Mission report
Sabah (Malaysia).

From 17 to 27 April 1998

By Michelle Pain-Orcet,
Cirad-Forêt – Natural Forest Programme

Campus International de Baillarguet - BP 5035 - 34032 Montpellier cedex 1 - France
Phone : 33 4 67 59 38 86 ■ Fax : 33 4 67 59 37 33 ■ E-mail : michelle.pain@cirad.fr

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ACKNOWLEGEMENTS

This mission, financed by MAE was carried out at the Forestry Upstream Division of Innoprise Corporation Sdn. Bhd in Kota Kinabalu and in the Luasong Forestry Center .

In the first place, I would like to express my sincere thanks to Mr Awang Mohdar Hamzani, General Manager and Mr Chan Ming Hon, Senior Manager, for their excellent welcome.

Secondly, I have also very much appreciated the efficient collaboration of all the staff, especially Miss Soo Sau Mee, Mrs Gunsalam Rosinam and Mr Asai Arthur.

Moreover, I am very grateful to Roberto Bacilieri, Cirad-Forêt expert in Sabah, for his support before as well as during the field trip.

1. Terms of reference

Aerial photo interpretation as an aid to plantation

Background

Innoprise Corporation Sdn Bhd (ICSB) is implementing since 1987 a large scale project for forest enrichment through rattan plantation. The plantation is done under a logged over forest, in 4-5 meter-wide strips. Up to now, 10.000 ha have been planted. The whole project area covers approximately 40.000 ha.

Recent studies at the Plant Improvement and Seed Production Project (PISP, CIRAD-Forêt/ICSB) have shown that the success of the plantation and the successive rattan growth are largely depending on the type and density of the forest. When the stand density and the percent of dipterocarps are large, the rates of rattan survival and growth are low. By contrast the plantation is more successful in more open conditions, where pioneer tree species dominate. At present being based on a topographic allotment that does not take in account the forest characteristics, the plantation is "blind", and a lot of effort is wasted in the enrichment of too dense forest stands.

Panchromatic aerial photographs taken during the 1995 overflights at a scale of approximately 1:25,000 are available for the Luasong Rattan Plantation Area. Available base maps are at scale 1:50,000. A "sketch master" equipment is available at the ICSB office to transfer information from one graphic support to the other. Several ICSB officers have had a photo interpretation training course at the local University. However, ICSB are lacking expertise in the area of applied photo interpretation, transfer of information from aerial photographs to base maps and subsequent verification of interpreted results in the field.

Objective

The overall objective of the mission is to help the PISP and ICSB to elaborate a strategy to use the information from the aerial photos to improve the planting procedure.

The expert is required to:

➢ evaluate the different elements of the problem, in particular:

a – the quality of the maps and photographs, and the suitability of the hardware equipment,
b – the scarcity of landmarks in the field, that will make difficult to locate given map points in the field,
c – the allotment already available that, for practical reason, will remain the main structure on which to base the planting programme,
d – the diversity of the forest and topographic conditions,
e – the staff capability to pick up the work.

- On the basis of the above analyses:

  a – help define different classes of forest type or crown closure,
  b – propose a procedure for the information transfer from photos to maps, and to the field or vice versa,
  c – suggest a method to prioritize the areas to be replanted in terms of suitability,
  d – propose a protocol for ground checking, and finally,
  e – advise on a staff structure (ground staff versus laboratory staff) that can optimize the whole task.

- Summarize observations, findings and suggestions in a mission report (written in English) to be submitted to both ICSB and CIRAD-Forêt.

2. Preliminary analysis of available means

2.1. Aerial photos and maps

2.11. Aerial photos

The Luasong Rattan Plantation Area is covered with panchromatic aerial photographs taken in September 1994. Because of clouds, part of the coverage was repeated in July 1998. The main technical specifications of this aerial survey are:

- camera focal length : 152 mm,
- flying altitude (above sea level) : 15 500 feet
- medium scale, ~ 1/32 000,
- size of each photo : 23 x 23 cm.

A preliminary interpretation has shown that the quality of these photos is satisfactory and their use for mapping this forestry area should not encounter any major problems.

Moreover, the scale of this coverage made it possible to easily assess without difficulty the main parameters needed to delineate the different types of stands (canopy density, crown size and shape, tree height,...).
Several photos were interpreted in the office before going to Luasong.

2.12. Topographic Maps

The study zone is almost entirely covered by the topomap at 1/50 000 scale : SUNGAI TIAGAU published in 1970. The contour interval is 250 feet (75 m). The information is quite coarse for this rough relief terrain and the micro-relief cannot be estimated.

Nevertheless the most important drawback is due to the tracing of the road network which is very basic and needs to be updated.

2.13. Rattan plantations maps

These maps were made by GIS staff of ICSB and show data about the rattan plantation. The elements of the basic map (contours, rivers, boundaries, main roads,...) were digitized using ARC INFO GIS.

The secondary roads and logging tracks have been updated and drawn using a compass and a GPS before being integrated into ARC INFO.

All the other data (boundaries of the planted blocks and sub-blocks, year of plantation, rattan species, etc) are displayed as working maps.

2.14. Vegetation cover map

This 1/50 000 scale document was made to evaluate the capability of SPOT data for updating existing maps.

This pilot project yielded spatial patterns of vegetation types (natural and artificial) and indicates the main roads and tracks network.

The different classes of forest vegetation were defined according to canopy appearance (closed, irregular, homogeneous or open).

Note: it would be useful to compare documents from 1987 and 1994 to define the similarities between satellite classification and aerial photointerpretation.

Comparing these two data types (photos and SPOT data) suggests that SPOT classifications tend to overestimate the amount of closed canopy forest (tree density at highest level > 80%). This was further demonstrated during the field reconnaissance. However, a decrease in forest cover has no doubt occurred since 1987.

2.2. Available Material

ICSB has all the necessary material to perform photointerpretation and transfer operations:

- pocket size lens stereoscope
- mirror stereoscope (TOPCON)
- aero-sketchmaster to transfer units from photos to maps

All instruments have been positively tested.

2.3 Human Resources

Miss Soo Mee, Mrs Gunsalam Rosinam and Mr Asai Arthur assisted the expert during this mission. All three have got training in photointerpretation and can perform this work. Mr Asai Arthur will also do a two-week training course in June at the Forestry Department of Sabah.

In addition, it would be good to make use of this forest mapping project based on photointerpretation to complete these technicians' training and apply their skills to their department.

3. Field Reconnaissance

Field trips were excellent thanks to the help of Salim Mat Rahim (Plantation Manager). Three itineraries were chosen (see map next page). The goal was to rapidly (in two days) get a general picture of the vegetation types found in the zones and to be able to positively identify them from aerial photographs.

3.1. First Zone

This was selected because of its dense and medium-dense forest cover. A systematic comparison was made between living stands and aerial photographs.

The presence of pure or nearly pure Macaranga stands could clearly be seen in the photos.

3.2 Second Itinerary

This led us through more diversified zones:

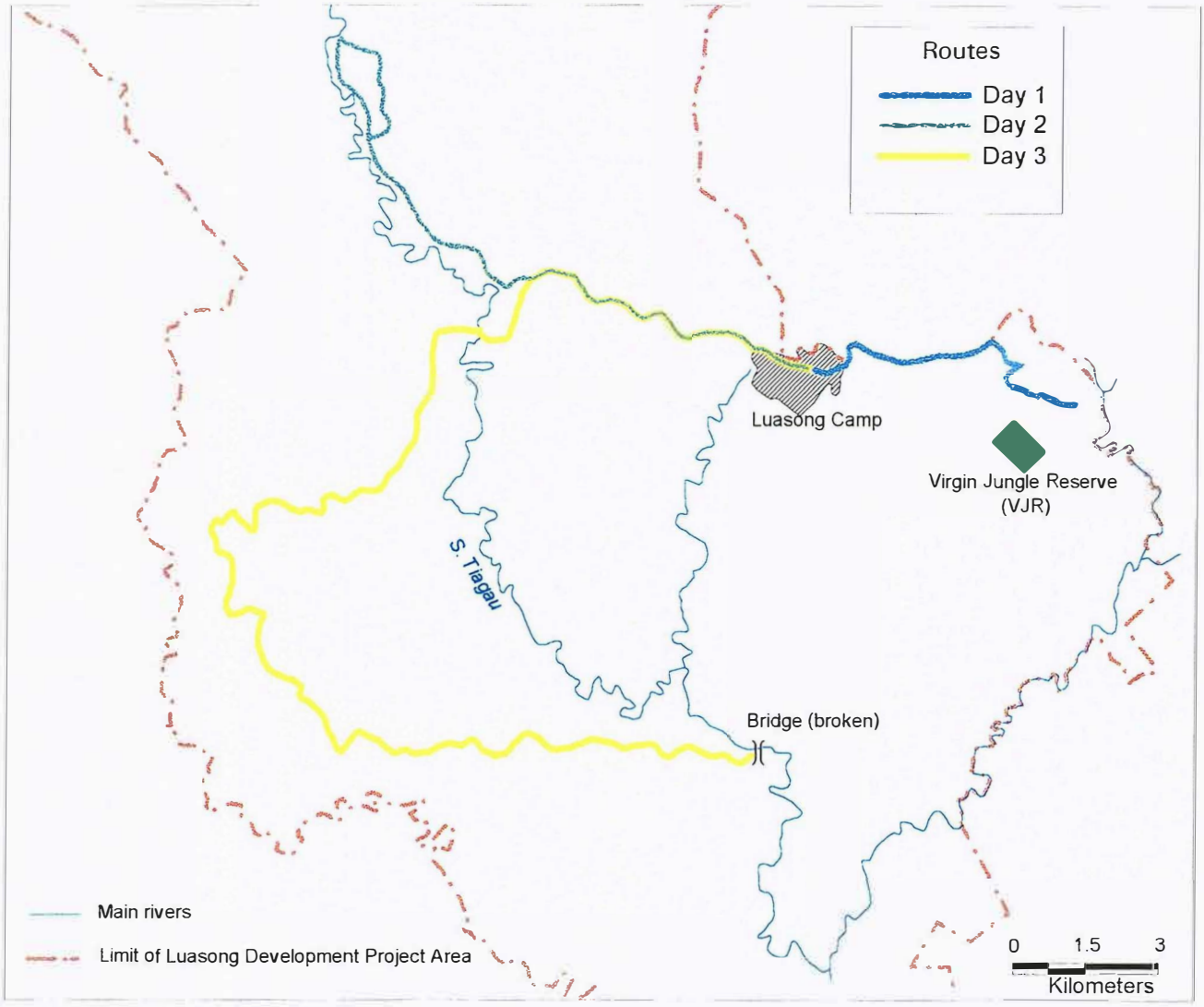
- Rattan and Gmelina plantation plots
- forest stands with varying cover which could be interpreted through the photos
- Macaranga stands
- specific riverbank vegetation
- cultivated zones
- banana plots

3.3 Third Itinerary

Here the goal was to identify a very open forest zone located west of the Tiagau River, which shows up clearly on the SPOT classification.

The area northern to the road has been planted with rattan since 1993. The southern part is located below the road and provided a good overview of the landscape, which was highly heterogeneous. Cover density of the dominant layer was both low and irregular. The middle layer was present practically everywhere with a highly variable density. This zone's topography was quite harsh, and slopes were often very steep.
The bridge over the Tiagau river had been destroyed and we had to return to Luasong along the same road. We performed a series of observations on different types of vegetation by comparing both stand features in the field and their stereoscopic image in the photos.

Reconnaissance routes



3.4 Comments

* During observations we attempted to establish a range of density classes (from open to closed) that was both valid and easy to measure on aerial photographs.

* The suggested legend was discussed in the field and yielded field/photo comparisons at the study locations for each of the itineraries.

* It was easy to identify field locations using the aerial photographs. Roads and rivers were clearly evident.

* Generally, the entire zone is covered by woody vegetation with a very open dominant layer.

4. Suggestions for Map Making

Based on the aerial mission performed in 1994-5, two projects could be undertaken.

4.1 Update of Road Network

Aerial photographs proved to be the most useful tool for field identification. The project could thus improve topographic maps by adding main roads and tracks based on photos.

This appears to be relatively easy and would give the workers at ICSB the chance to familiarize themselves with photomapping and transfer operations.

In addition, the map background obtained could be used to create a more accurate up-to-date document which would make future vegetation mapping much easier.

4.2 Vegetation Type Mapping

The descriptions of photointerpretation performed for several photos-pairs were verified in the field.

The main criteria used to define stand types were: tree height, crown size and density, structure, cover texture and color, topographic location.

Considering the high degree of heterogeneity in the map zone:

- a preliminary division of the sector into morphological and pedological units is advisable.

Two possibilities should be studied to obtain a good stratification:

- use the agroforest landscape maps created for the SPOT pilot project in 1989,

- use data stored at GIS on topography and pedology to divide the zone based on morphology and pedology.

The legend designed for the vegetation type map based on field observations and discussion led to defining the following categories:

- closed forest: tree density of upperstorey:	d > 80%
- open forest: 3 categories were found:	moderate: 50% < d < 80%
	scattered: 20% < d < 50%
	very open: d < 20%

- Macaranga stand
- Grassland
- Plantations
- Gallery forest
- Swamp formations
- Bare soil

Some suggestions for photointerpretation

- Pre-defined grids exist to estimate density classes. Several models are provided in the annex 3.

- To facilitate mapping and yield greater homogeneity in the photos, drawings illustrating each category interpreted (field/aerial view) should be made.

An example is given in the annex 4.

- Due to the distortion noted on the photos caused by the zone's topography, photointerpretation should only be performed on the middle part of the photos.

- Several procedures can be used for transfer operations:

- In the least uneven zones, photographic processes can be used to blow up or reduce interpretation overlays depending on the scale to line then up with the map background.

- In the most uneven sectors, optical processes such as the aero-sketchmaster are the best adapted.

- A better semi-automatic technique currently being developed could be tested. It involves scanning the map of each photo and superimposing the image over the map background on the computer screen using common tie points.

4.3 Map of Zones Suitable for Forest Plantations

As a second phase, it is entirely possible to use the maps of vegetation types to define sectors where the cover density is suitable for forest plantations.

This type of data, combined with other geographic data (topography, pedology, etc.) would lead to defining aptitude categories based on the existence of limiting factors linked to the field characteristics.

In addition, this type of map is entirely appropriate to this project as very poor results have been obtained in rattan plots set up over the past ten years.

5. Training Requirements

Three ICSB technicians who participated in this mission have good backgrounds in photointerpretation in general, but lack practical experience in photointerpretation of forested areas.

Mr Asai Arthur is already planning a two-week training course at the Forestry Department.

However, to develop this activity within the map division and to integrate this practical technique into the work performed at GIS, additional training is required.

This training should:

- focus on thematic applications, particularly in forestry

- specifically examine subjects, e.g. zoning, diachronic approach, field accuracy methods, etc.

- study how to use aerial photographs along with other available data, particularly optical and radar satellites,

- take stock of the latest developments and research on aerial data acquisition

Annex 1 : Mission Schedule

16/4/98	Montpellier – Paris.
17/4/98	Departure from Paris : 11 : 45 a.m.
18/4/98	Arrival in Singapour : 6 : 55 a.m. Departure from Singapour : 8 : 50 a.m. Arrival in Kota Kinabalu : 11 : 10 a.m.
19/4/98	Arrival of R. Bacilieri from Tawau.
20/4/98	Innoprise Corporation Sdn. Bhd – Forestry Upstream Division, Meeting organized by Mr Chan Hing Hon, Senior Manager, Presentation of ICSB and discussions about the mission schedule, Visit of the « GIS and Mapping Section », Study of maps, photographs and equipment.
21/4/98	Preparation of the field mission, Flight from Kota Kinabalu to Tawau.
22/4/98	Tawau – Visit of the Forest Research Institute of Malaysia (FRIM) organized by Antoine Gahana, Drive to Luasong, Visit of Luasong Forestry Center and meeting with Mr Gideon Peter, Nursery Manager and Salim Mat Rahim, Plantation Manager, First visit in the field : «Virgin Jungle Reserve area».
23/4/98	Work in the field = comparison between forest types and their image in the aerial photos.
24/498	Drive to Tawau.
25/4/98	Flight from Tawau to Kota Kinabalu, ICSB : meeting with Mr Chan Hing Hon to sum up the mission in Luasong and discussions about the main conclusions.
26/4/98	Flight back to Singapour and Paris/Roissy.
27/4/98	Connecting flight to Montpellier.

Annex 2 : Main Contacts mad

ICSB – Head office in Kota Kinabalu

Mr Awang Mohdar Hamzani,	General Manager of Forestry Upstream Division – ICSB
Mr Chan Hing Hon,	Senior Manager – Research Division
Mr Edward Chua,	Forest Officer
Mr Arthur Asai,	Coordinator
Miss Soo Sau Mee,	Forest Officer – Cartography
Mrs Rosinam Gunsalam,	Senior Tracer
Mr Esther Li,	Systems analyst.

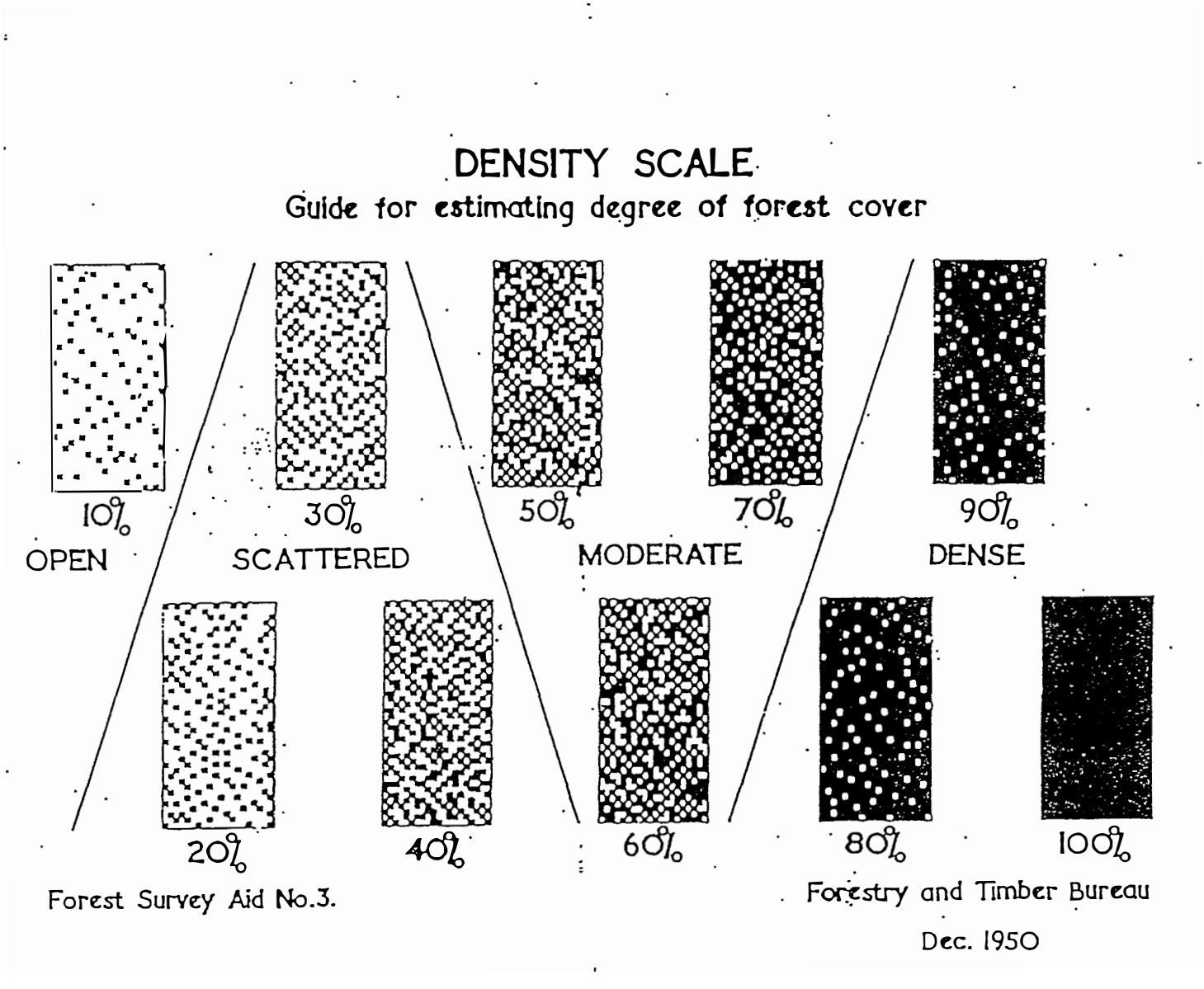
Luasong Forestry Center :

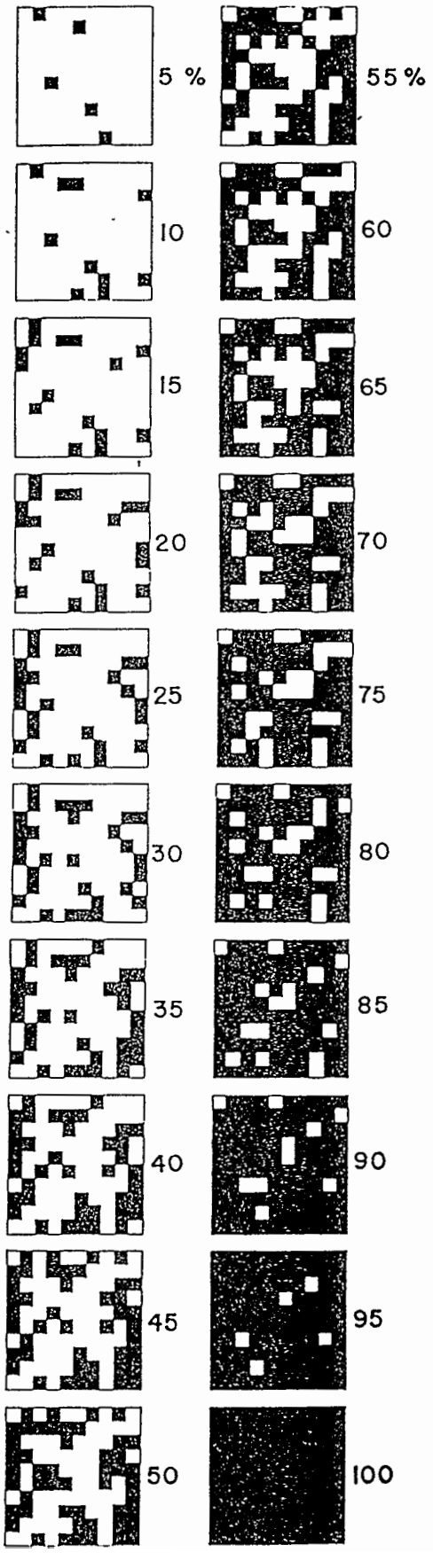
Mr Charles Garcia,	Project Manager
Mr David Alloysius,	Research Partner
Mr Peter Gideon,	Nursery Manager
Mr Salim Mat Rahim,	Plantation Manager

Cirad-Forêt experts :

Mr Roberto Bacilieri,	Trees and Plantations Programme
Mr Antoine Galiana,	Trees and Plantations Programme
Mr Wildfrid Schueller,	CSN
Mr Kevin Pouêt,	Trainee.

Annex 3 : Examples of density scales

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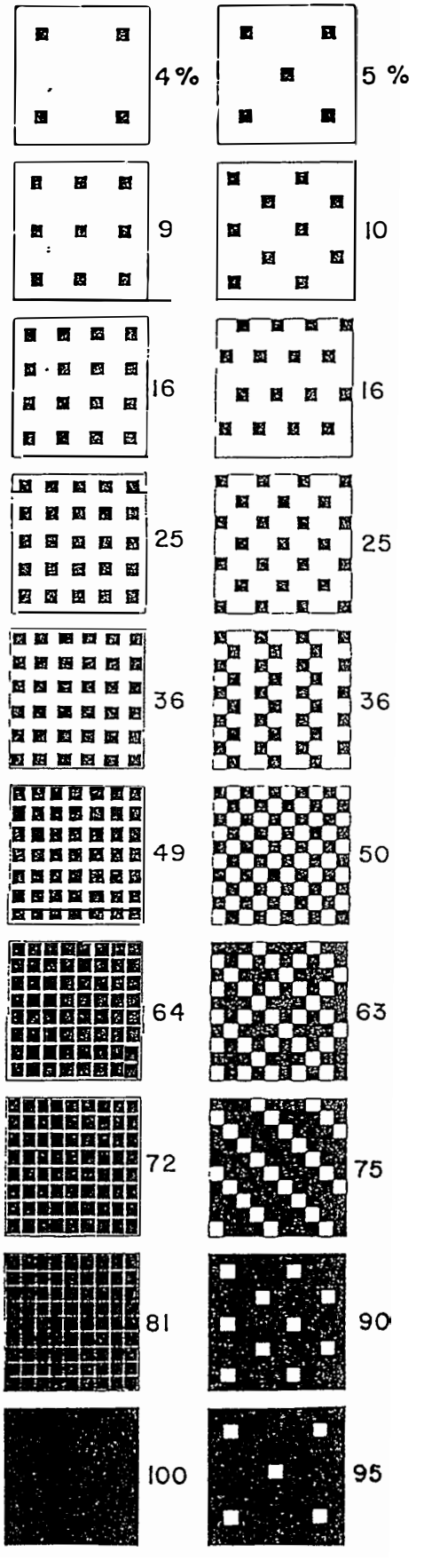
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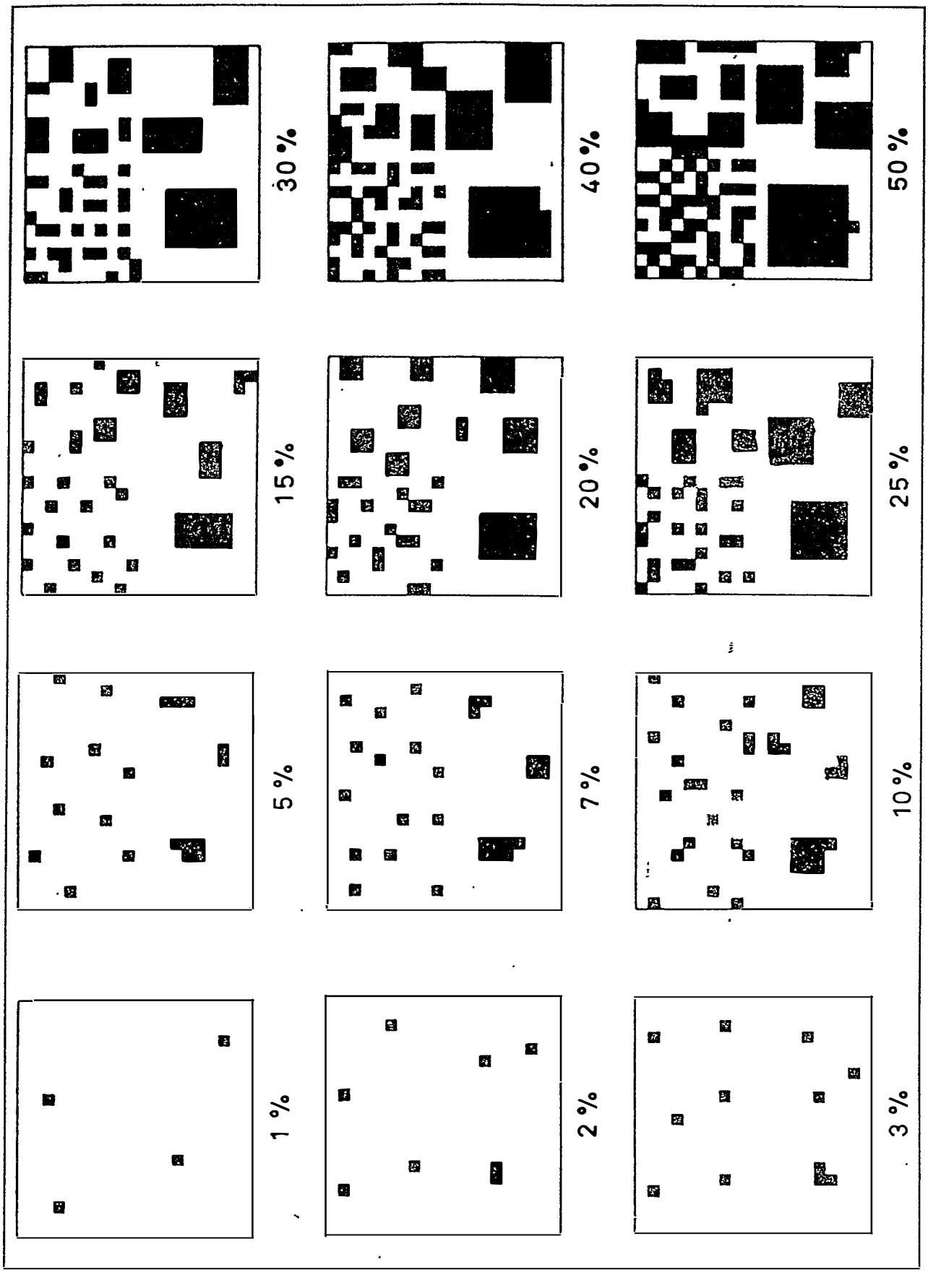
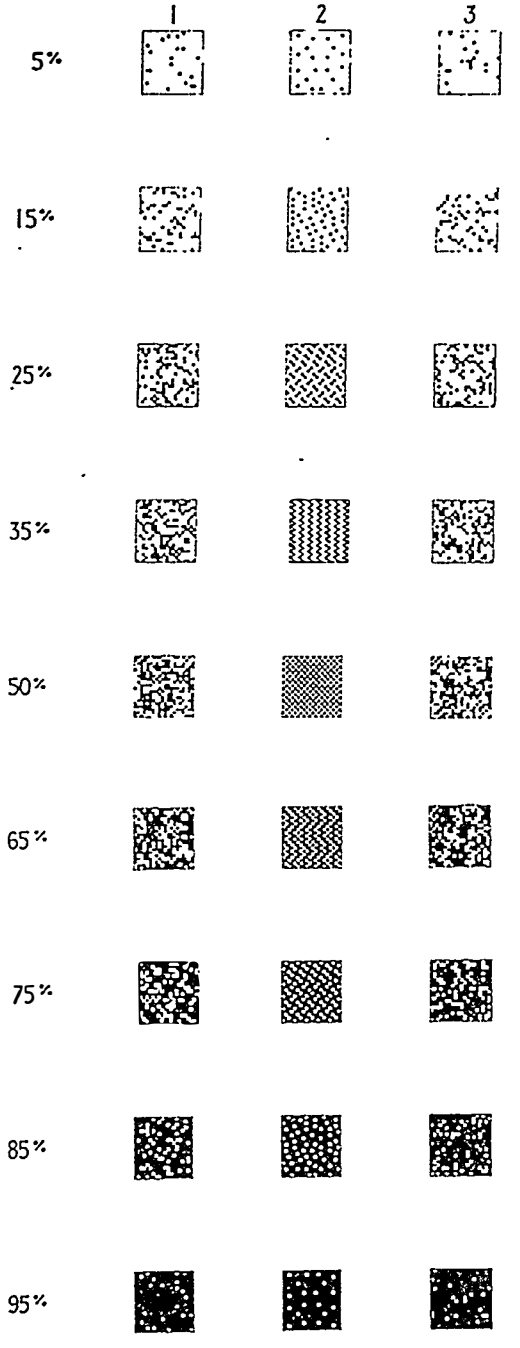
Estimation visuelle des rapports de surface



source : Emberger,1969 : VADE-MECUM pour le relevé méthodique de la végétation et du milieu (d'après Folk, 1951).

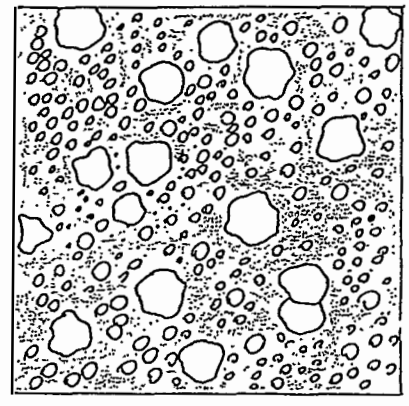
ECHELLE DE DENSITE DE COUVERT 1/25000

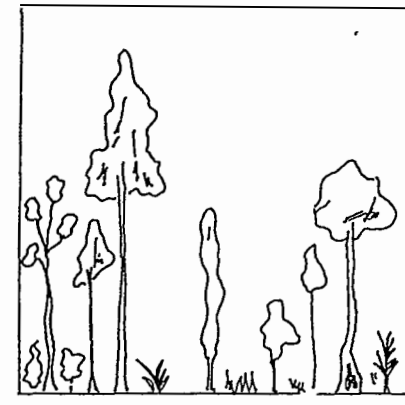


2 REPARTITION REGULIERE DU COUVERT
1-3 REPARTITION AU HASARD

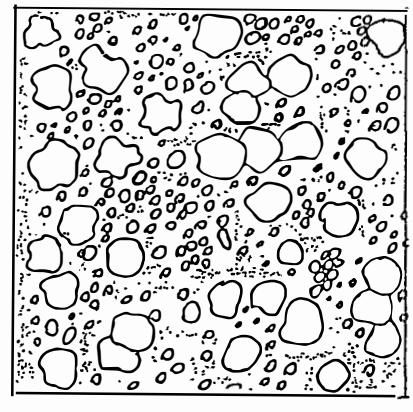
Annex 4 :
Examples of Drawings Used to Determine Stand Density

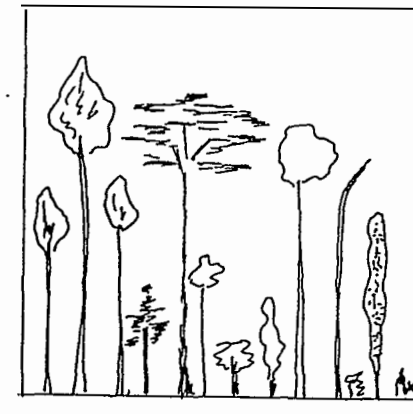
Density of mature trees
D < 20 %



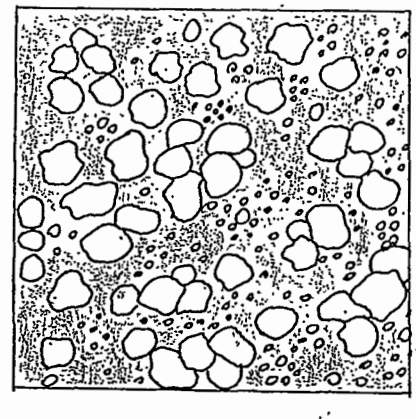


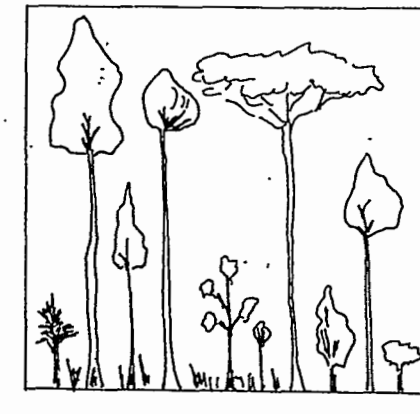
20 < D < 50 %





50 < D < 80 %





D > 80 %