NEWSLETTER

Number 3 June, 1977

KERALA FOREST RESEARCH INSTITUTE

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ABOUT OURSELVES

A significant event during the last quarter was the laying of the foundation stone of our Sub-centre at Nilambur by the Minister for Forest, Kerala, on 11th June 1977. This Sub-centre, with a laboratory, modern experimental yard, staff quarters and a Rest House, is expected to be ready by December this year. In his Address, the Minister indicated the possibility of establishing a Teak Museum as an adjunct to the Sub-centre. Nilambur, we hope, will vindicate the right to be a great centre of learning on Teak.

There have been additions to our Scientific staff. Prof. V.P. Krishnan Nambiar has joined us on deputation, from Kerala Education Department, as Plant Taxonomist. Dr.P.W. Amin has bolstered our Entomology Division with his background and experience of Forest Insects. Dr.M. Padmanabhan, Shri. N. Sasidharan, Kumari K. Shobana and Kumari C. Renuka have joined as Research Assistants.

A Research Advisory Committee has been constituted under the chairmanship of the Chief Conservator of Forests (Development). We had the first meeting of the committee to consider our Research Projects.

In this issue of the Newsletter, an extract from a paper in the December 1976 issue of the Commonwealth Forestry Review, has been included. This is the beginning of our effort to transmit information of topical value from published literature to the benefit of those who do not get the opportunity to see international journals in forestry. The conclusions in this paper are of special significance to us in Kerala.

It is with deep anguish that we record the untimely death of the founder-chairman of our Executive Committee. Dr. N.K. Panicker was a gifted Scientist and an accomplished science administrator. In his death, we have lost a friend, philosopher and guide.

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EUCALYPTUS BARK VOLUME

Extensive areas in Kerala State have been planted with *Eucalyptus*. At around a rotation age of 10 years, the trees are felled, cut into billets, and after debarking they are piled and measurements taken. The debarked billets are then transported to factories. So far, little attempt has been made to study the volume of bark and relate it to the usual tree parameters, viz. dbh and height and overbark volume of the tree.

It was thought that the forester should be provided with the information on *Eucalyptus* bark volume so that it would be possible to estimate the underbark volume of a standing *Eucalyptus* plantation.

Data were collected from sample *Eucalyptus* trees felled in Industrial Plantation Circle by Forest Department staff during the 1976-'77 felling season. Information on bark volume collected by the Working Plan party for the Pamba Grassland Afforestation Division were also made available.

There are some essential differences in the data collected in the Industrial Plantation Circle and Grassland Division. While in the Industrial Plantation Circle, girth measurement (by tape correct to 0.5cm.) were recorded for every 1 meter billet, in Pamba Division diameter measurements with callipers correct to 1 cm. for two meter billets were recorded.

Only a preliminary analysis of the available data has been attempted for the purpose of presenting in the current Newsletter. (Data from only one division of the Industrial Plantation Circle and a part of data from the Pamba Division have been utilised). Hence the figures shown herein have indicatory value only. Investigations are continuing to present final results.

Table I.A shows percentage bark volume to overbark volume in Kothamangalam Division of Industrial Plantation Circle. Table I.B shows bark volume figures for the Grassland Division. Table II.A shows form factors and form quotients for Kothamangalam Division and Table II.B shows similar figures for Pamba Division.

Form factor is defined as the ratio of overbark volume of tree to the volume of cylinder having dbh as diameter and height of tree as its height. Form quotient is defined as diameter at half the bole length to diameter at breast height.

We are grateful to Shri. M. Sivarajan, Conservator of Forests for identifying this problem and for assistance in the field.

TABLE - I.A.

BARK VOLUME IN EUCALYPTUS

Division: Kothamangalam. Age of Plantation: 10 Years. Altitude: Below 200 metrs.

Girth at Breast height (Cms.)	Percentage of Bark Volume to Overbark volume		
	Eucalyptus hybrid	Eucalyptus grandis	Eucalyptus grandis and hybrid
35 - 45	24.03 (6)	25.32 (2)	24.35 (8)
45 - 55	24.34 (6)	20.60 (2)	23.40 (8)
55 - 65	22.63 (5)	17.84 (2)	21.26 (7)
65 - 75	21.39 (5)	15.11 (2)	19.60 (7)
75 - 85	16.15 (5)	17.20 (2)	17.19 (6)
85 - 95	15.71 (3)	24.42 (2)	18.00 (6)
95 - 105	10.53 (2)	..	10.53 (2)
All girths	20.60 (32)	20.08 (12)	20.46 (44)

TABLE - II.A.

TREE PARAMETERS (EUCALYPTUS)

Division: Kothamangalam. Age of Plantation: 10 Years. Altitude: Below 200 metrs.

Girth at Breast Height (Cms.)	FORM FACTOR			Form Quotient
	Eucalyptus hybrid	Eucalyptus grandis	Eucalyptus hybrid and grandis	Eucalyptus hybrid
35 - 45	0.632 (6)	0.682 (2)	0.644 (8)	0.766 (4)
45 - 55	0.509 (6)	0.492 (2)	0.505 (8)	0.696 (4)
55 - 65	0.513 (5)	0.499 (2)	0.509 (7)	0.723 (3)
65 - 75	0.512 (5)	0.558 (2)	0.525 (7)	0.700 (3)
75 - 85	0.502 (5)	0.492 (2)	0.499 (7)	0.703 (2)
85 - 95	0.623 (3)	0.488 (2)	0.569 (5)	0.822 (2)
95 - 105	0.469 (2)	..	0.469 (2)	..
All girths	0.540 (32)	0.535 (12)	0.539 (44)	0.732 (18)

Figures given in brackets are sample numbers.

TABLE - I.B

EUCALYPTUS GRANDIS

PERCENTAGE OF BARK VOLUME TO OVERBARK VOLUME

Pamba Grassland Afforestation Division. Altitude: 900-1200 Meters.

Girth at Breast height (Cms.)	Age (in years)								All Ages
	10	11	12	13	14	15	16	17	
15-25	..	..	..	..	..	28.36(1)	24.89(2)	..	26.05(3)
25-35	18.08(1)	..	..	..	17.32(3)	20.41(3)	..	6.74(1)	17.25(8)
35-45	16.31(2)	20.39(1)	13.93(1)	12.46(1)	16.67(4)	15.84(2)	13.22(1)	18.83(1)	16.14(13)
45-55	26.02(1)	16.92(5)	..	15.30(4)	15.11(3)	18.05(4)	..	13.78(1)	16.84(18)
55-65	18.36(1)	15.17(7)	..	13.30(4)	14.70(3)	15.74(6)	16.70(2)	..	15.20(23)
65-75	..	14.59(2)	..	15.83(3)	12.26(2)	15.17(4)	..	..	14.72(11)
75-85	11.40(1)	..	21.86(1)	..	19.61(2)	12.93(6)	14.13(2)	8.69(1)	14.39(13)
85-95	16.30(1)	..	..	16.59(1)	..	12.86(2)	..	..	14.65(4)
95-105	..	..	..	13.87(1)	..	12.43(4)	..	..	12.72(5)
Over 105	..	..	..	..	..	11.00(3)	10.78(2)	..	10.91(5)
All girths	17.54(7)	16.02(15)	17.89(2)	14.63(14)	15.99(17)	15.27(35)	16.25(9)	12.01(4)	15.58(103)

Figures given in brackets are sample numbers.

TABLE - II.B.1.

FORM FACTOR (EUCALYPTUS GRANDIS)

Pamba Grassland Afforestation Division. Altitude: 900 to 1200 Meters.

Girth at Breast height (Cms.)	Age (in years)								All Ages
	10	11	12	13	14	15	16	17	
15-25	..	..	..	..	..	..	..	..	..
25-35	0.970(1)	..	..	..	0.585(3)	0.520(3)	..	0.547(1)	0.604(8)
35-45	0.576(2)	0.646(1)	0.606(1)	0.556(1)	0.557(4)	0.616(2)	0.669(1)	0.565(1)	0.589(13)
45-55	0.535(1)	0.518(5)	..	0.570(4)	0.541(3)	0.556(4)	..	0.470(1)	0.540(18)
55-65	0.595(1)	0.485(7)	..	0.498(4)	0.537(3)	0.491(6)	0.543(2)	..	0.505(23)
65-75	..	0.539(2)	..	0.454(3)	0.493(2)	0.501(4)	..	..	0.494(11)
75-85	0.502(1)	..	0.369(1)	..	0.557(2)	0.492(6)	0.479(2)	0.482(1)	0.491(13)
85-95	0.411(1)	..	..	0.495(1)	..	0.444(2)	..	..	0.448(4)
95-105	..	..	..	0.455(1)	..	0.463(4)	..	..	0.461(5)
Over 105	..	..	..	..	..	0.413(3)	0.492(2)	..	0.445(5)
All girths	0.595(7)	0.514(15)	0.487(2)	0.510(14)	0.548(17)	0.497(34)	0.528(7)	0.516(4)	0.520(100)

Figures in brackets are sample numbers.

TABLE - II.B-2.

FORM QUOTIENT - EUCALYPTUS GRANDIS

Pamba Grassland Afforestation Division. Altitude: 900 to 1200 Meters.

Girth at Breast height (Cms.)	Age (in years)								All ages
	10	11	12	13	14	15	16	17	
25-35	..	..	..	..	0.732(3)	0.748(2)	..	..	0.738(5)
35-45	0.752(2)	0.756(1)	0.760(1)	0.737(1)	0.731(4)	0.685(2)	0.750(1)	0.731(1)	0.733(13)
45-55	0.719(1)	0.698(4)	..	0.718(4)	0.724(3)	0.768(4)	..	0.667(1)	0.723(17)
55-65	0.782(1)	0.689(5)	..	0.671(4)	0.726(3)	0.683(6)	0.701(2)	..	0.695(21)
65-75	..	0.692(2)	..	0.657(3)	0.682(2)	0.702(4)	..	..	0.684(11)
75-85	0.705(1)	..	0.527(1)	..	0.600(1)	0.672(6)	0.711(1)	0.692(1)	0.661(11)
85-95	0.616(1)	..	..	0.699(1)	..	0.645(2)	..	..	0.651(4)
95-105	..	..	..	0.662(1)	..	0.680(4)	..	..	0.676(5)
Over 105	..	..	..	..	..	0.583(4)	0.678(2)	..	0.615(6)
All girths	0.721(6)	0.698(12)	0.644(2)	0.687(14)	0.714(16)	0.683(34)	0.703(6)	0.697(3)	0.694(93)

Figures in brackets are sample numbers.

Commercial future of Albizzia falcata - An Entomologist's view point.

Albizzia falcata, a native of Molucca, has shown great promise as a pulp-wood species due to its fast growth, high survival rate, and tolerance to congestion created by taungya crop in the early stages of growth. Based on initial success of small-scale plantations in several areas, the Forest Department is tempted to plant this species in more extensive areas. However, at present, there are several insects that are causing damage to the Albizzia plantation at Vazhachal. When Albizzia is planted on large scale, the present pest problems will certainly aggravate. In addition, some new pest problems are likely to arise. Albizzia falcata appears to be extremely susceptible to defoliation and bark injury. We believe that the commercial success of this species will depend, to a great extent, on how best we are able to control its insect pests.

Of the several insect pests that have been observed to attack Albizzia in Vazhachal area, the economically important ones are discussed below:

(1) CASEWORM (Psychidae, Lepidoptera): A large-scale incidence of caseworms was noticed in April 1977, in Vazhachal plantation of 1974. Substantial number of trees were found defoliated. Due to severe defoliation and bark damage, most of the branches and terminal shoot of such trees were dead. The major attack, which gives the plants a 'burnt' look, is now confined to two patches but the insects are spreading to healthy trees. If unchecked, these healthy trees would also suffer extensive defoliation and subsequent drying-up of branches and terminal shoot.

Marks of identification:

Caseworms can be easily recognized by their cases which are, when full grown, about 1.5 cm. long and cone shaped. The caterpillars remain inside these cases and feed on the foliage and bark. The cases are held erect and resemble small thorns. The larvae usually feed on the lower surface of leaves and on the bark. The pupae are found hanging on twigs within cases.

Nature of damage:

This insect causes defoliation of Albizzia as well as bark injury. Due to feeding by large number of larvae, the leaves wither and fall off and the entire tree becomes leafless. The extensive defoliation and bark injury results in death of branches and terminal shoots. Some trees produce very limited new flush of leaves which is again attacked by the caseworm. Such trees are likely to die in due course.

(2) <u>Eurema blanda silhetana</u> (Pieridae, Lepidoptera):

The incidence of this species was noticed in September, 1976 in *Albizzia* plantation of 1976 at Vazhachal. Some plants suffered heavy defoliation but no mortality was observed, apparently because the defoliation was not total. There was heavy incidence of parasitization of pupae by a hymenopterous insect which seems to have prevented further build-up of this pest.

The same insect was again observed in small numbers in June 1977 at Vazhachal in the 1974 and 1976 plantations.

Marks of identification:

Clusters of white, narrow, oval eggs are found on the terminal portion of tender, unfolded leaves. The larvae are greenish in colour with dark black head. When full grown, they measure about 4cm. in length. The larvae feed on the leaves gregariously throughout their lives. Pupae remain attached to leaves by their narrow tail end. Pupation occurs on *Albizzia* or other plants of understorey including tapioca.

The adults are butterflies of deep sulfur coloured wings with dark black margins on the upper surface of both wings. The under surface of wings have numerous black spots. The wing expanse is about 4cm.

Nature of damage:

The larvae feed gregariously leaving only the main and secondary rachis. Heavy incidence of this pest results in defoliation of the trees.

(3) <u>Stem borer</u> (Bostrychidae, Coleoptera):

Incidence of this pest was noticed in September 1976 at Vazhachal in the 1976 plantation.

Marks of identification:

Presence of small, slightly oval holes (0.25cm. diameter) in the stem indicates the attack of this insect. The larvae which live in tunnels in the pith are typical bostrychids with white-grub - like appearance. They are about 2cm. long when full grown with large head and well developed mandibles.

Nature of damage:

The larvae of this beetle feed on the pith of the plants. Such plants, although not directly harmed by the insects, are made weak by their feeding and the trees break at this point due to severe wind. Although the accessory buds below the broken stem grow, there is set back in growth.

(4) Other insect pests: At Vazhachal, several insect pests have been observed to feed on Albizzia. They are hairy caterpillars and loopers (eating leaves), membracids and coccids (sucking sap) and the borer Sahyadrassus malabaricus.

Control strategy:

In the 1974 plantation at Vazhachal, we are planning to apply the insecticide lindane to control the caseworms and prevent their further spread. Lindane has very short residual effect and is not expected to affect the biological control agents adversely. It is planned to take up detailed studies on the bionomics of each pest and the role of parasites and predators in governing their population. Studies will also be carried out to find out the most effective insecticide, timing and frequency of application, and its cost benefit ratio. Ultimately, an optimum pest control strategy based on ecological principles will be developed to contain the pest populations under economic injury level.

A word of caution:

Looking at the susceptibility of Albizzia falcata to insect pests, it is advisable not to plant this species on a large scale without developing methods to control the pests economically. It will not be desirable to use long lasting insecticides although they may give immediate relief. It has been observed in several cases, that use of such long lasting broad spectrum insecticides results in resurgance of target insects as well as other insects which are being kept under check by their natural enemies. Therefore, it is imperative to find out optimum pest control stategy based on ecological principles before large scale plantations are taken up. Without adequate knowledge of present and potential pests and methods for their control, the commercial future of large scale plantations of Albizzia is uncertain.

A request:

Our understanding of present pest problems of Albizzia has been mainly due to Shri. M. Sivarajan, Conservator of Forests, whose painstaking observations and timely reports have helped us immensely in our investigations. Our observations are based on Albizzia plantations of Vazhachal. If you come across these or other insects causing damage to Albizzia plantations in your area, kindly write to us. It will not be out of place to mention that your observations on these insects, howsoever limited they may be, will provide us an insight in to the problem and help us to develop a suitable control strategy.

WHAT FUTURE FOR NATURAL REGENERATION OF TROPICAL HIGH FOREST? AN APPRAISAL WITH EXAMPLES FROM NIGERIA AND UGANDA

(Extracts from the paper of P.R.O. Kio, University of Ibadan, Nigeria, published in the Commonwealth Forestry Review, December 1976)

INTRODUCTION

The rosy picture of plantations frequently painted by advocates of exclusive plantation forestry in the tropical high forest zones is based in large measure on seemingly overwhelming economic arguments. Briefly, we are told that concentration of a large volume of a highly marketable economic species justifies the high cost of establishment. Compound interest figures are given to show that at the end of the rotation it takes much less to produce a cubic metre of plantation grown wood than of wood produced under natural regeneration.

For long this fallacy has been fed to an uncritical forestry audience unduly awed by the jargon and formulae of a profession whose miscalculations based on over-simple models have recently played havoc with the economy of much of the world. The survival of Forestry as a viable enterprise will depend on the ability of foresters to master the Greek alphabet and use the modern tools of statistics and applied economics to explain and justify sound biological principles.

The argument of an overwhelming superiority of plantations over natural regeneration is only valid where the forest to be converted is proved to be completely valueless - such as degraded high forest with little or no advance growth or an open savanna. But where the forest is rich in young timber trees, poles and saplings, justification for plantations can be sustained only by failure to take account of some of the vital facts or by elimination of variables that tend to diminish the profitability of the favoured system.

Too often the analyst seems to survey the list of variables and select only those that will contribute positively to the desired end. Inconvenient factors are designated as constants or are assigned derisory co-efficients. The stage is then set to launch an apparently unassailable hypothesis full of exotic symbols.

Primary considerations

The conversion of the natural forest into plantations involves the destruction of the existing timber capital since salvage felling rarely removes more than half of the residual crops, even after intenstive exploitation. The true cost of establishing the plantation should also include the "foregone costs" of the wasted forest capital. This cost should be compounded using the rotation age of the plantation and added to the compounded value of the cost of establishment.

Moreover, it is often taken for granted that natural regeneration treatment involves the clear felling of all trees above 60cm. in diameter and that the residual pole crop and saplings could only be harvested at the rotation age of 80 years. These assumptions have no basis in reality. Natural regeneration as practised in Nigeria, for example, is a selection system with intermediate timber yields, harvested before the end of the putative rotation age.

Past computation of costs at rotation age have therefore tended to place a natural regeneration system at a disadvantage. An unusually high rotation age and an abnormally low volume per unit area are assumed. No account is taken of the possibility of increase in yield which may result from scarcity of highly economic species and advancement in wood utilization methods. For a plantation system, the high initial cost is adequately taken care of by predicting a rotation age half that of the natural regeneration, during which timber of comparable quality is supposed to be produced.

Comparisons are only valid if they are based on relatively equal conditions. An attempt must be made to compute the intermediate yield of the treated high forest which corresponds to that obtained at the rotation age of the plantation. Costs at the same point in time should then be compared.

In this paper, costs will be computed for the two systems as practised in Nigeria; natural regeneration and plantations by direct labour. Experts agreee that the taungya system will lapse within the next ten years since the massive rate of planting will outstrip the supply of client farmers. In any case the universal primary education, future salary reviews and increasing militancy of labour unions may push wages to levels considered uneconomic for plantation establishment. In Canada, a worker with a chain saw may gross a higher income than a fresh graduate forester.

Comparative costs of natural regeneration and direct plantation systems.

The following assumptions are made for the study:

1. Yield from plantations at rotation age of 40 years in moist forest zone in Nigeria at 260 m^3/ha.
2. Yield from the high forest at the end of a felling cycle of 40 years is at 50 m^3/ha. (Justified below)
3. "Foregone cost" of wasted forest capital during the establishment of a plantation at ₦*0.20/m^3 (a rather low estimate)
4. Cost of establishment of the plantation at ₦120/ha.
5. Cost of treating a moist high forest at ₦15/ha.
6. The average real interest rates of 3% and 5%. /Real interest rate is the difference between inflation and commercial interest rates. Taken as a long-term average, the (positive) difference between the interest rate for a low-risk project and the inflation rate is probably less than 4 per cent and this value seems to differ little from country to country. The use of real interest rate therefore eliminates the need to make arbitrary forecasts on a long-term basis in the face of wide ranging inflation factors whose values cannot be precisely predicted./
7. A growth rate of 2m^3/ha/annum for treated moist high forest.
8. A reduction of 25% in the yield of a second rotation plantation.
9. In the high forest, yield at the end of the first felling cycle is 50% of total exploitable volume.
10. Formula for computing compound interest is:

$$Ca = Co(1+i)^n$$

where

Ca = accumulated amount

Co = initial capital

i = interest rate in per cent

n = no. of years

*₦ Naira (approx. £.0.60 in May, 1976).

At compound interest rates of 3 and 5 per cent the accumulated amounts of one unit of capital for 40 years are:

$$Ca = 1(1.03)^{40} \text{ and } 1(1.05)^{40}$$

or 3.262 and 7.04 units respectively.

The above presentation is a highly simplified solution and it is adopted here to give results which can be directly related to past methods of computing cost of producing a Unit volume. For realistic comparisons Olawoys has suggested the following formulae:

For Plantations:

$$Vo = \frac{a(1 + i)^t - c(1 + i)^s - D}{(1 + i)^t}$$

Vo	=	initial value or present net value
a	=	net value realized through each harvest
t	=	rotation length in years
s	=	intervals of treatment in years
c	=	sum of costs incurred at the beginning of each rotation
i	=	compound interest rate in per cent
D	=	harvesting cost at the end of rotation

For Treated Natural High Forest

$$Vo = R - H - C_b(1 + i)^t$$

where

R	=	revenue
H	=	harvesting cost
C_b	=	cost incurred at time of treatment
t	=	time between treatment and exploitation
i	=	interest rate

The cost of hazards

In spite of the more impressive performance of the natural regeneration system as compared to the plantation system, the prediction for the latter can only be attained if there is complete absence of natural and man-made hazards. The cost of protecting a plantation from fire hazards, with all the paraphernalia of the modern fire-fighting industry, will make the original cost of plantation establishment pale into insignificance. Compounded cost of maintaining annually the staff and equipment, and of controlling fire outbreaks, will produce a staggering cost per unit volume at the end of the rotation.

Yet, notwithstanding the heavy cost of fire protection, periodic uncontrollable outbreaks of fire, particularly in plantations sited on difficult terrain, will have the effect of reducing the average yield of the forest. Needless to add, moist natural high forest is virtually free of such outbreaks.

It is well known that plantations are more prone to insect infestation and fungal attack than are natural forests.

The social effect which may result from large-scale replacement of native forests with faster-growing exotics poses a far more serious threat. Already, forestry as a profession is fighting almost for its existence as producers of timber in United States, Britain and Australia. Inhabitants of over-crowded cities whose daily existence is hemmed in by concrete jungles do occasionally wish to escape into the countryside to re-discover and appreciate nature. They are particularly incensed when they find that the dead monotony of cities is being replicated in the countryside by, for example, coniferous monoculture. Fearing that there is no escape from the ever-tightening ventures of a materialistic section of society, urban dwellers are questioning what foresters have been doing, and demand a say in future undertakings.

Conclusion

It is not the intention of this paper to advocate the abandonment of plantation forestry. It has been emphasized that what is required is a balanced appraisal of the consequences of adopting that system or that of natural regeneration. There is evidence that, contrary to popular views, plantation forestry is not invariably more profitable than treated natural high forest. There are, of course, impoverished high forests which must be cleared and planted, just as there are plantations which have failed due mainly to unsuitability of the site.

Suggestions that all the moist natural high forest of the southern parts of Nigeria and elsewhere in the tropics should be clear-felled and planted are not in the long-term interest of the countries concerned. Records of existing plantations are at variance with the exaggerated claims made for the plantation system. It is common knowledge that probably up to 70 per cent of the existing plantations are successful due to insufficient tending at the early stages of establishment and little or no thinning in subsequent years. The emphasis has been to clear new areas since it is easier to convince a government to release money for a new plantation than to justify further expenditure on a plantation which is alleged in annual reports to be fully established!

Well-stocked high forest should be treated by a Tropical Shelterwood System prescription shown by research to give the best timber production under prevailing ecological and economic conditions. Every forest reserve must be treated on its merit.

The question posed at the beginning of this paper was whether natural regeneration of tropical moist high forest has any future. It is asserted that the answer must be in the affirmative.

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