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The potential of mangrove forests in Sarawak

by

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Summary

Past exploitation in the mangrove forests of Sarawak was unsystematic, selective and uncontrolled, resulting in serious damage being done to the forest crop. The first proper management plan was introduced in 1968. Research on the ecological and silvicultural aspects was initiated in 1970. Studies so far indicate that in certain areas, particularly the Rejang delta, where the ground level is considerably raised and the soil thick and clayey, regeneration after exploitation is unlikely to be very successful. The future management system for the mangrove forests will largely be determined by the results of the research programme.

Brief history

There are approximately 429,000 acres of mangrove forests in Sarawak. Of these, about one-third have been constituted as permanent forest reserves. The three Rejang delta reserves in the Sixth Division cover about 66,651 acres. The other reserves are the Sarawak Mangrove F.R. in the First Division (24,214 acres, of which 7,600 acres have been excised for agriculture), the Lawas Mangrove Reserve in the Fifth Division (10,000 acres), and the Sibuti Mangrove Reserve in the Fourth Division (300 acres).

In the past the mangrove forests, particularly in the Sungai Sarawak and Rejang delta areas, were worked extensively for bark, firewood, poles and charcoal. A total of 137 licences (41 for charcoal, 45 for firewood and 51 for pole) were issued, many of which are still in operation. Felling was widespread, uncontrolled and unsystematic. Because of this, the forest crop was seriously damaged and reduced to an unbalanced state.

In 1938 an attempt was made to introduce a systematic working plan in the Sarawak Mangrove F.R., but before this plan could be drawn up in 1940, Sarawak was occupied by the Japanese. After the Japanese occupation, the forest was exploited mainly for charcoal and firewood and the felling was still largely uncontrolled and selective. As the state developed, there was a great demand for Bakau piles, the production of which increased rapidly, but the demand for charcoal and firewood declined.

The first proper and systematic management of the mangrove forests was introduced in 1968 in the Sarawak Woodchip Company licence area in the Rejang

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delta. This forest is to be worked on a sustained yield basis using a 25 year rotation and an annual coupe of 1,500 acres. The minimum felling limit is 9 inches girth.

Research on mangrove forests

The value of the mangrove forest as a source of raw material for pulping cannot be denied, and the Government has realised that the establishment and expansion of a pulping industry would provide employment especially for the coastal people. It is, therefore, the policy of the present Government to exploit the mangrove resources along this line. However, very little is known about our mangrove forests, especially their ecology and silviculture. Research projects were, therefore, initiated in 1970. Subsequently, the forests in the Sarawak and Lawas reserves were reinventoried. Research on the mangrove forests include the following: —

(i) a survey of the types of mangrove forests and their distribution;

(ii) level survey to study inundation frequency;

(iii) the establishment of systematic transects to study colonisation, regeneration and succession;

(iv) the establishment of yield plots;

(v) studies of the soil and water properties.

Our studies so far indicate that we are very likely to encounter many problems in regenerating the exploited mangrove forests, especially those in the Rejang delta.

Most parts of the forests in the Rejang delta and part of the Sarawak Mangrove F.R. are situated on high ground. The raising of the ground level is mainly due to the work of lobsters (*Thalassina anomala*) which build numerous mounds on the stiff inland soil. These mounds then coalesce, adding 4 to 5 feet to the ground level. These areas subsequently fall under Watson's inundation classes 4 and 5. The mounds are almost immediately invaded by the Piai fern *Acrostichum aureum* which becomes particularly abundant in exploited areas. *Excoecaria agallocha, Heritiera littoralis* and, to a certain extent, *Xylocarpus granatum*, also favour drier habitats and these species replace *Rhizophora* and *Bruguiera* inland. The scrambler, *Caesalpinia nuga*, is another serious weed which colonises open places.

The soil in the Rejang delta is greyish brown, thick and a sticky clay which is non-porous and is insufficiently aerated. Regeneration of *Rhizophora* and *Bruguiera* species on this soil is very scarce except on the soft mud near river and stream banks. The seedlings do not get anchored easily, and even if they do, most of

them fail to develop. This type of soil is favoured by the lobsters because the mounds built here do not collapse easily, and protection against flood waters is ensured.

The situation in the Rejang and Sarawak mangroves is, therefore, one of constant building up of land and, as a result, the area becomes less and less frequently flooded. The level survey in the Rejang mangrove F.R. indicates that only areas that are flooded at least 50 times a month (equivalent to Watson's Inundation class 2 and below) are likely to regenerate and these areas are confined to river and stream banks and other low-lying areas. Natural regeneration could have been more successful (extending to Watson's Inundation class 3) if the clay were not so thick and compact and if there were fewer lobster mounds.

The mangroves in Lawas and Sibuti are quite different. Both these reserves are bordered by extensive areas of Peat Swamp forests inland whose influence on the mangroves is obvious. The water at the river estuaries is tea-coloured, and the soil is a dark brown, sandy clay loam, very soft, friable and more porous. Lobster mounds are comparatively few and most of them remain low as they collapse easily. As a result, Piai fern also fails to thrive. The ground generally remains low and is frequently flooded. The forest is less complex and the species present are mainly *Rhizophora apiculata* and *Bruguiera gymnorrhiza*. There are very few *Excoecaria agallocha, Heritiera littoralis* and *Xylocarpus granatum*. There appears to be very little problem in getting regeneration of *R. apiculata* and *B. gymnorrhiza* and exploited areas are densely covered with their seedlings and saplings.

To compare the soils in the two areas, a summary of the soil analyses is tabulated below.

Location	pH		Total Reserves (P.P.M.)				Mechanical Analysis			
	Wet	Dry	Ca	Mg	K	P	Silt	Clay	Sand	Texture
Rejang	6.2	4.2	2000	5188	7738	293	31.20	32.40	24.30	Clay loam
Lawas	5.2	2.9	1800	2690	5530	173	16.40	20.20	49.10	Sandy clay loam

In general, the more clay there is in a soil, the greater the cation exchange capacity. The pH and relative nutrient availability relationship also indicates that the Rejang soil, with a wet pH of 6.2, has more available nutrients than the Lawas soil which has a lower pH of 5.2 (Tamhane et al 1964).

The results show that the Rejang soil is generally more fertile than the Lawas soil. However, the low dry pH value of 2.9 in Lawas indicates that the soil is much more acid sulphate in nature than the Rejang soil. When the soil is wet, the sulphate remains in the reduced form as hydrogen sulphide (H_2S) and Pyrite (FeS). Oxidation takes place when the soil becomes dry and this happens when the frequency of inundation is reduced as a result of the raising up of the ground level. A high sulphide content in the soil may, therefore, be important for the growth of *Bruguiera* and *Rhizophora*.

The texture of the soil may be another important factor. Clay loam soil is more stable and its accretion is faster than sandy clay and, as mentioned earlier, it is also a favourite habitat of the lobster. Also, the seedlings of *Bruguiera* and *Rhizophora* are able to establish themselves more quickly and more successfully on the more porous sandy clay soil than on the thick clay loam soil. The soil in the Matang mangroves in Perak in Peninsular Malaysia is also dark brown, friable and porous in nature and even in inland areas, which apparently fall under Watson's inundation class 4 (flooded 2 to 25 times per month), about 75% of natural regeneration can still be expected. The situation in the Johore mangroves, on the other hand, approaches that in the Rejang and Sarawak mangroves.

It is obvious from the foregoing discussion that we are likely to find it difficult to regenerate the exploited forests in the Rejang delta, which unfortunately, is the largest mangrove area in Sarawak. The Forest Department is planning to carry out silvicultural research in the Rejang reserves next year. This research may include:

(i) enrichment planting of logged-over areas in the lower inundation classes as a means of regenerating the forests;

(ii) leaving unlogged strips of forests between logged areas in experimental logging blocks to see whether stocking can be improved through retention of seed trees;

(iii) stick-thinning as practised in Peninsular Malaysia;

(iv) removal of logging slash in experimental logging blocks to gauge whether the regeneration environment can be improved.

This research will later be extended to the Lawas mangrove reserves. Enrichment planting is important particularly in the Rejang mangrove reserves. This will be carried out initially in the more frequently flooded areas following the delineation of the inundation classes in 1975.

Conclusion

The future management system for our mangrove forests will depend on the outcome of the research programme. Large scale exploitation would not be

advisable if efforts to regenerate a second crop, either by natural or artificial means, prove to be unsuccessful or economically unfeasible. If such were the case, it would be best to conserve those mangrove areas that can regenerate for the supply of piles, charcoal and firewood for domestic consumption.

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