

**ASIAN DEVELOPMENT BANK**

**RE:MAL XXX**

Reevaluation Study Series (Number 22)

**REEVALUATION  
OF THE  
COMPENSATORY FORESTRY  
SECTOR PROJECT  
(Loan No. 709-MAL)  
IN  
MALAYSIA**

October 1996

## I. HIGHLIGHTS

1. **Objectives and Scope.** The major objective of the Project was to support the Government's ongoing Compensatory Forestry Plantation Program (CFPP) to help meet its long-term goal of maintaining self-sufficiency in domestic general utility timber. Aimed to produce an additional output of about 11.7 million cubic meters (m<sup>3</sup>) of timber, the Project was designed to replant about 40,000 hectares (ha) of logged-over forest with fast-growing species of trees, thereby establishing a sustainable source of timber as an alternative to the dwindling natural forest supplies. A sector lending approach was adopted in that small plantation subprojects, each with a minimum area of about 1,500 ha in the four participating states of Pahang, Negri Sembilan, Selangor, and Johore were selected for financing under the Project.

2. **Postevaluation Assessment.** At postevaluation in 1991, about 35,000 ha of plantations were established under the Project, which was about 12.5 percent below the appraisal target. It was estimated that about 92 percent of the plantations were planted to one species, *Acacia mangium*, which is fast-growing, easy to propagate, and hardy. The Postevaluation Mission (PEM) estimated that the trees would yield about 15 percent less than the appraisal estimate because of frequent delays incurred in silvicultural treatments. Based on prevailing wood prices—which were about 30 percent higher than at the time of appraisal—and establishment costs—which were 40 to 50 percent lower than anticipated—PEM estimated an economic internal rate of return (EIRR) of about 23 percent and a financial internal rate of return (FIRR) of about 21 percent, both of which were higher than the appraisal estimates of about 22 percent and 15 percent, respectively. PEM noted that the Project's organizational structure, staffing pattern, and management system were generally satisfactory. Project sustainability could be achieved provided adequate attention is given to recruitment of labor, research to alleviate a fungal disease called heart rot, promotion of market demand for *Acacia mangium*, and improved recruitment of contractors. PEM rated the Project as generally successful.

3. **Reevaluated Project Performance.** The reevaluation confirmed many aspects of the general findings and assessments of the postevaluation. Although the Project Performance Audit Report (PPAR) highlighted major issues like delays of silvicultural treatments, labor constraints, and the need for research to control heart rot disease, these issues continued to persist at the time of the Reevaluation Mission (REM). Operation and maintenance works were continuously hindered by lack of labor and by inexperienced contractors, resulting in substantial further delays in silvicultural treatments. Such delays have seriously limited tree growth and resulted in a lower than expected agronomic performance. As a consequence, tree growth is substantially lower than the PEM estimates. Growth plot analyses indicated that the trees will only attain an average diameter of about 31 centimeters (cm) at maturity (age 15 years), a reduction of about 31 percent from the appraisal target of 45 cm. Fungal diseases such as heart rot and root rot occurred in some areas and are especially serious where trees were over 10 years of age, leading to losses in planted areas. The latest measurement made in 1993 by an overseas private company using the latest mapping technology indicated a total Project area of 29,503 ha of plantations, which was about 75 percent of the appraisal target. This was also significantly lower than the PEM estimate of 35,000 ha because there were losses due to diseases and PEM could have adopted the perimeter method to estimate plantation area, which included plantation roads and swamp areas. Nevertheless, the Government has initiated a number of actions to overcome labor constraints by (i) conducting tendering at state level, (ii) adopting less intensive silvicultural treatment, and (iii) improving ongoing research and plantation management.

**4 Institutional Impacts.** The functions and capability of both the federal and the state forestry agencies have been expanded and the Project provided a good opportunity to the management and technical personnel to gain experience in various aspects of the forestry plantation development. The organizational structure and management system have improved, but staffing needs to be strengthened, especially in the monitoring aspect. A substantial pool of knowledge on plantation management has been built up by the Executing Agency (EA).

**5. Environmental Impact.** Much of the area cleared for the plantations consisted of logged-over, degraded land. The establishment of plantations with rich varieties of undergrowth flora, fauna, and shrubs has had a net positive effect on the environment in terms of erosion control, biodiversity, and prevention of forest exploitation by local inhabitants.

**6. Economic Impacts.** The EIRR was calculated at ate-out 8 percent. This is significantly lower than the EIRRs calculated at appraisal and at postevaluation. Similarly, the FIRR was calculated at about 6 percent compared with the appraisal estimate of about 15 percent and PPAR's 21 percent. The large difference relative to appraisal and PPAR estimates was due to the lower expected prices for *Acacia* wood, slower tree growth, and losses in areas from disease attacks. If the growth rate and disease control are improved in the future to give a 10 percent increase in yield, sensitivity analysis indicated that an EIRR of about 9 percent could be achieved. The Project provided employment to about 500 contract workers, most of whom are immigrants from neighboring countries.

**7. Overall Performance and Sustainability.** The Project is considered partially successful in view of the deteriorating situation relating to area losses due to diseases and slow growth rate. The sustainability of Project benefits (in terms of existing unharvested timber) depends very much on the increased availability of labor for silvicultural treatments, growth and disease monitoring, and urgent research and development programs to prevent or combat further disease outbreaks.

**8. Lessons Learned.** The lessons brought out in the PPAR are confirmed by the reevaluation. In particular, the adoption of a single-species forest plantation faces the possibility of a major disease outbreak if forest management and silvicultural treatments did not incorporate measures to deal with the higher risks of pest and disease outbreaks. Planting of a single species over a large area should be treated with caution. The pioneering nature of the forestry plantation should be emphasized so that alternative management strategies could be tested. The current single management strategy limits the range of data and knowledge that can be collected from the Project. Research and development is crucial even before Project commencement to determine the optimum maintenance and operation schedules as well as disease control. Regular growth and performance monitoring should be an integral part of implementation management. Labor availability must be ascertained during appraisal as its constraint would delay most silvicultural treatments and affect growth.

## II. BACKGROUND

### A. Forestry Sector

9. Peninsular Malaysia has 5.9 million ha of natural forests, of which 2.5 million ha are classified as reserves and protection forest, 2.8 million ha as production forest, and 0.6 million ha as state land. Sustainable harvesting of timber is permitted in the production forest. However, forest on state land may be cleared for other developments. Current estimates by Government indicated that a sustainable harvest of 8-9 million m<sup>3</sup> per annum from the production forests is achievable in perpetuity. Other independent estimates set a level lower, but nevertheless indicate a considerable sustainable volume.

10. Since 1990, log exports have been banned from Peninsular Malaysia, at which time log production was 13 million m<sup>3</sup> per annum. This resulted in a significant decline in wood exports from 4.1 million m<sup>3</sup> in 1990 to 2.6 million m<sup>3</sup> in 1994. The total harvest from the natural forests was reduced and in 1994, log production dropped to 11.4 million m<sup>3</sup>. Because of this decline in timber production, the general feeling within the industry is that the domestic processing sector is now too large, and some reduction in capacity is expected.

11. The Government's current policy on sustainable forestry emphasized the maintenance of sustainable harvest from natural forests and all state governments are to ensure that forestlands are properly managed and protected from excessive exploitation. Forestry plantations are to be established in forestlands that are degraded and with few trees left because of overexploitation by loggers and local inhabitants. Forestland is owned by each state which controls its use. Population pressure in most of the forest areas is not high, although there is pressure to develop land for agricultural crops or for industrial development, especially in areas close to the urban centers. In addition to the natural forestland, Peninsular Malaysia has some 50,000 ha of plantation forests under the CFPP administered by the Forestry Department Peninsular Malaysia (FDPM). Forest management is the responsibility of FDPM, a unit within the Ministry of Primary Industries (MPI), based in Kuala Lumpur. FDPM is organized into eight units, viz. planning, silviculture, economics, engineering, management, industry, training, and plantation forestry. The Plantation Forestry Section has a regulatory role related primarily to planning, monitoring, identifying research, and policy matters on plantations. Each state has a Forestry Office, which owns the natural and plantation forests within the state. These state Forestry Offices are responsible for forest management, planning, budgeting, proposals on royalty rates, monitoring of logging, and collection of revenues. The Forestry Research Institute of Malaysia (FRIM), based in Kuala Lumpur, is responsible for all forestry research.

## **B. The Project**

12. The purpose of the Project was to increase the productivity of degraded forest lands in Peninsular Malaysia by planting quick-growing, high-yielding general utility timber species to compensate for a forecast timber shortage and to maintain self-sufficiency in timber. Estimates made by the Government in 1983 predicted that from the mid-1990s, Peninsular Malaysia would experience a shortage of timber, which would grow from about 2.5 million m<sup>3</sup> in 2001 to 4.25 million m<sup>3</sup> by 2010. The major objective of the Project was to support the Government's ongoing CFPP to help meet its long-term goal of maintaining self-sufficiency in domestic general utility timber. The Project was intended to accelerate the CFPP in order to produce an adequate volume of timber to meet the expected shortage. To this end, the Project aimed to generate an additional output of about 11.7 million m<sup>3</sup> of timber. A secondary objective was to protect and preserve the country's ecosystem and to bring about a general improvement in the quality of the rural environment. On hindsight, the rationale for the Project appeared less relevant because prudent management practice adopted by the Government has resulted in sustainable harvest from the production forest (see para. 9) and the urgency for plantation timber becomes a lower priority.

13. The Project adopted a sector lending approach in that small plantation subprojects, each with a minimum area of about 1,500 ha, in the four participating states of Pahang, Negri Sembilan, Selangor, and Johore were appraised by FDPM for financing under the Project. Each subproject involved the following activities: (i) clearing of degraded logged-over forests and establishment of plantations; (ii) upgrading of existing forest roads and construction of new roads as needed; (iii) construction of firebreaks and fire watchtowers and installation of fire-fighting equipment; (iv) institutional support comprising vehicles, support facilities, staff quarters and other buildings, monitoring and evaluation, and research; (v) overseas and local training for Project staff; and (vi) consulting services.

14. The Project was appraised from 23 May to 7 June 1984 and a loan amount of \$24.5 million from the Bank's ordinary capital resources was approved by the Board on 20 November 1984. It was envisaged that the Project would be completed over a three-year period commencing 17 September 1985, but the Project was completed in December 1989, with about 15 months delay, including a 3-month delay in loan effectivity. The Loan was closed on 17 April 1990, following two extensions. Total Project cost at appraisal was estimated at about \$49.1 million, consisting of \$13.6 million in foreign exchange and \$32 million in local currency equivalent, as well as about \$3.5 million in interest and service charges during implementation. Disbursement under the Project came to \$10.2 million compared with the original loan amount of \$24.5 million. The actual cost of the Project was \$17.8 million, which was about 64 percent less than the appraisal estimate primarily because of lower than estimated establishment cost in single-species plantations and recession in the economy.

15. The EA was the FDPM. Project implementation was carried out by the respective Forestry Offices of the states of Pahang, Negri Sembilan, Selangor, and Johore.

### **C. Postevaluation Findings**

16. The PPAR was prepared by the Bank in August 1991, 17 months after the Project Completion Report (PCR) was prepared. At Project completion, about 35,000 ha of forest plantation was estimated to be established in the four participating states. The PPAR reported that the bulk of the trees planted belonged to a single species called *Acacia mangium* instead of the multiple species envisaged at appraisal. This situation developed because there was no previous knowledge in Malaysia on the agronomic performance of the recommended species and it was apparent during implementation that *Acacia mangium* was the only species that showed promise to attain the expected growth targets. Two other species, viz. Yemane (*Gmelina arborea*) and Batai (*Paraserianthes falcataria*), were more site demanding and performed poorly during the initial growing phase. Furthermore, the seeds of *Acacia mangium* were available in adequate quantity and were easy to propagate in nurseries. The Project subsequently developed a single-species forest plantations. The PPAR highlighted the risks associated with a single-species plantation in terms of (i) high susceptibility to pests and diseases; and (ii) lack of alternative species to supplement output, in case of poor performance and nonmarketability of the selected species. The advantage of monocultural plantations was the ease of replication and management that could lower establishment costs substantially.

17. To attain the expected growth in forestry plantations, timely input of silvicultural treatments is essential. The PPAR reported that the contractors faced two major constraints in the delivery of timely silvicultural treatments. These were shortage of labor and inexperience on their parts. At the time of appraisal, labor shortage was a major element constraining development progress in the rural areas in Peninsular Malaysia. The Project design did not emphasize this constraint. Moreover, forestry plantation establishment was a

new venture embarked on by the Malaysian Government and there were no experienced local contractors. As a consequence, there were delays in silvicultural treatments in all the plantations. This affected the growth of the trees. It was estimated at the time of PEM that the net output of acacia sawlogs was 44 percent lower than the appraisal estimate, but the smallwood output would be 19 percent higher. PEM estimated that overall the growth performance of *Acacia mangium* would be about 15 percent lower than the appraisal estimates.

18. The PPAR reported that the organizational structure, staffing pattern, and management of the executing and implementing agencies were generally satisfactory. Management policies and systems were consistent with Project goals. Project staff were technically qualified and well trained to execute their functions. An area of weakness identified was the forestry researchers' lack of responsiveness to the needs of the Project. There was little coordination between FRIM and FDPM during the course of Project implementation. The situation developed because of the establishment of FRIM as a statutory body in October 1985, and the separation of the research function from FDPM. An additional bureaucratic layer was created between researchers and Project implementors.

19. The EIRR estimated by PEM for the Project as a whole was about 23 percent. This result was similar to the appraisal estimate of about 22 percent—despite the lower tree growth rates estimated by PEM—because the adoption of monoculture lowered by about 40 to 50 percent the anticipated establishment cost. The PPAR raised concerns about the sustainability of the Project to achieve the expected high economic return at the end of the Project life. The sustainability of Project benefits depended to a large extent on (i) continued availability of a labor force to apply the required silvicultural treatments, (ii) research efforts to alleviate diseases that could reduce the commercial value of the timber, (iii) measures to promote market demand and alternative uses for *Acacia mangium*, and (iv) improvements in the process of selecting and engaging plantation contractors. Nevertheless, the PPAR rated the Project as generally successful.

#### **D. Rationale and Objectives of Reevaluation**

20. The Bank's reviews and assessments of the Project at completion and at postevaluation were made when the Project was still at a relatively young stage. Forestry plantations sawlogs take about 20 years to mature (including initial years of establishment and 15 years of growth). At the time of postevaluation in 1991, the oldest stands were about 6 years old and the trees were still immature. Although the Project's actual expenditures on forestry plantations were known, evaluation results were based largely on expectations and projections of product prices, tree growth, and other operating performance. Hence, judgment about long-term benefits and sustainability of the Project could only be considered indicative or preliminary. In addition, the PPAR raised a number of issues (see paras. 16-19) on which the sustainability of the Project benefits depended. To attain the expected outcome of the Project, it is crucial that the Government resolve these issues after postevaluation.

21. Reevaluation of the Project enables the Bank to take a second look at the performance of the Project's forestry plantations when many planted areas would have trees about 11 to 12 years old. The trees at this age would have attained maturity and the estimation of tree growth would be more accurate. Thus, the reevaluation would be able to arrive at firmer conclusions on the long-term performance and sustainability of the Project. Reevaluation also enables the Bank to critically examine the Government's resolution of various issues raised during PEM. Since large-scale forestry plantation development is new in Malaysia, it is an opportune time to identify and examine the new constraining factor(s) that may have emerged during the period after Project completion. Another objective is to examine and

identify Project issues of relevance prior to the last phase of plantation growth leading to harvesting of trees.

22. The Reevaluation Study Report is based on the findings of a Reevaluation Mission (REM) that visited the Project area from 17 March to 2 April 1996 and on a review of the Bank's previous postevaluation findings and the PCR; Project material in the Bank's files; and discussions with officials of the Bank, the EA, and other concerned agencies of the Borrower and with relevant research institutions and private contractors involved in implementation. The draft report was circulated to other departments of the Bank and the EA for their review and comments. Comments received were taken into consideration in finalizing the Report.

### **III. REEVALUATION FINDINGS**

#### **A. Assessment of Project Design and Implementation**

23. The broad design of the Project was straightforward and addressed mainly the key technical aspects of plantation development in terms of plantation establishment, forestry infrastructure development, and provision of support services. REM concurred with the comments of PPAR on the risks and advantages of developing the forestry plantations as single-species plantations. However, two major issues were not mentioned in the PPAR and were important from the Project design viewpoint. The risks involved in establishing a forestry plantation industry on a large scale for the first time had not been carefully analyzed during the design stage. The size of the Project (40,000 ha) is considered too large in view of the uncertainties in both the agronomic and marketing aspects. There were no trial results/information or data on silvicultural treatments or maintenance regimes best suited to a particular species under local conditions. This was the first large-scale forestry plantation development not only in Malaysia, but in the region as well. The second design defect was the lack of design measures to overcome the inexperience of the local contractors. As this was a new undertaking to be developed, foreign contractors with forestry plantation experience should have been allowed to participate, at least during the initial establishment phase. The inexperienced local contractors, coupled with labor constraints, affected the timeliness and quality of plantation work, both vital to plantation success.

24. As indicated in the PPAR, the implementation of the Project followed closely the major technical requirements as envisaged at appraisal. However, delays in operational activities and maintenance of planted trees were experienced. Delays in silvicultural treatments were mainly due to the longer than expected bidding process and the contractors' inability to recruit sufficient laborers to fulfill their obligations. The inexperience of the contractors was also partly to blame for the delays. A notable feature during implementation was the flexibility displayed by the executing and implementing agencies as well as the Bank in responding to changing circumstances. As a result of their flexible attitude, the plantation was planted with the most promising species and two other species that were not performing well were dropped. There was also substantial improvement in the tendering procedure, which substantially sped up the bidding process.

#### **B. Operational Performance**

## 1. Plantation Establishment

25. The Project envisaged completion of the establishment of 40,000 ha of forestry plantation by 1989. PEM reported the achievement of about 35,000 ha at Project completion. The estimate made at the time of REM indicated a total stocking area of about 29,500 ha plantations in the four participating states. This represents some 5,500 ha, or 16 percent less than the PEM estimate. The latest figure was based on a remapping exercise conducted by FDP in association with a Swedish mapping company in 1993, which used updated aerial photography and modern satellite technology to determine the stocking area. The main reasons for the reduction in area estimate are thought to be (i) miscalculation of internal gaps in the original survey, which concentrated on perimeter measurements; and (ii) subsequent mortality of trees. The bulk of such discrepancy appears to be in Johore state, where swampy ground and root rot disease resulted in many gaps (open areas) within the plantation.

26. The Project forestry plantations comprised 92 percent *Acacia mangium*, 6 percent *Paraserianthes falcataria* and 2 percent *Gmelina arborea*. The final distribution of plantation areas was 39 percent in Pahang, 35 percent in Johore, 22 percent in Selangor, and 4 percent in Negri Sembilan. Plantation areas by year of planting and locations are given in Appendix 1.

27. Establishment operations were considered appropriate and successful, with nursery management and production efficiently carried out. The growth of seedlings in the nurseries was good and no incidence of pests and diseases was reported. This was attributed to adequate light and water, fertile soil, and proper nursery treatments. Initially, *Acacia mangium* seeds were procured from Australia, but from 1988, seeds were increasingly purchased from Sabah. The seeds from Sabah appeared to have yielded better results in terms of growth and form.

## 2. Silvicultural Management

28. The plantations were established on a 15-year rotation cycle with the objective of producing sawlogs and smallwood. All stands essentially had the same schedule of silvicultural treatments (details are given in Appendix 2), which entails five treatment operations between planting and harvesting, each consisting of one or more operations of singling, pruning, thinning, and fertilizer applications. Delays in applying silvicultural treatments were reported by PPAR, but the situation became worse in subsequent years. The combination of lack of experienced contractors, labor shortages, and delays in tender approvals led to further delays in most operations, ranging from about one year for initial singling and pruning, to about four years for final thinning. Many of the older stands are approaching, or have already passed, the age of final thinning (scheduled to be around 8-9 years). It is observed that contractors have a tendency to thin the good quality trees in the final round of thinning, and this affects the final value of the plantation crop. The contractors do not understand that an important priority in thinning is that the trees with high quality should be left unthinned to ensure the highest quality for the final crop. Field staff should give greater emphasis to overseeing the commercial thinning operations to ensure that good quality trees are not extracted by contractors. It is noted that FDP field supervisors are intensifying monitoring, and higher penalty will be imposed on contractors who fell good quality trees.

### 3. Growth and Yield

29. Growth rates have not been as high as envisaged at appraisal. The main reason for this was the delay in silvicultural treatments, which has resulted in overstocked plantations. This, in turn, has seriously affected tree growth, as *Acacia mangium* requires timely thinning to ensure continued diameter growth. Heart rot and root rot in some areas also have a detrimental impact on expected yield. REM observed that because of delays in silvicultural treatments, average stocking rate was often higher than the schedule stipulated, and this has contributed toward a lower average tree size. Recent growth plot analyses indicate that the trees will have an average diameter at breast height (dbh) of only around 31 cm at age 15, compared with the target dbh of 45 cm. This will have a major impact on yields and returns. Given similar tree heights, the average tree volume will only be around 50 percent for a tree with 45 cm dbh. The volume of the knot-free pruned wood will only be about 40 percent of the appraisal estimate or even less, given the significant delays in pruning treatments.

30. Commercial thinning was planned to be undertaken at age 8 to 9 years, but so far only about 350 ha have been thinned commercially. Because of delays in silvicultural treatments, the areas thinned were mostly around 11 years of age. The products from commercial thinning are a combination of sawlogs (larger than 20 cm diameter) and smallwood. The latter, however, has limited local market. Results from the 350 ha commercially thinned to date indicate that an average of 10 m<sup>3</sup> of sawlogs per ha and 4.5 m<sup>3</sup> of smallwood per ha can be obtained from the operation. Because of poor tree form (resulting from delays in maintenance operations), presence of heart rot, and the unproven nature of the species (new product in local market), the Project plantations receive only the standard royalty and cess revenues from wood sales with the average income of about RM137 per ha (see Appendix 3).

31. At appraisal, acacia plantations were expected to yield 159 m<sup>3</sup> of sawlogs per ha and 161 m<sup>3</sup> of smallwood per ha at final harvest. Based on current growth rates, REM estimates that clear felling total yield at age 15 years is about 227 m<sup>3</sup> per ha, comprising 60 m<sup>3</sup> of sawlogs per ha (26 percent) and 167 m<sup>3</sup> of smallwood per ha (74 percent). Appendix 3 gives the yield projection of *Acacia mangium*. These estimates take into account deductions and down-grading because of heart rot, root rot, poor form, and logging damage. In terms of final yield, the estimation indicates an average mean annual increment (MAI) of 15.1 m<sup>3</sup> per ha per year, compared with the appraisal estimate of about 20 m<sup>3</sup> per ha per year.

### 4. Pests and Diseases

32. The trees are generally in good health. However, heart rot after Project completion became a problem in some areas. This was considered sufficiently serious that the FDPM placed a moratorium on planting *Acacia mangium* from 1992 to 1993 while the matter was under investigation. The series of studies then undertaken on the 3- to 9-year-old trees indicated that the disease was localized and affected only a small portion of the area planted. The actual volume affected was between 5 and 10 percent of the stand volume. The studies also confirmed that the extent of heart rot increased with age, and this trend is expected to continue through to planned harvest age. The moratorium was subsequently lifted in 1993. Unfortunately, the Government did not monitor the situation and there has been no ongoing research into the incidence of heart rot in the older stands. The Project has not collected any data on the extent of heart rot damage in the planted area, but REM's observation and discussions with local sawmillers (who processed sawlogs and smallwoods

from thinnings) and plantation managers indicated that the heart rot problem is worsening, especially with older stands in the wet and low-lying areas of the Selangor plantations (Rantau Panjang).

33. Another main fungal disease problem is root rot, which is causing significant mortality in Johore Ulu Sedeli plantation. Over 35 percent of the planted area was estimated to have root rot infection. The disease appears to attack trees in the older stands (over 10 years old). The effect of root rot is easy to identify as the trees show symptoms of drying up. At the time of REM, the Project had not collected information on the extent of damage from root rot and no causal factors had been identified by FRIM. Only preliminary samples were collected for testing and identification. Lack of research efforts in disease control and prevention from the early stage of plantation development has been the biggest drawback in the CFPP. The Government has recently intensified research efforts in identifying the diseases and in undertaking long-term research activities through collaboration between FRIM and the Agricultural University of Malaysia.

## **5. Forest Protection and Infrastructure**

34. To date, there has not been any significant fires in the Project plantations. A few small fires were reported, but they caused little damage. The forestry plantations are all located in areas with reasonable year-round rainfall, thus reducing the risk of a major fire outbreak.

35. The main road network within the forests appears to be satisfactory, except that a few roads in some plantations are in poor condition and are usable only by four-wheel drive vehicles. REM noted that all the main arterial roads are well maintained and kept open at all times to facilitate fire control, and to assist in general forest monitoring and management.

## **C. Institutional Impact**

36. Under the Project, the technical capability of FDPM and state Forestry Offices in forestry plantation development has been strengthened. In the past, the forestry officers were engaged mainly in some silvicultural work in the natural dipterocarp forests, and forestry plantations development was new to them. The local training provided under the Project enabled field staff such as rangers and foresters to acquire skills in various aspects of managing large-scale forestry plantations. The overseas training provided to senior officers enabled them to strengthen their fields of specialization and gave them opportunities to interact with forestry plantation experts in countries where forest plantations have been well established. Ongoing contacts and exchange of information among local officers and foreign experts have been beneficial to the Project. There were indications of significant improvements in plantation establishment practices in those plantations established at the later stage of Project implementation as well as those established under the second phase of the Compensatory Forestry Sector Project.<sup>1</sup> Project management has been responsive to field conditions, and the lessons learned from nursery establishment and initial plantings were incorporated in subsequent plantings. Thus, the Project has had an institutional impact on the Malaysian forestry sector in terms of creating a technically capable institution to establish an entirely new forestry plantation industry. Nevertheless, some less than satisfactory institutional impacts were observed with respect to (i) creating an effective

---

<sup>1</sup> Loan No. 921-MAL: *Second Compensatory Forestry Sector Project* for the amount of \$29.5 million, approved on 17 November 1988.

monitoring system, (ii) developing different schedules of silvicultural practices for different environments, and (iii) establishing effective research capability in plantation forests.

#### **D. Socioeconomic Impact**

37. The Project generated about 200 employment opportunities for Project management and technical personnel and about 500 jobs for contract laborers. Nearly all of the plantation workers are immigrant laborers. Most of the plantations are located in areas with low population pressure. There is little or no community involvement in the Project. The Project has provided very little direct benefits to women; very few of them are employed either as contract laborers or as Project staff.

#### **E. Environmental Impact**

38. The Project has been environmentally beneficial. The creation of a forest on a degraded area has reversed land degradation.<sup>2</sup> In the without-Project situation, the degraded land would have been continuously subjected to exploitation by local people through extraction of any valuable wood and poles from small trees. Eventually, the area would become highly degraded and exposed to erosion and river silting. Under the Project, the forest plantations enhanced local microclimatic conditions. Except for a short time when the trees were being established, the forests generally have a positive effect on erosion control and on water quality. Although essentially a monoculture, the undergrowth in the older stands is significant and variable, with a wide range of fauna and flora growing under the forest plantation trees. The forests have allowed the revival of animal, bird, and insect populations, thereby improving biodiversity. During land clearing, soil is exposed to greater erosion. However, the Project adopted good erosion control measures normally practiced in rubber and oil palm plantations, such as terracing in steeper areas, and retained ground cover whenever possible during the establishment phase. After two to three years, the tree canopies coupled with the undergrowths effectively eliminate soil erosion.

#### **F. Economic Impact**

39. The EIRR for the Project was reevaluated to be about 8 percent (see Appendix 4). This is significantly lower than the appraisal and postevaluation estimates of about 22 and 23 percent, respectively. The PCR did not calculate any EIRR. The EIRR was lower because the yields and outputs from the commercial thinning and final harvestings are expected to be significantly lower than the estimates made at appraisal and at postevaluation. As mentioned in paras. 28-30, delays in silvicultural treatments resulted in poor yield and, coupled with the disease problem, substantially affected the volume of timber to be harvested in year 15 of planting. In addition, the prices used in the EIRR estimation at appraisal and postevaluation were based on the price of Meranti sawn wood (with adjustments), which is a high-value product from natural forest. It was anticipated at appraisal that Malaysia would face shortage in timber wood and need to import timber and timber products by mid-1990s and, hence, used the import parity price of Meranti for estimation of economic stumpage values. At appraisal, the Meranti price was discounted by 30 percent to adjust for the quality differences of the timber produced. Similar assumptions were used in the PPAR. A 50 percent discount

---

<sup>2</sup> Degraded land denotes land where most of the trees have been cut down and removed. The land consists of secondary bush/shrub dominated by lalang-lalang (*Imperata cylindrica*).

was made to adjust for the quality differences. No basis was given for the percentage discount. REM, however, used lower prices for the wood products in the EIRR reestimation, and this is another reason for the lower EIRR derived. It was found that the smallwoods obtained from commercial thinnings fetched a significantly lower price (about RM20 per m<sup>3</sup>) than anticipated at appraisal and postevaluation (about RM40 per m<sup>3</sup>). Discussions with local sawmillers and timber traders indicated that it would be more realistic to use the price of rubberwood as a basis for estimating the value of acacia wood. The sawlog prices used by REM is about RM60 per m<sup>3</sup> compared with over RM200 per m<sup>3</sup> used by PEM (based on World Bank commodity forecast on Meranti wood in 1991). Appendix 3 provides details on estimating the stumpage values. Sensitivity analysis indicated that the EIRR is more sensitive to changes in price in relation to other factors like yield, harvesting cost, and actual cropped area. If the price increases by 20 percent, EIRR goes up to 11.8 percent. On the other hand, if the price decreases by 20 percent, the EIRR goes down to 2.1 percent. Similarly, in view of uncertainties in the spread of heart rot and root rot diseases, if the area or yield declines by 20 percent, EIRR will be reduced to about 6 percent (see Appendix 4, Table 3).

40. The FIRR estimated by REM is about 5.8 percent. The lower value was derived because the financial prices for wood products were lower than the economic prices.<sup>3</sup> The FIRR is significantly lower than the appraisal and PEM estimates of 15 percent and 21 percent, respectively. This is because REM has made more realistic assumptions of lower tree growth rates and wood prices in the estimation. The current estimated FIRR indicates that the financial return on forest plantation to produce sawlogs (15 years cycle) is not a financially attractive proposition. From the current stocking area, tree size, and growth rate, REM estimated that the total wood production from the Project is expected to decline from a target at appraisal of 11.7 million m<sup>3</sup> to about 6.7 million m<sup>3</sup> (57 percent of target) by the end of the Project cycle.

#### **G. Project Sustainability**

41. The Project has resulted in the establishment of some 29,500 ha of forestry plantations. Although some areas are infected with fungal diseases (heart rot in Selangor and root rot in Johore) and tree growth rates are below expected levels because of delays in silvicultural treatments, the plantations in general are well established and in healthy state. The FDPM and state Forestry Offices are well staffed with qualified personnel to manage and operate the plantations. Given the current lower than expected growth rates and yields at the four subproject sites, the final harvesting yield (at age 15) could further be eroded if the disease problem becomes serious in the older stands. Hence, a sustainable yield from the plantations can only be attained provided that (i) the heart rot and root rot diseases are placed under control and prevented from spreading to other areas; (ii) silvicultural treatments particularly the commercial thinnings are speeded up in areas due for treatments; and (iii) research and development programs are immediately formulated to provide recommendations on optimum silvicultural treatments; protection from pests and diseases; and market development, promotion and downstream processing of acacia wood.

#### **IV. KEY ISSUES**

---

<sup>3</sup> The price divergence is due to the conversion of the domestic prices of some non-traded items to their border prices for the economic evaluation.

## **A. Research and Development**

42. The decision in 1985 to support the Compensatory Forestry Sector Project to grow *Acacia mangium* for sawlogs was a major management decision, considering the fact that such large-scale plantations had not been undertaken in Malaysia before and the Project could be considered experimental in nature. Applied research and development is crucial to devise optimum nursery and plantation establishment practice, silvicultural treatments, protection from pests and diseases, market development and promotion, and downstream product processing. Given the experimental nature of the Project, applied research and development efforts by concerned agencies have been seriously lacking in the Project. Although a Research Committee was formed, it meets only once a year, and low priority is accorded to plantation research and development. REM noted that in 1995 the Research Committee decided to set up special working groups to tackle specific problem areas; however, the tangible results of this decision are yet to be seen. The major issue facing the Project is how to organize the Research Committee into an effective entity to develop the urgently needed program for research and development. Research activities should also aim to provide recommendations on soil-specific planting material, planting design, and cultural practices.

43. Given the poor record in initiating and maintaining research work, there is urgent need for the Government to provide additional funding for FRIM to (i) undertake serious studies and to analyze and advise on a variety of issues, including a comprehensive disease identification and control program; (ii) formalize a forest growth monitoring program, train relevant field personnel in disease identification and growth monitoring; (iii) prepare growth and yield tables for *Acacia mangium*; (iv) develop a computerized stand recording system; and (v) introduce provenance trials and species improvement research.

## **B. Growth Monitoring**

44. Growth monitoring is done by periodic measurements of a series of growth plots. This helps to determine the proper timing of silvicultural treatments (e.g., pruning and thinning). Growth monitoring is the responsibility of FDPM. Currently, there are far too few growth plots for reliable analyses to be made. The growth plot coverage is only 0.01 percent of the planted area (i.e., 3 ha out of 29,500 ha). This is insufficient to provide reliable growth prediction, let alone analyze variations by provenance, soil, location, rainfall, stocking or other variables, which would be crucial for management decision making. Nevertheless, FDPM has recently extended its effort on growth monitoring by including more growth plots throughout the plantations. There is urgent need to increase the number of permanent sample plots and establish a system of random plot measurements throughout the plantations. The inventory work should be the responsibility of the field staff in each state Forestry Office. Forest inventory should be considered a management responsibility rather than a research responsibility. The results of this inventory should be made available for research, but would also be useful for the field staff to understand their forests better and thus improve their ability to make appropriate management decisions.

## **C. Labor Constraint**

45. At the time of PPAR, a major issue affecting the sustainability of the Project was the inadequate supply of plantation labor. It was difficult for contractors to find local labor to work in the plantations. The main source of labor was foreign immigrants, who were less stable

and more difficult to control. The labor situation has worsened since the time of PEM and seriously affected the timeliness of maintenance operations. Treatment operations are significantly delayed in most plantations. Given that overcrowding of *Acacia mangium* leads to significant reductions in diameter growth, these delays, especially in thinning, would result in lower yields than originally envisaged. Another labor-related issue was that the significant increase in local crimes, possibly committed by foreign immigrants, has led to the Government's intention to tighten measures to curb illegal foreign laborers and control the issuing of foreign work permits. These measures would further put pressure on labor availability in the local market. This will further delay the silvicultural treatments in the forestry plantations. Recent efforts by FDPM through introduction of less labor-intensive silvicultural treatment and improved management practices would help in relieving the labor constraint in the future. If labor constraint is a permanent feature in Malaysia, there is need to examine the strategy for forestry development to change the maintenance schedule to a less labor-intensive one, such as growing the trees on a shorter rotation to produce pulpwood only. The areas managed for sawlog production could then be scaled down to only those with the best growth rates.

#### **D. Privatization**

46. In line with the Government's policy under the current Seventh Malaysia Plan (1996-2000), the MPI intends to privatize all plantations established under the Project. REM supports the policy as it will bring about more efficient usage of resources and the private sector would introduce better and efficient management practice into Project operations. Although a number of private companies (including some from overseas) have expressed interest in joint ventures with the state governments to buy over the forestry plantations, the details of the privatization program (such as pricing and future land status) have not been worked out. There is a need to carefully map out the privatization scheme to prevent the private companies from converting the land to non-forestry usage after the first harvest. It is, therefore, important to ensure that the pricing policy and regulatory environment in the timber industry are conducive enough to enable the private company to manage its operation in a most efficient manner so as to realize a viable financial rate of return from its investment. Under private management, it is possible to streamline maintenance, operational, and harvesting processes so that the unit cost of production could be substantially lowered. To overcome the potential disease problem associated with the aging of acacia trees, the private company could consider changing the harvesting strategy to produce pulpwood rather than sawn log. This, and various other options, could be pursued by the private sector to realize a high return from its investment.

47. It is envisaged that the privatization process will entail the selling of the existing crop, and the leasing of the land for subsequent rotations. To get the best return in the privatization process, the value of plantations must be properly assessed. Therefore, there must be reliable and detailed information about all important aspects including stocked area by age-class, tree size, growth rates, likely future yields, costs of management, harvesting costs, potential markets, and revenues. This will provide a basis to determine a reliable value of the Project plantations. The time frame for the privatization process has not been determined yet. If it is to occur in the short term, then a rapid program of data collection and analysis will need to be initiated. Experience from other countries has proven that the greater the reliability of information on forest resources, the higher will be the sale value. Potential buyers tend to offset uncertainties by increasing the discount rate used in the valuation, resulting in lower assessed value. It is important that consultants with experience in forest privatization in other countries be employed to assist in the valuation and in developing a strategy on how the plantations should be privatized.

## **E. Harvesting Policy**

48. Constraints in labor supply coupled with contractors' inexperience in forestry plantation management had delayed maintenance operation, which subsequently affected tree growth. Localized disease outbreaks (root rot and heart rot) significantly reduced the older stands (over 10 years old), which are due for harvest in a few years. If the disease outbreak continues to spread to other areas, losses would be significant if harvesting were to commence at the scheduled 15th year of growth, as stated in the Project design. The Government needs to quickly determine the extent of damage caused by root and heart rot, how fast these diseases are spreading to other areas, and examine the need to harvest the trees earlier than the scheduled date to cut losses. The Government recently initiated a survey to determine the extent of root disease in Johore. If necessary, early harvesting will need to be carried out to reduce loss from the disease.

## **V. CONCLUSIONS**

### **A. Overall Assessment**

49. The reevaluation study has confirmed the PPAR's finding that the Project played an important role in developing forest plantations as a source of timber supplies in Malaysia. The establishment of plantations on logged-over and degraded area has brought about a positive impact on the environment in terms of erosion control and increased biodiversity. The Project has also had a significant institutional impact on the Malaysian forestry sector in terms of creating a technically capable institution to establish and manage forest plantations. However, the reevaluation has found that the problems of shortage of labor to carry out silvicultural treatments and of pests and diseases, which were identified during postevaluation in 1991, have not been resolved. In fact, the labor constraint has worsened causing significant delay of treatment operations in most plantations. This, coupled with the unabated diseases (heart rot and root rot) among the older stands, would adversely affect tree growth and yields. It is estimated that the production of sawlogs resulting from the Project would reach only 57 percent of the appraisal target. The EIRR was reestimated at 8 percent, which is significantly lower than the appraisal and postevaluation estimates of 22 percent and 23 percent, respectively. In view of the significantly lower economic benefits, the Project rating is reclassified from generally successful given at postevaluation to partly successful.

### **B. Lessons Learned**

50. Venturing into the development of a new industry (forestry plantation) coupled with the adoption of a single-species technology entails potential high risks and uncertainties. Large-scale support by the Bank in developing a new industry technically experimental in nature should be avoided. Support should be provided on a pilot basis and accompanied by a strong research and development program.

51. Plantation forestry relies heavily on regular growth monitoring and updating of forest descriptions. Without these tools, it is very difficult, if not impossible, to make the necessary management decisions to achieve optimum results. Regular monitoring of growth and performance should be part of forestry management inputs.

52. The availability of project inputs such as labor, seeds, and land must be considered in more detail at project design stage. Insufficient supply of labor in the current Project is the single major factor limiting its success. Project design should give due emphasis to address the labor constraint in all future Malaysian projects where labor constitutes a major input in establishment, operation, and maintenance of project outputs.

53. Perennial crops such as forest trees usually undergo a long immature phase and factors affecting project benefits may show at a late stage of development. Postevaluation of the Project at about two years after Project completion may not capture those aspects that may develop later and which will affect growth and yields (e.g., incidence of diseases increased with age of trees). A reevaluation at a later stage would be appropriate for perennial crop projects. Related to the long maturation of timber plantation and uncertainties in benefits, there is need to avoid rushing into implementing a similar project until the lessons learned from the first Project have evolved.

## **C. Follow-up Action**

### **1. The Government**

54. The Government needs to ensure that additional funding is provided to both FDPM and FRIM to develop and initiate a research and development program for plantation forests to determine the most appropriate regimes for silvicultural treatments and to identify and treat fungal diseases (such as heart and root rot) as well as to determine ways to prevent the diseases from spreading to other areas.

55. FDPM and the state Forestry Departments should initiate an improved growth monitoring program.

56. The Government should make clear its time frame and general concept for privatization of the plantations. FDPM should develop and initiate a strategy to determine the most appropriate value of the tree stocks as an important part of the privatization process.

### **2. The Bank**

57. Since forest plantations have also been established under the Second Compensatory Forestry Sector Project (Loan No. 921-MAL) which is still ongoing, the Bank's Projects Department concerned should continue to monitor the progress of the actions taken by the Government to address the problems of pest and diseases. Progress on privatization of forest plantations should also be monitored. The feedback from these two aspects is important for designing future forestry projects.