Some Useful Derivation and Application of Diameter Growth of Commercial Dipterocarps in the Basilan Working Circle

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(Continuation)

This table does not give as yet conclusive information on growth, the data from which it was based having been only the result of two measurements for the first four-year periodic growth. It gives only indicative results. It may, therefore, be used only for tentative evaluation for sustained yield under selective timber management for the forest tract in which the samples are located and other areas where conditions are similar to or approach that of the said forest tract. Without such evaluation, our attempts at management will be haphazard; we will not have an idea as to whether or not a continuity of operation will be more or less assured.

We will modify and improve regulation of the cut as more refined statistical analysis can be made on the data and as more reliable data from future measurements become available.

Sample Evaluation for Sustained Yield

For simple illustration, let us consider a management unit of 10,000 hectares in the Basilan Working Circle having the following data from average samplings per hectare:

1. Structure — diameter or size distribution of commercial dipterocarps (excluding hardwoods)

In Virgin Forest

Table 2

Diameter Class Cms.	No. of Trees	Volume Cu.M.
(1)	(2)	(3)
20	11.9	1.60
30	14.4	5.70
40	15.1	19.34
50	11.1	28.70
60	9.4	39.49
70	7.7	41.63
80	4.0	32.52
90	2.5	29.75
100	1.2	14.33
110	.4	6.61
120	.4	7.80
130	.3	4.84
TOTAL	78.4	232.31
Total, 50 Cms. & up	37.0	205.67
Total, 60 Cms. & up	25.9	176.97
Total, 70 Cms. & up	16.5	137.48
Total, 70% of 70 Cms. & 80 Cms. & up	13.20	124.99

In Logged-over
(Healthy Residuals)

Tale 3

Diameter Class Cms. (1)	No. of Trees (2)	Volume per Tree (3)	Total Volume Cu.M. (4)
(Seedlings)	(7,500)		
(Small Saplings)	(800)		
10 cm.	(26)		
20	5.4	.27	1.46
30	8.3	.81	6.72
40	5.8	1.37	7.95
50	4.8	2.08	9.98
60	3.1	3.91	12.12
70	.9	6.15	5.54
Total	28.3		43.77

2. *Determination of the period of adjustment.*—Our problem is to apportion the annual cut in the virgin timber and the residual stands in such a way that there will be no abrupt reduction of cut until the next lower size group (small poles saplings or seedlings), as are estimated to be sufficient in number, will reach the exploitable diameter and fairly profitable volume. A new crop of seeds after primary logging should be the safest basis, but this takes long to reach harvestable size. It will be to advantage to remove as fast as possible the mature and overmature timber, hence, we have to look for the size classes bigger than seedlings for the connecting link to the next rotation, and the possibilities of smaller diameter that will be profitable to utilize in future years.

Trends in utilization show trees of smaller diameters cut profitably either for lumber or plywood. With improved techniques and equipments in utilization and cost of road construction that will be already written off some years after primary logging, 50-cm. trees will likely be no longer marginal to log. We, therefore, take *50 centimeters* as the exploitable diameter of trees that can be exploited profitably in the future.

At present, the number of trees cut per hectare ranges from 15 to 30. We see in our stand structure and distribution the following smaller size classes left per hectare: seedlings, 7,500; saplings, (5 cm.), 800; 10 cm. diameter class, 26; and 20 cm. diameter class, 5.4. The 20 cm. diameter class should be a good link as it will take only about 40 years to reach 50 cm. diameter, (See Growth Table1), but the number is insufficient. We go now to the next class, 10 cm.: Allowing for 50% mortality, a survival of 13 is estimated. This could be augmented from the 5 cm. class and the 20 cm. class, so that more than 30 trees may safely be expected as the final crop per hectare in the third cycle.

We, therefore, choose 10 cm. diameter as our connecting link which takes about 56 years to reach 50 cm. diameter (Col. 6, Growth Table). But since we will augment the number of trees from the 5 cm. class which takes about 66 years to reach 50 cms., we take the average of these years, or 61 years, rounded to *60 years*, as our *period of adjustment.*

3. *The cutting cycles.*—The size class groups of residuals for the second cut will be 30 cms. and over in diameter since we will use the 20 cm. class trees to augment the 10 cm. class trees. The 30 cm. class trees will reach 50 cm. class in 25 years. For facility and allowance for further augmentation of exploitable residual volume to approximate that of the exploitable virgin volume, we take *30 years as the first cutting cycle* for cutting the virgin forest. *The remaining period* (60-30) or *30 years will be for cutting the residual stands.*

4. *Prediction of diameter and volume of residuals 30 years hence.*—We now predict the volume of the healthy residuals using roughly 25% as further loss by mortality (as also indicated by data from the sample plots):

Table 4

Diameter Class Cms. (1)	No. of Trees (2)	Average No. of survival at 25% mortality (3)	Diameter reached 30 years hence (4)	Average No. of Logs per tree (5)	Average Volume per tree (6)	Total Volume Cu.M. (7)
30	8.3	6.2	55	3.0	2.87	17.79
40	5.8	4.4	70	3.5	5.49	24.16
50	4.8	3.6	90	3.5	9.52	34.27
60	3.1	2.3	105	4.0	15.00	34.50
70	.9	.7	115	4.0	18.22	12.75
Total	22.9	17.2				123.47

NOTE: Data under Column (2) are from Table 3; Column (3), roughly determined from data on mortality in sample plots; Column (4), derived from Growth Table; rounded to facilitate volume computations.

5. *Effect of cutting trees at certain diameters on the residual cut.—*

Table 5

Diameter Class Cms. (1)	LEFT AFTER LOGGING AND EXPECTED SURVIVAL 30 YEARS HENCE											
	If 50 cms. & up are removed			If 60 cms. & up are removed			If 70 cms. & up are removed			If 70% of 70 cms. & up are removed		
	No. of Trees (2)	Dia. reached (3)	Vol. Cu.M. (4)	No. of Trees (5)	Dia. reached (6)	Vol. Cu.M. (7)	No. of Trees (8)	Dia. reached (9)	Vol. Cu.M. (10)	No. of Trees (11)	Dia. reached (12)	Vol. Cu.M. (13)
30	6.2	55	17.79	6.2	55	17.79	6.2	55	17.79	6.2	55	17.79
40	4.4	70	24.16	4.4	70	24.16	4.4	70	24.16	4.4	70	24.16
50				3.6	90	34.27	3.6	90	34.27	3.6	90	34.27
60							3.1	105	34.50	3.1	105	34.50
70										.7	115	12.75
Total	10.6		41.95	14.2		76.22	17.3		110.72	18.0		123.47

NOTE: Data under Column (4), (7), (10) and (13) are taken from Column (7) of

2. Trial Annual Cuts in Virgin and Logged-over

Table 6

Diameter Class Groups (1)	Virgin cut 1st 30 yrs.		Logged-over cut 2nd 30 yrs.		Total cut in 60 years
	Per Hectare (2)	In annual cutting area 333 Has. (3)	Per Hectare (4)	In annual cutting area 333 Has. (5)	(6)
50 cms. & up	205.67	68,488.11	41.95	13,969.35	82,457.46
60 cms. & up	176.97	58,931.01	76.22	25,381.26	84,312.27
70 cms. & up	137.48	45,780.84	110.72	36,869.76	82,650.60
70% of the 70 cms. trees; 80 cms. & up	124.99	41,621.67	123.47	41,115.51	82,737.18

NOTE: Data under Colmun (2) are from Colmun (3), Table 2;
Data under Column (4) are from Volume totals under Column (4), (7), (10) and (13), Table 5.

6. *Analysis and choice of size groups to be cut and to be left.*—It will be seen from the above table that a drastic reduction of cut in the second cycle will result if in the virgin logging all the exploitable trees 50 cms. and up in diameter are cut. It is necessary to leave higher diameter class trees so that a gradual adjustment can be effected. The lower the diameter class group cut in the virgin forest, the less will be the volume of residuals available in the second cycle. Cutting the 70% of the 70 cm. trees and 80 cms. and up group will give a residual cut of 41,115.51 cubic meters which is nearer to the annual cut of 41,621.67 cubic meters in the virgin forest. *Therefore, we allow to be cut this size group and require by marking the leaving undamaged a minimum of 60% of the trees in the lower class groups (30-70 cm. diameter classes).* The allowable annual cut should be the average of 41,300 cubic meters roughly. To cushion the transition, if the virgin annual cut found for the last size class group is considerably higher than that for the residual or logged over cut, the allowable annual cut in the first cycle may be gradually decreased until it will be equal to the annual cut in the logged over. Deduction should be made for natural defects, say 20%, thus reducing our first calculation to (41,300 — 8,260) or 33,040 cubic meters. If the present annual cut is substantially more or less than the foregoing determined annual cut, the same should be gradually adjusted annually or periodically to the determined cut, depending on market conditions.

The annual cutting areas in the second 30 years cutting cycle should be worked in the same sequence as in the first 30 years cutting cycle, so that the expected volumes, more or less, will be cut. (In actual operation, the annual cutting areas are not uniform as in our example; they will vary depending on volume per hectare and site quality).

Check of the Annual Cut with Those Determined by other Methods

1. Annual cut by this method — 41,300 cu. m. (gross)
2. Annual cut by growth per cent: — 2.9% (based on basal area 20-70 cm. dia.)
   Annual cut = 136.46 cu.m. (from Table 2) × .029 × 10,000
   = 39,573 cu.m. (gross)
3. By Brasnett's method:

$$\text{First Felling Cycle (F.C.)} = \frac{\text{60 years, the period of adjustment}}{1 + \frac{\text{Volume of residual stand per Ha.}}{\text{Volume of permissible cut per Ha. Now (in virgin forest)}}}$$

$$= \frac{60}{1 + \frac{123.47}{124.99}} \quad \text{(from Col. 7 Table 4)}$$

$$= 60/1.99 = 30 \text{ years}$$

$$\text{Second Felling Cycle (F.C.)} = 60 - (30) = 30 \text{ years}$$

$$\text{Annual Cut, Virgin forest} = \frac{124.99 \times 10{,}000 \text{ Has.}}{\text{First F.C.}}$$

$$= \frac{124.99 \times 10{,}000}{30} = 41{,}663$$

$$\text{Annual Cut, Residual forest} = \frac{123.47 \times 10{,}000 \text{ Has.}}{\text{Second F.C., 30}}$$

$$= 41{,}157 \text{ cu.m.}$$

$$\text{Average} = \frac{41{,}663 + 41{,}157}{2} = 41{,}410 \text{ cu.m. (gross)}$$

NOTE: Above is an adaptation of the formula.

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SOME USEFUL...

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Our estimate of annual cut is approximate those by the other two methods shown above. The growth per cent method is less favored for the present due to the variations of the number of healthy residuals. The growth per cent should be applicable where there is not much change caused by damages to immature trees in the course of logging.

The advantage of this crude method (adjusting virgin cut to residual cut) is that the annual cut is correlated directly to diameter class groups. This fits the selective logging practice in the dipterocarp forests where injury to thrifty trees is a primary factor in the volume of the second cut.

Application and Limitation

The table and demonstration can be used as a rough guide in checking up sustained yield capabilities of license areas in Basilan, so that proper adjustments could be made to assure a continuity of operation. When more refined statistical analysis will have been worked out and more reliable data will be available by subsequent measurements, this table will have to be changed and re-evaluation shall be made.

It may be used for doing the same in other regions having similar or approaching the forest conditions of Basilan. For other regions, the growth data presented here may be applied meantime that growth data is not yet available in those regions. However, they should be used only as an index by the use of a factor, such as the ratio of the stand or volume per hectare of a region to that of Basilan. Such ratio should be applied to the predicted volume of healthy residuals using the Basilan Growth Table to get the predicted volume of another region. This table used with the stand structure and distribution in virgin and logged over areas is very essential in the formulation of marking guide.

Possibilities

It may be possible that the period of adjustment may be shortened by more trees saved from injuries in the course of logging and by more intensive silvicultural treatment of the residual stands. A few isolated trees observed and proved by records reach certain diameters in shorter time than as shown in the table.

In the third cycle, by indications, a greater volume per hectare will be realized. It is in this and second cycles where the forest manager will have easier manipulation of the stands to suit the proper arrangements as dictated by silviculture and utilization.

Giving yourself, learning to be tolerant giving recognition and approval to others, remaining flexible enough to mature and learn—yields happiness, harmony, contentment and productivity. These are the qualities of rich life, the bounteous harvest of getting along with people.

—Jack C. Yewell