

**CIRAD-Foret / ICSB**  
**Plant Improvement and Seed Production Project**

***PISP RESEARCH PROGRAMME:  
REVIEW AND PROPOSITIONS***

**Contribution of Dr. Roberto Bacilieri**

**December 1997**

**LUASONG, SABAH, MALAYSIA**

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# ***PISP RESEARCH PROGRAMME: REVIEW AND PROPOSITIONS***

**Contribution of Dr. Roberto Bacilieri**

**December 1997**

## ***INTRODUCTION***

After height years of work and experience in the field, it is time for the Plant Improvement and Seed Production Project (PISP) to make a balance of its research activity, reviewing positive and negative aspects, achievements and inconsistencies.

In 1989, our predecessors have launched PISP with much enthusiasm. At the beginning, it was an easy-to-fund structure, because of its original concept and of the encouraging effort of French and European Institutions. However, everybody's expectation is that along the years a child grows up and is able, one day, to self-sustain.

The running costs of PISP have increased during time, because the personnel as well as the range of activities have constantly been improved and expanded; on the other hand, funding from external agencies has decreased. Thus, PISP evolution must be reviewed and redefined very carefully, in order to avoid that the combination of increasing costs and decreasing external funding deflates, one day, the whole structure, leaving both companies poorer in term of research.

There is a way to improve the deceleration trend, and is to give a better focus to our work by discarding or delegating the useless or low priority activities on one hand, and moving towards fields of expertise where there is a larger economic interest on the other hand. The present document analyses the pertinence of the present research activity, both from the economic and scientific point of view, and suggests alternative directions to boost PISP, together with CIRAD-Forêt and ICSB, to a brighter future.

## ***DEFINITION AND FUNCTIONS OF PISP***

The objectives of PISP as described in the Plan of Operations (PoO) 1993-1997 are summarised in Table 1.

A first problem arises at this point. PISP is physically located at the Luasong Forestry Centre (LFC). The scopes of LFC are two-folded: on one hand, LFC is designated to the enrichment of a logged-over dipterocarp forest by rattan (80%) and high-value timber species (20%) line planting (approximately 1,000 ha / year); on the other hand, through its Inventory



and Production Units, LFC manages the conventional activity of timber logging (around 5,000 ha / year) in the Yayasan Sabah's forest concession (Tawau region).

Thus, the PISP's objectives are not really coherent either with those of ICSB or with those of LFC. This is evident at several points:

- 1) considering that the main ICSB's source of revenue is timber production from the natural forest, the task to enrich a small portion (1/5) of the logged area with rattans, even if legitimate, seems not to be the first priority.
- 2) pulpwood and industrial species cannot be planted in LFC;
- 3) commercialisation of superior quality seeds or propagules is not coherent with the LFC activity of line planting; Luasong is also too far from the market;
- 4) more technically, it is not worth to establish a costly improvement program for high-value timber species only for the 20 % of line planting (200 ha/year) that is carried out in LFC.

On one hand, we have to congratulate our predecessors who wrote this PoO, for it is broad and ambitious, thus leaving to PISP much space for evolution. This is specially appropriate for a research structure that wants to be a centre of excellence for forestry at an international level. On the other hand, we have to regret that since 1989, PISP has not been able to expand its influence beyond the LFC's activity of enrichment planting.

A further contradiction resided into the list of duties given in December 1995 by ICSB to the CIRAD-Forêt's scientist, which only mentioned rattans. This contributed to dig a larger gap between ambitions and reality.

### ***EVOLUTION OF EXTERNAL FINANCIAL AIDS TO PISP***

Since its inception in 1989, PISP has received the support of the Ministry of Foreign Affairs (MFA) and Ministry of Agriculture (MA) of France. Direct funding from MFA and MA totalled around 450,000 RM<sup>(\*)</sup> per year in 1989 and 1990, but decreased slowly along the years, to attain a low 50,000 RM in 1997 (PBL and GIS included); in 1998, this amount is expected to drop again.

Together with the direct funding, MFA also provided the French Junior Scientists (JS) that contributed so much to the quality of the PISP's work. This line has been closed with Mr. Pajon (1996 and 1997), who was the last JS as far as MFA was concerned. The next JS must be hired directly with the company's fund.

The Commission of the European Community (CEC) supported the rattan project with a first funding of 110,000 RM for the period 1992-1993. Then, a new project started in 1994, injecting

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<sup>(\*)</sup> All the estimations given here must be considered as large approximations ( $\pm 15\%$ ), due to the instability of the exchange rate between Ringgit and French Francs, to the fact that not all the information is available in Tawau, and to the fact that I am not an expert accountant.

a total of 330,000 RM to CIRAD-Forêt and 640,000 RM to ICSB over four years. This aid will also be terminated in June 1998.

Since 1989, all together French and European Institutions have injected to PISP through both CIRAD-Forêt and ICSB about 2,500,000 RM (this calculation takes in account that, starting from 1991, about 50% of the MFA's contribution was attributed to the Plant Biotechnology Laboratory). Both CIRAD-Forêt and ICSB further supported PISP with their own funds. For what it is given to know in Tawau, as an example in 1996 the running costs of PISP have been of 650,000 RM for ICSB and 300,000 RM for CIRAD-Forêt (BCRD). In addition, ICSB also reimbursed to CIRAD-Forêt a percentage of the Senior Scientist's salary (~100.000 RM / year). But I leave the precise analysis of these contributions to our respective company's accountants. Just let me say that ways to evaluate the investment into research include: 1) to calculate the percentage it takes compared to the total company's income, and 2) to compare expenses to benefits.

### ***ANALYSIS OF THE PRESENT RESEARCH ACTIVITY***

The above-mentioned discrepancies among LFC's objectives, PISP's objectives and the list of duties of the CIRAD-Forêt's Scientist have made the choice and prioritisation of the research activities a complicated task. Table 2 summarises the important activities of the period 1995-1997. In the following paragraphs, we will analyse and comment the research activity species by species.

#### **- RATTANS: TECHNIQUE**

*From 1995 to 1997, PISP devoted a large effort to rattans, thanks also to the financial support from the CEC. MFA and CIRAD-Forêt provided two expert backup missions for rattan silviculture (M. Bourgoing, 1995, and M. Deleporte, 1996) and one mission on rattan genetics (M. Bouvet, 1996).*

*Most of the important points of rattan silviculture have been studied. For the majority of the experiments the results are already available and have been published in internal notes or international papers.*

*Technical knowledge for improving the rattan silviculture is now available. We estimated that the rate of growth of rattans in the field can be increased of about 30% by improving the nursery practices (fertilisation, better substrate, better watering, slightly bigger polybags, better selection and culling practices) and the quality of the plants at plantation. We also gave evidences that another gain of at least 30% can be achieved by improving the plantation technique, especially by using aerial photo interpretation of the forest cover to chose the compartments to be planted.*

*Some of our recommendations have been absorbed by the LFC staff, especially those concerning the nursery. By contrast, progress in the plantation has been slow if not*



*absent: 1) a map of the forest cover (drawn from a SPOT satellite image, IFN/CIRAD-Forêt) was available since 1992 but has never been used; 2) aerial photos were available since November 1996 but the interpretation work has not started yet; 3) the LFC's control of the plantation contractors is poor and there is no evident effort to change this status quo (in contrast to what has been achieved by contractors-training at INFAPRO<sup>o</sup>, for example); 4) in spite of the fact that recommendations were given since 1992 (R. Nasi) to switch to large diameter canes with higher market value, for long time LFC has persisted with nearly exclusive planting of *C. caesius*, a small cane with a low market price; *C. caesius* covers at present about 75% of the plantation; 5) in general, the response of the plantation unit is low.*

Thus, many PISP's suggestions for the improvement of rattan planting are still waiting for implementation in the field. A further point to be developed in 1998 remains the harvesting technique.

Rattan genetics have been worked out through collection and establishment of provenance/progeny trials; taking in account the difficulty to reach the farthest natural populations and the depletion of the most accessible ones, collections in Luasong are now as complete as possible. Controlled pollination has been achieved in PISP for the first time within the scientific world.

The work on rattan conservation, domestication and genetics, apart from the evident advantage to have in-house seed sources for species with depleted natural resources, is important to develop rattan "varieties" with better growth and better quality. For *C. caesius*, the first analysis showed that a gain of about 15% in growth can be achieved by a selection pressure of 0.1 (i.e. by selecting 10 parental plants out of 100), and additional value can come from parallel selection on cane quality characters. However, we estimate that at least three to five additional years will have to pass before the first results of the genetic improvement program can transfer to the field.

#### **- RATTANS: ECONOMICS**

*The first point to highlight is that on the average the performance of the LFC's rattan plantation under logged-over forest is poor. The main reason behind this is that in the past the plantation was "blind", covering 100% of the forest even when it was very dense; six years after plantation, in some of these highly stocked compartments, rattan growth can be measured in terms of few centimetres. However, even in the best compartments the growth is still heterogeneous, most probably due to a combination of variable seedling quality at plantation, poor maintenance and environmental heterogeneity.*

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<sup>o</sup> ICSB / FACE foundation project for Absorption of Carbon Emissions through forestry, Lahad Datu, Sabah.

*Some improvement can be achieved by adopting the above-mentioned techniques (aerial photo-assisted plantation, better plant quality, better maintenance, contractor training, etc.). However, with so heterogeneous forest conditions, it seems clear that a perfectly homogeneous and fast growing rattan plantation is not an attainable target.*

*Consequences: compared to other rattan plantations under fast growing tree species (as Sejati or Boon Rich) the production per hectare will be lower and the harvesting costs higher. The final income and competitiveness of the product on the market will be affected.*

*As for the market, the scarce available information (the rattan market study has not started yet) indicates that rattan price is very low, mainly due to the import of cheap raw material from Kalimantan. As a consequence, even good mature plantations as Sejati (which has few hundred acres of 13-years-old *C. manan*, one of the most valuable canes) do not harvest because the low market price does not justify the harvesting costs.*

A precise figure of the costs and revenue with rattan plantation was given by FRIM. In 1997, they harvested a 12-years-old *C. manan* plantation established under a pine forest. The plantation cost (including maintenance) was of about 1,200 RM, that at a composite interest rate of 10% (bank loan), sums up to 2,500 RM after 12 years. Harvesting cost 4,000 RM ha<sup>-1</sup>. Finally, the product (2,800 mature sticks of 4 meters long) was sold at 14,000 RM ha<sup>-1</sup>, leaving a balance of 7,500 RM ha<sup>-1</sup>, that translates to a net average revenue of 620 RM ha<sup>-1</sup> year<sup>-1</sup> (of course this calculation does not take in account expenses related to land tenure, planning, administration, monitoring, road maintenance, etc.). I obtained a similar estimation by replacing in the *C. merrillii* model developed for Philippines by Belcher (1997), the actual cane and labour price of Sabah<sup>9)</sup>.

However, both the FRIM and Belcher's case studies seem to be too optimistic to be applied in LFC. The main difference is due to the fact that the LFC plantation is established under a dipterocarp forest, and here the growth is slower. Our prediction, made at year 6 on the LFC's *C. subinermis* plantation, is that at year 12 the production will be of only 8,000 linear meters (mature plus immature cane), that translates to some 1,200 mature 4-meter sticks per ha. In this case (and assuming again a price of 2 RM for a 4-meter batu stick) the net average revenue is 100 RM ha<sup>-1</sup> year<sup>-1</sup> (with an IRR at only 4% and a NPV at 57 RM).

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<sup>9)</sup> In the model of Belcher, I replaced: a site preparation and plantation (400 p/ha) cost of only 152 US\$ / ha for the Philippines with a cost of 400 US\$ for Sabah; the harvesting cost, estimated to be 156, 235 and 312 US\$ at ages 8, 12 and 16 in the Belcher's case, with costs of 300, 500 and 700 US\$ at the same ages in Sabah; a price of 0.37 US\$ for a 4 m pole in the Philippines, with a price of 1 US\$ in Sabah. With his assumptions, Belcher estimated that the Net Present Value (NPV) of a *C. merrillii* line plantation under dipterocarps was of 133 US\$ at a discount rate of 15%, with an Internal Rate of Return (IRR) of 19.5%. According to my calculation, in Sabah the net average revenue would be of 400 RM / ha / year, the NPV (at a discount rate of 15%) would be of around 500 RM, with an IRR near to 15%. Yet, this model assumes a good and continuous harvest, that most probably will not be the case in the real plantation.



Other factors that will affect the final income are: 1) lower rattan price in Sabah as compared to Peninsular Malaysia (hence the need of a rattan market study); 2) high percentage of low quality canes (*C. caesioides*) in the Luasong's plantation. By contrast, the lower manpower cost of Sabah and the plantation improvement obtained through silviculture and genetic improvement may contribute to balance the figure.

The rattan price is expected to increase in the future, mainly because there is still an important regional and local demand and the resource is depleted. However, the dynamics of the price in Sabah depends strictly on the Indonesian situation (Dieter & Bernaulus, 1997): if the illegal export can be stopped (by a stricter enforcement of the law or by a more attractive [government-controlled] rattan price in Indonesia), then the price in Sabah will increase. But the question persists to know if it is worth to invest the company's money on a matter the control of which is completely beyond the country's boundaries.

#### **- RATTANS: CONCLUSION**

*Considering the above studies, our suggestions for the future activity on rattans are to:*

*1) continue the routine long-term work on rattan genetic improvement; waiting for the trials to fruit, this mainly consists of trial maintenance and assessment; 2) put on stand-by other researches on rattan silviculture, at least until all the previous recommendations are successfully implemented in the field; 3) give a lower priority to rattans in the plantation. This will allow both PISP and LFC to pay more attention to other timber tree species (next chapters).*

#### **- HIGH-VALUE TIMBER TREE SPECIES: TECHNIQUE**

*From 1995 to 1997, Teak has been the most important timber species for PISP. Both genetic improvement and silviculture trials were established in the field. PISP has now a very complete genetic collection, which also includes improved material from Ivory Coast. Silviculture trials were established to study the appropriate thinning regimes, the performances of teak in open-planting, line planting, on compacted soils, and the characteristics of tissue culture material.*

*Years of research have given to PISP the mastering of the vegetative propagation (VP) technique for Teak. In 1996 and 1997, PISP produced Teak plantlets on a commercial scale, and some 40.000 cuttings were sold over two years. At present the commercial cutting production has been handed over to the LFC's nursery.*

*For *Khaya ivorensis*, field observation of eight-years-old line and open plantations indicated that this species performs very well in LFC's conditions, provided it is given a good maintenance. A provenance trial identified the best African provenances (Mopri, Yapo) for LFC. In 1997, thirty kilograms of seeds from these provenances have been imported*

through CIRAD-Forêt for the commercial plantation. Other species that perform well are *Xylia xylocarpa* and *Cedrela odorata*.

VP technique has also successfully been adapted to most of the high-value timber species (*K. ivorensis*, *X. xylocarpa*, *Teronema canescens*, *C. odorata*, etc.), and it is possible now to select and propagate superior plant material.

Concerning silviculture, we can confidently assume that the same set of indications given for rattans will also apply to high-value timber species plantation: improved plant quality at the nursery level; choice of the compartment to be planted on the base of their density (aerial photo interpretation); fine tuning of the plantation according to the microsite characteristics; choice of the superior provenances and genotypes; silviculture treatments.

#### - HIGH-VALUE TIMBER TREE SPECIES: ECONOMICS

*Concerning the line planting operation in LFC, the same set of observations made for rattan also applies to the high-value timber species line planting. At present, the average growth of high-value timber species in line planting is not satisfactory, mainly due to: 1) "blind" plantation; 2) lack of proper maintenance; 3) lack of silviculture (shade adjustment, liberation thinning); 4) lack of control on the contractors (i.e.: during maintenance, by mistake they slashed even the "good" plants; in some compartments, more than 50% of the plantation was destroyed in this way).*

*However, in the rare cases where the trees received good conditions (for example in the Macaranga-dominated forest or in the PISP trials) the growth was remarkably good. In our Khaya progeny trials, annual volume increment (calculated only for an average clear bole of 4 meters of height) from year 5 to 6 after plantation was of about 11 m<sup>3</sup> in open planting and 5 m<sup>3</sup> in line planting. It has to be noted that a shade adjustment treatment in line planting was applied only at year 6, and had no effect on the assessment. An earlier treatment could have improved the measured annual volume increment.*

Assuming that:

- 1) the plantation establishment cost for *Khaya* is the same than for rattans (1,200 RM / ha including maintenance) and the bank loan will be supported for 30 years at the same interest rate of the example above (10%);
- 2) the mean volume increment from year 6 to 30 is a conservative 8 m<sup>3</sup>;
- 3) the cost of thinning is repaid from selling the timber (this will not be the case for the first thinning but the later thinnings will give a positive balance);
- 4) the rotation is 30 years with a final merchantable volume (clear boles only) of 200 m<sup>3</sup> (this is not science-fiction; please refer to the study of Mallet & Bertault, 1990, where



they measured a merchantable volume for *Khaya* in line planting of 248 m<sup>3</sup>ha<sup>-1</sup> at 30 years, the additional volume of other timber species at the same assessment being of 185 m<sup>3</sup>ha<sup>-1</sup>; or, for a reference to Malaysia, to the tables for *Shorea platyclados*, *S. parvifolia* and *S. leprosula* [Kollert *et al.* 1994]);

- 5) the final harvest will be sold at 600 RM/m<sup>3</sup> (market price of 750 RM / m<sup>3</sup>, minus 150 RM / m<sup>3</sup> as harvesting cost);

then the net average revenue will be of 3,400 RM ha<sup>-1</sup> year<sup>-1</sup>. This is fairly better compared to the potential income that can be obtained by rattan plantation (see above).

Additional value will result from: 1) the sale of secondary timber products (branches); 2) the sale of the timber from other timber species present in the line planting; 3) or, if the line planting is done under *Macaranga*, the rehabilitation of the *Macaranga* forest, that as a matter of fact must at present be considered unproductive.

As for Teak, at present even not one hectare could have been planted within ICSB. The economic interest of planting Teak is even larger than for *Khaya*. If in the calculation presented for *Khaya* we just replace the market price of 750 RM / m<sup>3</sup> by a reasonable quotation of 1,500 RM / m<sup>3</sup> for Teak, we obtain a net average revenue of around 9,000 RM ha<sup>-1</sup> year<sup>-1</sup> over a thirty-year rotation. Maybe some imprecisions affect this estimation, however it is quite conservative and it just want to show the potential of this species.

The current strategy of focusing most of the ICSB's efforts to sell Teak plantlets to Lim and RISDA's companies should also be revised. It should be taken in account that by selling plantlets at 2.50 RM each to these companies, we are also selling the whole technology of Teak plantation. As the in-house plantation activity is non-existent, our genetic and silviculture trials for the moment only serve the purpose to allow Lim and RISDA to do better plantations. In a fifteen-year period, these companies will be able to earn large profits from Teak timber sale, while ICSB will have nothing. On the other hand, the stability over time of the Teak plantlets market is in doubt if we consider that no one will be able to stop RISDA and Lim to go ahead on themselves with the conventional cutting technique, once our material and our technology are available in their nurseries.

Our field surveys have shown that within LFC there is a large amount of open spaces, not covered by any tree (due to fire, log-landing, heavy logging, ex-logging camps, etc.); to this, we must add the areas available to ICSB in the Tawau Forestry Region, in Taliwas and in Brumas.

We have suggested since 1995 to start replanting open spaces with high-value timber species, especially with the Teak tissue culture material. This can give to ICSB both an important future revenue, and information on the open planting potential and problems. However, nothing has been done yet. The much invoked reasoning that the ex-logging camp areas have compacted soils and can not sustain any tree plantation is not correct because the soil can (and should) be rehabilitated by ploughing and/or mulching, fertilisation and tree plantation.

#### **- HIGH-VALUE TIMBER TREE SPECIES: CONCLUSION**

Both the technical knowledge and the plant material are now available for moving into real-scale plantation. For the beginning of 1998, ICSB is planning to line-plant about 100 ha of *K. ivorensis* in a *Macaranga*-dominated compartment. This should be considered only as the beginning, and more effort on tree plantation should be promoted, both for line and open planting.

Several reasons for this: 1) from an economic point of view, the prospects for high-value timber production are much better than for rattans; 2) in Luasong and all over the ICSB concession, there is a huge area of unproductive forest that can be profitably rehabilitated; 3) there is a need to test the plant material on a larger scale (tissue-cultured Teak, *Khaya* against shoot borers, *Cedrela*, *Xylia*, etc.); 4) even other ICSB's sub-companies as SSSB will take advantage from the diversification of their investment in timber production, as protection against the light-wood market fluctuations; 5) finally, there is a need to be coherent with the reasoning behind the foundation and the work of PISP.

In other words, why have our companies invested so much for high-value timber tree species improvement and silviculture if nothing is done for the implementation of the research's results in the field? To offer our best Teak material to the Malaysian market will maybe provide some income in the short term (as for the medium term, no one can predict what will happen). However, this must be considered as a side activity. The best genetic material and the main plantlets production should be planted within the ICSB's land and not sold for a price that will hardly cover the next few years' running costs.

#### **- FAST-GROWING TREE SPECIES: TECHNIQUE**

PISP has worked on this group of species since 1990, with special emphasis on *Acacias*. A genetic improvement programme has been initiated for *A. mangium*, *A. auriculiformis*, *A. aulococarpa*, *A. crassicarpa*, by establishment of progeny trials; these were later transformed in seed orchards by selective thinning.

**ANNUAL ASSESSMENTS OF THESE TRIALS AND STATISTICAL ANALYSIS HAVE PERMITTED TO RANK THE BEST PROVENANCES AND FAMILIES. SEED COLLECTIONS WERE THEN CARRIED OUT ON THE BEST PHENOTYPES OF THE BEST FAMILIES. IN 1997, A SECOND-GENERATION SEED ORCHARD HAS BEEN ESTABLISHED WITH THE BEST GENETIC MATERIAL OF *A. MANGIUM*.**

**GENETIC TRIALS HAVE BEEN ESTABLISHED IN THE EARLY 90S FOR *GMELINA ARBOREA*; THEY ARE STILL REGULARLY MAINTAINED, ASSESSED AND THINNED WHEN NECESSARY.**



**SILVICULTURE TRIALS STUDYING THE EFFECT OF WEEDING AND SITE PREPARATION HAVE BEEN ESTABLISHED FOR *OCTOMELES SUMATRANA*. THEY ARE CONCLUDED AND WILL SOON BE TRANSFORMED IN THINNING TRIALS.**

**OTHER SPECIES TRIALS HAVE BEEN ESTABLISHED AT THE BEGINNING OF THE PROJECT FOR MINOR FAST GROWING TREE SPECIES, BOTH INDIGENOUS AND EXOTIC.**

**- FAST-GROWING TREE SPECIES: ECONOMICS**

*For the time being, the work on fast growing tree species has had zero impact on the field activity, because industrial plantation is completely beyond the LFC's scopes. On the other hand, no new ICSB's project for industrial plantation has succeeded, and the possibility for PISP to access SSSB has not realised yet. Finally, during his last visit to LFC, the Sabah Forestry Department's Director made it clear that further authorisation for trial establishment with fast-growing tree species will be denied to LFC.*

*In terms of potential revenue, a short visit to SSSB permitted to work out the following figure:*

- 1) Acacia wood for pulp production can be sold at 85 RM / m<sup>3</sup>*
- 2) Acacia species in Brumas have a production rate of 22 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup>*
- 3) Rotation can be as short as 7-8 years, with a minimum accepted diameter of 8 cm and a final harvest of 150 m<sup>3</sup> ha<sup>-1</sup>*

*Using the same calculation of above, the net average revenue for Acacias is 1,350 RM ha<sup>-1</sup> year<sup>-1</sup> and 1,600 RM ha<sup>-1</sup> year<sup>-1</sup> with rotations of seven and eight years respectively. It is admitted that because of large-scale economic factors, plantation for pulp-wood species become viable only at a large scale, say above 3-40,000 ha, that can continuously supply a pulp and paper mill.*

*We have no available data for other species as *G. arborea* or *O. sumatrana*. However, a visit to Pacific Hardwood indicated that both these species can be used for plywood, and their price is becoming interesting due to the shortage of other more valuable timbers.*

*Finally, over the last few years, Acacia seeds have been sold by PISP at the international market. The current price is between 1,000 and 1,500 RM / kg. However, the demand is decreasing, and in 1997 it was not possible to sell any quantity of seeds. It appears clearly that seed sale is a marginal activity as compared to the investment involved and the scopes of ICSB.*

#### **- FAST-GROWING TREE SPECIES: CONCLUSION**

*The discrepancy among PISP programme and implementation in the field is flagrant.*

*While for high-value timber species some space for enrichment and/or open planting can be found within the LFC project or elsewhere in the ICSB concession, for fast-growing tree species there is no other solution than to promote a co-operation with SSSB.*

*Besides, SSSB has its own genetic improvement programme for both Acacias and Gmelina, and the two programmes should be merged to avoid duplication and loss of energy, for the overall benefit of ICSB.*

#### **ALTERNATIVES TO THE PRESENT RESEARCH ACTIVITIES**

From the above review, it should appear clearly that in order to both give a sense to the PISP activity and to establish a better forestry strategy for ICSB, there is a need to: 1) re-define the planting strategy of ICSB, all over LFC, SSSB and more generally over the Tawau Forestry Region; 2) re-define the priority list for PISP; 3) find a new strategic involvement of PISP within ICSB. A couple of scenarios are described below.

# ***1) PILOT PROJECT FOR REHABILITATION AND SUSTAINABLE MANAGEMENT OF THE NATURAL FOREST***

## **- RATIONALE**

A new agreement concerning sustainable forestry management has recently been reached between the government of Malaysia and some forest concessionaires (ICSB included). The vocation of the agreement is to comply with the ITTO's directives for sustainable forestry and thus to allow the forest concessionaires to obtain the consequent ITTO's timber marketing certification. Details of the agreement are not available yet, however it is known that:

- 1) Whole concessions will be subdivided into Forest Management Units (FMU) of around 1-200,000 ha.
- 2) In order to obtain permission for logging, each FMU must submit a sustainable forestry management plan to the Forestry Department.
- 3) The period of time allocated to the concessionaire for complying with the new system is three years from the agreement (that means the end of year 2000).

The sustainable forestry management plan includes:

- 1) Inventory of the timber stock, of the condition of the forest (topography, ecology, etc.) and of the regeneration at the FMU's scale.
- 2) Definition of logging intensity based on the predictions of a growth simulator model (DIPSIM, FRC Sepilok): on the base of the existing stock, this model allows to calculate how much timber can be extracted at each rotation without depleting the forest.
- 3) Real-scale implementation of the Reduced Impact Logging (RIL) techniques: i. mapping of the trees to be logged; ii. assessment of the regeneration (if the regeneration is absent, then the mature tree can not be logged); iii. mapping of the skid-trails; iv. cutting of the lianas six months before logging; v. directional felling; v. reduction of the area covered by log-landing; vi. reduction of the impact of road construction on the environment; vii. continuous (five or ten-year interval) survey of the forest recovery; viii. silviculture treatments after logging (re-planting and tending) when necessary; etc.....

Within concessionaires, it is largely admitted that this ambitious agreement, even though it is positive for the long-term management of the forest, will bring with it a number of connected problems that will make the overall viability of the operation questionable. Among the main problems:

- 1) The large scale of the FMUs. Very few of the concessionaires are technically equipped to face the above requirements.



- 2) The level of technology required. Very few if any of the concessionaires have the knowledge to implement these directives. Even to find enough trained personnel to hire from the labour market will be difficult.
- 3) The costs of the operation: in the short-term, the whole operation implies higher costs for lower revenues. The burden of higher costs will be shared among the concessionaire (increased costs for assessing, mapping, survey, administration, etc...) and the logging contractors (increased costs for liana cutting, directional felling, environmental-friendly roads and logging-areas, etc...), as well as the decreasing revenues (less timber extracted per units of time and space).
- 4) The local timber price, that is at present established only on the extraction costs and not on the cost of global forest management (as it is in other Western countries).

A great concern should be paid to the risk that the difficulties listed above will sink the whole operation. The contractors will be reluctant to accept such constraining conditions; the revenue for the concessionaire will decrease; the exploitation of the forest will be gradually abandoned. As the forest loses its value for the economy of the country, the government will have to make a choice: a) to abandon the implementation of sustainable forestry management by reverting to previous logging practices; b) to convert the land use from forest to agriculture (though fire) or anything else. In the medium term, choice –a– will be non-practicable because of the exhaustion of the timber stock brought by the conventional logging system.

It is much regrettable that the combination of the habit of excessive logging with too strict and abrupt regulation implementation will make the forest as a source of revenue to disappear. I am convinced that dipterocarp forest management can be an economically viable option for Malaysian forestry, provided the problem is approached from the right angle.

In the next chapter, we will analyse the economic interest of the dipterocarp forest and work out a pilot project that can successfully be submitted to the authority. The objectives of the project are:

- 1) to allow a gradual switch towards sustainable forest management;
- 2) to study which conditions should be met and which modifications are needed for the system to be workable;
- 3) to analyse which are the advantages for both the concessionaire and the whole Malaysian society;
- 4) to attract funding from national and international agencies with a high quality project addressing one of the most important issues of tropical forestry<sup>4)</sup>;

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<sup>4)</sup> For exemple, Indonesia alone is estimated to have 36 millions ha of depleted forests requiring rehabilitation (ITTO 1990). Up to 1990, 4.65 millions ha (55%) of the productive forest area in Malaysia was (heavily) logged once (Forestry Department 1992). Up to 1996, more than 90% of the Yayasan Sabah concession has also been logged.



- 5) to gain the authority's confidence by showing the commitment of the company to this target of excellence.

#### **- SILVICULTURE AND ECONOMIC VALUE OF THE DIPTEROCARP FOREST**

The silviculture system adopted at the ICSB's forest concession is the Modified Malaysian Uniform System (MMUS), a selective system with a minimum exploitable diameter of 50-60 cm and a period of 60 years. The present trend is to halve this period to allow a second harvest. The concessionaire has practically no obligations concerning forest maintenance and silviculture. The concession has duration of 99 years.

Among foresters and scientists, there is a general consensus that at the concession's scale the MMUS is not sustainable (see for an authoritative example: Udarbe & Chai, 1992). It may work on small areas where the logging has been light and the soil is fertile. However, this generally only amounts to a very small percentage of the whole concession's area. The majority of the area is generally composed of heavily logged forests with low growth rate. Often, the suggestion of the scientists is to lengthen the cycle to minimum 70 years (DGFU/FAO 1990, Burgess *et al.* 1992, Bertault 1996), but this has a considerable impact on the economy of logging. If the cycle of 70 years is adopted within the ICSB's concession, as the concession's first harvesting will be almost completed during the first 35 years, there will be a period of about 35 supplementary years without any logging.

Estimations carried out in Indonesia throughout a network of permanent plots established across the country by the Forestry Department showed that the average growth rate of merchantable timber species in logged-over forests is of about 0.5 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup>. The Indonesian Selective Logging with Replanting System (ISLR or TPTI) is very similar to MMUS, at least in the way it is implemented in the field. Thus, there is no reason to believe that in Malaysia the actual growth rate is much different. This figure leaves no hope for the sustainability of MMUS, and this system should be definitely abandoned.

Research on RIL indicated that this method could bring a significant improvement in growth. However, the results apply to small plots, often established into the best forests, particularly well treated by extremely competent personnel.

Once again, there is a general agreement among scientist that RIL alone is not enough to insure sustainability at the concession's scale (see the conclusion of the International Meeting: Secondary Forest Management in Indonesia, Bogor 1997). A more realistic representation of the treatments needed for sustainability will come by partitioning the concession into forest types, according to: fertility, species composition, history (more or less degraded by previous logging exercises, fire, etc.). Then the treatments can be defined for each type. For the best forest types, RIL may be sufficient; for the others, it may be necessary to go through:

- 1) complete replacement of the vegetation; this may be justified when the forest left after logging is mainly composed of non-commercial / pioneer species. Being a consequence of the heavy logging, extracting and damaging the commercial trees, this case is more frequent of what it is usually thought. Potential of *Shorea* or other dipterocarp species for open (or nearly open) planting has been demonstrated in a number of scientific studies. Just to mention: Ang *et al.* (1996) showed that in the FRIM's plots, *S. platyclados* gave a merchandable volume of 216 and 370 m<sup>3</sup> ha<sup>-1</sup> at age 22 and 40 respectively. According to Appanah & Weinland (1993) and Evans (1992), the growth of Southeast Asian dipterocarps may vary from 8 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> to 17 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup>. Maximum current annual increment (CAI) and mean annual increment (MAI) for three *Shorea* species are given in Table 3 (Kollert *et al.* 1994) and represented in Figure 1 (see also: Miller 1981; Whitmore 1984; Bertault 1994, Bruenig 1996).
- 2) enrichment planting; this practice has been worked out in a number of projects and its mastering is, theoretically, almost complete. The supply of plant material is not as difficult as initially thought, as wildings collected in the wild and seedlings raised in the nursery can be stocked for long periods in the forest understorey (examples in INFAPRO).
- 3) liberation of the potential crop trees, tending, regulation of the species composition, shade adjustment, etc. These are the most important but less studied silviculture practices. They can bring a considerable and fast improvement in the forest growth as they affects almost adult plants, that can very quickly react to the liberation and are near to the mature stage. Consider, for example, that a seedling may require 40 or more years before to attain the mature stage, while if tending liberates a 20-year-old tree, it takes only 20 additional years to harvest the fruit of the treatment. In addition to improve the growth of potential crop trees (PCT), these treatments have also the effect to concentrate the wood increment on the commercial species. The positive effect of tending has already been evaluated. For example, Sutisna (1996) recorded a growth rate of 10 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> for a tended forest, compared to 1.4 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> for the non-tended control. In the experience of Weidelt (1996) the 50 fastest growing trees per 0.5 ha plot registered a growth increase of 75-110% after the treatment of potential crop trees liberation.

The economic value of dipterocarp forest is well known by the concessionaire, even if the present timber market price is under-estimated. To correctly estimate the global value of a sustainable dipterocarp forest management, one should consider that:

- these species can have a surprising rapid growth of some 8-10 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup>, provided "good conditions" are given to the plants through silviculture
- they have a good timber quality
- their timber price is presently under-estimated, but it is expected soon to raise because
- the stock is rapidly depleting
- there is a large availability of low productive forest areas that need rehabilitation
- indigenous species often offer better resistance to local pests and diseases



- they are ecological adapted
- they are environment-friendly (associated flora and fauna)
- seeds and wildings supply is locally available (try then to find hundreds of kilos of seeds per year of good provenances of *Swetenia*, *Cedrela* or *Khaya*)
- the whole project is politically correct (with reference to the ITTO Ecolabel [year 2000] and to the new agreement with the Malaysian government)
  - it can be very attractive for both national and international financing agencies
- the manpower cost is lower in Sabah as compared to other world region.

Considering the above points, and comparing the situation with other countries as Europe where:

- 1) the average "natural" forest, with a growing season of only 6 months, produces around 3-4 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup>, and its management is economically profitable and sustainable;
- 2) *with few exceptions, the main wood production come from indigenous forest tree species (for example in France more than 30% come from indigenous oaks [rotation: 80 to 120 years], and 40% from indigenous conifers [Pinus, Abies, Picea; rotation: 40 to 100 years]; in Germany or UK the figure is more or less the same).*

it seems that a better management of the dipterocarp forest toward an economically viable and sustainable development is not only feasible but also recommended, at least on a portion of the concession. The portion dedicated to the project can subsequently be expanded if the final output of the project confirms positive.

#### **- IMPLEMENTATION**

*Sustainable Forestry Management can be started at any time of the forest exploitation cycle: it can start since the first logging on a virgin forest; or it can start on a logged-over forest, that is caught at a given state and brought towards sustainability through rehabilitation and silviculture. More emphasis will be given to the first or the second approach according to the weight of the two respective forest types (virgin versus logged-over) within the concession.*

*The divers phases of the project should be under scientific supervision, in order to have a continuous checking of the difficulties and proposition of "sustainable" solutions. The scientific supervisor should base the management of the forest on the modern methods for sustainable tropical forestry that are largely available in the region (see for example the experiences of GTZ, FRIM, CIRAD-Forêt, of the Forestry Departments of Malaysia and Indonesia, etc.).*

The scientific supervisor will also have the duty to implement experimentation at a suitable scale, where to compare the several available silviculture options at a near-to-real scale. In parallel, it will have to insure the training of the personnel.

*He will maintain* useful work contacts with the other projects on dipterocarps as Deramakot (FRC / GTZ) and INFAPRO (FACE / ICSB) in Sabah and other project in Peninsular Malaysia (FRIM / GTZ or FRIM / JICA for example) or Indonesia (CIFOR, STRECK, etc.).

Finally, if the scientific supervision comes from an international partnership with CIRAD-Forêt, it should also bring along studies on wood technology, transformation and marketing.

### ***Location***

*The project should have a size comparable to the real scale of a FMU, say between 30,000 and 50,000 ha. It can physically be located within the Tawau region and can be based in Luasong itself.*

*One appalling idea that I share with the LFC's Project Manager (C. Garcia), is that the LFC Project of forest enrichment with rattans can be redefined as follows: 1) the area interested by rattan enrichment is maintained at the present state; further operations on rattans will concern only maintenance, improvement, harvesting and replanting of the existing 10,000 ha; 2) the remaining 30,000 ha under the LFC Project will be assigned to the Pilot Project for rehabilitation and sustainable forestry management; 3) the Pilot Project can be extended outside the LFC Project if the need arises (explanations for this case will be given below).*

*The interest of having the Pilot Project based in LFC is that the structure is already there. The present project can bring additional value to LFC, as: 1) rattan cultivation is in a decline phase, and 2) other options as open planting or large scale line planting of high-value exotic species will first of all meet the opposition of the Forestry Department, and second will not have any chance to get approved by the funding agencies.*

### ***Action***

*Whether or not the Pilot Project will be based in LFC, it should have a gradual start:*

*First year:*

- a) composition of the teams and assembling of the equipment;*
- b) retrieval of the data referring to the last pre-felling inventory (1) and timber extraction (2). The difference among (1) and (2) will give an estimation of the stock left after logging (3);*
- c) re-measurement of some blocks (4) to estimate the actual growth of the forest since the last felling operation (4-3);*
- d) aerial photo interpretation as a support to operations (this can help to define homogeneous forest blocks and quantify the area that need one or another treatment);*



- e) *starting of the rehabilitation operations on some compartments chosen as representative of the general forest conditions;*
- f) *analysis and compilation of the data and preparation of a Master Plan to be submitted for funding.*

*Points b to e have the interest to allow the Master Plan to be based on real data and not on speculations. Points b and c can extend outside the LFC area if, along the data gathering process, it is decided that more recent coupes (compared to those in LFC that are 20 or more year-old) are also interesting to study.*

*Second year and forward:*

*The following phase should take in account all the above-mentioned steps for sustainable forestry management:*

- a) *inventory of the timber stock, of the condition of the forest and of the regeneration (that does not need to be a 100% inventory as it is today, and can be supported by aerial-photo interpretation)*
- b) *definition of logging intensity based on the predictions of DIPSIM (FRC Sepilok), readjusted by using the data obtained by the estimation carried out at the year one*
- c) *road construction (not needed in the LFC's case)*
- d) *timber extraction (if the inventory shows that it is available) according to RIL*
- e) *silviculture treatments, modulated according to the condition of the forest: complete replacement of the vegetation; enrichment planting; liberation of the potential crop trees, tending, regulation of the species composition, shade adjustment, etc. **Because of its costs, replanting will be considered as the last option.***

Progress and results will be reported in scientific annual reports.

#### **- CONCLUSION**

This can be the first real example of sustainable forestry management, and as such be a model for all the remaining FMUs within the ICSB's concession. Being on the spot and by discussion with the involved people, I really can not imagine another way to achieve this high-priority target, that must necessarily be achieved even if it is only on a small portion of the concession (50% out of the present 900,000 ha?).

## 2) INDUSTRIAL WOOD PRODUCTION

### - RATIONALE

SSSB is a well-known company (fully owned by ICSB) that does not need much presentation. Just to mention, SSSB currently harvests and replants 2-3,000 ha per year of fast growing tree species (mainly *Acacias*, *Albizzia*, *Gmelina*).

For the future, SSSB is planning to be the main supplier of wood for a pulp and paper mill (under construction near Tawau). The requirement will be of around 300,000 m<sup>3</sup> of *Acacia* wood per year, that with a cycle of seven years and a production of 21 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> corresponds to additional 2,000-2,500 ha to be harvested and replanted per year.

Within SSSB there is also the possibility, not developed yet, to plant (on a smaller scale) Teak and other high-value timber species in open planting, thing that is not possible anywhere else in the ICSB concession.

Because the 60,000 ha under SSSB are already fully utilised (including 10,000 of oil palm), in 1996-1997 ICSB has applied to the Forestry Department for the conversion of 100,000 ha of its natural forest concession into industrial timber plantation. The name of this new project is Bentawasan. Being located within Brumas and Luasong, Bentawasan will be developed mainly by SSSB (because of its experience in this domain) but will also receive the contribution of LFC (improved plant material of *Acacia* and Teak).

The former research team of SSSB, which furnished in the past some work on the above species, in 1997 has completely been dismantled by the new manager (Raymond Tan). At present, it is still not clear what is the true strategy about this, but the ICSB's management seems to suggest that both PISP and PBL can be involved as the research structure of SSSB.

If this can be considered as an appalling perspective, it seems to me that the matter should be considered much more seriously: the task is very ambitious and it is not in few days and from the backdoor that the PISP and PBL can take over the SSSB's research sector.

A recent visit made by the PISP and PBL's staff to SSSB has brought the following results:

- A short visit to their genetic and silviculture trials has shown that their scientific standards are apparently low: experimental designs, if existing at all, seem poor; information is scattered and often not properly recorded, and the former researchers are not any longer accessible (after their block-dismissal); rather, putative exceptional performances of putative superior material (as *Acacia* hybrids) seem to be fed on myths or on reports from other remote companies as Indakyat (Indonesia) or SAFODA (North of Sabah, with other ecological conditions).
- Raymon Tan seems to be very attracted by the new biotechnologies as the *in vitro* propagation of *Acacias*, and has very seriously asked the PBL to produce some 3-6,000,000 plantlets of *Acacia* hybrids per year. We have seen their hybrid trial (4-year-old) that should supply the material for tissue culture, and we have been all but impressed. I honestly think that our pure-species improved material in LFC is far better.



So it is clear that there is a risk of being involved in a low quality collaboration, limited to some day-to-day instructions from the top management, as it is the case today. For the reputation of our company and for the success of the operation, this should definitely be avoided.

By contrast, the potential for an interesting collaboration is there. For example, a bare 10% of gain in growth due to the use of better silviculture and genetically improved material may translate, over the 300,000 m<sup>3</sup> harvested per year, to 2,550,000 RM. The conditions that should be met for a constructive collaboration are worked out hereafter.

#### **- ESTABLISHMENT OF A COLLABORATION CIRAD-FORÊT / ICSB / SSSB**

First of all, let me highlight that, because of its high cost, *in vitro* plantlets production has a sense only if it is based on really superior material (otherwise, the risk is that the operation will be started with dubious material, the laboratory will develop the technique and expand its capacity, just to the day that the whole operation sinks because of the high costs and the low efficiency, and the PBL will find itself with tripled capacity but no demand). So the two parts, selection and field trials on one hand and laboratory on the other are not dissociable.

Both PBL and PISP should then be involved in several main activities:

- 1) in-depth evaluation of the existing "superior" material (LFC + SSSB)
- 2) estimation of the actual gain that can be obtained through this material
- 3) definition of strategies responding to the SSSB requirements, and making the best use of the resource (plant material, personnel, facilities [nursery, laboratory, plantation, etc.], financial funding, etc.)
- 4) upgrading of the nursery (mist system, flow-gallery for rooting-hardening, etc.), of the stock-plant park and of the seed stands, and training of the personnel
- 5) establishment and optimisation of appropriate protocols for vegetative propagation
- 6) establishment of new trials for silviculture and genetic improvement
- 7) establishment of new trials testing the material produced by the PBL

Both PBL and PISP should then be fully involved within SSSB, and given free access and support (in term of manpower) to study to the existing field trials and relative data, to collect and exchange plant material, and to plant new trials when needed. A senior scientist with the appropriate level of experience should also be identified within SSSB to act as a local counterpart to the CIRAD-Forêt scientists.

The first step of the Bentawasan project, once approved, will be the blanket harvesting of the natural forest, that I estimate can interest some 2-3,000 ha per year. It is illusory to start, at year one, planting such a huge area from zero; rather, the process of upgrading the production and preparing the material should be done gradually through the few years still in front of us.

Thus, in the meantime that PISP and PBL go through the seven steps of above, both the SSSB and LFC nurseries can start to produce "improved" material of several species (mainly Acacias, but also Teak, both from seeds, cuttings and micro-cuttings) for planting at a sub-real scale within the present SSSB plantation. The functioning of the whole structure (PISP + PBL + LFC + SSSB) can thus be gradually tested and finely tuned before the big operation starts.

**Table 1. Objectives of PISP according to the Plan of Operations 1993-1997.**

**- Short term:**

- \* to develop applied plant improvement strategies for rattans, pulp-wood, industrial and high-value tree species
- \* to develop production programmes of improved plant material for the above species to meet the planting stock requirement of ICSB
- \* to develop the technical capability in plant improvement and improved planting material for ICSB

**- Long term:**

- \* to develop commercial production of superior quality seeds or propagules on a joint-venture basis
- \* to improve the technical potential of ICSB to reach the level required to bring the Luasong Forestry Centre into a centre of excellence for tropical forestry management, development and research, and to enable ICSB/CIRAD-Forêt to undertake consultancies in the relevant fields if the opportunity arise

**Table 2. List of activities carried out by PISP in the period 1995-1997.**

**- Rattans**

*Silviculture*

Seed technology – germination and storage trials

Fertilizer trials both in the nursery and in the field

Containers and substrate trials

Size and age of the plants at plantation trial

Light trials in the nursery and shade adjustment trial in the field

Study of the relationships among environment and rattan growth

Yield plot for the establishment of growth tables

Harvesting and Maturation studies

*Genetics*

Collection and establishment of provenance/progeny trials

Collection of genetic material for the genetic diversity study

Controlled pollination

Floral biology, phenology, sex-ratio studies

**- Trees**

*Acacias*

Measurement and statistical analysis of the old progeny trials

Establishment of a second generation seed orchard (20 best families of SSOs)

Genetics of the heart-rot disease

Establishment of a tissue culture material trial

Seed collection in the old progeny trials (SSOs)

Seed testing and cleaning

*Octomeles sumatrana*

Establishment and assessment of site preparation and weeding trials

Transformation of the above trials into a single thinning trial

*Teak*

Establishment of two inter-connected provenance/progeny trials (total: 11 ha)

Establishment of a Correlated Curve Trend Plot (7 ha)

Improvement of the vegetative propagation technique

Commercial production of cuttings

Contribution to the feasibility study for the Teak commercial production

Seed technology – study and improvement of the germination technique

*Khaya ivorensis*

Improvement of the vegetative propagation technique – now operative

Thinning and measurements of the old provenance trials

*Xylia xylocarpa*

Observation of the good performances and purchase of new material

Trials for the vegetative propagation technique – now operative

*Swetenia macrophylla*, *S. mahogany*, *Cedrela odorata*, *Khaya ivorensis*

Systematic observations in the old line planting, statistical analysis

**Table 3. Maximum current annual increment (CAI) and mean annual increment (MAI) for three Shorea species [Kollert *et al.* 1994], in a 60 year-old plantation in FRIM (Appanah & Wieland, 1993).**

Species	CAI ( $m^3 h^{-1}$ )	MAI ( $m^3 h^{-1}$ )
<i>S. platyclados</i>	39 (at age 25)	21 (at age 35 to 45)
<i>S. parvifolia</i>	19 (at age 25 to 35)	13 (at age 45)
<i>S. leprosula</i>	26 (at age 25)	17 (at age 40)

**Figure 1. Diameter, height and clear bole length development of two stands of *S. platyclados* (Pasir Hantap Experimental Forest, Java and FRIM, in Kollert *et al.* 1994).**



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