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A Critical Review of the Silvicultural Treatments of the Teak- Bearing Forests of the Bago Yoma with Some Suggested Remedial Treatments

U Saw Kelvin Keh, B.Sc. (For.) (Rgn.), M.Sc. (Path) Aberdeen,
Deputy Director
and
U Mya Aung, B.Sc. (For.)(Rgn.), Director,
Forest Department, Ministry of Forestry,

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ကျွန်းများပေါက်ရောက်သော ပဲခူးရိုးမသစ်တောကို တိုးတက်ကောင်းမွန်အောင် ဆောင်ရွက်ခဲ့သောပြုစုပျိုးထောင်ရေးနည်းလမ်းများကို အသေးစိတ်လေ့လာစူးစမ်းခြင်းနှင့် ထပ်ဆင့်ပိုမိုကောင်းမွန်လာအောင်အကြံပြုသော ပြုစုပျိုးထောင်ရေးနည်းလမ်းများ

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ကျွန်းပေါက်ရောက်သောပဲခူးရိုးမရှိသစ်တောများကို နှစ်ပေါင်း၁၃၀ကျော်မှစ၍ယခုအချိန်ထိ၊ ကိုလိုနီသစ်တောပညာရှင်နှင့်စစ်ပြီးခေတ် တိုင်းရင်းသားသစ်တောပညာရှင်များ အသုံးပြုခဲ့သောပြုစုပျိုးထောင်သောနည်းလမ်းများကို အကျဉ်းချုပ်တင်ပြထားပါသည်။ နိုင်ငံတော်၏ သစ်တောများကို ဒေါက်တာဘရန်းဒစ်၏ အကြံပေးလမ်းညွှန်မှုအပြင် ဥရောပတိုက်တွင် အသုံးပြုသော သစ်တောပညာအခြေခံမှုများကို အသုံးပြု၍ စမ်းသပ်ပြုစု အုပ်ချုပ် လုပ်ကိုင်ခဲ့ပါသည်။ မိမိတို့သစ်တောပညာကို တန်ဘိုးထားသော ဗြိတိသျှသစ်တောပညာရှင်များမှအပ ဗြိတိသျှကိုလိုနီများ ကျွန်းသစ်ကို ထုတ်လုပ်ပြီးအမြတ်ထုတ်ခဲ့ခြင်းကိုဖော်ပြထား ပါသည်။ ဤစာတမ်း၏ ရည်ရွယ်ချက်မှာ လက်ရှိအခြေအနေအရ နိုင်ငံတော်အတွက် အကျိုးရှိစေရန် လုပ်သင့်လုပ်ထိုက်သော သစ်တောပြုစုပျိုးထောင်ရေး နည်းလမ်းများကို စာရေးသူများ၏ အတွေ့အကြုံနှင့် ဥာဏ်မီသလောက် အကြံပြုတင်ပြထားပါသည်။

A Critical Review of the Silvicultural Treatments of the Teak- Bearing Forests of the Bago Yoma with Some Suggested Remedial Treatments

U Saw Kelvin Keh, (B.Sc. (For.) Rgn), M.Sc. (Path) Aberdeen,
Deputy Director,
and
U Mya Aung (B.Sc. (For.) Rgn),
Director, Forest Department,
Ministry of Forestry

Abstract

A critical review of the silvicultural treatments of the teak bearing forests of the Bago Yoma, implemented by the colonial foresters, as well as the post war foresters for the past 130 years is presented summarily. Silvicultural treatments had been given in the past through experimental trial and error method, making use of the principles of European Forestry, against the guided advice of Dr. Brandis. Exploitation of teak by the British colonialists, though not by some of the British Foresters, who were, presumably, true to their profession, is presented. The object of this paper is to review these works with a critical but constructive perspective and some redress, suited to the present conditions is given within the capability and experience of the writers, for the benefit of the country.

Contents

1. Introduction

With the directives given by the Chairman of the State Law and Order Restoration Council to boost the production not only in the agriculture sector but also in the trade, mining, forestry, fishery and other sectors (New Light of Myanmar 1994) and the definition of " Forest " by F.A.O[1] . in mind, this paper is presented with the aim of boosting the timber production in Myanmar, in the long run, through the improvement of the Bago Yoma forests by natural means and if necessary in combination with artificial means as an aid to the natural means.

Various forms of silvicultural treatments for inducing and improving the natural regenerations of teak and other valuable commercial species of the Tanintharyi forest, Bago Yoma forests and the remaining forests in Myanmar had been carried out since 1856 when scientific forestry had humble beginning in Myanmar over 130 years ago. These include Nyanugbat-felling, Improvement-fellings, Y-fellings, O-fellings, Natural regeneration fellings, thinnings in natural regeneration of teak (TNR), fire protections, natural regeneration by Taungya and climber cuttings, carried out with inadequate spasmodic funds alloted to the Department by the Colonial British Government (Watson, 1923). Although the Forest Department was well established and provided with sufficient staff for implementing all forest works and for improving the forests the meagre allotment of funds for improving the Myanmar forests, became the dominant issue between the Department and the British Government, not only as regards its affect on the future of the forests, but also in its consequences on the morale of the personnel of the Forest Department (ibid).

Although teak is an excellent timber, it is a bad forester; it does not improve the soil (like Pyinkado *(Xyila dolabriformis)* and its leaves do not readily form humus. It should never be forced on unwilling localities (i.e. never be grown on unsuitable sites). and thus require the utmost care (Baden- Powell, 1874). The aim of the department according to Dr. Brandis is therefore not to grow pure teak forests as the tree thrives best if associated with bamboos and other trees and it will be well in this respect to follow the indications of nature. Pure or nearly pure natural teak forests are rare, and where they are found, their condition is not satisfactory (Brandis, 1881). Nature has to be studied closely, imitated and even coerced where necessary to make fuller use of the productive capacity of the soil by increasing the proportion of valuable species, improving the density of the crop and or other bringing the forest into the condition of producing the maximum amount of valuable timber or other produce year after year and century (Troup, 1917).

Natural regenerations must always constitute the main-stay for the maintenance and regeneration of the extensive "tropical" forests of India and Burma aided by suitable improvement cultural operations and taking recourse to artificial means only when the natural mean failed (Ribbentrop, 1887). Long (1916), confidently stated that natural regeneration is fully capable of restocking our forests if efficiently assisted and controlled. With the rapid demand of other species other than teak and exploitation being followed up by a suitable series of improvement felling, we can make the future stock of the forest whatever we like.

Furthermore, pure teak is soil depleting as well as soil deteriorating, being a voracious soil or mineral consumer, with its big leaves inducing splash and sheet erosion where there is little or no undergrowth beneath it. (Cham pion, 1936) and hence the introduction of the Burma Selection System by Brandis. The past British Forester, presumably compelled or very mush influenced by their ingrained European practice of the Clear-Cutting System and the

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1. Forests is a legacy bequeathed by the past generation to the present generation and to be handed over intact, if not improved, to the following generation.

Uniform as System had established plantations of teak and also some valuable commercial species as compensating to the trees that had been extracted. The post war foresters had followed the British lead but on a very much bigger scale. The British forester had treated some of the teak bearing forests with various forms of regeneration fellings with some success but found it very costly and finally abandoning then. They must however be commended for exerting their best effort to improve the forest with the then available knowledge and expertise. Teak plantation establishment by artificial mean can be said to be part of the evolving process in Myanmar forestry which should finally culminate in improving and boosting the timber production by making use of natural means other than artificial, according to present -day silvicultural trend or practice.

After a lapse of over 130 years of British- Myanmar forestry and acquiring a vast knowledge and experience, presumably the time is now set or over due for the Myanmar foresters to pool their knowledge and experiences and evolve some new methods and treatments fitted to each particular local forest situation for the improvement of the forests in Myanmar in all its aspects. The ideal is to improve the forest by natural means or methods in these tropical areas but in limited suitable localities, artificial means could be made use of provided sufficient funds that are made available for the cultural operations and complete protection assured.

The object of this review is not to discredit what had been done in the past as all works had been carried out with the best of intention but to find new ways and means, in the light of modern forestry practice and knowledge for improving the Myanmar forests.

2. Past and Present Treatments

As most foresters are familiar with the past and the present silcultural treatments given to the Myanmar forests, very little of it will be presented here. However, striking facts pertinent or peculiar to the treatments will be presented much more thoroughly. Much emphasis will be given to the proposed remedial treatments.

The Bago Yoma forest is a very mixed crop of trees of various species intermingling with vast stretches of bamboos. According to the growing stock estimate, worked out by H.W.A Watson, Conservator of forests, Working Plan Circle, Burma, in 1923, the proportion of teak in the Bago Yoma varies from 7 to 20 percent, Pyinkado 10-30 percent, and other species seldom exceeding 3 percent while the remaining 50 percent or more of the crop consists of many lesser known species that for some years may remain unsaleable or unusable, partly on the ground of the their unknown quality and partly on the ground of their small quantity which will not allow them to gain any proper hold on the market. Some of the lesser known species are now in the process of being marketed.

The Burma Selection System aims at increasing the proportion of the more useful commercial species at the expense of those of less valuable unknown species. This can either be done by improving the forest through various means of cultural operations as had already been pointed out in the introduction, or by restocking it through artificial means. The farmer does not adversely affect or endanger the productive capacity of the soil nor its environmental conditions while restocking by artificial means is rather risky in the long run and mistakes made are liable to be very costly, not only from the standpoint of labour and money wasted but also from their disastrous effect on the productive capacity of the soil. It is no simple matter to replace a good, vigorous mixed natural crop of many component species with a " crop of necessity" planted in blocks of single species thereby destroying or changing the fauna and flora of the forest eternally or destroying the biodiversity or genetic pool of the forest. Such matter should never be rushed at without silvicultural adequate certainty of silvicultural as well as financial success based on sound long-draw silvicultural research,

especially in such tropical forests as the Bago Yoma (Watson, 1923). Blanford (1921) gave the warning that teak should be planted with caution and he still believed that there may be great danger in creating large extents of practically pure teak.

Up to 1923, improvement fellings which are an integral part of the " Selection" System and also an important feature of all sanctioned working plans, have nowhere been carried out to the extent originally proposed by Dr.Brandis. The funds alloted for improvement of the forest were miserably inadequate resulting in the inevitable progressive proportional reduction of teak stock (Watson, 1923).

He stated that development in the past had been hampered by inadequate, or at best, a spasmodic application of funds, and this problem came more and more to the forefront until it became the dominant issue between the Forest Department of Burma Province and the Government of British, India, not only as regards to its affect on the future of the forest, but also in its consequences on the morale of the Department. During a period of twenty years, the expenditure on roads to open up these forests and on buildings had averaged Rs 1,11,500 or 2 percent of the gross revevus; the expenditure under the comprehensive head of organization, extension, maintenance and improvement of the forests had been so inadequate that the proportion of valuable species in the crop is falling. Appendix (I) and (II) (The Annual Return of Forest Satistics 1918-1919) show the meagre allotment of funds for improvement fellings, and other extension works. To present the picture clearly, a case will be cited in which, in the year 1918-19, the gross revenue for Burma amounted to Rs 1, 25, 28,852 while that of Bombay amounted to Rs 1, 04,94, 031. Comparably, Burma has a forest area totalling 146,165 square miles while Bombay has a forest area of 12,587 square miles. The total expenditure for Burma, excluding establishment, amounted to Rs 30,93,076 while Bombay's expenditure amounted to Rs 61, 76, 105, out of which Rs 2,97,307 was alloted to communications and building and Rs 2,89, 374 alloted to demarcation, improvement and extension of forest for the Burma province while the corresponsing amounts alloted to Bombay was Rs 6, 46,080 and Rs 1,51,414 respectively.

Although the Burma forest area is approximately 12 times, and reserve-wise 2½ times that of Bombay, the total expenditure for Burma amounted to half that of Bombay. (Rs 30,93,076; Rs 61,76,105.)

This demonstrated the disparity of the allotment of funds by the Colonial Government of British India to its various provinces, inciting the Conservator of the Working Plan Circle, Mr. Watson to decry the megre allotment of fund for the improvement of the forest in the Bago Yoma, saying that the Department cannot be blamed if the natural forest tend towards regression or at best stagnation, rather than progress. Furthermore, the surplus revenue for Burma amounted to Rs 68,36,870 while that of Bombay was Rs 26,21,834. At least 8 to 10 lakhs rupees from the Burma surplus of 68 lakhs could or should have been alloted for the demarcation, improvements and extension of forests in Burma. This showed that our forests were financially made use of without being provided with adequate fund in return, for maintenance and general improvements, even though the Burma Forest was then run by British foresters, a few of whom can be said to be true to their profession even a very small meagre fund can help increase the growing stock a bit Watson, 1923).

The following table is shown to demonstrate the effect of fund, provided for improvement fellings, N.B. fellings and climber cuttings, which is adequate enough to effectively treat the forest, as in this case, the Kangyi Reserve forest, resulting in the teak stock, 6 feet and above being more than, double what is was 30 years ago. If more funds had been provided for other reserves, similar results could have been achieved.

Analysis of Trees of 3' girth and over

Reserve	No. of Tree per acre				Reactive Density			Cost R.S. per acre for 30 yr period
	Teak	Po	Others	Total	Teak	Po	Others	
1	2	3	4	5	6	7	8	9
Kabaung								
Estimated-								
1892-93	1.9	3.5	10.1	15.5	.12	.23	.65	0.19
1921-22	2.2	4.1	12.8	19.1	.12	.21	.67	
Bondaung								
Estimated-								
1892-93	5.5	4.4	10.9	20.8	.26	.21	.53	0.45
1921-22	5.6	4.2	9.8	19.6	.29	.21	.50	
Taungnyo								
Estimated-								
1890-91	2.9	3.0	10.4	16.3	.18	.18	.64	0.35
1921-23	3.5	3.8	15.6	22.9	.15	.17	.68	
Bawbin								
Estimated-								
1889-90	3.6	3.5	12.4	19.5	.19	.18	.63	0.29
1921-23	3.7	3.4	13.9	21.0	.17	.16	.67	
Kangyi								
1921-22 (Estimated)	9.8	2.7	25.8	38.3	.26	.07	.67	
Analysis of trees 6' girth and over								
Kangyi								
Estimated								
1891-92	*1.1	0.4	2.4	3.9	.28	.10	.62	3.90
1921-22	2.3	0.2	2.5	5.0	.46	.04	.50	

* In Kangyi Reserve, one girdling had been carried out between 1891-1922. The yield trees from girdling were not included in this estimate.

After the Second World War, those cultural operations were carried out either separately by itself or concurrently with the girdling operations. Due to the unreliability of some of the subordinates and the difficulty of the nature of work for inspection of these cultural operations, these operations were discontinued. In its place, by way of compensating for the extracted timber and also for increasing the growing stock of the commercial species, larger scheme of plantation establishment were implemented by the Department.

3. Proposed Remedial Treatments

The Bago Yoma covers roughly an area of 3.8 million acres, lying between 17º and 21º latitude and 95º and 97º longitude. Rainfall Stations maintained in the plains showed a range of 42 inches in the north to 120 inches in the south on the eastern slope, the heavier rainfall starting in North Toungoo and Southwards. On the western slopes the rang is between 37 inches in the north and 100 inches in the south, the heavier rainfall starting in the Zigon division. From the records of the rain stations set up in some of the villages in the forest, the rainfall is much high in the forest than the corresponding area in the plain.

Depending upon the extent of the rainfall the geology, rock and soil of an area, various forms of forest types are formed ranging form the evergreen, semi-evergreen, moist-deciduous forest from the south to the dry bamboo forests in the northern most part. (Watson, 1923).

The proposed treatments will thus depend upon rainfall, forest types, nature of the growing stock, openness (canopy) of the forest, degree of past extraction and pattern of natural regeneration of the more important commercial species, particularly Teak, Pyinkadoa and Padauk *(Pterocarpus mecrocarpus).* The Yoma can arbitrarily be divided into 3 main regions, namely:

3.1 Areas where rainfall is 100 inches or more
3.2 Areas where rainfall is between 50 inches and 100 inches.
3.3 Areas where rainfall is less than 50 inches

3.1 Areas where rainfall is 100 inches or more

In this category, the vegetation is gradually becoming much moister, somewhat undergoing a successional change into the semi-evergreen forest type, where natural regeneration of teak is very scarse (Keh, 1993). But due to heavy extraction of timber and other forest produce, particularly bamboos, the canopy of the forest may become somewhat open, as in the South Zamayi Reserve Forest. The generalized treatments had already been presented. (ibid, 1993). But the light of teak being a " bad forester", not only Teak but also Pyinkado and some Padauk will be planted interspersed between Teak in the open areas available, not as a plantation but as gap or group planting, using a very wide spacing for teak (25' to 35'). Some other, commercial species which are lacking in the area may be planted depending upon the availability of fund. Spots of grassland will be burnt and planted up and maintained by cultural operation up to 2 or more years until the plants become established. All these recorded will be entered into the compartment register and areas treated will also be mapped and entered in the register. Each locality, or each macro-area will be treated on its own merits, taking into consideration the silvicultural characteristics of the trees to be planted. Treatments will be carried out compartment-wise.

The need to replenish these dwindling commercial species is an urgent national responsibility when we consider the extent to which these accessible North and South Zamzyi Reserve forest had been 'used' for years. The soil and climate are still ideal for plant growth and we need only put these useful, valuable commercial species in these vast area of land and maintained them until they become established. It will not be an easy process but ways should be found to make use of our vast fertile forest land in restocking our depleting commercial species.

In Spessart, Germany, in raising natural beech and oak, under the Shelter wood System, it was found that although beech natural regeneration was very good after the regeneration fellings, oak natural regeneration was very much deficient owing to the mast years occurring at long intervals. (4 years to 16 years). Oaks were therefore replenished by sowing the acorns in the natural forest mixed with the naturally regenerated beech (Troup,1921). So also here in the Zamayi forests where natural regeneration of teak is deficient or absent, owing to the environmental conditions which are not conductive to the germination of teak seeds, teak regenerations can be replenished by any artificial mean or method, suited to our particular conditions, so as not to adversely affect or impair the productive capacity of the soil. Precaution should be taken, not to treat localities in which the slope is more than 30º with teak as these heavy rainfall localities are liable to erosion. Teak

is best planted in flat alluvial area along or beside the streams, Thitkyin areas, or on flat plateau on ridges as had been done in Nilamber, India (Kyi, 1962).

3.2 Areas where rainfall is between 50 inches and 100 inches

In these areas, as the rainfall is less than 100 inches the likelihood is that conditions for germination of seeds, particularly teak seeds, will be more favorable. Even than, in areas where the rainfall approaches the 100 inches range, the vegetation will be more or less still moist and the successful germinations of teak seeds might still be a problem. As we move northwards and the rainfall approaches the 50 inches range, environmental conditions for the germination of teak seeds will become all the better. Here improvement felling, N.B cutting and climber cutting will have to be rigorously carried out and repeated both for inducing regeneration and for improving the already existing regenerations. In places where there are profuse regenerations of teak, thinnings or even weedings may have to be carried out. (TNR). In such places, it may be noticed that, not only sheet erosion but rill erosion had set in. Such places should be treated very thoroughly. In certain places, under or near teak mother trees, seedlings of one to 1½ feet height will be found with the charred skeletons still standing erect close beside them. This is the affect of annual/repeated forest fires. Every year the stool coppices, crop up during the rains into seedlings of various height and these seedlings are burnt down during the summer forest fires. Around June/July/August seedlings with the charred skeltons will be observed. However, if the fires are too severe, only the seedlings will be observed during the rainy season. This will be repeated year after year, and due to some favorable conditions, some seedlings would shoot up and become established, having overcome the annual forest fires (Troup, 1921). If such areas are large, it may be worthwhile to fire protect such areas for 3 or 4 years until the seedlings become established. Or it might even be possible to fire-protect each seedling (spot fire protection) starting from the month of January. The expense incurred might be compensated by the established seedlings.

Fire protection may be carried out during the second year, and if some of the seedlings still have not become established after the third rains, then fire protection will have to be carried on for the third year. The treatment here is also compartment-wise and recorded in the compartment register.

If needs be, in moist areas where the canopy is open and where natural regenerations fails to come up, the treatment will be more or less the same as those treated in areas of category (a). It may take a lot of time, energy, money and inspiration, but such effort spent on the establishment of natural regenerations will have a very positive affects on the fauna, flora, environment and biodiversity of the natural forests and these positive effects are most invaluable from the stand point of maintaining the soil fertility of the forest.

Some areas in section (a) may overlap with some areas in section (b) and vice versa. As no two localities have the same environmental conditions, and as said before, each locality will be treated on its own merit with particular emphasis on rainfall and regeneration patterns. Preferably, treatments should possibly be given to those areas away from human habitation and villages so as to lessen the damage and danger from biotic interference.

3.3 Areas where Rainfall is less than 50 inches

The vegetation in this area will be much spares, the rainfall irregular, the soil degraded, the trees much stunted and the canopy much open. Natural regeneration is likely to be more successful, including teak. The soil is more or less exposed in which case

germination crops up easily. Dieback is prevalent and Growth is slow and it will taken much longer for the seedlings to become established. Where natural regeneration is scarse or deficient the establishment of the seedlings can be accelerated through protection and cultural operations as had been successfully done in some provinces of Thailand making use of the influence of the presiding abbots from the nearly villages. They termed the process "Accelerated Natural Regeneration (A.N.R) (Post. B, 1993). Irrigation may be included in some of the cultural operations.

Intensive cultural operations in suitable places (bamboos felling, weeds cutting, ground clearing and weeding) can be carried out where natural regenerations are deficient. This operation can be applied to any of the categories, 3.1, 3.2 or 3.3. This results in abundant natural regenerations, although it is much more costly than taungya plantation establishment (Kermode, 1964). The natural regenerations should be seen through until they become established. Although the process is costly, it should be seen in the light of such positive advantages in keeping the fauna and flora, the environment, the biodiversity of the forest and the productive capacity of the forest, more of less intact. Forestry is a long term enterprise and every operation should be carried out with this foresight in mind so as to keep the forest intact. These treatments presented here are only generalised treatments and specific treatments can only be given when an areas is thoroughly gone through on the ground.

4. Conclusions

There is a vast area of land along the Bago Yoma waiting to be made use of. Some of it are still very fertile and the environmental conditions are still very much conductive to rapid plant growth, especially in the southern and middle part of it. The productivity of the soil to still intact.

The object of this paper is thus to replenish the dwindling commercial species in these vast fertile forest land of the Bago Yoma by natural means. Artificial Regeneration has its merits when planted in suitable areas, and when maintenance and protection are completely assured. Even then, when teak is managed intensively and maintenance fully afforded as in Nilambar, India, the site quality gradually degenerates and there is much evidence of this degeneration at he start of the second rotation (Kyi, U; 1962, Lecturer). If restocking by artificial mean is decided upon in suitable areas, which of the commercial species should we chose for planting Teak, Padauk or Pyinkado? Watson (1923) advocated Pyinkado rather than teak. From the present "market" standpoint, teak and Padauk should be planted. From the long-term forestry standpoint, Pyinkado should be chosen for plantation establishment so as not only to maintain but also to improve the productive capacity of the soil in the forest. Padauk and some other valuable species, which are not detrimental to the soil, can also be chosen for planting.

The choice of any species depends upon the silvicultural and economic characteristic of the species chosen in combination with the national need and also with the sustained maintenance of the productivity of the soil (Troup, 1921,1917). It may also depend upon climate, nature of terrain and soil, and protection against external dangers and diseases. A species which is very suitable from the economic standpoint may be entirely unsuitable from the silvicultural point of view and vice versa. This is a very delicate issue and every aspect related to the issue should be examined thoroughly for its long term affects before any decision is made.

What kind of species should we choose to grow? The future of mankind depends upon being able to efficiently convert solar energy into a chemical which can be digested to form a source of muscular energy. The farmer makes a choice between growing a crop whose

tissues, fruits, or seeds can be eaten by man or one which needs alteration by insect, animal, fish, fowl or fungi before ingestion.

The forester is constrained by soil, climate and social parameters but then chooses the tree or species of vegetation whose attribute is that it grows fastest, biggest, easiest, cheapest, or that it converts best into firewood, furniture or paper or it provides the best soil stability, shelter and habitat, or is the most nutritious, healthiest or prettiest, or a combination of some of these characteristics. Others decide that the investment of money, land and labour to achieve a particular silvicultural goal is the most desirable way in which these resources can be applied.

What kind of species should we choose to grow (Rodgers, 1984)? and what kind of silvicultural system or method of regeneration should we adopt? Or should we adopt a "marriage of convenience" between the artificial regeneration and natural regeneration methods?

Should we reinstate the temporarily defunct T.N.R, N/R fellings, Improvement fellings, Nyaungbat Cuttings and Climber Cuttings, findings new ways and means of effectively using the funds allotted to them? In the light of evidences produced by H.W.A Waston (1923), it is definitely worthwhile to make use of the above mentioned natural methods in suitable localities in increasing the growing stock of our commercial species.

Are we still practicing the "Burma Selection System"? If not, concerted effort should be taken to evolve new treatments or new system of a combination of systems and methods to suit the varying environment, climate, soil and social conditions for the improvement of our Myanmar Forest, resulting in improved sustained yield and thereby boosting our future timber production.

Appendix I.

Control Record of Silvicultural Improvement in Areas Under Working Plan in Pegu Yoma Reserved Forests to the close of 1921-22

Division	Working Circle	Year when brought under working plan	**Area in Acres**	**Areas in acres**				Expenditure in Rupees on Improvement felling including N.B feeling and climber cutting	
				Climber Cutting	N.B felling	I.F	Planted or Regenerated whole Division	Total (Rs)	Per Acre of Working Circle (Rs)
Pyinmana	Yeni	1897-98	47509	34921	18726	4907	-	16122	0.34
	Minbyin	1899-90	125,798	74944	19287	5290	-	16039	0.13
	Yombin	1900-1901	78,039	52178	15726	4775	-	10046	0.13
	Ngalaik	1902-03	80,013	56409	-	-	-	6933	0.09
	Sinthe	1902-03	67,963	35374	-	-	-	4713	0.07
	Taungnyo	1903-04	67,038	52992	-	2610	-	7509	0.11
	Pozaung-daung	1903-04	51,557	33212	-	3310	-	5752	0.11
	Yanaung-myin, Kaung Palwe	1903-04	115,641	71715	9072	3280	-	11939	0.13
	Total-	-	633,558	411745	62811	24172	2411	79053	0.12
North Toungoo	3.W.C	1897-1900	231784	140,009	10147	63060	4143	56335	0.24
South Toungoo	3.W.C	1894-1903	500338	304,482	19111	76271	1452	66044	0.13

Appendix I.. (contd. 1)

Control Record of Silvicultural Improvement in Areas Under Working Plan in Pegu Yoma Reserved Forests to the close of 1921-22

Division	Working Circle	Year when brought under working plan	Area in Acres	Areas in acres				Expenditure in Rupees on Improvement felling including N.B feeling and climber cutting	
				Climber Cutting	N.B felling	I.F	Planted or Regenerated-whole Division	Total (Rs)	Per Acre of Working Circle (Rs)
North Pegu	2.W.C	1906-07	379905	122,649	1092	16528	1942	31961	0.08
South Pegu	2.W.C	1905-06 1915-16	319071	85144	-	13185	3184	36830	0.12
Insein	2.W.C	1915-16	173,584	103156	14964	68525	3147	71490	0.41
Tharrawaddy	8.W.C	1885-1905	214,887	171494	34244	98295	16247	1,10,397	0.51
Zingon	4.W.C	1891-1893	259,656	237979	73921	123280	11396	96914	0.37
Prome	2.W.C	1892-94	208,081	203365	-	131142	13500	89098	0.43
Allanmyo	1W.C	1906-07	85,346	36401	130047	19408	4036	32642	0.38
Magwe	1.W.C	1907-08	255,239	130510	-	77590	1504	68280	0.27
Grand Total			3,261,449	1946934	229337	711455	62,962	7,39,044	0.23

Total Revenue surplus for Burma 1901-1919 = Rs. 108,703, 178. Corresponding Expenditure on I.F.B.B. felling and climber Rs. 7,39,044 (for Bago Yoma)

Appendix II

Summary of Revenue and Expenditure of Forest Dept. in India for the Financial Year 1918-19

Budget Heads		United Province	Burma	Bombay
	REVENUE			
I.	Timber and forest produce removed by Govt. agency	19,82,369	35,47,722	53,76,744
II.	Timber and produce removed by consumers or purchasers	44,30,844	83,55,714	48,31,818
III.	Drift, waif and confiscated forest produce	7,273	2,49,569	5,045
IV.	Revenue from non-Governmental forest	12,463	1,54,655	14,887
V.	Miscellaneous	204,217	2,21,192	2,65,537
	Total	66,37,166	1,25,28,852	1,04,94,031
	EXPENDITURE			
	A. Conservancy and works			
I.	Timber, forest produce removed from forest by Govt. agency	19,48,491	20,54,011	51,18,306
II.	The above, removed by consumers or purchasers	74,816	1,29,441	58,673
III.	Drift, waif and confiscated forest produce	2,114	98,815	230
IV.	Expenditure from non-Govern mental forest	7,349	281	2
V.	Rent of leased forest	2,26,702	-	44,063
VI.	Livestock, stores, tools, plant	1,97,922	1,76,295	1,01,272
VII.	Communications and building	5,93,490	2,97,307	6,46,080
VIII.	Demarcation, improvements and Extension of forests	3,41,487	2,89,374	1,51,414
IX.	Miscellaneous	61,645	47,552	56,065
	Total	34,54,016	30,93,076	61,76,105

Appendix II. (contd.)

Budget Heads		United Province	Burma	Bombay
	B. Establishments			
I.	Salaries	8,18,479	20,57,949	14,64,083
II.	Travelling allowances	1,63,363	3,76,044	1,60,915
III.	Contingencies	1,63,105	1,64,913	71,094
	Total	11,44,947	25,98,906	16,96,092
	Grand Total of Expenditure	45,98,963	56,91,982	78,72,197
	Surplus	20,38,203	68,36,870	26,21,834

Note More than 50% of the Revenue is used for Conservancy and works for United Province and Bombay while only 25% of the Revenue is used for Conservancy and works for Burma.

Appendix .III (a)

Comparison of Growing Stock, Past and Present Reserve- Wise, Township -Wise

Reserve	Township	Year	Teak 3' and Up per acre	Pyinkado 3' and Up per acre	Other 3' and Up per acre	Total Per acre	Remarks
Bondaung		1921-22	4.89	4.10	11.30	20.29	1921-22 data is taken from Watson's report and 1986-87 data, taken from the N.F.I. report .
Kabung		1921-22	1.84	4.07	9.19	15.10	
	Taungoo	1986-87	2.04	2.65	13.13	17.82	
	Bago	1986-87	0.82	1.86	14.13	16.81	
	Oktwin	1986-87	2.38	2.69	38.62	43.59	
	Yedashe	1986-87	2.22	2.20	12.92	17.34	
	Lewe	1986-87	3.11	1.81	12.70	17.62	
	Pyinmana	1986-87	0.57	1.03	11.10	12.70	
Ngalaik		1921-22	3.42	2.82	10.79	517.03	
	Takon	1986-87	0.41	0.67	14.13	15.21	
	Yamethin	1986-87	0.021	0.32	8.11	8.45	
	Leapadan	1987-88	1.86	3.05	12.46	17.37	
	Okpo	1987-88	2.47	3.42	13.32	19.21	
	Gyobingauk	1987-88	1.62	2.16	8.91	12.69	
	Paukkaung	1987-88	1.33	1.32	8.75	11.40	
	Tharrawaddy	1921-22	2.74	2.07	9.00	13.81	
	Zigon	1921-22	2.83	2.66	10.55	16.04	
	Prome	1921-22	2.45	2.42	11.67	16.54	

Appendix .III (contd. b)

Comparison of Growing Stock, Past and Present, Reserve- Wise

Reserve	Township	Year	Teak 3' and Up per acre	Pyinkado 3' and Up per acre	Other 3' and Up per acre	Total Per acre	Remarks
S.Zamayi		1921-22	1.73	3.64	12.84	18.21	The 1994 data are taken from a straight line 100 feet wide, 3 miles long across the valleys and ridges in the reserves the 1982-83 data is taken from the N.F.I report. The 1921- 22 data is taken from Watson's report.
		1982-83	2.39	-	20.05	22.44	
		1994	0.75	0.19	1.00	1.94	
Kabaung		1921-22	1.84	4.07	9.19	15.10	
		1994	7.28	0.94	15.97	29.22	
Saingya		1921-22	1.17	3.07	13.40	17.64	
		1994	2.08	-	4.31	6.39	
Minbyin		1921-22	1.97	2.93	14.00	18.90	
		1994	0.14	0.19	5.56	5.89	
Yonbin		1921-22	2.01	3.55	10.97	16.53	
		1994	1.75	0.72	11.67	14.14	
South Nawin		1921-22	2.59	2.88	10.67	16.14	
		1994	2.56	2.69	9.97	15.22	

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