SILVICULTURAL PRACTICES IN THE PHILIPPINES

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In the Philippines, while significant strides have now been made in the field of forest utilization, the production aspect has still to come up with a system most appropriate for the management of forest lands.

Silviculture, as essential tool of forest management, has not advanced so much at this stage; a lot more of improvement is desirable.

This paper deals with the silvicultural practices currently observed in the country with respect to natural as well as artificial regeneration.

I NATURAL REGENERATION

As the main source of wood for domestic construction purposes as well as the top dollar earner in the past, the dipterocarp forest of the Philippines in which selective cutting is applied, as a natural means of regeneration is composed of eight genera and fifty one species. The forest presently occupies an aggregate area of about 9.5 million hectares of which approximately 5.8 million hectares are composed of young growth (residual stand) and the rest of old growth (mature stand).

The dipterocarp forest abounds in all the geographic regions of the country, the bulk of which is found in Mindanao island. The forest thrives luxuriantly at elevations up to 800 meters.

In the past, there seemed to be an overwhelming thought that the dipterocarp forest is inexhaustible, considering that dipterocarp forests grow abundantly. In the light of such misconception, indiscriminate exploitation of the forest became a common observation. Loggers with short-term objectives proliferated all over the country and went into massive log extraction. Many of them gave less regard to the established principle of selective logging that has been designed to promote the sustained-yield concept.

As a result in a very short period of time the forest ecosystem became destroyed, as dramatized by the alarming acceleration of soil erosion rate and frequent occurrence of flash floods in many lowland areas.

Until recently, the implementation of selective logging had been met from the start with difficulties which caused such attempt to resemble a boat rocked by the complexity of demographic pressure that is often inspired by political backings and the seemingly ineffective implementation of rules and regulations advocated in the principle of selective logging.

Selective logging

The selective logging practice in the Philippines is a modification of selection method of regeneration in which the mature and overmature trees are removed. The former, on the other hand, advocates the retention of some mature trees - a practice which is considered not only to help ensure adequate reproduction but also a step towards attaining a regulated, uneven-aged forest.

Selective logging, which now involves as allowable cut the removal of 55% volume of 70 cm diameter breast-height (dbh), 25% volume of 60 cm dbh plus the whole volume of 80cm and over dbh (and 70% recovery factor), consists of three principal phases, namely:

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1 Tree Marking

Considered to be a very important phase, tree marking ensures adequate number of trees that shall be left and protected as future crop. This phase serves to familiarize with what quality of trees should be retained as residual growing stock along with a sound basis for forecasting future crop yield. It likewise serves as a basis for imposition of regulatory fines and penalties.

After providing minimum allowance for log landings, cableways and the directtion of fall of trees, tree marking is carried out beginning from 20 cm diameter class. Trees marked to be retained as residuals amount to 70% of the number of trees of 20-60 cm diameter class and 40% of the number of trees of 70 cm diameter.

Sometimes, as need arises, trees to be felled are also marked, particularly when thick, good residuals surround the tree. The tree then is painted with an "arrow mark" on the side, indicating the direction of the fall where it will cause least damage to the marked residuals.

It may be of interest to point out that a premarking sampling is undertaken to provide a basis for the determination of marking goal (number of trees to be retained). Thus, before tree marking is undertaken, a sampling check of 5% estimate is conducted inside a logging setting in order to get an estimate of the number of trees of 20-60 dbh.

2 Residual Inventory

This phase is carried out after logging operation to determine the magnitude of damage incurred on the marked residual trees. The healthy trees left serve as basis for predicting the volume to be harvested in the next cutting cycle. The "Criteria for Residual" contained in the Handbook of Selective Logging for the Philippines provides the guidelines for determining whether a damaged tree can be considered healthy or not. The guidelines are as follows:

1) Healthy residuals
   a. A tree to be considered a "healthy residual" must be sound, thrifty, with straight cylindrical bole, uninjured, or with slight injuries of not more than 1/6 of the crown being severed or badly damaged.
   b. Any injury on the trunk reaching the wood (beneath the cambium) should not be more than 5 cm wide and 50 cm long, more or less, along a straight line parallel to the longitudinal axis of the trunk.
   c. Not more than 1/3 of the number of buttresses should be badly battered.
   d. Not more than 1/2 of the circumference at any place on the trunk should be girdled and deeply indented by wire rope.
   e. Not more than 1/6 of the root system should be removed or disturbed.

2) Substandard doubtful residuals
   a. More than 1/6 to not more than 1/2 of the crown severed or badly damaged.
   b. Any injury on the trunk reaching the wood, over 5 cm wide to 1/3 of the circumference and not more than 2 meter long along a straight line parallel to the longitudinal axis of the trunk.
   c. More than 1/2 but not more than 2/3 of the circumference of the trunk girdled or seriously indented by wire rope.
   d. Over 1/3 but not more than 1/2 of the number of buttresses battered.

3 Timber Stand Improvement (TSI)

Shortly after logging operation has created an opening in the forest canopy, various gap species in the form of vines, shrubs and medium-sized trees quickly take over the opening, thereby tending to overtop and inhibit the course of the young dipterocarp reproduction. This is a general phenomenon inherent to any tropical rain forest. Thus, 4-5 years after logging operation, the logging company concerned is required to conduct TSI in order to provide favorable conditions for

the acceleration of growth of the young residual trees. Removal of the unwanted vegetation which tends to interfere with the growth of the desired crop is carried out. Recommendations listed in the Handbook of Selective Logging state that it is not advisable to carry out TSI earlier than four years after logging because, aside from being expensive, it encourages rapid growth of vines, shrubs and other herbaceous species. It is claimed to be advisable that the application of TSI be made five to ten years after logging, as it has been thought that at this stage, many vines will have died due to suppression caused by the upper canopies of tree-shrub mixture, hence easing the penetration of the thicket in the conduct of TSI.

Research needs

The devastation consecutive to the rapid depletion of the dipterocarp forests brought forth the awareness of the need to protect the dwindling forest ecosystem. Appropriate measures are now being taken towards this direction, and at the same time a management scheme most fitting to the remaining forests is being sought to ensure perpetual productivity.

The silviculture of dipterocarp forest, a vital component of the management scheme, has now become a priority in research in the Philippines. Problems identified are as follows:

1 Efficiency and reliability of selective logging

Theoretically, selective logging is the natural means of regeneration most suitable to the virgin dipterocarp forest, which is characterized by an uneven-aged nature. However, some skepticism is being raised as to the soundness of the applicability of the method. The opposing group claims that, although selective logging is theoretically sound, it does not seem to work as well as expected on the dipterocarp forest based on indications that residual stands are unlikely to be able to approximate, as predicted, the yield of the original stand.

Thus, experimentation is called for to verify the efficiency and reliability of selective logging as well as the need to try shelterwood as another method of natural regeneration.

2 Criteria for determining healthy residuals

The criteria, as mentioned previously, have evolved on the basis of scanty observations made in the past. Therefore they appear to be empirical. Considering that the country has four different climatic types, it is possible that the guidelines would not be entirely applicable to some archipelagic regions. Evidently, a comprehensive investigation is thus needed to provide a strong basis for the guidelines.

3 Minimizing felling damage

This is an adjunct to the problem on assessment of healthy residuals, as it has been observed that felling and logging damage involves as much as 30% of the number of residuals. To minimize felling damage, a search for a more efficient, yet economical, method of timber harvesting is necessary.

4 Timber stand improvement

It has likewise been estimated that a logged-over area, when left alone to develop into a mature stand, will yield timber volume that is markedly below that of the original stand. As expressed earlier, this has been a basis for others to believe that selective logging is not the most appropriate method for the dipterocarp forest. On the other hand, it is also not hard to believe that, with the application of proper TSI, the logged-over areas will ultimately develop into stands in which harvestable volume will not only be realized at an earlier period but also will be equal to, if not even exceed, the original stand.

There is an on-going TSI study carried out by the Forest Research Institute of the country which is expected to be completed within a twelve-year period.

II ARTIFICIAL REGENERATION

The rapid rate of forest destruction in the Philippines has been viewed with evident alarm not only by the indigenous forestry sectors but also by the visiting foreign foresters. The rate of forest denudation resulting in the creation of vast tracts of marginal, open land has prompted several remedial measures in the past, the most important of which being the creation of a distinct, separate forestry agency that was charged with the sole responsibility of reforesting these open lands. Sad to note, however, the agency concerned, in its twelve years of existence (1960-1972), obtained little success in its function. The rate of its reforestation work struck a low average rate of 15,000 hectares annually as compared to the rate of forest destruction at the tune of 172,000 hectares a year.

The advent of martial law saw the urgent need for reforming the forestry agencies of the country, and one significant step made was the merging of the said agencies into a unified and more functional forest development bureau. Massive reforestation work has now been given equal priority through the national program on forest ecosystem management of the bureau. Lately, the bureau announced that it was able to augment the rate of reforestation up to 30,000 hectares annually.

Reforestation practice

There was not much improvement made on the techniques of artificial regeneration since the implementation of the reforestation program in the Philippines. To date, the reforestation work carries the following two principal phases:

1 Nursery phase

This phase involves planting stock production including seed collection, seed storage, and raising of seedlings.

In collection, fallen mature seeds are picked up from the ground, but in some cases, the gatherer climbs the tree and causes the seeds or fruits to fall by shaking the branches vigorously. Seeds of *Pinus kesiya* are rather more difficult to gather, and are thus usually purchased from individual seed dealers. The dealer employs a destructive way of collection by cutting the branches of the pine trees thereby leaving a tree with only two or three upper branches left.

Pine seeds are extracted by exposing the cones under the sun to facilitate cone opening, and the seeds shaken off by tapping the cone vigorously against a hard object. Soft, pulpy fruits such as *Anthocephalus chinensis* are extracted from seeds by macerating the fruits in a tub of water; the pulp-seed mixture is separated from water by decantation, air-dried, and the seeds are separated from pulp by winnowing.

The seeds are air-dried and placed in large plastic bags, tin cans or gunny sacks, and stored at room temperature. Fine seeds, and those having a short viability period (e.g. *Anthocephalus chinensis, Pinus kesiya, P. merkusii*) are stored at 3-5°C.

Potted seedling is the type of planting stock being used for outplanting. Seeds are first germinated in seedbeds, allowed to develop a first set or two of true leaves before potting them in polyethylene bags. The newly potted seedlings stay in the potting shed for about two weeks to establish themselves, and are then gradually exposed to full sunlight. Depending upon the species, it takes four to six months to raise seedlings of plantable size.

Attempts are now made by some government reforestation nurseries to do away with the practice of raising some species in seedbeds prior to potting. As seeds of *P. kesiya, P. merkusii, Leucaena leucocephala* and *Albizzia falcataria* are directly sown in pots, much of the cost of potting work can be avoided. Two seeds are sown in a pot to assure full stocking. In a pot containing two seedlings that have grown one seedling will have to be removed to be transplanted into an empty pot.

2 Outplanting and tending

Planting sites are poor sites dominated by grasses. Planting holes are prepared well ahead of the outplanting activity. At the onset of the rainy season, the seedlings are set out, with the immediate, respective periphery of the planted seedlings cleared of grasses. Replanting is almost always done the following year and this contributes on the average to about 50% of the outplanting work.

Weeding for the first and second year is undertaken when funds for this purpose are available.

Dry season is the most crucial period for a newly established plantation. Aside from being a drought period that endangers the survival of the young plants, grasses are dry and ignite so easily as to cause a forest conflagration. Despite great effort exerted to minimize forest fire problems, it seems that the frequency of fire occurrence for every period has not been substantially lessened. The problem is more intensely felt in the pine areas in the northern Philippines where forest fire contributes to about 30% of the over-all cause of mortality of the outplanted seedlings.

3 Use of nurse crop

Because sites needing reforestation are found to be generally hostile especially those in the northern region of the country that possesses six months of distinct dry season, a two-step reforestation scheme becomes necessary. Nurse crops such as *Leucaena leucocephala* and *Gliricidia sepium* are first introduced so as to improve the microclimatic conditions of such sites before planting the desired species in-between rows of the nurse crop.

Research needs

Low survival is the major, perennial problem of the reforestation program in the Philippines because it significantly contributes to the slow pace of reforestation work. Protection from fire of forest plantation in the dry regions has always become the common concern of the forest bureau when comes the drought period. About 30% of seedling mortality is attributable to fire. This sad situation thus emphasizes the need for the government's effort in protecting the forest plantations from fire. Perhaps, it is essential to make the laws even stricter in this respect.

Coupled with the fire problem is also the lack of sound silvicultural system for plantation establishment which extends from the nursery down to the stage at which the stand is ready for harvesting. While it is true that there is already some knowledge of the techniques acquired through research made in the past, these, however, are evidently fragmentary and do not, therefore, permit the establishment of a solid or complete silvicultural system for each plantation species.

Generally, the research needs for the artificial regeneration in the country are as follows:

1) Nursery studies to increase seedling vigor

One factor that helps increase survival is the condition of outplanted seedlings. More vigorous seedlings have better chance of surviving when planted in adverse sites. With proper techniques employed, healthy seedlings can be developed in the nursery.

Some nursery studies designed to improve seedling quality have already been made for some species. But a complete set of studies for each species is yet wanting.

2) Plantation studies

Similarly, investigations made on plantation phase of natural regeneration are only few. For many reforestation species, studies on planting techniques, types and frequency of weeding and fertilization are yet to be undertaken. Thinning practice for a young plantation is yet to be backed by comprehensive research findings for every climatic region and species, and direct seeding in plantation has to be explored in order to help minimize the present high cost of plantation establishment.

3) Tree improvement studies

In line with the program on forest ecosystem management, a massive reforestation activity has been launched just recently. The activity, being nationwide, gave birth to a problem of seed shortage, hence prompting the implementing agency concerned to resort to the use of seeds

gathered from trees of inferior quality.

Establishment of plantations of trees of desired quality has to be sought for, but tree improvement research is just beginning in the country. More studies on origin as well as, seed orchard establishment, hybridization and progeny testing studies have yet to be undertaken.

III THE RESEARCH ARM OF THE GOVERNMENT ON FOREST PRODUCTION

Admittedly, forest production research in the past was carried out without much vigor. This was reflected by the lack of direction, as shown by the absence of a good research program. The main cause for such lukewarm attitude was the lack of logistical encouragement from the authorities concerned, perhaps because the more pressing national needs had to be given higher priority.

The promulgation of martial law made possible and facilitated the creation of the Forest Research Institute which is in charge of forest production research including outdoor recreation and wildlife research. The Institute, a relatively well organized forest production research arm of the government, is moving forward with utmost vigor, and one of the main emphasis is placed on silvicultural research. Now in its third year of existence, the Institute has begun tackling with enthusiasm many of the above mentioned research needs.

References

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Discussion

Liew T.C. (Malaysia): *Anthocephalus chinensis* has been listed as a major plantation species in the Philippines. In Sabah, it exhibits good growth at the early stage but its subsequent development, particularly its growth rate has been found unsatisfactory in logged-over forests.

Answer: *Anthocephalus chinensis* has been considered in the Philippines as one of the reforestation species owing to its rapid rate of growth. It thrives well in fertile hollows as well as at the foot of the mountains along the creeks where adequate soil moisture abounds but this species does not develop well along the slopes with low soil fertility and moisture.

Ohba, K. (Japan): As far as tree marking is concerned, 1. Are there any rules or criteria to cut or leave certain tree species at the tree marking? 2. Are there any special procedures to follow so as to attain an even distribution of residual trees after selective cutting?

Answer: 1. As presented in my paper, the rule being followed as marking goal is 70% of the number of trees of 20 - 60 cm diameter plus 40% of the number of trees of 70 cm diameter. The allowable cut involves the removal of 55% volume of 70 cm d.b.h., 25% volume of 60 cm d.b.h. plus the whole volume of 80 cm d.b.h. and over. These rules apply to all dipterocarp species obtained in the area to be logged. 2. No specific procedure has been spelled out in the handbook of selective logging. Such matter, however, has never been overlooked. The forester in charge always sees to it that as far as situation permits, residual trees are more or less evenly distributed in the area.