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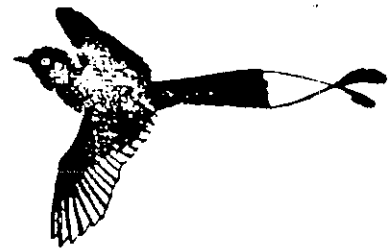

The Impact of Forest Based Industries on the Evergreen Forests of Uttara Kannada

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CES Technical Report

IMPACT OF FOREST MAJOR INDUSTRIES ON THE EVERGREEN FORESTS OF UTTARA KANNADA

INTRODUCTION

The evergreen forests of the Uttara Kannada District are mainly confined to the western slopes and valleys of the Western Ghats, where the average annual rainfall exceeds 300cm. These forests, which mostly conform to the category 'West Coast Tropical Evergreen' of Champion, largely occur in the ghat areas of Karwar and Honnavar Forest Divisions. To a lesser extent they are also present in the taluks of Siddapur, Sirsi, Yellapur and Supa where they are in more fragmented state due to human habitations and vulnerability to forest logging due to relatively easy access. Many of the hilltops and gentler slopes are barren and rocky due to shifting cultivation practised by the tribal people in the past. Such areas support savanna type vegetation with scattered trees mostly of the deciduous species which are stunted in growth. Due to differences in topography, within the evergreen forest belt itself many drier hilltops and steeper slopes support moist deciduous to semi-evergreen communities. Areas clear-felled in the past have now forests of secondary deciduous nature. Forests of semi-evergreen type also occur in very disturbed places.

Due to ages of exploitation the evergreen forests are almost wiped out from the western coastal plains and plateaus and foothills of the Ghats. Any relict patches, enjoying some degree of protection, provide valuable insight into the past composition of the coastal forests where an evergreen climatic climax appears to be replaced by various disclimax forms. Major part of this tract coming under the administrative category of 'minor forests', is denuded and lateritic. Evergreen forests were also cleared for raising forest plantations. Evergreen forests declared as 'betta', for the benefit of the areca growers were subjected to intensive lopping and litter collection and consequently are in a impoverished state. Forests were also burned down for creation of grazing land

EVERGREEN FORESTS: PRESENT STATUS

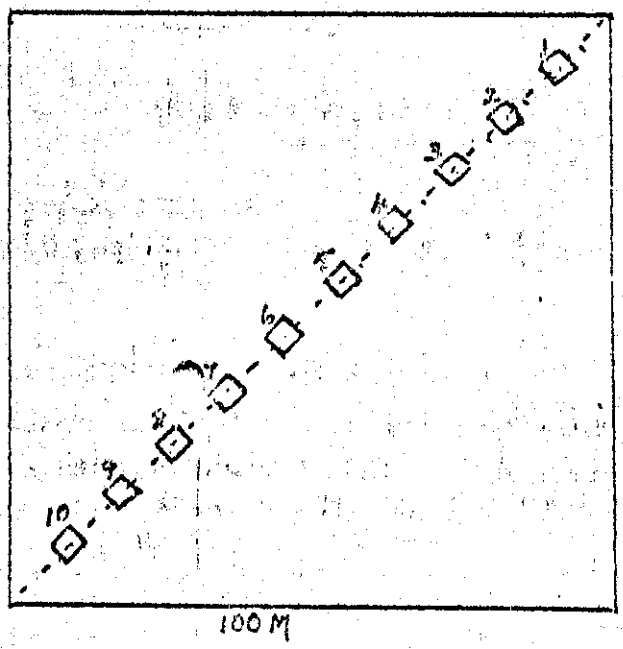
Today the evergreen forests of the district are mainly to be found in the western slopes and valleys of the major rivers and their tributaries. This forest belt stretches along a rugged and rocky terrain towards the windward side of the Western Ghats. These evergreen forests remained unorganised for any systematic felling till recent times due to the poor demand for softwood before the arrival of the major forest based industries on the scene. However many parts of this forest belt were partially worked during the Second World War and also for supplying timber to the Railways. Some of the plywood and match companies also made selective felling in the evergreen forest belt. The impact of such felling, though significantly perceptible is under investigation. Eversince 1956 forest working plans have been prepared to cover most of the unorganised forests, which at that time covered around 2000 sq.km. in the district, though part of it was also semi-evergreen to moist deciduous. The latest of these working plans is the one for Karwar and Honnavar Forest Divisions covering an area of roughly 500 sq.km. This plan which covers some of the richest evergreen forests of the district was approved by the Govt. of Karnataka in 1977. Though the felling is on the principle of 'sustainable yield' there has been no significant study about what its impact would be on the evergreen forests, especially at a time when there is global concern over this biological ~~wealth~~ wealth which is steadily declining in the world.

PROGRESS OF WORK

The work on the project was started soon after its institution. Surveys were undertaken all over the district to estimate the extent, species diversity and structure of the evergreen forests. Vertical profiles and canopy coverage of good and degraded evergreen forests have been worked out for comparison and illustration. Good progress is also achieved in building up a herbarium of the plant species of Uttara Kannada. All the forest working plans of the district, past and present, are being collected and scrutinised to learn more about the working of the evergreen forests.

METHODOLOGY

The methodology adopted from the beginning was subjected periodical review and necessary changes were made. Finally, after many field trials, one hectare area was accepted as the sample size for forest study, especially for tree diversity. Any woody plant, excluding the lianes, 30 cm at b.h is considered as a tree. Within each one hectare quadrat the smaller plants, the ones over 1m in height and less than 30 cm at b.h, are sampled in ten small quadrats of 5X4 m arranged diagonally along the larger quadrat as shown in the following illustration.



1 to 10 are sub-Quadrats each 5x4 M

These subquadrats numbered 1 to 10 provide a fairly good i the regeneration of the forest under study. Names of all the othe plants less than 1 m in ht. are noted. Information is also being collected about the lianes and climbers and epiphytic plants. Various other general information is also collected about the qu In the early stages of the study only tree diversity was taken in account. Five of the one hectare quadrats about which information is presented in this report is affected by this lacuna. However the inadequacy was noticed and rectified in five of the other qu

A BRIEF OUTLINE OF THE WORK CARRIED OUT

After the adoption of one hectare as the sample size ten quadrats have been so far studied from an ecological angle. The quadrats are within the evergreen forest belt of Uttara Kannada and the details are shown below:

QUADRAT NO.	LOCALITY	ELEVATION	GHAT/REGION	TALUK	CATE
I	Doddamane Ghat	200M	Doddamane Ghat complex	Kumta	Rese
II	Huladevarkodlu	50M	-do-	-do-	-d
III	Medine Ghat	450M	-do-	-do-	-d
IV	Anshe Ghat	500M	Anshe Ghat complex	Karwar	-d
V	Ambole Ghat	600M	-do-	Supa	-d
VI	Melemane	600M	Melemane Ghat	Siddapur	-d
VII	Sharavati Valley	100M	-do-	Honnavar	-d
VIII	Kallabbe	70M	Muroor-Kallabbe Village Forest	Kumta	Vi fo
IX	-do-	70M	-do-	-do-	-d
X	-do-	25M	-do-	-do-	-d

Reasons for Selection of the Sites:

Q I, Q II, Q V, Q VII) These are good samples of evergreen reserve forests o the Western Ghats of the District. These forests appe to be unlogged in the recent past. The quadrats repre low and medium elevations of the District.

Q VI - Good evergreen reserve forest; logged but recovering

Q III, Q IV) Reserve forests of the ghats; but due to past logging and other disturbances especially in Q III (Medine) evergreen nature is diminished.

Q VIII - A good relict evergreen forest patch in the Munoor-Kallabbe village forest complex in the low hills of the coastal tract. A forest of immense significance showing perhaps evergreen forest was the climatic-climax of the Uttara Kannada coastal hills which are today highly denuded and lateritic.

Q X - A very degraded evergreen forest with large deciduous mix and from the same village forest complex.

Q IX - A secondary moist deciduous forest in the above village forest complex.

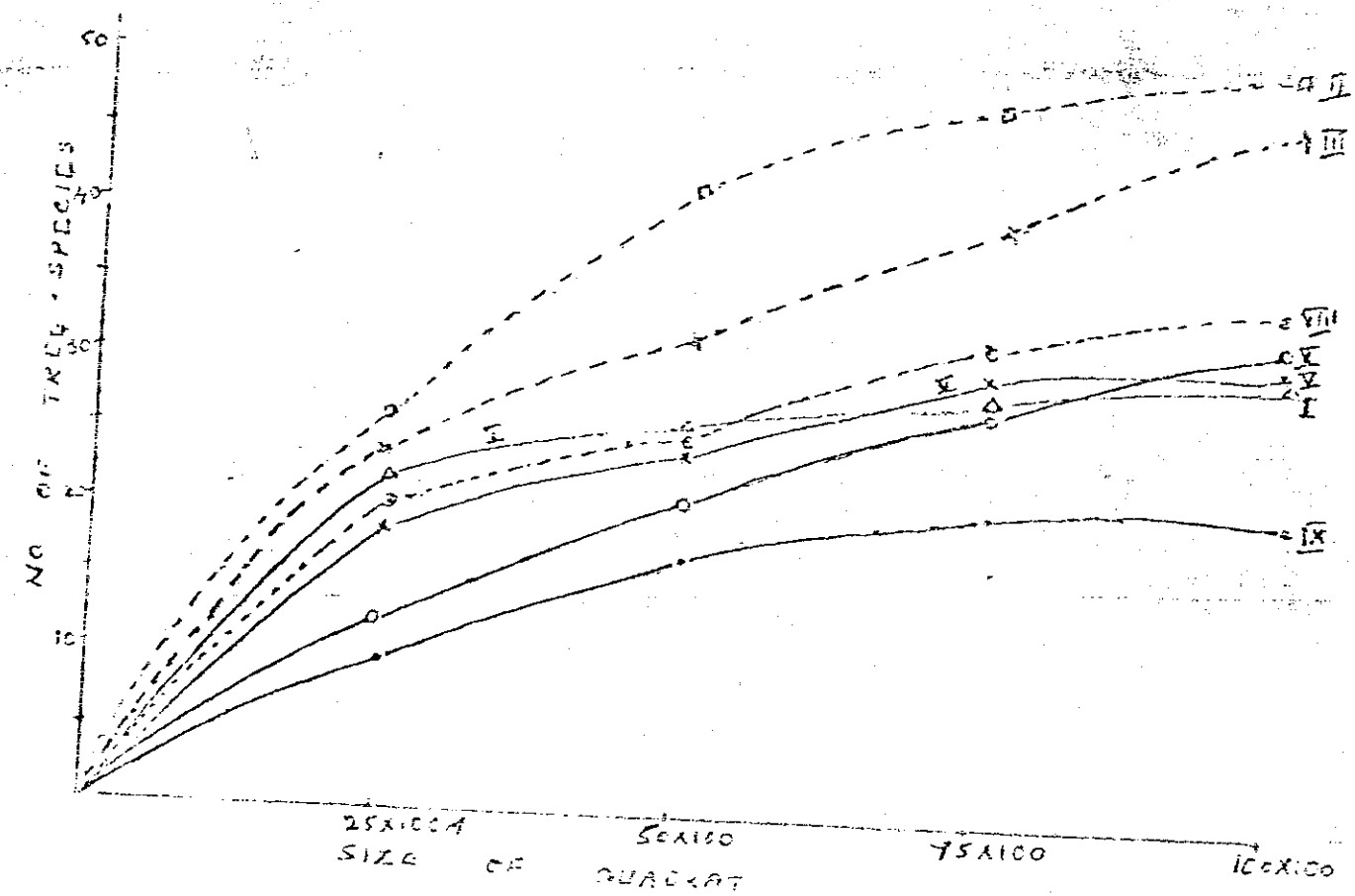
Note: Quadrats VIII, IX and X from the same village forest complex represent different stages in the degradation of the evergreen forest and could simulate the actual impact of industrial logging in the evergreen ghat forests depending on the intensity of logging.

Grading of Quadrats according to the degree of evergreenness, degree of logging, tree species diversity and other considerations

The ten quadrats represent cosiderable differences though all are within the evergreen forest belt of Uttara Kannada. The quadrats could be graded for comparison which is brought out in the subsequent parts of this Report.

LOCALITY	GRADE OF FOREST	NO. OF QUADRAT	NO. OF TREE SPECIES
Doddamane	Gr.I	I	31
Huladevar kodlu	Gr.I	II	51
Ambole	Gr.I	V	31
Sharavati valley	Gr.I	VII	42
Melemane	Gr.II A	VI	49
Kallabbe	Gr.II A	VIII	35
Medine	Gr.II B	III	47
Anshe	Gr.II B	IV	52
Kallabbe	Gr.III	IX	21
Kallabbe	Gr.III	X	33

FIG. 1 AREA SPECIES CURVE



TREE DIVERSITY

It is evident from the previous page that the quadrats from Gr. II forests numbered III, IV and VI have 47, 52, and 49 tree species respectively, equalling or even exceeding the tree species in relatively less disturbed and best preserved of the forest samples like Q I (31 species), Q V (31 species), and Q VII (42 species). Even the 35 species from Q VIII of Kallabbe village forest, a relict evergreen patch from the coastal hills, surpass 31 species each of I and V. Let us examine now how some of the degraded forests possess more tree species than some of the best evergreen forests.

SPECIES - AREA RELATIONSHIP

Seven out of the ten one hectare quadrats were made in four longitudinal strips of 100M X 25M. Please see the fig.1 for the species-area curves of seven of the quadrats. The fig. 1 reveals the following information.

1. The species-area curves of Gr.I forests like Q I (31 species), Q II (51 species) and Q V (31 species) almost reach the plate at one hectare.
2. Q III of Gr.II B type forest, logged for industrial purpose, has not shown plateauing trend at one hectare.
3. Q VIII and Q X from a village forest also show plateauing trend at one hectare. Q VIII, largely evergreen, comes under Gr. II A whereas Q X, a very degraded evergreen forest comes under Gr. III level.
4. In Q IX, the most degraded of the quadrats, the curve has reached the plateau at 75X100M itself. It has the lowest number of tree species (21 only).

ARE DEGRADED FORESTS RICHER IN PLANT SPECIES?

It is apparent from the above data that at one level of degradation of evergreen forest (Gr. II level), the number of tree species equals or even exceeds the number from samples of some of the best preserved forests of the evergreen belt. At another level of forest degradation, as in the Gr.III level

tree species number per quadrat might be still at par with the the good forest samples. This is found in Q X which has 33 species of trees. But here some of the evergreen tree species like Holigarna grahamii, Persea macrantha, Cinnamomum sp., Mimusops-elengi seem to be on their way out of the area due to opening up of the tree canopy, soil erosion, laterisation of the ground, and lopping of the ground vegetation and litter collection by the farmers, since it is a village forest. A study of the regeneration of these species within the quadrat shows that these species are very scanty in numbers in the younger age groups. These species are almost ecologically extinct from this type of habitat though there may be one or two adult trees in the quadrat. This situation is better represented in QIX, from where all the sensitive evergre trees have altogether vanished and therefore the species-area curr reaches the plateau at 75 X 100M itself. In other respects there is much similarity between Q IX and Q X. On the other hand Q VIII, also from the same village forest, happened to be spared from logging and though disturbed very much is surprisingly evergreen. In short Q VIII, Q IX and Q X represent different degrees in the degradation of the evergreen forest and in many respe compare with evergreen reserve forests logged for industrial purposes.

INVADERS OF THE EVERGREEN FORESTS

It is not uncommon to find in an evergreen forest some species of trees from drier habitats like the moist deciduous forests of the eastern parts of the Western Ghats or from the Deccan Plateau or from the dry lateritic zone of coastal Uttara Kannada. Often rocky areas, steep slopes and hilltops with scanty soil have a fair mix of these tree species. On the other hand the occurence of more of these elements from the drier habitats, whic we may call the 'invader species', in the high rainfall zone of Uttara Kannada district could often indicate degradation of the evergreen forests as a consequence of forest logging or other for human interference. The species changes are also accompanied by changes in vertical stratification, growth forms of trees, soil erosion and changes in ground vegetation.

A List of Invader Tree Species of the Evergreen Zone:

This list is based on the floristic studies carried out in this region by earlier scientists and also on present studies. The invader species found in the ten quadrats alone are listed below:

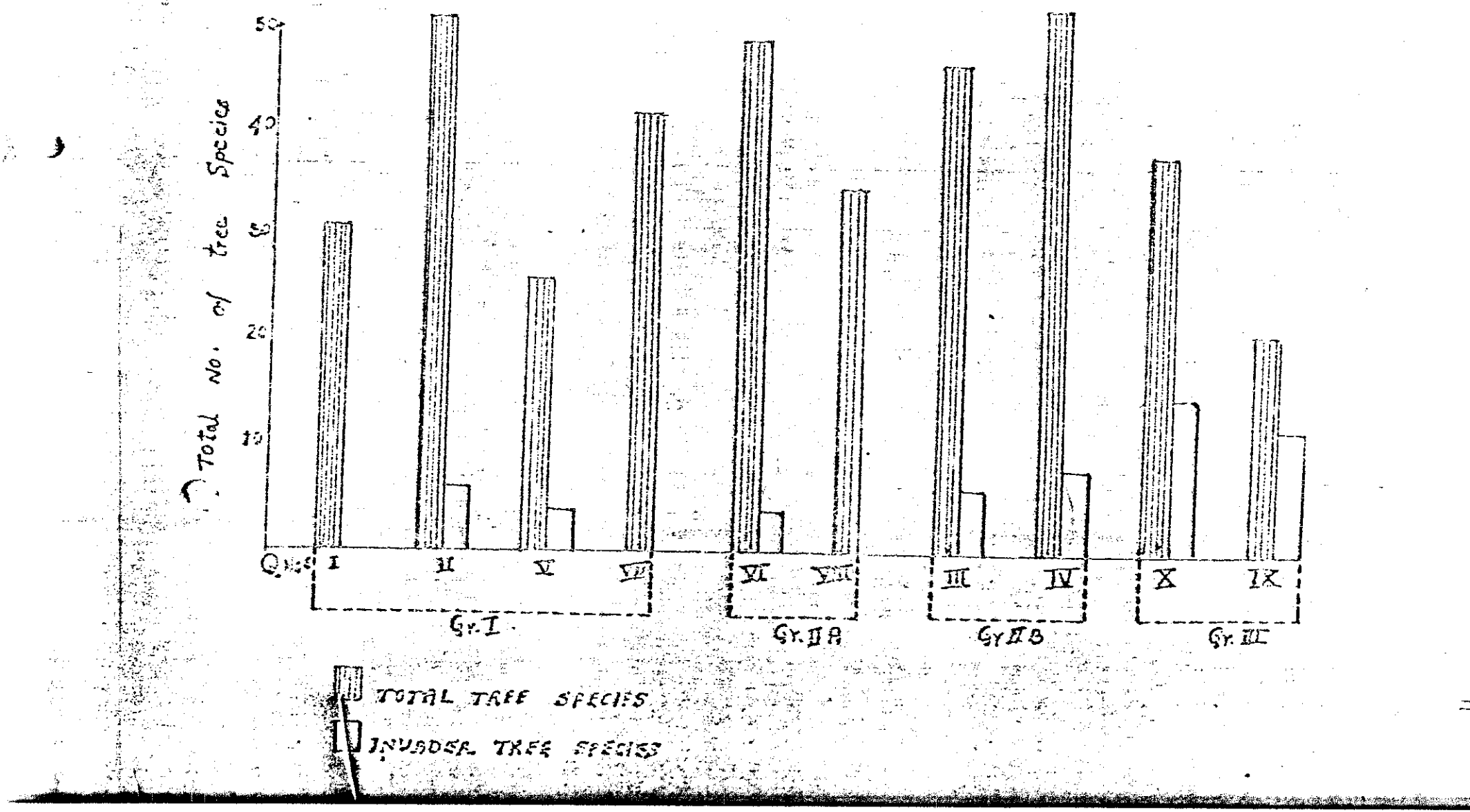
1. Adina cordifolia
2. Artocarpus gomezianus
3. Bauhinia spp.
4. Buchanania lanzan
5. Careya arborea
6. Dillenia pentagyna
7. Ervatamia heyneana
8. Grewia sp.
9. Heterophragma roxburghii
10. Lagerstroemia microcarpa
11. Lannea coromandelica
12. Mallotus sp.
13. Nothapodytes foetida
14. Randia dumentorum
15. Salmalia malabarica
16. Schleichera oleosa
17. Strychnos nuxvomica
18. Syzygium corymbosa
19. Terminalia bellerica
20. Terminalia paniculata
21. Terminalia tomentosa
22. Xylia xylocarpa

The occurence of these invader tree species against the total number of tree species in every quadrat is presented in fig.2.

INDICATOR SPECIES

It is a well established fact that tree species in a forest indicate the type of this forest. The present studies are in concurrence with the earlier studies by several authors as to the largescale occurence of members of families like Lauraceae,

FIG-2 INVADERS OF EVERGREEN FORESTS



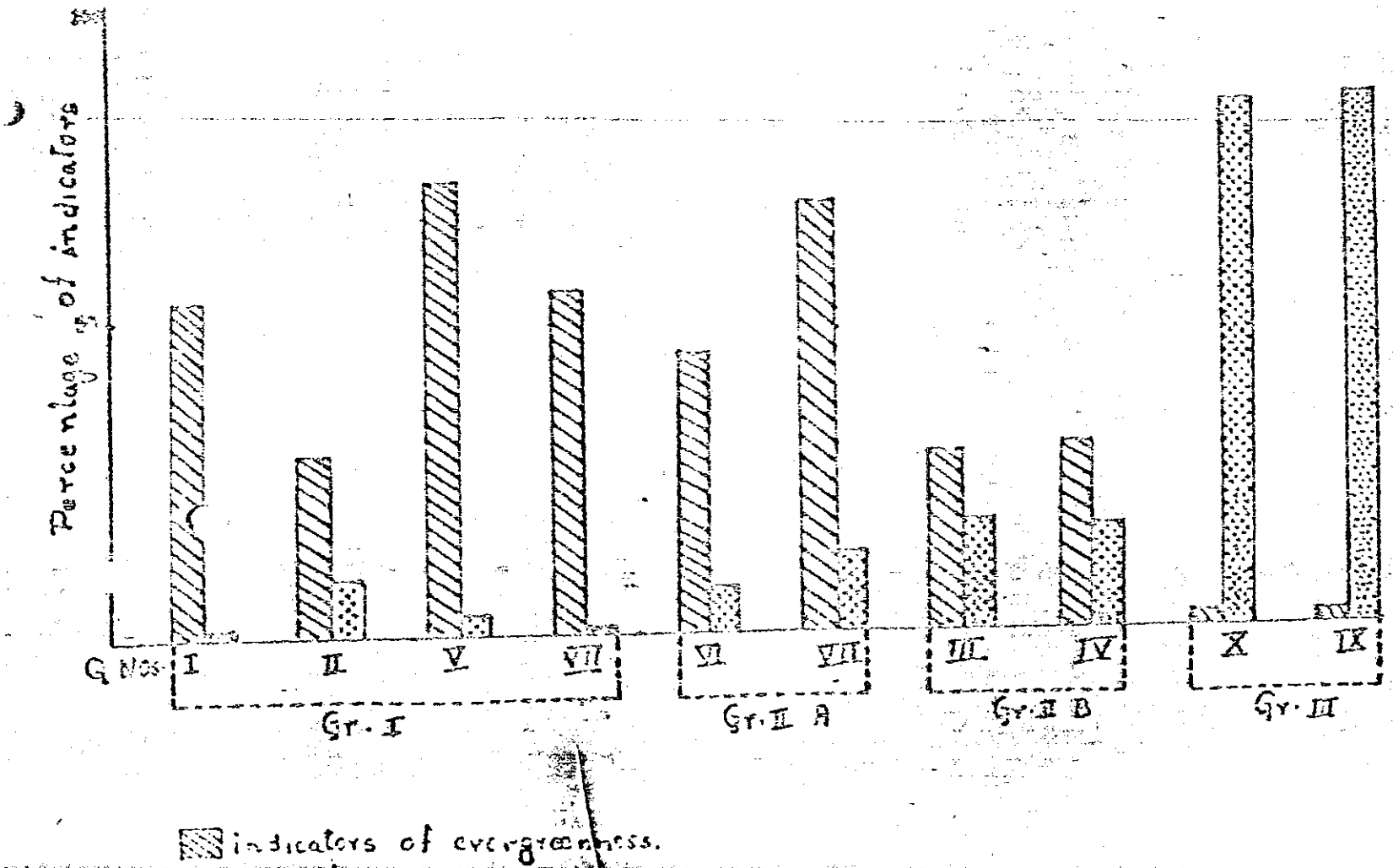
Clusiaceae, Myrtaceae, Myristicaceae and a number of other spec from other families in the evergreen forests. Based on these earlier observations, which have been strengthened by our field work, a list of evergreen tree species with generalised distrib in the evergreen forests has been prepared. These species could indicate the relative evergreenness of a forest. This list does not cover every evergreen species encountered and could be adopt as a working hypothesis for the present programme, with suitabl modifications in future. Please see Table-1 for the list of ever- green indicators.

Conversely there is also a list of trees indicating t degradation of evergreen forest. These indicators need not be necessarily only the invader species listed on page-8. Whereas the invaders are mostly deciduous plants from drier habitats there are also some evergreen species which occur in increased numbers in the degraded evergreen forests of the evergreen forest For instance species like Holigarna arnottiana, Ixora brachiata, Olea dioica and Aporosa lindleyana, though may be present in every good sample of evergreen forest, there is enormous increase in their numbers in very degraded forests. Along with selected invader tree species these evergreen species make a good yardstick for measuring the degradation of an evergreen forest. (Please see Table-2) .

DEGRADATION OF EVERGREEN FOREST

1. Degradation Based on Indicator Species: Fig.3 is a histogram based on the combined occurence of indicators of evergreenness versus indicators of degradation in the 10 quadrats studied. The quadrats are arranged in graded series. Gr.I represents samples of good evergreen patches with no history of logging in the recen past. Here the quadrats are comparatively very evergreen. However the decline in the percentage of good evergreen indicator species in Q II is due to the fact that a part of this quadrat is on a rocky riverbank, namely Aghanashini flowing through the gorge of Doddamane Ghat in Kumta Taluk.

FIG.3 INDICATORS OF EVERGREENNESS VERSUS DEGRADATION



DISTRIBUTION OF TREE SPECIES INDICATING EVERGREENESS

SR NO	NAME OF THE TREES	GR.I				GR.IIA		GR.IIB		GR.III		TOTAL
		I	II	V	VII	VI	VIII	III	IV	X	IX	
1.	Holigarna grahamii	2	5	21	2	30	3	-	10	1	-	74
2.	Dimocarpus longan	-	25	70	5	54	2	50	11	-	-	217
3.	Strombosia ceylanica	17	-	-	25	-	3	-	-	-	-	45
4.	Calophyllum spp.	-	4	-	2	4	-	1	63	-	-	74
5.	Garcinia spp.	1	3	46	-	16	-	2	84	5	4	161
6.	Persea macrantha	6	14	15	7	16	-	4	20	1	-	83
7.	Cinnamomum spp.	2	-	-	9	5	-	5	3	1	-	25
8.	Ficus nervosa	3	2	-	4	3	8	-	-	-	-	20
9.	Knema attenuata	90	49	9	104	92	120	143	50	-	-	657
10.	Myristica spp.	3	2	131	2	3	79	2	3	-	-	225
11.	Syzygium spp. (excluding S.corymbosa)	65	14	24	17	32	10	-	-	1	-	163
	TOTAL INDICATORS	189	118	316	177	255	225	207	244	9	4	1744
	TOTAL NO. OF TREES IN QUADRAT	352	421	416	328	575	334	727	848	513	236	4757
	% OF INDICATORS	53	28	76	54	44	67	28	29	2	2	37

TABLE -2

DISTRIBUTION OF TREE SPECIES INDICATING DEGRADATION OF EVERGREEN FOREST

SR NO	NAME OF THE TREES	GR.I				GR.IIA		GR.IIB		GRIII		
		QI	II	V	VII	VI	VIII	III	IV	X	IX	TOTAL
1.	Olea dioica	5	7	11	4	28	10	74	67	77	44	327
2.	Ixora brachiata	-	26	-	-	3	4	8	27	51	3	122
3.	Holigarna arnottiana	-	-	-	-	10	26	2	-	71	-	109
4.	Aporosa lindleyana	-	-	-	-	1	-	18	16	83	-	118
5.	Syzygium corymbosa	-	-	-	-	-	-	-	-	22	-	22
6.	Terminalia spp.	-	-	-	-	-	-	3	24	48	11	86
7.	Dillenia pentagyna	-	-	-	-	-	-	17	2	2	3	24
8.	Careya arborea	-	-	-	-	-	-	2	3	7	7	19
9.	Xylia xylocarpa	-	-	-	-	-	-	-	-	56	23	79
10.	Schleichera oleosa	-	3	-	-	-	-	-	-	6	106	115
	TOTAL INDICATORS	5	36	11	4	42	40	124	139	423	197	1021
	TOTAL NO. OF TREES IN QUADRAT	369	421	416	328	575	334	727	848	513	236	4757
	% OF INDICATORS	1	9	3	1	7	12	17	16	82	83	21

The quadrats of Gr.IIA are still good evergreen forests though have been logged in the past ~~xx~~ (Q VIV) or lopped, litter collected and occasionally a tree being cut(Q VIII) . Whereas Q VI, a reserve forest, is recovering Q VIII, a village forest, is degrading further as the threats continue from the population of the village. If the threat faced by Q VIII is not minimised it will degrade to the Gr.III level like Q IX and Q X, also from the same village forest. Q X still has the vestiges of an evergre past indicated through single surviving trees like Cinnamomum spp. Persea macrantha, Holigarna grahamii and to a lesser extent by Nothopegia colebrookeana. Since their regeneration is scanty on a terrain full of exposed laterite and since the forest is ravaged by the local population for the biomass needs these species are facing their ecological death. All such sensitive evergreens have already vanished from ~~xxxxxx~~ Q IX, which has just 21 tree speci

The forests of Gr.IIB are perhaps a grade more desiccated than Gr.IIA due to more pronounced soil erosion and occurence of more percentage of indicators of degradation. Though the quadrats are quite rich in tree species there is increased occurence of invaders as shown in fig.2. The logging history and other possible threats, past and present, are being investigated.

2. Canopy Openings and their Effect on Vertical Stratification:

A good vertical stratification with with two or three strata of trees is a special feature of most of the evergreen forests. For instance please see the actual vertical profile diagrams of good evergreen forests of the region in fig. 4,5,6 & 7. An emergent layer of trees is quite clear in these profils. Gaps in the canopy, as a result of past logging, are observed in Fig.8. Fig 9 is more a picture of degradation and is a part of Q III of Gr.II B type. The forest here seems to have suffered from more severe logging in the past. The canopy openings ~~xxx~~ permitted many trees to branch from a lower height as competition for light was minimised. There is a decline in the canopy height compared to other profiles. Species-wise this forest is richer in trees though many are invaders and indicators of degradation as already explained elsewhere.

FIG.4 PROFILE OF A SOLD EVERGREEN FOREST

DODDAMANE GHAT
30 X 20 M

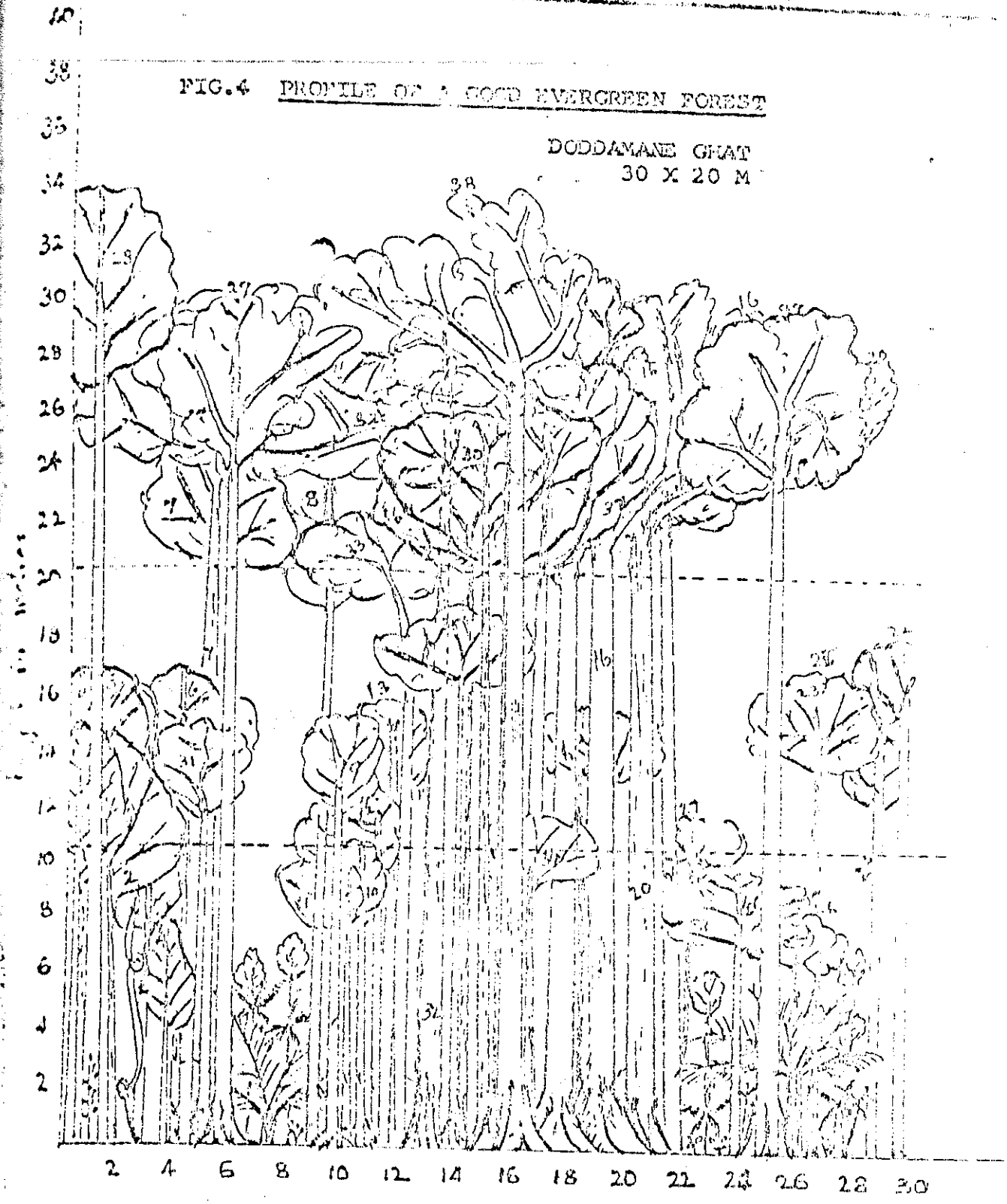


FIG.5 PROFILE OF A GOOD EVERGREEN FOREST

DODDAMANE GHAT 30 X 20M

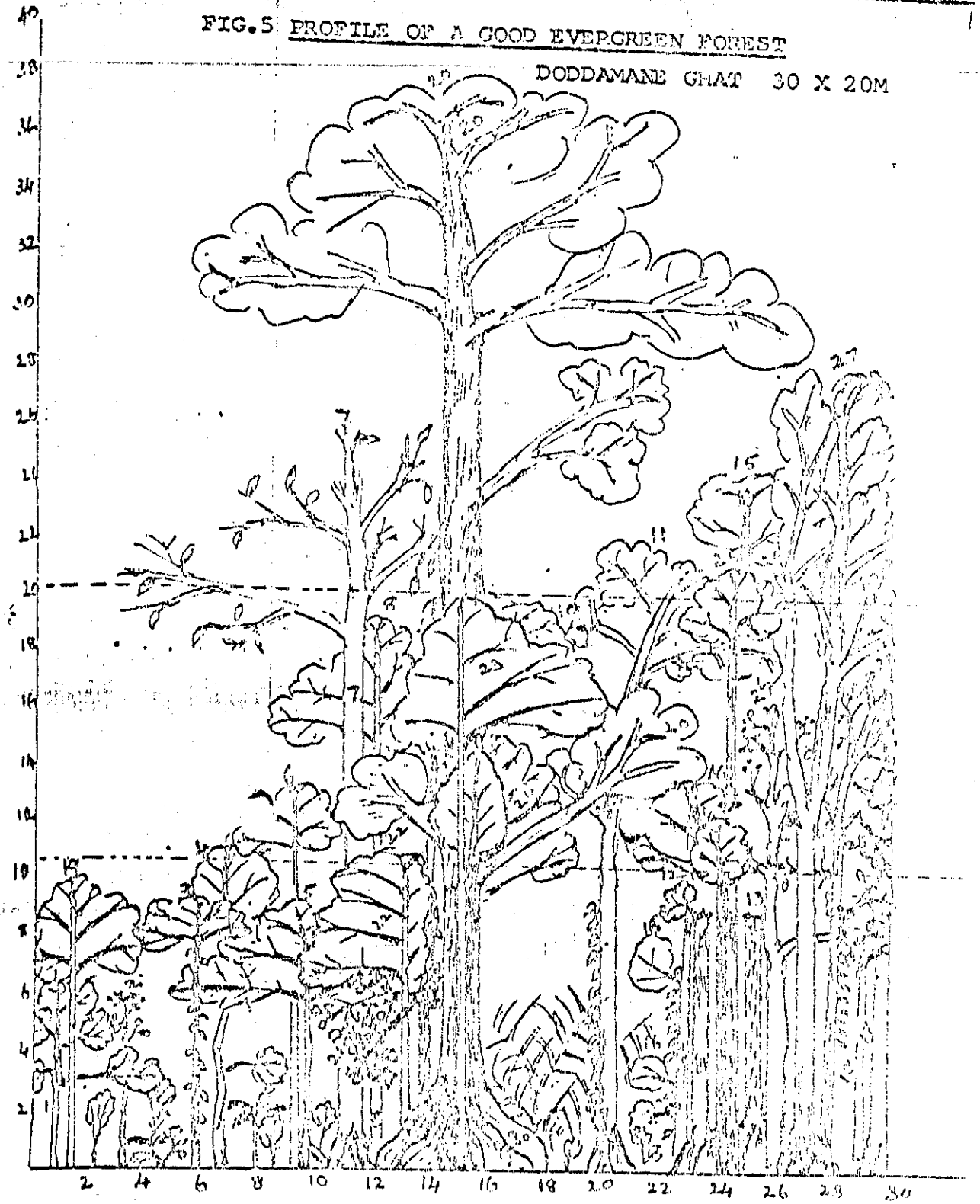


FIG. 6 PROFILE OF A GOOD EVERGREEN FOREST

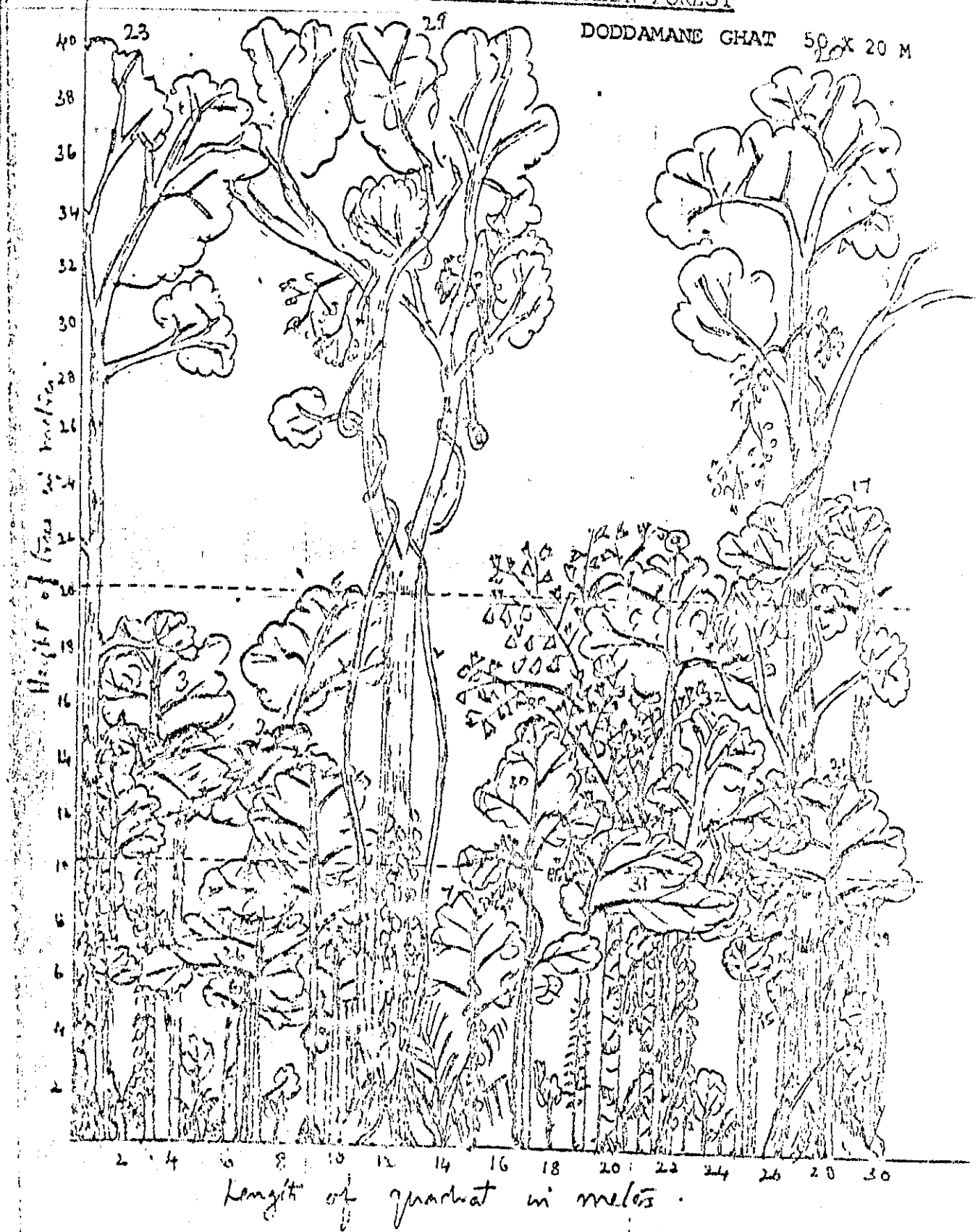


FIG. 7 PROFILE OF A GOOD EVERGREEN FOREST
DODDAMANI GHAT
50X20 M

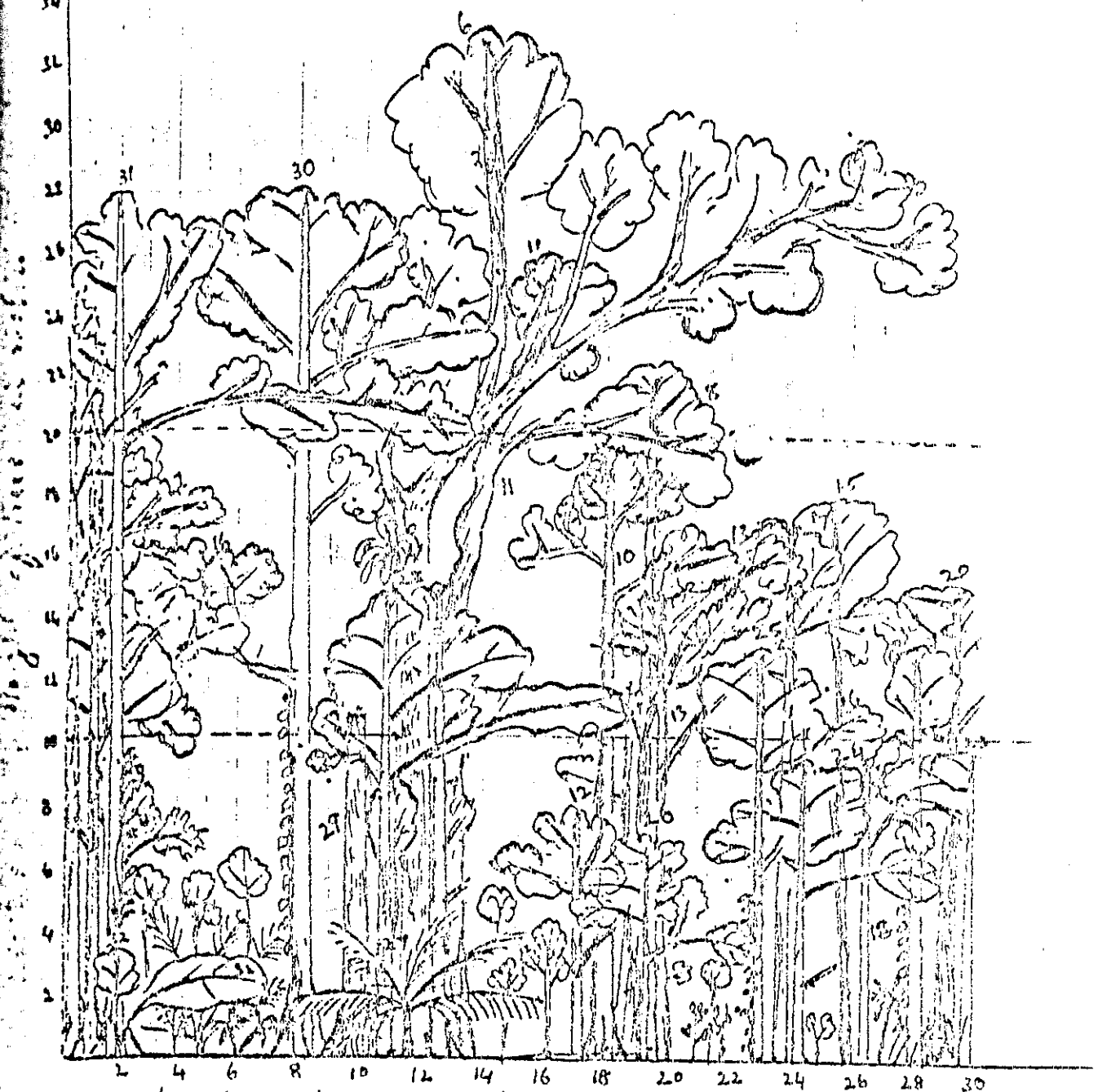


FIG.8 PROFILE OF AN EVERGREEN FOREST - A STAGE IN DEGRADATION

DODDAMANE GHAT

30 X 20 M

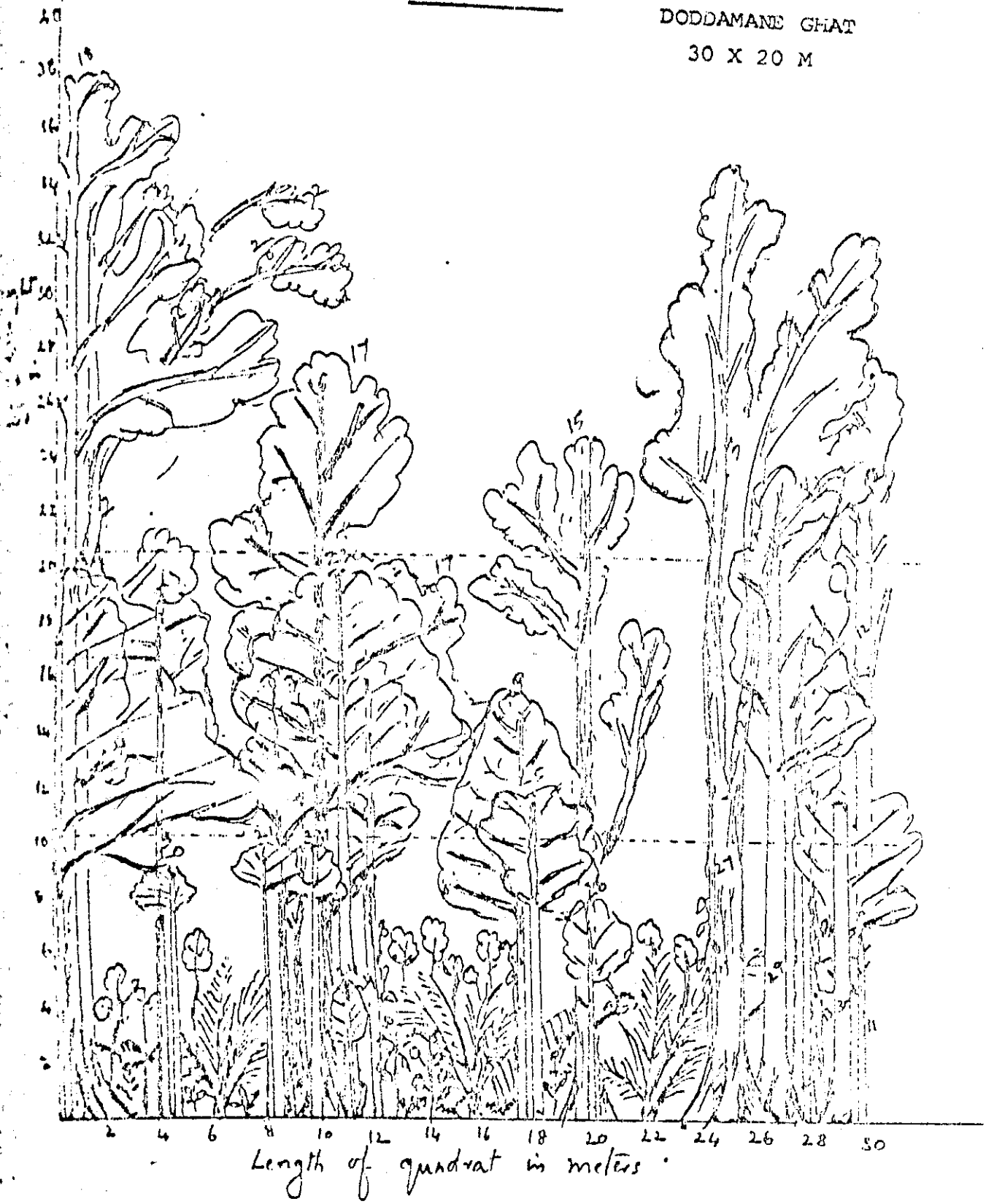


FIG. 9 PROFILE OF AN EVERGREEN FOREST

A STAGE IN DEGRADATION

MEDINE GHAT 30 X 20 M

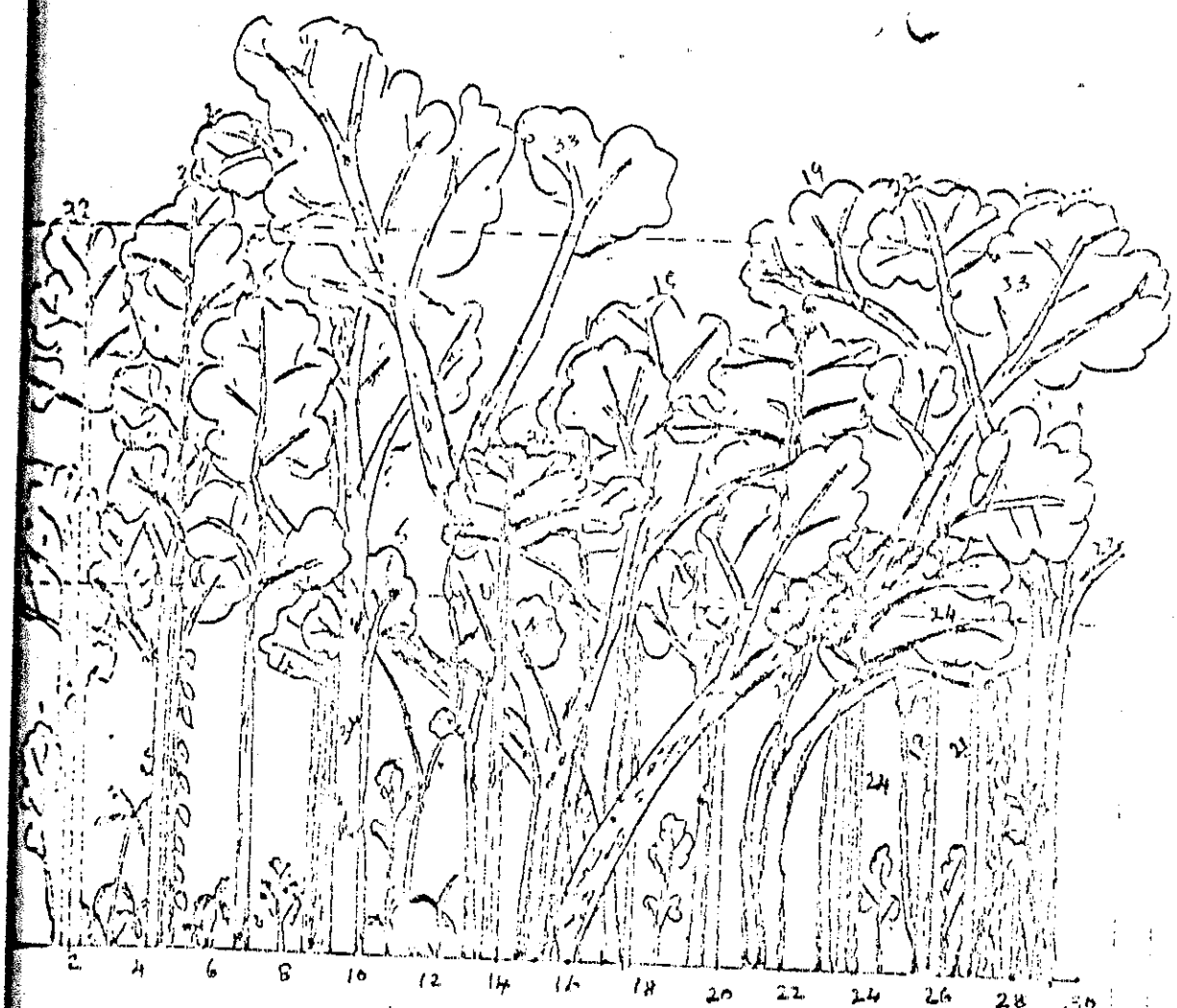
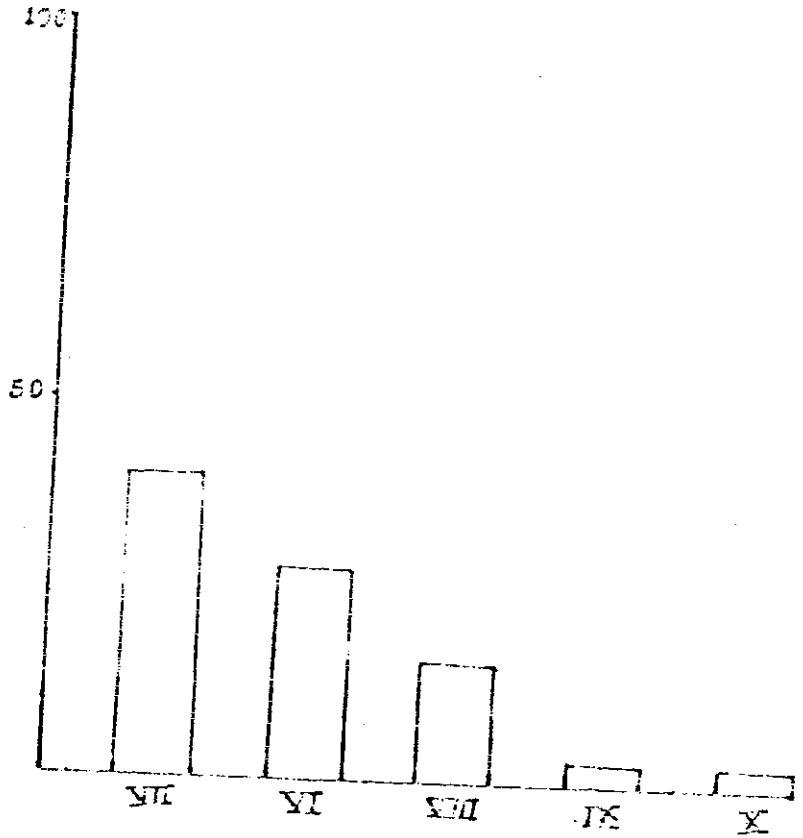


Fig 10 PERCENTAGE OF TREES OVER 20 M. IN HEIGHT.



3. Decline in Height: The average height of the trees shows a declining trend in the exploited evergreen forests. The dimensions of all the trees in five of the ten quadrats have been already studied. See figure 10 for the percentage of trees over 20M in heigh. Though height alone is not a decisive factor for the quality of the evergreen forest, within the limited altitudinal range of Uttara Kannada good height is an important indicator of forest quality. In the figure 10 Q VII is a sample of Gr.I forest. Q VI and Q VIII are from Gr. II forests . Q IX and Q X are samples of Gr. III forests.

CONCLUSIONS

It will be too early to conclude from the limited data available about the impact of forest based industries on the evergreen forests of Uttara Kannada. However the background has already been prepared for more specific studies on the impact. The history of forest exploitation by the forest based industries is being investigated. It appears that forest logging does have some impact on the evergreen forests which may be summarised as foll.

1. The felling of trees create gaps in the canopy. The gaps in the canopy are also created by natural tree fall. If many mature trees a cut in a small area the forest itself could change its character.

2. A study of the forests logged in the past show the arrival of several light loving invader species of trees. These plants which are mostly from drier habitats perhaps also have more survival value than evergreen species on more eroded and rocky terrain. Evergreen forests of the district are today mostly confined to the ghat areas which are very sensitive to soil disturbances.

3. Along with the invader species some of the hardy evergreen species are also found to increase in numbers in the previously logged forest

4. The change in the composition of the degraded evergreen forest could bring about fluctuations in the populations of different specie

5. At certain level of degradation the native species along with the invaders create more tree diversity in the forest.

6. During further degradation, which could happen due to several other factors also, the sensitive evergreen species tend to vanish and indicators of degradation flourish. Continued exploitation could result in drastic reduction in tree diversity. The forest is now secondary deciduous in nature along with evergreen indicators of degradation.

7. The decline in tree height and average canopy height is noticed in the logged forests.

8. Ground vegetation also undergoes changes in relation to logging.

The question still at large is whether the evergreen forest could be logged at all and if it could be to what degree without threatening its natural composition and harmony. The future work will be aimed towards shedding more light into this problem.

xxxxxxxxxxxxxxxxxx

APPENDIX-1

TREE DIVERSITY IN TEN ONE HECTARE QUADRATS IN UTTARA KANNADA DISTRICT

SR NO	NAME OF TREE SPECIES	DODDAMANE GHAT			ANSHE GHAT		MELEMANE GHAT		KALLA V.FOR	
		QI	II	III	IV	V	VI	VII	VIII	IX
1.	Holigarna grahamii	2	5	-	10	21	30	2	3	-
2.	Spondias acuminata	1	3	-	-	-	-	-	-	-
3.	Polyalthia fragrans	16	4	-	-	-	-	6	8	-
4.	Bocagea dalzelli	8	14	-	-	-	-	6	-	-
5.	Annonaceae X	1	-	1	-	-	-	-	-	-
6.	Arenga wightii	2	-	-	-	-	1	8	-	-
7.	Hydnocarpus wightiana	3	-	-	-	1	2	2	2	-
8.	Strombosia ceylanica	17	-	-	-	-	-	25	3	-
9.	Lophopetalum wightianum	2	-	-	-	-	-	-	6	-
10.	Diospyros candolleana	10	15	93	146	12	2	2	1	-
11.	Diospyros ebenum	6	-	-	-	2	-	2	-	-
12.	Blachia denudata	1	-	-	-	2	9	-	-	-
13.	Garcinia morella	1	-	1	2	-	1	-	-	-
14.	Garcinia cambogea	1	2	2	-	-	9	-	-	-
15.	Persea macrantha	6	14	4	20	15	16	7	-	-
16.	Cinnamomum spp.	2	-	5	2	-	5	9	-	-
17.	Lansium anamallayanum	42	11	-	38	1	-	12	-	-
18.	Dysoxylum malabaricum	7	18	1	18	3	-	5	2	-
19.	Pithecellobium bigeminum	1	-	-	-	-	-	-	-	-
20.	Ficus nervosa	3	2	-	-	-	3	4	8	-
21.	Knema attenuata	90	49	143	50	9	92	104	120	-
22.	Myristica malabarica	2	2	2	3	-	3	2	79	-
23.	Myristica beddomii	1	-	2	14	131	-	-	-	-
24.	Syzygium gardneii	59	8	-	-	-	13	8	-	-
25.	Syzygium macrosepalum	6	-	14	-	-	1	2	-	-
26.	Olea dioica	5	7	74	67	11	28	4	10	44
27.	Alstonia scholaris	1	-	-	-	-	-	-	3	1
28.	Melia dubia	5	-	-	-	-	1	-	-	-
29.	Pterygota alata	41	-	-	-	-	-	-	-	-
30.	Pterospermum acerifolium	10	3	-	-	-	-	5	-	-
31.	Others	1	-	-	-	-	-	-	-	-

SR NO	NAME OF TREE SPECIES	DODDAMANE GHAT			ANSHE GHAT		MELEMANE GHAT		KALLABBE V.FOREST		
		I	II	III	IV	V	VI	VII	VIII	IX	X
32.	Mangifera indica	-	3	9	1	2	-	1	1	-	3
33.	Nothopegia colebrookeana	-	10	53	8	6	27	1	4	-	1
34.	Saccopetalum tomentosum	-	4	-	-	-	-	-	-	-	-
35.	Caryota urens	-	5	1	1	*	4	-	-	-	-
36.	Flacourtia montana	-	1	2	16	-	1	1	2	3	-
37.	Stereospermum personatum	-	21	1	6	-	-	-	-	-	-
38.	Hopea wightiana	-	83	33	44	-	2	-	2	-	-
39.	Diospyros spp.	-	1	-	-	-	-	-	-	-	-
40.	Diospyros nigresens	-	2	-	2	-	-	-	-	-	-
41.	Saraca indica	-	12	-	-	-	-	-	-	-	-
42.	Glochidion spp.	-	2	-	-	-	5	-	-	-	-
43.	Diospyros spp. (fibrous	-	11	1	-	-	-	-	-	-	-
44.	Calophyllum apetalum bark)	-	4	-	-	-	-	1	-	-	-
45.	Garcinia talbotii	-	1	-	83	35	2	-	-	-	-
46.	Dysoxylum binectariferum	-	2	-	-	-	-	1	1	-	-
47.	Walsura trifolia	-	1	-	19	-	-	1	-	-	-
48.	Lagerstroemia microcarpa	-	1	15	2	1	-	-	-	5	-
49.	Artocarpus gomezianus	-	2	2	2	-	-	-	-	-	1
50.	Ficus spp. (Strangler)	-	1	1	-	-	-	-	-	-	-
51.	Syzygium cumini	-	3	13	18	-	4	4	7	-	1
52.	Ficus spp.	-	1	-	-	-	-	-	-	-	-
53.	Syzygium spp.	-	3	-	-	-	-	-	-	-	-
54.	Ixora brachiata	-	26	8	27	-	3	-	4	3	51
55.	Dimocarpus longan	-	25	50	11	70	54	6	2	-	-
56.	Schleischera oleosa	-	3	-	-	-	-	-	-	106	6
57.	Madhuca neerifolia	-	6	-	-	-	-	-	8	-	-
58.	Madhuca spp.	-	1	-	-	-	-	-	-	-	-
59.	Ailanthus malabarica	-	1	-	-	-	-	-	-	-	-
60.	Pterospermum reticulatum?	-	8	98	-	-	-	-	2	3	-
61.	Vitex altissima	-	2	11	4	-	-	-	-	1	8
62.	Vitex leucoxylon	-	5	-	-	-	-	-	-	-	-
63.	Unknown -1	-	1	-	-	-	-	-	-	-	-
64.	Unknown -2	-	5	-	-	-	-	-	-	-	-
65.	Unknown -3	-	1	-	-	-	-	-	-	-	-

SR NO	NAME OF TREE SPECIES	DODDAMANE GHAT			ANSHI GHAT		MELEMANE GHAT		KALLABBE V.FOREST		
		I	II	III	IV	V	VI	VII	VIII	IX	X
66.	Holigarna arnottiana	-	-	2	-	-	10	-	26	-	71
67.	Dillenia pentagyna	-	-	17	2	-	-	-	-	3	2
68.	Diospyros X	-	-	2	-	-	-	-	-	-	-
69.	Cyclostemon confertiflo	-	-	1	-	-	-	-	-	-	-
70.	Aporosa lindleyana rus	-	-	18	16	-	1	-	-		83
71.	Calophyllum polyanthum	-	-	1	63	-	4	1	-	-	-
72.	Terminalia paniculata	-	-	3	19	-	-	-	-	6	38
73.	Litsea stocksii	-	-	2	-	-	-	-	-	-	-
74.	Careya arborea	-	-	2	3	-	-	-	-	7	7
75.	Memecylon umbellatum	-	-	1	26	-	-	-	-	-	-
76.	Artocarpus hirsuta	-	-	1	3	-	1	-	9	-	-
77.	Ficus spp.	-	-	4	-	-	-	-	-	-	-
78.	Syzygium spp.(Koleneerilu	-	-	9	-	21	-	-	3	-	-
79.	Carallia brachiata	-	-	1	-	1	2	-	-	-	-
80.	Pterospermum (smaller	-	-	6	5	-	0	-	-	-	-
81.	Sterculia foetida leaves)	-	-	2	-	-	-	-	-	-	-
82.	Symplocos spp.	-	-	7	17	8	16	8	-	-	-
83.	Elaeocarpus glaucum	-	-	3	-	-	-	-	-	-	-
84.	Unknown X-3	-	-	1	-	-	-	-	-	-	-
85.	Heterophragma roxburghii	-	-	1	-	-	-	-	-	2	-
86.	Terminalia tomentosa	-	-	-	4	-	-	-	-	-	-
87.	Terminalia bellerica	-	-	-	1	-	-	-	-	5	10
88.	Diospyros montana	-	-	-	2	-	-	-	-	-	-
89.	Garcinia indica	-	-	-	1	11	4	-	-	4	5
90.	Cinnamomum sulphuratum	-	-	-	1	-	-	-	-	-	-
91.	Alseodaphne semecarpifoli	-	-	-	1	-	-	-	-	-	6
92.	Neolitsea scorbiculata	-	-	-	1	-	-	-	-	-	-
93.	Other Lauraceae	-	-	-	3	-	-	-	-	-	-
94.	Syzygium spp.	-	-	-	3	-	-	-	-	-	-
95.	Canthium didymum	-	-	-	18	-	-	-	-	-	-
96.	Acronychia laurifolia	-	-	-	2	-	-	-	-	-	-
[illegible]		-	-	-	*	-	-	-	-	-	-
97.	Rutaceae X	-	-	-	5	-	-	-	-	-	-
98.	Sideroxylon tomentosum	-	-	-	8	-	-	-	-	-	-
99.	Gnidia glauca	-	-	-	1	-	-	-			

SR NO	NAME OF TREE SPECIES	DODDAMANE GHAT			ANGHE GHAT		MELEMANE GHAT		KADLADKE V.FOREST		
		I	II	III	IV	V	VI	VII	VIII	IX	X
100.	Unknown X	-	-	-	2	-	-	-	-	-	-
101.	Unknown XX	-	-	-	2	-	-	-	-	-	-
102.	Euonymus indicus	-	-	-	-	20	-	-	-	-	-
103.	Mallotus sp.	-	-	-	-	1	-	-	-	-	-
104.	Syzygium sp.	-	-	-	-	3	-	-	-	-	-
105.	Bischofia javanica	-	-	-	-	15	-	1	-	-	-
106.	Diospyros oocarpa ?	-	-	-	-	2	-	-	-	-	-
107.	Diospyros pruriens	-	-	-	-	3	3	2	-	-	-
108.	Diospyros sp.	-	-	-	-	3	-	-	-	-	-
109.	Unknown -1	-	-	-	-	1	-	-	-	-	-
110.	Unknown- 2	-	-	-	-	1	-	-	-	-	-
111.	Unknown-3	-	-	-	-	2	-	-	-	-	-
112.	Unknown- 4	-	-	-	-	2	-	-	-	-	-
113.	Diospyros sp.1	-	-	-	-	-	12	-	-	-	-
114.	Litsea sp.	-	-	-	-	-	49	38	-	-	-
115.	Lauraceae sp.	-	-	-	-	-	38	-	-	-	-
116.	Syzygium sp.1	-	-	-	-	-	14	-	-	-	-
117.	Mallotus phillippinensis	-	-	-	-	-	6	-	-	-	-
118.	Meliaceae X	-	-	-	-	-	59	-	-	-	-
119.	Diospyros sp-2	-	-	-	-	-	5	-	-	-	-
120.	Nothapodytes foetida	-	-	-	-	-	4	-	-	-	-
121.	Macaranga peltata	-	-	-	-	-	1	2	-	-	-
122.	Dipterocarpus indicus	-	-	-	-	-	1	-	-	-	-
123.	Linociera malabarica	-	-	-	-	-	1	-	-	-	-
124.	Ficus callosa	-	-	-	-	-	1	-	-	-	2
125.	Ficus sp.	-	-	-	-	-	1	-	-	-	-
126.	Elaeocarpus serratus	-	-	-	-	-	1	-	3	1	12
127.	Unknown -1	-	-	-	-	-	14	-	-	-	-
128.	Unknown -2	-	-	-	-	-	7	-	-	-	-
129.	Unknown -3	-	-	-	-	-	2	-	-	-	-
130.	Diospyros sylvatica	-	-	-	-	-	-	18	-	-	-
131.	Diospyros microphylla	-	-	-	-	-	-	1	2	-	-
132.	Cleidon javanicum	-	-	-	-	-	-	15	6	-	-
133.	Trewia nudiflora	-	-	-	-	-	-	3	-	-	-

SR NO	NAME OF TREE SPECIES	DODDAMANE GHAT			ANSHE GHAT		MELEMANE GHAT		KALLAHBE V.FOREST		
		I	II	III	IV	V	VI	VII	VIII	IX	X
134.	Meliaceae XY	-	-	-	-	-	-	1	-	-	-
135.	Actinodaphne hookeri	-	-	-	-	-	-	1	-	-	-
136.	Syzygium sp.	-	-	-	-	-	-	3	-	-	-
137.	Tree X	-	-	-	-	-	-	1	-	-	-
138.	Tree X2 (with black fruit)	-	-	-	-	-	-	2	-	-	-
139.	Unknown (with flaky bark)	-	-	-	-	-	-	3	-	-	-
140.	Pajanelia longifolia	-	-	-	-	-	-	-	2	-	-
141.	Casearíam esculentum	-	-	-	-	-	-	-	2	-	1
142.	Diospyros montana	-	-	-	-	-	-	-	1	-	-
143.	Salmalia malabarica	-	-	-	-	-	-	-	-	1	-
144.	Xylia xylocarpa	-	-	-	-	-	-	-	-	23	36
145.	Ervatamia heyneana	-	-	-	-	-	-	-	-	4	9
146.	Randia spp	-	-	-	-	-	-	-	-	6	3
147.	Bauhinia sp.	-	-	-	-	-	-	-	-	1	-
148.	Strychnos nuxvomica	-	-	-	-	-	-	-	-	1	20
149.	Lannea coromandelica	-	-	-	-	-	-	-	-	1	-
150.	Adina cordifolia	-	-	-	-	-	-	-	-	-	1
151.	Grewia sp.	-	-	-	-	-	-	-	-	-	1
152.	Syzygium corymbosa	-	-	-	-	-	-	-	-	-	22
153.	Mimusops elengi	-	-	-	-	-	-	-	-	-	1
154.	Sapindus laurifolius	-	-	-	-	-	-	-	-	-	1
155.	Alseodaphne semicarpifolia	-	-	-	-	-	-	-	-	-	4
156.	Buchanania lanzan	-	-	-	-	-	-	-	-	-	7