

Pale → ? Palquium

→ Red bark ?

Milky latex.

Chola Vengai: good for timber