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Modifying Myanma Selection System

Dr. Kyaw Tint

Director General (rtd.), Forest Department

MODIFYING MYANMA SELECTION SYETEM

Dr. Kyaw Tint
Director-General (rtd.), Forest Department

ABSTRACT

The Myanma Selection System (MSS) evolved from the Brandis System. Dr Dietrich Brandis, a German botanist, became Superintendent of Bago Yoma Forests in January 1856. This system has been operated since 1857 in the management of the natural teak-bearing forests in the country. Although MSS is claimed as a selection system, it is not in actuality; it is in fact a Girth- or Diameter-Limit system not entirely suited to teak-bearing forest, because teak is a light-demander (Dawkins, 1998). Besides, cutting all trees of and above the girth limit results in creaming the forest and, in consequence, its degradation. Most common methods for estimating the sustainable harvest level for continuous-cover forests assume some normal residual forest structure (Gadow et al, 2000). MSS does not take the residual stand structure into consideration. Thus, both the quality and the production of the forest are deemed to decline in the long run. In view of it, the current study suggests a norm in terms of stand basal area distribution, smaller management/yield regulation unit, shorter felling cycle, fixation of yield by basal area, cultural operations and research to improve stand structure and uplift the growing stock level.

Keywords: *norm, residual stand, continuous-cover forest, creaming, cultural operation*

CONTENTS

I. BACKGROUND

The Myanma (Burma) Selection System (MSS), originally known as the Brandis System, was developed during the period 1880-1920 as a combination of yield regulation by the Brandis method and periodical improvement fellings to favour teak.

The Brandis's model of forest management was adopted from Europe. In Europe, the selection system was practiced over small patches of forests for continuous forest cover, protection against wind, erosion and other natural disasters. The harvesting of mature and thinning of degrading stems were concentrated when ground was snow-capped to minimize felling damage. When the forest area was small and the skilled foresters were sufficient, it was possible to cover the area annually according to the theory. But when the area was big and the skilled foresters were insufficient the area had to be divided into coupes to be treated annually. The number of the annual coupes defined the cutting/felling cycle. In such a case the annual coupe remained untreated as long as the felling cycle. Then, the resulting forest structure was not the perfect all-aged structure, and if the species was a shade bearer, natural regeneration was not very much affected, but if it was a light demander, the natural regeneration was very much restricted. The European forests comprised of mostly shade bearers.

II. JUSTIFICATION

Teak is a light demander and the felling cycle of 30 years is too long from silvicultural perspective. Furthermore, the unit of yield regulation being a Felling Series, is too extensive to derive and control the desirable stand structure needed to ensure sustained production in perpetuity. MSS does not in fact consider the residual stand structure after harvest. That is why the natural regeneration of teak has continued to decline and in the absence of adequate remedial measures the stand structures, of teak especially, have deteriorated and deviated from the norm. Therefore, MSS in the current form is not perfectly suited to teak-bearing poly-specific and all-aged natural forest specifically because Myanma forest management is teak-centered.

MSS is actually not a selection system but is better termed, according to Dawkins and Philip (1998), a *Stratified Uniform* or *a Girth-limit system.*

The MSS has been being applied in Myanmar practically to all types of natural forests with virtually blanket silvicultural prescriptions, although it is well aware that silvicultural techniques are sometimes highly site-specific.

In light of the above, the need is obvious to either modify the MSS or to implement a gradual transformation method to convert the natural forests to the uniform system. For higher productivity and economics, the current status of the teak forests undoubtedly highlights the need for transformation. However, Myanmar Forest Policy (1995) has clearly stipulated not to substitute natural forests with plantations. Furthermore, it is absolutely essential to seek and find methods of utilization that do not destroy the original ecosystems (Catinot, 1974). The objective of creating nature-oriented commercial forests, the control of which can to a large extent be biologically automated, is both ecologically and economically right....(Lamprecht, pp.135-136). Worldwide trend in forest management is towards less artificiality and more harmony with nature. World silvicultural thought increasingly favours Selection as the method biologically more robust (Dawkins, p.72). On no account should it be lost sight of that a high degree of diversity is indispensable if the ecosystem of moist tropical forests are to retain their ability to function (Lamprecht, p.112).

Again during the past decades, domestic demand for timber for general use has greatly increased. There has been a hugh deficit in firewood demand and supply and it will continue to grow. One important task of Myanmar forestry is, therefore, to meet these growing internal markets. Economically valuable species will no doubt continue to play a role as very desirable sources of foreign exchange. However, it would be wrong to regard this as the only objective, to which all other needs must be subordinated (Lamprecht, p.135). Moreover, many currently unknown and lesser-used species will add to the present list of valuable species through research in the not very distant future.

In this context, the choice has been to continue the Selection system and modify the MSS.

III. MODIFIED MYANMA SELECTION SYSTEM

The forest management system needs to be devised to bring conservative silviculture into harmony with profitable exploitation on a sustainable basis. In this perspective the Modified Myanma Selection System (MMSS) integrates modifications on: -

i. Unit of yield regulation;
ii. Length of felling cycle;
iii. Residual growing stock;
iv. Assessment of growing stock;
v. Obligatory extraction;
vi. Method of yield regulation;
vii. Cultural operations; and
viii. Research.

3.1 Unit of yield regulation

Under the MSS, yield (of both teak and other hardwoods) is regulated by felling series, which is to be completely covered during the felling cycle of 30 years. Neither residual growing stock nor stand structure is identified. To enable regulation of growing stock and stand structure to achieve desirable levels, the size of the felling series is too big.

Thus, under the MMSS yield will be fixed by compartment, which has a total area of about 300 to 400 ha.
Each compartment will be subdivided according to different forest types or ecosystems, and each type will be assessed separately. This practice will of course lead extensive forest management to intensive forest management.

3.2 Length of felling cycle

The MSS employs a 30-year felling cycle irrespective of site and forest types. The MMSS will apply site- specific felling cycles. The felling cycle must allow the accumulation of growth at least sufficient for efficient and economically profitable extraction. The longer the felling cycle the more profitable is the extraction; but it must not be too long to prevent the trees from becoming over mature and wasted. On the contrary, silviculture prefers short felling cycles so that climatic and near-depreciating stems can be harvested before they are lost, and also to enable more frequent visits to the forests and hence more cultural operations.

The felling cycle, therefore, should not exceed the age of over-mature size (diameter or girth), but may be as short as desired provided the profitable volume is available at the end of it (Dawkins, 1958).

The study of diameter- age relationships of teak trees in Bwet forest reserve in Paungde Township of Pyay Forest District, in Kabaung forest reserve in Toungoo Township of Toungoo Forest District, in Sabe-natha forest reserve in Kanbalu Township of Shwebo Forest District and in Meintha Public Forest Coupe XI in Mabein Township of Kyaukme Forest District indicates that a teak tree takes on the average 53 years to reach the size of 40 cm d - the minimum marketable diameter- and 196 years to attain 80 cm d - supposed to be the over-mature age. Thus, the felling cycle could be as long as 143 (= 196-53) years. Detailed information on the diameter-age relationships is presented in Table 1. *(The data for Mabein forest was collected in Mabein Public Forest Coupe XI by Dr. Nyi Nyi Kyaw for his doctoral thesis).*

Table 1. *Relationship between breast height diameter and age of teak trees*

DBH, cm	Age at breast height of teak trees, years				Mean age
	Mabein	Kanbalu	Toungoo	Pyay	
10	14	4	12	8	10
20	30	9	27	18	21
30	49	16	44	31	35
40	72	27	64	49	53
50	99	44	87	74	76
60	132	70	113	109	106
70	171	108	143	157	145
80	216	166	178	223	196

Source- *Kyaw Tint, 2002a.*

The table has been derived from the following functions.

In A = 0.375 + 0.936 In D + 0.01126 D (Mabein)
In A =-0.146 + 1.245 In D + 0.02223 D (Kanbalu)
In A = 0.044 + 1.033 In D + 0.007609 D(Toungoo)
In A = 0.240 + 0.7089 In D + 0.02577 D(Pyay)

Note: *The mean tree of Kanbalu has very poor growth and considered not representative. It is shown in the table below, and ignored. The best growing tree is included instead, as the mean for the four areas is reasonable.*

Dbh,cm	10	20	30	40	50	60	70	80
Age,years	19	56	116	208	342	537	812	1198

As a general guideline, the MMSS has adopted a felling cycle of **20** years for the accessible areas and **30** years for the areas with difficult access. This is more or less in agreement with Dawkins' findings who says" A Selection system must work on a felling cycle of less than 30 and preferably less than 20 years. A longer period would require the premature removal at each felling cycle of numerous still appreciating stems, indeed with a felling cycle over 20 to 30 years they would outnumber those properly due for removal on the correct grounds of depreciation (Dawkins, 1958)".

Then, the next question is to see whether the 20-year felling cycle will allow a minimum economically- profitable harvest.

Suppose that we need 5 true tons (250 cubic feet) per acre for profitable extraction. This is approximately equal to 17.5 m^3 per ha. To achieve this minimum profitable stand, the annual growth must be 17.5/20 = 0.875 m^3 per ha. The stand table projection of the Paukkhaung forest has produced the following growth estimates (Kyaw Tint, 2002a): -

	TEAK	GR I	GR II	GR III	GR IV	GR V	TOTAL
CAI, m^3	**0.146**	**0.174**	**0.361**	**0.066**	**0.106**	**0.461**	**1.315**

From teak to Group IV, the annual increments add up to 0.854 m^3 per ha. So, teak and all trees from group 1 to 4 must be made compulsory for simultaneous extraction so that economic exploitation is feasible. The Paukkhaung forest under study has the worst growing conditions. Other forests, therefore, could have better growth rates. Anyhow, given the prevailing status of the teak forests, it might not be possible to reduce the length of the felling cycle to less than 20 years.

3.3 Residual growing stock

It is essential to define normal or desirable residual growing stock levels for specified forest types, tree/size classes and felling cycles in order to be able to calculate harvest levels and to identify stand improvement options. The desirable residual growing stock levels of the forest types other than the mixed deciduous forests will be decided for each compartment or sub-compartment only after specific assessments have been made. But for the mixed deciduous forests the Mabein forest will be treated as the norm (model). It was of lower mixed deciduous type and last girdled in 1972-73. Least disturbed, it is reasonably well stocked with 141 trees 20 + cm d, and the growing stock of 21 m^2 per ha. Teak constitutes about 30% of the total stand by number of trees and about 48% by basal area. The negative exponential model fitted to the original structure will be adopted as the desirable residual growing stock level (normal stand or norm) for the mixed deciduous forests. The model ($n = k\ e^{-ad}$) has the following parameters (Kyaw Tint, 2002a):

k = 249.6111, a = 0.05417, and the diminution quotient is 1.719

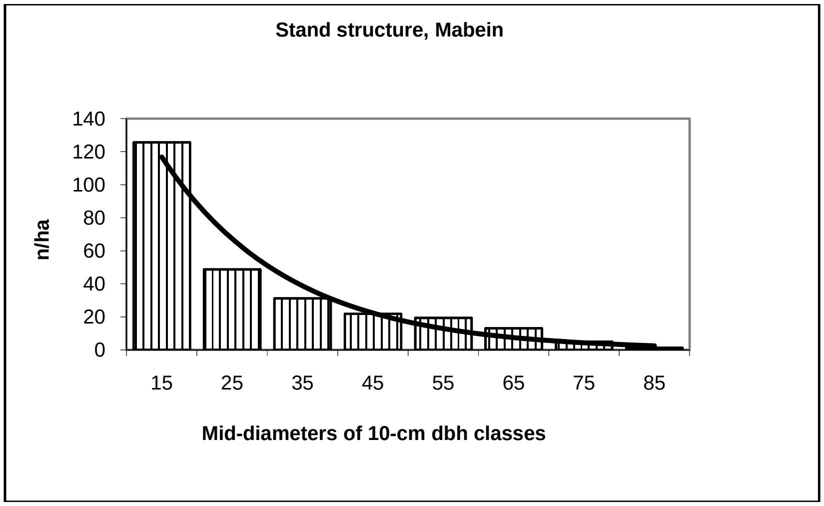


Figure 1. *Original and fitted stand structures of Mabein forest*

The original and the fitted growing stocks are shown below (Table 1).

Table 1: Original and fitted stand tables of mixed deciduous forest in Coupe XI of Mabein Public Forest

Dbh,cm	Original stand		Fitted (or desirable) stand	
	n/ha	g,m^2/ha	fitted n/ha	g, m^2/ha
20-30	49	2.09	67	3.30
30-40	31	2.87	39	3.72
40-50	22	3.37	22	3.54
50-60	19	4.68	13	3.05
60-70	13	4.26	7	2.45
70-80	5	2.01	4	1.88
80-90	1	0.69	2	1.39
Total	141	19.97	155	19.33

The fitted stand structure will be defined as the desirable residual forest structure, the normal or the norm, for the natural teak-bearing forests in Myanmar with a total residual basal area of 19.33 m^2/ha above 20 cm in diameter for a felling cycle of 20 years. If trees smaller than 20 cm d are included the total residual basal area could be more than 20 m^2. In the Northern Hardwoods- *a multi-species forest*- in Canada Hansen (1987) proposed a residual basal area of 19.8 m^2/ha for a cutting cycle of 15 years and 19.8 m^2/ha for a 30-year cutting cycle (in Sustainable Forest Management, Gadow et al eds). African evergreen moist forests showed that growth stagnates as soon as the basal area exceeds 18-23 m^2 per ha (Lamprecht, 1989).

Therefore, a stand basal area of about 25 m^2 per ha could be optimum for Myanmar's moist deciduous forests.

To ensure sustainability or perpetuation of the forest as a producer, the forest must maintain 'normal' age or size structure. The normal forest is a concept which may rarely materialize, but a necessary target to aim at to perpetuate forest production.

3.4 Assessment of growing stock

To provide a quantitative estimate of silvicultural condition and stand dynamics for continuous monitoring and improvement of the forest, the following assessment method will be used;

a) Permanent sample plots: to study change of forest conditions, mortality, recruitment and individual tree growth, and to develop growth models. Two 1/2 ha PSPs will be established subjectively in each compartment to represent different forest ecosystems.

b) Temporary sample plots. Two types of inventories will be carried out-

b.1) Pre-harvest inventory: to study stand composition and structure for decision on the desirable residual growing stock levels for other types of forests than mixed deciduous forests, and to calculate sustainable harvest level, and also to collect information for harvest planning. Systematic strips each 30-m in width will be used at 10% sampling intensity.

b.2) Post-harvest inventory: to study felling damage, residual stand and silvicultural condition of the forest to identify treatment requirements. Systematic strips each 30-m in width will be used at 10% sampling intensity. Detailed planning is necessary to acquire information on the condition of regeneration, stocking, crown exposure, stand density, stage of development, and the intensity and effect of felling damage caused to the soil and the residual crop.

3.5 Obligatory extraction

Simultaneous extraction of teak and all tree species belonging to Groups I to IV must be made obligatory. This will not only make the harvest more profitable but improve the residual forest as well. In case girdled teak is desired, girdling should have been done at least two years prior to the simultaneous extraction.

3.6 Method of yield regulation

Yield will be regulated by forest types within the compartment.

a) Forest types

Owing to a very diverse climatic and soil conditions and altitudes in a relatively wide latitudinal range, Myanmar possesses a rich biodiversity. A very large number of vegetative species of all ages occur naturally and mixed together all over the country, and form a variety of ecosystems. In an attempt to describe all these forest ecosystems, the Forest Department of Myanmar recognized and adopted eight dominant forest types.

These are-

- I. Tidal forests
- II. Beach and dune forests
- III. Swamp forests
- IV. Evergreen forests
    - a. Riverain evergreen forests
    - b. Giant evergreen forests
    - c. Typical evergreen forests
- V. Mixed deciduous forests
    - a. Moist upper mixed deciduous forests
    - b. Dry upper mixed deciduous forests
    - c. Lower mixed deciduous forests
- VI. Dry forests
    - a. *Than-dahat* forests
    - b. Thorn forests
- VII. Deciduous Dipterocarp or *indaing* forests
    - a. High *indaing* forests
    - b. Semi-*indaing* forests
    - c. Scrub *indaing* forests
- VIII. Hill and temperate evergreen forests
    - a. Hill evergreen forests
    - b. Dry hill forests
    - c. Pine forests

For detailed description of each type see "Standard types of forests in Myanmar" (Kyaw Tint, 2002b).

b) Tree groups

Different tree species and size classes are classified on the basis of their current commercial values as follows-

i. Commercially valuable tree species. These include teak and trees belonging to species Group I to Group IV.

ii. Non-commercial tree species. These include trees belonging to species group- Group V and all remaining species.

c) Residual growing stock level

c1: Original and desirable stands

Normal or desirable residual growing stock level for mixed deciduous forests in Mabein Township has been defined above. The original and desirable stand structures both in number of trees and basal area are presented in figures 2 and 3 respectively. The original stand table constitutes a total of 140 trees of 20 + cm diameter per ha with a total of 19.97 m^2, while the desirable stand table has a total of 154 trees of 20+cm diameter with a total stock of 19.33 m^2.

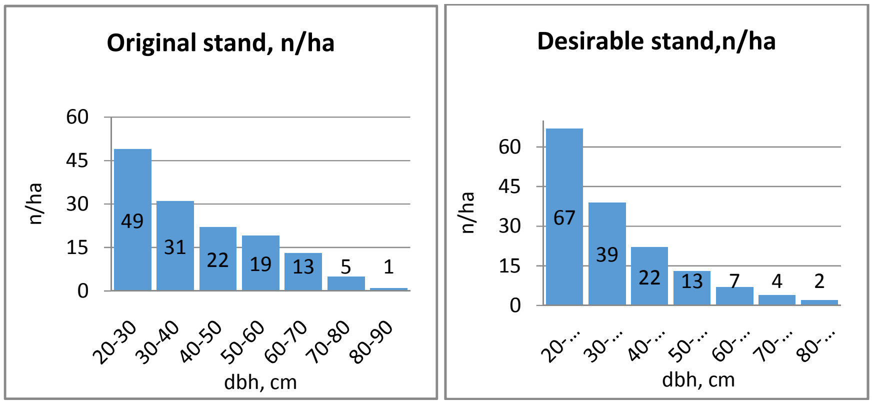


Figure 2*: Original and desirable stands in tree numbers*

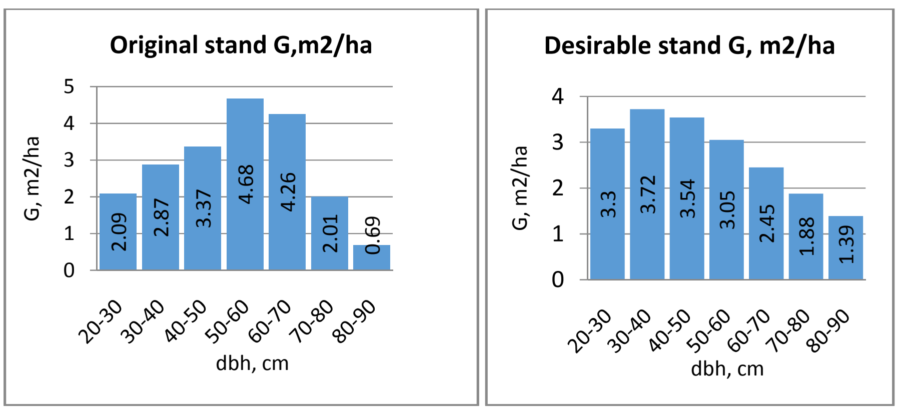
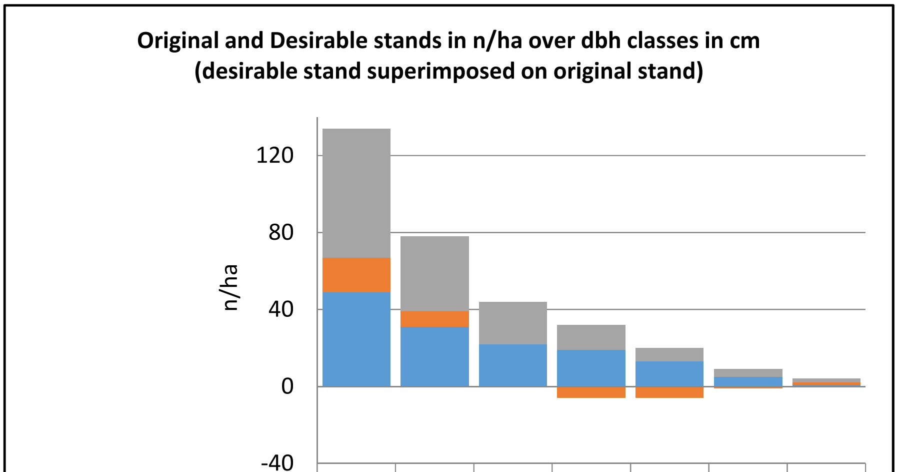


Figure 3: *Original and desirable stands in basal areas*

C2: Improving stand structure and estimating yield

As seen in the above figures, there are differences over the diameter classes between the two stand structures. The original stand structure must be improved through harvesting timber to achieve the desirable stand structure. In the following figures the desirable stands are superimposed on the original stands (Figures 4 and 5).



	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Desirable stand, n/ha	67	39	22	13	7	4	2
n/ha to add to or remove from original stand	18	8	0	-6	-6	-1	1
Original stand, n/ha	49	31	22	19	13	5	1

Figure 4*: Desirable stand in number of trees superimposed on the original*

The above figure (Fig. 4) shows that the classes 1, 2 and 7 are short of the norms by 18, 8 and 1 trees respectively. So, they must be given rest.

In class 3 the original and the desirable stands have the same frequencies. The diameter classes 4, 5 and 6 have 6, 6 and 1 trees in excess of the norms respectively. So, they could be removed as yield trees.

The yield in tree number, therefore, is

6 trees from 50-60 cm diameter class
6 trees from 60-70 cm diameter class, and
1 tree from 80-90 cm diameter class

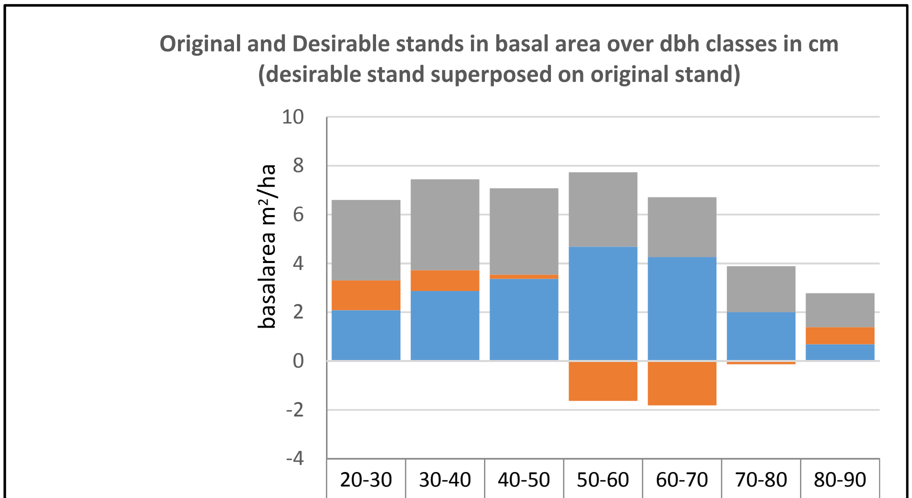
Figure 5 shows that the classes 1, 2 and 7 are short of the norms by 1.21 m^2/ha, 0.85 m^2/ha and 0.17 m^2/ha respectively. So, they must be given rest.

In class 3 the original and the desirable stands have the same frequencies. The diameter classes 4, 5 and 6 have 1.63 m^2/ha, 1.81 m^2/ha and 0.13 m^2/ha in excess of the norms respectively. So, they could be removed as yield.

The yield in basal area, therefore, is

1.63 m^2/ from 50-60 cm diameter class
1.81 m^2/ha from 60-70 cm diameter class, and
0.13 m^2/ha from 80-90 cm diameter class, which altogether sum up to 3.57 m^2/ha.

This yield can be harvested in one or several years, but the selection of the trees to be harvested must be made over the entire management unit. In the subsequent years the original stand structures or stand tables should be reconstructed through pre-harvest inventories and the yields must be estimated accordingly. The yield is suggested to be fixed in stand basal area, not in tree number, because it is more flexible and better to adjust to achieve the normal basal area distribution.



	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Desirable stand, G(m2/ha)	3.3	3.72	3.54	3.05	2.45	1.88	1.39
G to add to/remove from original stand	1.21	0.85	0.17	-1.63	-1.81	-0.13	0.70
Original stand, G(m2/ha)	2.09	2.87	3.37	4.68	4.26	2.01	0.69

***Figure 5**: Desirable stand in basal area superimposed on the original*

C3: Residual stand structure

After timber harvesting has been completed, the residual stand structures are expected to become as shown in the following figures (Figure 6).

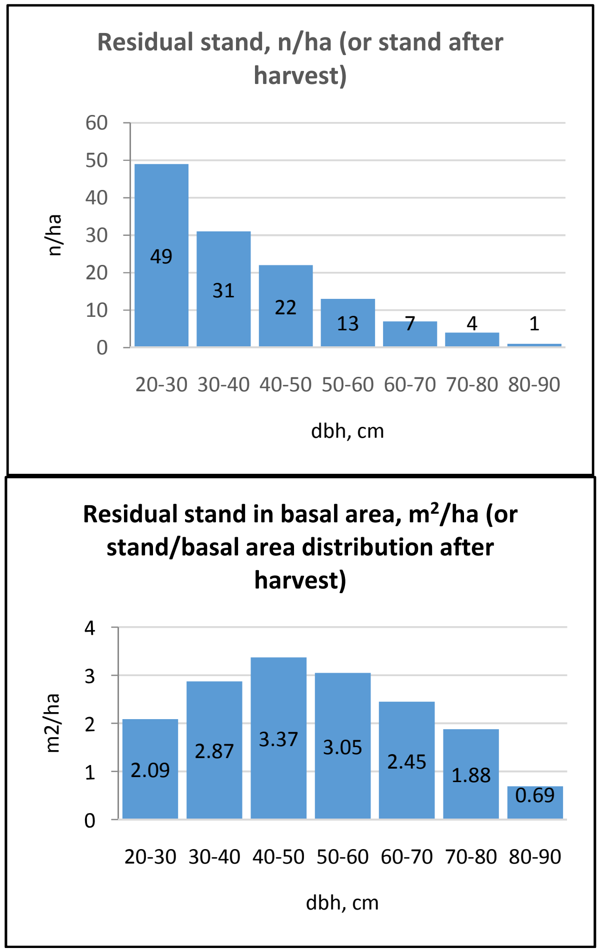


***Figure 6**: Expected Residual Stands after timber harvest*

The residual stand structures will change after each harvest until the normal stand structure either in terms of tree numbers or basal areas has been accomplished.

3.7 Cultural operations

Cultural operations are needed to improve the stand structure and enhance the level of growing stock.

Cultural operations include -

(a) Liberation, and
(b) Refining

(a) Liberation

Liberation is the freeing of priority species by removing competition from inferior species, and involves-

i. Girdling, poisoning or cutting of the impeders of the priority or desirable species.
ii. Canopy opening for inducement of regeneration.
iii. Thinning out of defective desirables and inferior competitors, and thinning of congested pole crop.

(b) Refining

Refining is the general clearing of the site for complete utilization by the priority species, and includes-

i. Climber cutting, felling ficus trees and trees infected by figs.
ii. Canopy-weeding, under-storey-weeding and ground-weeding.
iii. Cutting bamboos.
iv. Removing misshapen desirables.
v. Pruning branches and cutting forks of the priority species.
vi. Coppicing damaged saplings and poles of the desirables.
vii. Broadcasting seeds and enrichment planting where natural regeneration looks impossible

3.8 Research

Myanma teak forests are degrading, and growing stocks and growth rates are very low. Furthermore, there still remain a lot of species to be developed. Thus, a continuing research is a prerequisite for their management on a sustainable basis. The research should focus on-

(a) Composition and structure.

Desirable levels of composition, structure and growing stock must be achieved and maintained. Lesser-used and lesser-known species must be promoted.

(b) Ecology.

Development of forest stands and the desirable species in relation to the site and the environment needs studies for their development and sustention.

(c) Silviculture

Silviculture of many indigenous species is unknown. Studies on seeding habits, site preferences, regeneration, establishment and performance, and growth and yield are critical. Research on genetic improvement of teak and other commercial species is urgent to increase production of quality timbers.

IV. CONCLUSION

Doubtless, the MSS in the current form needs to be revised. Various related literatures in respect of the system and the results of its application have demonstrated its weaknesses in sustaining the forest resources, especially the teak resources. As a matter of fact this girth-limit system has been creaming the forests. There could be arguments that teak stands have deteriorated not because of the system but because of lack of mandated adequate and timely silvicultural treatments. It is true to some extent, but the inappropriate technicalities inherent in the MSS are evident.

The proposed revision is not an end but just a beginning for the foresters to make a second thought about the MSS. We have been practicing very extensive forest management in the country for more than one and a half centuries now, but time will come sooner or later when we must resort to intensive forest management to increase forest production vertically since we are going to be left only with a limited extent of forests due to policy and land use changes.

The teak-bearing natural forests in the country are very complex, heterogeneous and variable. So, it is very difficult to model the entire forest community. The current model can, therefore, be only teak-focused. Since a forest reserve compartment of about 300-400 ha is identified as a yield regulation unit, the proposed revision may lead to a forest management that is too intensive for the Forest Department to materialize given the current enabling environment. If it is so, the unit of yield regulation can be enlarged in compliance with the available resources.

It may be worthwhile to pilot the proposed MMSS.

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