Leaflet No. 1/ 93-94

Government of the Union of Myanmar
Ministry of Forestry
Forest Department

The Problems of Natural Regeneration of Teak in the Lower Reaches of Bago Yoma Particularly in the South Zamayi and North Zamayi Reserved Forests

U Saw Kelvin Keh, B.Sc. (For.) (Rgn.), M.Sc.(Path) Aberdeen,
Deputy Director,
Forest Research Institute
1993

ပဲခူးရိုးမ အောက်ပိုင်းရှိ တောင်ဇာမရီ ကြိုးဝိုင်း နှင့် မြောက်ဇာမရီ ကြိုးဝိုင်းတွင် တွေ့ရှိရသော ကျွန်း၏ဓမ္မတာမျိုးဆက်ခြင်း ပြဿနာ။

ဦးစောကယ်လ်ဗင်ကဲ (B.Sc. (For) (Rgn.), M.Sc.(Path.) Aberdeen)
ဒု-ညွှန်ကြားရေးမှူး
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

ကိုယ်တိုင် တွေ့ရှိချက်နှင့် သင်းသတ်ခြင်း စာရင်းများမှတွေ့ရှိချက်များအရ၊ တောင်ဇာမရီ ကြိုးဝိုင်း နှင့် မြောက်ဇာမရီကြိုးဝိုင်းရှိ ကျွန်းပင်များသည်သာမန်တောများတွင် တွေ့ရှိသောကျွန်းပင်များ၏ အရွယ်အစား အလိုက်၊ အချိုးအစားမရှိဘဲ အပင်ငယ်များ၏ ဦးရေသည် အပင်ကြီးများ၏ ဦးရေထက် နည်းနေသည်ကို တွေ့ရှိရသည်။ ယခုကဲ့သို့ ဖြစ်ရိုးဖြစ်စဉ်မဟုတ်သော ဖြစ်ရပ်ကို ဖြစ်ပေါ်စေနိုင်သည့် အကြောင်းရင်းများနှင့် ၄င်းဖြစ်ရပ်ကို ကုစားနိုင်မည့် နည်းလမ်းများကို တင်ပြထားပါသည်။

The Problems of Natural Regeneration of Teak in the Lower Reaches of Bago Yoma Particularly in the South Zamayi And North Zamayi Reserved Forests

U Saw Kelvin Keh, B.Sc. (For.) (Rgn.), M.Sc.(Path) Aberdeen,
Forest Research Institute

Abstract

From personal observation and from girdling records, it was found that natural regeneration of teak does not follow the normal pattern of a normal forest. The number of trees in the lower age gradations were found to be smaller than the number of trees in the higher age gradations. The reasons for such abnormality and the measures for combating such abnormality were presented in this paper.

Contents

1. Introduction

After the second annexation of lower Myanmar in 1852 by the British, Dr. Dietrich Brandis, a trained German forester was hired by the British to take up the administration and management of the vast and complex Bago Forest, so as to bring in some from of systematic and scientific Management of the forest. They did not want to repeat the mistake they made in Antaean and Taninthayi forests. They had ruined the forests by giving a free hand to the contractors in selecting the trees the contractors wish to fell. (Stebbing, E. P., 1922).

Dr. Brandis knew that the Bago Yoma forest was most valuable and he wanted to manage it on a sustained yield basis so as to get the best economic benefit of teak timber both for home use in Britain and for exporting it to other countries. At the period, teak production under British Rule was only 27, 000 tons while their import from the Upper Myanmar Region was 220, 000 tons. (Stebbing, E. P., 1922).

When hired by the British in 1856 and given a colossal monthly salary of Rs. 3250, Dr Brandis carried out his monumental work in the Bago Province with success, after some trials and conflicts with the contractors and certain British forests as well as the Administrative Authorities.

He found out the Bago Forest was not a normal forest as pertaining to teak. The number of bigger-sized trees were unusually high when compared to the number of small-sized trees. (Kyi, 1962)This fact was supported by the National Forest Inventory figures carried out in North and South Zamayi Reserves in 1982-83 and from the Consolidated Girdling Report. (Appendix IA, I B and II) Brandis therefore decided to leave out every third tree above the girth limit during girdling. Furthermore, not only to compensate for the Teak trees that were extracted but also to increase the proportion of the Teak trees in the forest, (1) Departmental plantations (2) Plantation establishment by the Taungya Method and (3) Other means of establishing teak regeneration were carried out by Brandis, incurring a vast sum of expenditures. The then British Administration foresaw the wisdom of his proposals and made no objection whatsoever to his proposals. Lord Dalhousie, the Governor General of India supported him fully in these "excellent plans" and wished him success in his endeavor. Brandis was given much help by Major (Afterward Sir Arthur) Phayre who was appointed Governor of the Bago Provice at that time. (Brandis, 1896)

The author, during the course of his duty as a girdling officer in 1965-67 and 1975-76 in the South and North Zamayi Reserves found out that there was very little regeneration in the form of seedling and established. The author was strict by the fact that even around teak trees with open canopy around them, there was no regeneration whatsoever. (where as in Pyinmana, Yobin Reserve, it was found that there may be as much as 65 trees left 4' and above after an exploitable teak tree had been marked).

In Appendix III, a graphic picture of the abnormal forest was shown. The teak yield in the coming cycle will have decreased by more the 50 % from the " first " cycle. Consequently, the most valuable South and North Zamayi Reserve have been devaluating at about 50 % or more feat every felling cycle will continue to do so if no "remedy" is provided.

The object of this paper is thus to redress this problem of defective teak regeneration, as is with the capability of the author and to call for advice and expertise from other capable foresters to redress this problem.

2. The Problem

Studying the growing stock of teak reserve-wise from Appendices 1(A) and 1(B), it will be found that in the North Zamayi Reserve, the growing stock increases from 62011 in the 2' 0" to 2' 11" girth class to 136, 147 in the 5' 0" to 5' 11" girth class. From there, as the girth class increases, the growing stock falls off to 11273 in the 10' and over girth class.

There are 76312 trees in the 7' 0" to 7' 11" girth class which is more than the growing stock found in the 2' 0" to 2' 11" girth class. This shows a great abnormality of teak regeneration and establishment in the structure of the forest. The structure of the South Zamayi Reserve shows, more or less the same pattern as in the North Zamayi Reserve. The growing stock pattern of other species both for the North Zamayi Reserve and South Zamayi Reserve shown the structure of a normal forest.

Expect for the 2' 0" to 2' 11" girth class, the growing stock in the North Zamayi is always greater than of the South Zamayi forest in all other girth classes. The growing stock of teak in the North Zamayi reserve exceeds that of the South Zamayi Reserve by about 100,000 trees, although its area is smaller than the South Zamayi Reserve by 38, 770 acres.

The trend of the growing stock year-wise for trees left 4' and above from the consolidated of girdling (Appendix II) shows the same pattern as in the reserves, the number of the growing stock increasing with the increasing girth classes up to a stage and then tapering off.

Studying the yield, future yield for the next cycle and trees left 4' and above, compartment-wise, (Appendix III) a very graphic picture emerges. In some compartments, the number of the yield trees is greater than the total number of trees left 4' and above was found to trees within 1' below the girth limit and above was found to be one half to one fourth of the number of the present yield which means that in the next felling cycle, the future yield will be only 50 % to 25 % of the present yield.

These figures present some acute problem with the teak regeneration and establishment in the North and South Zamayi Reserve forests which at one time was reputed to be part of the best teak forests in Myanmar, but now being devalued at a very fast rate. The need thus arises to evolve a remedy do as to check part of our best teak forest from becoming devalued.

3. The Possible Caused of the Problem

3.1 High rainfall

According to the accepted principle of forest ecology, when annual rainfall is 100" or more, the tropical forest progresses towards the semi-evergreen and evergreen stage i.e. the climatic climax, the tropical evergreen forest, provided there is no biotic interference. (Puri, G. S., 1960). In the teak bearing high rainfall area in Myanmar, (e. g . Monhyin and South Zamayi) it appears that the natural succession is towards an evergreen of semi-evergreen type of forest from which teak will gradually disappear. This succession is quacked of attributed to the results of fire protection in the early days of forest conservation. (Kermode, C. W., 1964; Stebbing , E. P. , 1922). In the semi-evergreen or tending to semi-evergreen moist state of conditions, teak regeneration and establishment can hardly take place and only those teak trees that had already established themselves before can thrive to maturity. In such moist conditions, teak seeds fallen on the ground from the mother trees are unable to go through the 3 stages of germination viz: imbihition of water, activation of metabolic processed and growth of the embryo. The teak seeds do not enough warmth or heat to activate their metabolic processes and a stage of dormancy sets in when any of these 3 stages of germination is blocked.

The rainfall in the Zamayi forest area is more than 3000 mm per year and the forest is surely progressing towards the semi-evergreen stage expect in areas proximal to human habitation where some form or another of biotic interference is taking place. Teak is thus gradually but surely disappearing.

3.2. Fire Protection

All reserved areas in the Zamayi forests, during the early stages of conservancy were fire protected incurring a large amount of expenses. (Stebbing, E.P., 1922). In later years, a big controversy cropped up between those who were for it and those who are against it. (Stebbing, E. P, Vol.III) Consequently, experiments and research pertaining to the affect of fire protection on teak were carried out by foresters.

R. S. Troup carried out an experiment in Tharawaddy in 2 adjoining forest plots, 50 acres each. One plot was fire protected successfully for 19 years while the other burnt over annually. The results showed that there were 10 times as many seedlings in the brunt over plot than in the fire protected plot and that some of the sound stems in the fire protected area were in danger of suppression and would probably disappear while those in the brunt-over plot were well grown, sound, without any sign of fire damage and in little danger of suppression. Mr. Troup concluded that with continued fire protection, teak must eventually disappear from the fire protected plot.

Mr. Bryant, another foresters, came to the same conclusion, saying that a combination of the Selection System with fire protection was gradually but surely killing out the teak in all the moist forests of Myanmar, over hundreds if not thousands of squares miles. When forest of a moist evergreen mature was fire protected, the evergreen species began to encroach upon the existing teak and teak will eventually become extinct in due time. At about the mid twenties, the fire protection policy was abolished except for plantations. The cumulative affect of over 70 years fire protection might have adverse affect on teak regeneration in the Zamayi forests.

3.3. Delayed Felling Cycles

Due to unavoidable circumstances such as war, rebellion and Depression, working schedules for the felling series and other cultural operations could not be implemented in time. Girdling operations could not be carried out very thirty years and the forest was left unattended for years (60, 70 or 80 years or more). This could possibly result in the accumulation of a great number of maturing and over mature trees. In such a situation, the canopy of the forest became much closed, light entering the forest became much more diffuse, giving little chance for teak seeds to germinate and establish themselves. (Troup R. S., 1921). This could possibly be one of the reasons for the "defective" regeneration of teak and lesser number of teak in the seedlings and sapling stages and consequently in the 2' 0" to 2' 11" girth class.

3.4. Other Causes

For years, the hill tribes on the Bago Yoma used to broad-cast teak seeds in their taungyas before they abandoned them. They knew the value of teak and they wanted to make sure that some teak trees grew up in their abandoned taungyas so that they can make use of it when they returned 20 or 30 hence to cut taungya again (Thein, P., 1982). This might be the reason why patches of pure teak are found purportedly originating from the broadcast seeds in the Zamayi forests while in other areas, little or no teak was found, either as seedlings, saplings or poles.

Another possible cause for the problem may arise from the fact that the local population generally utilize only small size teak trees from 1' gbh to 4' gbh for their domestic use. Their domestic animals can extract only such size-not bigger than 4' gbh. Permit or lethmat holders were used to extracting teak up to 4' of 4½ / gbh (Stebbing , E. p., 1922). Teak is also a good firewood and charcoal and plentiful small-sized teak were used as such as such by the local people. In some localities along the Bago River, it is the tradition of the local people to brew the country spirit with teak firewood as they bring about a better quality or taste of the country spirit. (Keh, K., 1965).

It was the tradition of the Karens is Bago Yomas in Myanmar and the people of the Garo hills in Assam, to prevent fires from entering of spreading from their taungya clearings. (Stebbing, E. P., 1922). This consequently resulted in the lack of forest to wards the semi-evergreen state and the resultant lack of teak regeneration.

4. Some Plausible Redress to the Problem

Before making any suggestion to redress the problem, it might be most worthwhile to make some accepted statements about teak and its natural regeneration.

Teak Occurs only in mixed deciduous forest but teak trees of big sizes are also found standing in evergreen forest, as in Myanmar, indicating recent encroachment of evergreen species in former forest of a deciduous type. This is an example of progressive succession from a deciduous to an evergreen type, for teak is incapable of regenerating in dense evergreen forest, and must have established itself when the forest was of a deciduous type. The gradual encroachment of evergreen species in moist deciduous forest can often be observed, particularly in areas where fire protection has been introduced, and in some cases teak trees may be found recently killed by the suppression of faster-growing invasive species.(Troup, R. S., 1921).

It is apparent that in the shade of the mixed deciduous teak-bearing forests with an average canopy density, very little of the teak seeds that falls to the ground germinates each year. Some that does germinate may survive for years as seedling coppice which can produce vigorous growth when full light is made available.

However, exceptional years may occur in which a crop of good seed coincides which unusually favourable conditions for germination. This results in a big increase in seedling recruitment, which should result in subsequent large stock of seedling coppice. Favourable factors such as taungya cutting, heavy extraction or flowering of bamboos, may lead to establishment of this seedling coppice, resulting in patches of highly stocked or almost pure teak forest.

Again, abundant natural regeneration generally occurs following cultural operations. Intensive cultural operations which cost more than taungya plantations (opening of canopy, bamboos felling, weeds cutting, clearing the ground and weeding) have resulted in patches of regeneration scatted here and there. (Kermode, C. W. D., 1964).

From the above facts, it is clear that one cannot count on the natural regeneration of teak and if one resorts to intensive cultural operations is which result in abundant regenerations, the cost of operation is more than the cost establishing taungya plantations. If plantations are established, then the ecology of the fauna and floral of the forest are adversely affected, depreciating and deteriorating the soil, which in the long term is not remunerative.

From the Appendix III, a sample is given of compartments which heave very few trees left 4' and above and the yield in the coming cycle is less than half of the present yield. The growing stock of teak of such compartment will thus be sparse. For such regeneration-defective compartments, the following operations are suggested as is within the capability of the author to redress the regeneration problem in this moist tropical Zamayi forest.

4.1. Controlled Burning and Canopy Opening

(a) In areas where the canopy is fairly open and in places proximal to big teak trees, controlled and repeated burning (Troup, R. S. , 1920) should be carried out before the pre-monsoon rain. During the rains, in areas where seedlings have cropped up, canopy opening should be carried out either by girdling or poisoning. Weedings should be carried out till the regeneration become established. Fire protection may not be needed as the majority of Zamayi forest are the moist type tending towards the semi-evergreen type.

(b) Where regeneration cannot be induced through repeated controlled burning and canopy opening, stump planting should be carried out at a spacing of 25' to 35' in suitable places where the canopy is likely to be opened i.e in areas where commercial species are absent. At each stake, a clearing of 5' diameter should be made and then the stump planted. Spot weeding should be carried out as many times as is necessary during the first year only. Weeding in the second year will not be necessary as the coppice from the stump will tower over the weeds. The trees will be allowed to grow up in its natural environment and no thinning is needed.

4.2. Stump Planting in Suitable Cleared Area

A temporary nursery will be established within the compartment near some stream. Stumps will be planted in suitable areas where spot clearing and soil working had been done on the 5' diameter spot. Spot weeding should be done as is necessary during the rainy season in the first year only. Spacing should be at about 30' apart. It needs not be exactly 3'. The distance between the spots should just be an estimated distance.

The object of stump planting is to overcome the weed problem. At present, the wood trend is towards reconstituted or restructured wood, in which case, the wood for use need not be of large size. (Wallance, I., 1991). Thus, the spacing can be reduced to 10' or 15' with a rotation of 10 to 15 years. If the rotation is short, coppices from felled trees can be made use of for the second rotation and it will not be necessary to introduce new planting stocks at all.

A spacing of 25' to 35' is used so as to avoid thinning and cultural operations in the later stages.

5. Conclusion

From the data given in Appendices I(A), I(B), II and III, it is clear that the value of the teak bearing Zamayi forest is being devalued with time and unless some redress is found within a decade, the devaluation will go on.

The paper is presented as a "food for thought" to the public so that "able" foresters who are not aware of this problem may use their expertise to redress this problem in quick time.

Appendix I (A)

Natural Forest Survey and Inventory of Myanmar

Division	:	Bago	Total for Area Covered	:	152,000 acres
Forest Res.	:	North Zamayi	Sampling Design	:	Systematic
Forest Type	:	All forest types combined.	Plot Interval	:	3300 yds.
filled Season	:	1982 - 83	Area of one plot	:	2.59 acres
Compiled on	:	Nov., 1992			

Number of Trees over Total Area

Species	Girth Classes in Feet and Inches (G B H)									
	2' 0" to 2' 11"	3' 0" to 3' 11"	4' 0" to 4' 11"	5' 0" to 5' 11	6' 0" to 6' 11"	7' 0" to 7' 11"	8' 0" to 8' 11"	9' 0" to 9' 11	10	Total
Group 1. KYUN (*Tectona grandis)*	62011	98858	110132	136147	115335	76312	44226	19945	11273	674239
Group 2. All other species	897123	803012	574942	364217	248014	156093	97991	55499	64171	3261062

Appendix I (B)

Natural Forest Survey and Inventory of Myanmar

Division	:	Bago	Total for Area Covered	:	200770 acres
Forest Res.	:	South Zamayi	Sampling Design	:	Systematic
Forest Type	:	All forest types combined.	Plot Interval	:	3300 yds.
filled Season	:	1982 - 83	Area of one plot	:	2.59 acres
Combined on	:	Nov., 1992			

Number of Trees Total Area

Species	Girth Classes in Feet and Inches (GBH)									Total
	2' 0" to 2' 11"	3' 0" to 3' 11"	4' 0" to 4' 11"	5' 0" to 5' 11	6' 0" to 6' 11"	7' 0" to 7' 11"	8' 0" to 8' 11"	9' 0" to 9' 11	10	
Group 1. KYUN (*Tectona grandis)*	85595	97123	104929	110999	87124	64171	12140	1734	667	564482
Group 2. Others All other species	1639572	1326790	1013737	595755	391099	315654	163030	109265	110999	5665901

Appendix II

Girdling Showing Trees Left 4' and Above Year-Wise

Res.	Year of Girdling	Acres	Number of Trees 4' and over left ungirdled								Total
			4'-0" to 4'-5"	4'-6" to 4'-11"	5'-0" to 5'-5"	5'-6" to 5'-21"	6'-0" to 6'-5"	6'-6" to 6'-11"	7'-0" to 7'-5"	7'-6" and over	
S. Zamayi	1959-1960	17825	3407	3402	4767	4850	5516	4922	4850	-	31714
`	1960-1961	5092	1046	1045	1220	1350	1656	1733	1854	-	9904
`	1962-1963	14938	3185	3179	5347	5414	6691	6333	7270	-	37619
`	1963-1964	11200	548	545	1011	1132	1398	1417	1284	-	7335
`	1964-1965	3607	468	467	919	948	1159	1145	1141	-	6247
`	1965-1966	9305	696	692	1308	1450	1840	2159	1877	-	10022
`	1968-1969	8880	1210	1206	2043	2062	2521	2653	2158	-	13753
N. Zamayi	1977-1978	20695	2620	3053	3979	4567	6052	5907	3740	20	29936
`	Total	91542	13180	13589	20594	21773	26833	26369	24174	20	146532

Appendix III.

Year of Girdling (1975-1976)

Res.	Compt.	Area in acres	Yield Trees	Number of Trees 4' and over left ungirdled									No within 2' below girth limit and above.
				4' 0" to 4' 5"	4' 6" to 4'11"	5' 0 to 5' 5"	5' 6" to 5'11"	6' 0" to 6' 5"	6' 6" to 6'11"	7' 0" to 7' 5"	7' 6" and over	Total	
S. Zamayi	64	1799	2449	-	434	305	271	486	479	195	-	2169	674
`	71	1514	2300	-	338	435	523	700	904	355	-	3255	1259
`	72	1109	1710	-	205	227	427	409	646	291	-	2205	937
`	73	1414	2196	-	309	322	526	552	814	308	-	2831	1122
`	74	1173	2076	-	266	158	150	234	323	207	-	1338	530
`	75	1527	1130	-	129	174	168	279	247	109	-	1106	536
`	76	1690	1621	-	304	289	249	405	499	232	-	1978	731
`	77	1037	1539	-	129	125	153	244	341	62	-	1054	403
`	78	1938	2917	-	387	367	291	510	522	250	-	2327	772
`	79	40	57	-	31	22	16	23	3	5	-	100	8
Total		13321	17795	-	2532	2424	2774	3841	4778	2014	-	18363	6792

Reference

1. Brandis, D 1896. The Burma Teak Forest. (Garden and Forest Vol. IX)

2. Han, Thein. 1962. Retired Conservator and Lecturer. Lecture Notes at the Faculty of Forestry, Rangoon University.

3. Keh, K 1966. personal Contact with local Villagers along the Bago River.

4. Kermode, C. W. D 1964. " Some Aspects Silviculture in Burma Forests".

5. Kyi. U. 1962. Professor, Faculty of Forestry. Rangoon University, Lecture Notes.

6. Stebbing, E. P. 1921. The Forests of India. Vol . I

7. Stebbing, E. P. 1922. The Forests of India. Vol . II

8. Stebbing, E. P. 1923. The Forests of India. Vol . III

9. Troup, R. S. 1920. Silviculture Systems.

10. Troup, R. S. 1921. The Silviculture of Indian Trees. Vol. II.