Technical Guideline for Arboretum Establishment in West Manggarai District, Flores, Indonesia

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DEPARTMENT OF GEOSCIENCES AND
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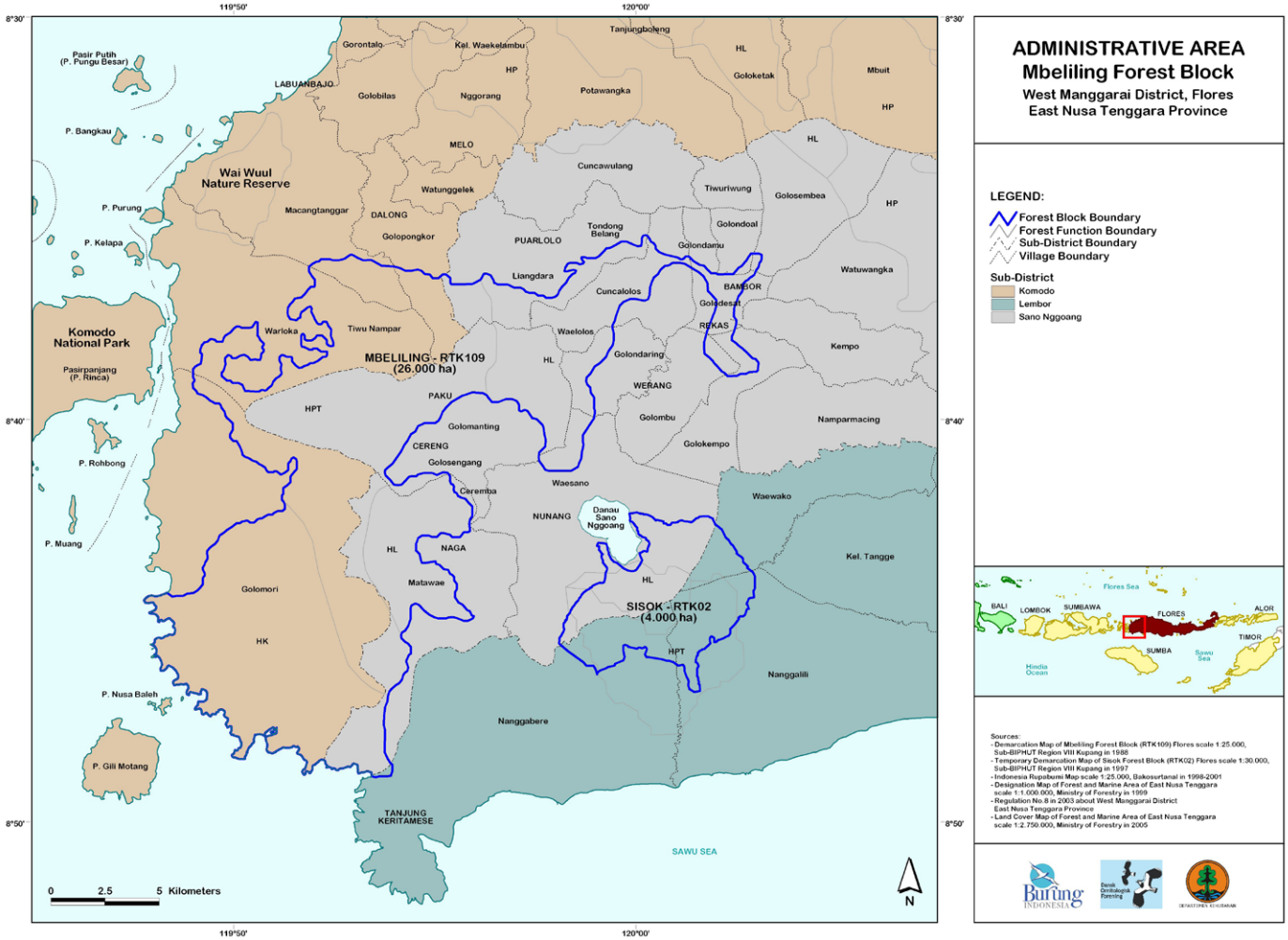
Technical Guideline for Arboretum Establishment in West Manggarai District, Flores, Indonesia

Compiled by
Fransiskus Harum and Soren Moestrup



Map of West Flores Island and The Mbeliling Lanscape Conservation Area

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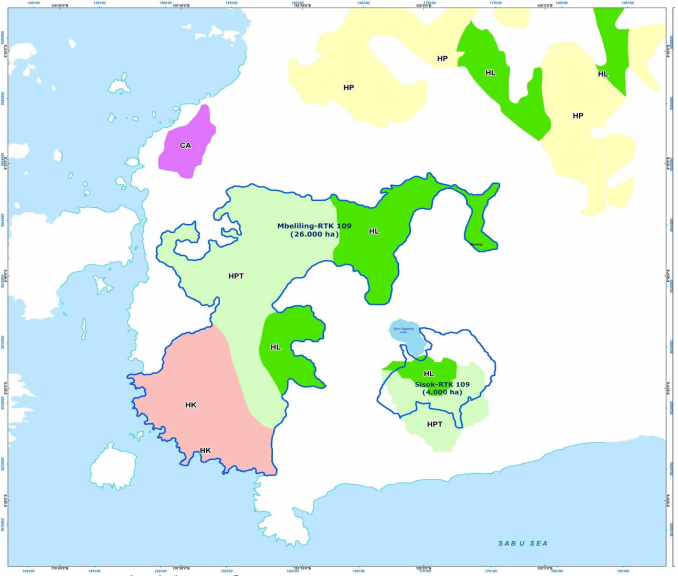


Mbeliling forest project area

1. Introduction

1.1. Background

Mbeliling forest is located in the southwestern part of Flores Island, which is part of West Manggarai Regency in East Nusa Tenggara Province. Mbeliling forest area is around 23.420 ha and consists of two types of tropical forest, green forest and deciduous forest. The forest area is divided into protected forest (7.240 ha), converted forest (4.180 ha) and limited production forest (12.000 ha). The area is dominated by the steep slopes, and 60% of the area is at an elevation of between 0-499 meter above sea level, 35% is at 500-1000 meter above sea level, while the remaining 5% is more than 1000 m above sea level. The forest in this area serves as a water catchment area for the surrounding villages and the city of Labuan Bajo. Rivers and springs provide water for drinking, cooking, washing and irrigation for 33,000 inhabitants in 27 villages. Mbeliling forest also provides protection from erosion, landslides and flooding.

In this area a project is funded by DANIDA, the Danish Government Development Assistance Agency and implemented by Dansk Ornitologisk Forening (DOF) and Burung Indonesia (BI). The University of Copenhagen (FLD) provides technical support.

The development objective of the project is through participatory forest management to improve sustainable livelihoods in communities in and around Mbeliling.

This objective is supported through three main activity areas: Empowerment, Poverty Reduction and Conservation.

The Mbeliling Project is focused on working towards sustainable and integrated management of Mbeliling Forest. It will be implemented through supporting and

building the conservation and sustainable livelihood capacity of Conservation Development Groups (CDGs), with members in 27 villages in the project area. The project provides training and runs activities in conservation and livelihood development topics as well as working closely with interested parties and government to develop a strategic management approach for the sustainable management of the Mbeliling Landscape.

The University of Copenhagen (FLD) provides support to conservation of native tree species in the project area. This support focuses on two main activities :

1. Identification of priority native tree species for protection and production purposes
   - exploration of selected priority native species
   - preparation of guidelines for seed handling and nursery production of the identified species
   - collection of seed from the local distribution range of the priority species
   - implementing training courses in sustainable, natural resource management.

2. Improve production of native species in the long term through local activities including an establishment of '*arboretum demonstration plots*' on lowland and highland areas in collaboration with the local government.

1.2. Definition of an Arboretum

An Arboretum is:

- An area which consists of trees as the dominant plant type
- It is established as a 'natural laboratory' for the purpose of science and education
- Various types of living collections of trees (species conservation areas, *in situ* and *ex situ*)
- A place for recreation or contemplation.

Anthocephalus cadamba

The arboretum can be used for education

1.3. Benefits of the Arboretum

The Arboretum will provide various benefits for people, environment and wildlife. The main benefits are:

- Preventing indigenous plant species from extinction
- Place for researchers and students to carry out research or learn about the different types of native plants
- More information about the ethnobotanics of native plant species can be made available through research
- Place for recreation
- Wildlife habitat
- A breathing space for the city
- Provide aesthetic values to the surrounding environment
- An Arboretum can be used as a seed source.

Arboretum has aesthetic values for the environment

1.4. Objective of Arboretum Establishment

The objective of the arboretum establishment in West Manggarai Regency is:

- To collect priority native tree species from Mbeliling forest area for conservation, education, research and demonstration.

2. Species and collection of genetic materials for the arboretum

The target tree species to be planted in the arboretum are the native priority tree species from Mbeliling forest area and surroundings in West Manggarai Regency (lowland and highland). If it is decided to include exotic tree species, it is recommended to plant in different planting compartments. The number of trees to be planted in the arboretum will be tailored to the native tree species priorities of West Manggarai area and to the total area of the arboretum to be established at each location. It is recommended to plant maximum 50 species gradually according to the colour grouping shown on Table 1: The list of target tree species. Group 1, marked in green, will be planted in the first phase, continuing with group 2 - marked in blue, and the last phase is group 3 – marked in yellow.

In order to ensure the level of genetic diversity of each species, it is recommended to use genetic material from a minimum of 10 individual mother trees per species. This implies that 10 individual trees, not related and mature trees, should be identified for seed or seedling collection. The 10 trees should be planted with a minimum of 50 meters between each tree.

The identity of seed lots or seedling lots covering family, genus and species should be documented and maintained from the collection of seed through raising the seedlings in the nursery and to planting in the arboretum block (see example of seed/ seedling documentation in chapter 3).

Collecting seeds from a mother tree is better than collecting wild seedlings. It is recommended to establish a herbarium collection for all species planted in the arboretum.

Produce the seedlings as required for arboretum establishment. The nursery establishment should be located inside the arboretum.

Manilkara kauki

2.1. List of Target Native Tree Species

No.	Local name	Botanical name	Family
1.	Nyatoh (Sita)	*Alstonia scholaris*	Apocynaceae
2.	Bintaos	*Whrightia pubescens*	Apocynaceae
3.	Aren (tuak)	*Arenga pinata*	Arecaceae
4.	Lontar	*Borasus flabellifer*	Borassoideae
5.	Keci	*Canarium aspermum*	Burseraceae
6.	Kenari	*Canarium ocidentale*	Burseraceae
7.	Kedondong	*Garuga floribunda*	Burseraceae
8.	Asam	*Tamarindus indica*	Caesalpiniaceae
9.	Ketapang	*Terminalia cattapa*	Combretaceae
10.	Mengge	*Teminalia zollingeri*	Combretaceae
11.	Kemiri (welu)	*Aleurites molucana*	Euphorbiaceae
12.	Uwu	*Bischoffia javanica*	Euphorbiaceae
13.	Nara	*Pterocarpus indicus*	Fabaceae
14.	Bintangor	*Callophyllum spectobile*	Guttiferae
15.	Kodal	*Stemonurus celebicus*	Icacinaceae
16.	Kayu manis (Ndingar)	*Cinnamomum burmanii*	Lauraceae
17.	Keben	*Baringtonia asiatica*	Lecythidaceae
18.	Bungur (Munting)	*Lagerstomia flos reginae*	Lythraceae
19.	Kalanggo	*Duabanga mollucana*	Lythraceae
20.	Lumu	*Manglietia glauca*	Magnoliaceae
21.	Wonot	*Colona kostermansiana*	Malvaceae
22.	Kapuk (Kawu)	*Ceiba pentandra*	Malvaceae
23.	Waso	*Hibiscus tiliaceus*	Malvaceae
24.	Kayu Kukung	*Schoutenia ovata*	Malvaceae

Planting Phase I

Planting Phase II

Planting Phase III

No.	Local name	Botanical name	Family
25.	Ojang	*Toona ciliata*	Meliaceae
26.	Mera	*Melia azadirach*	Meliaceae
27.	Nangka	*Artocarpus heterophyllus*	Moraceae
28.	Beringin	*Ficus benjamina*	Moraceae
29.		*Ficus urupaceae*	Moraceae
30.	Ara	*Ficus elongata*	Moraceae
31.	Mpui	*Decaspermum triflorum*	Moraceae
32.	Lui	*Fraxinus griffichii*	Oleaceae
33.	Bambu kuning	*Bambusa* spp.	Poaceae
34.	Bambu (betong)	*Dendrocalamus asper*	Poaceae
35.	Tilu Tuna	*Podocarpus blumei* Endl.	Podocarpaceae
36.		*Podocarpus neriifolius*	Podocarpaceae
37.	Bidara	*Zizyphus jujuba*	Rhamnaceae
38.	Kenda	*Prunus walleceana*	Rosaceae
39.	Jabon (Kawak)	*Anthocephalus chinensis*	Rubiaceae
40.	Cendana	*Santalum album*	Santalaceae
41.	Sawo Kecik	*Manilkara kauki*	Sapotaceae
42.	Natu	*Palaquium sp.*	Sapotaceae
43.	Kempo	*Palaquium obovatum*	Sapotaceae
44.	Kesambi	*Schleisera oleosa*	Sapindaceae
45.		*Mischarpus sundaicus*	Sapindaceae
46.	Kalumpang	*Sterculia foetida*	Sterculiaceae
47.	Cue (Gaharu)	*Gyrinops versteeghii*	Thymelaeaceae
48.	Redong	*Trema orientalis*	Ulmaceae

Planting Phase I

Planting Phase II

Planting Phase III

Planting block of Kawak (*Anthocepalus sp.*)

Sterculia foetida

3. Documentation and Data Handling

The arboretum will serve multiple functions including reference for species identification and basis for research activities. Therefore documentation is very important. All data and information are entered into a database/register and kept at the office of the Arboretum Management Unit.

The Data and information which should be documented are:

- Each seed/seedling lot (expected to represent a single mother tree) is allocated a unique identifier number (S-number) from S1 and upwards. The S-identifier number is followed by a serial number, which refers to the seedling within the seed/seedling lot. If 9 seedlings are planted from seedlot S1, these will then be allocated number S1-1, S1-2….S1-9.
- Taxonomy Information: Family, genus and species
- Site of seed/seedling collection: Name of location (GPS position and herbarium no).
- Collection Type:
  - seed collected from identified single tree (S)
  - seedlings collected under identified single tree (WS)
  - seedlings collected with no obvious seed tree identified (W)
  - seed collected from several identified single trees, but bulked (SB)
  - seedlings collected under several identified single trees and bulked (WB).
- Total Number of seedlings or weight of seedlot entering the nursery.
- Date/Month/Year of seed/seedling collection
- Date/Month/Year of sowing in the nursery
- Date/Month/Year of planting
- Other information or comments

4. Labelling of Trees

Trees in the arboretum will be labelled with a permanent sign providing key information for both visitors and professional users.

The material used for signs has to be resistant to sun, heat and rain.

An example of labelling

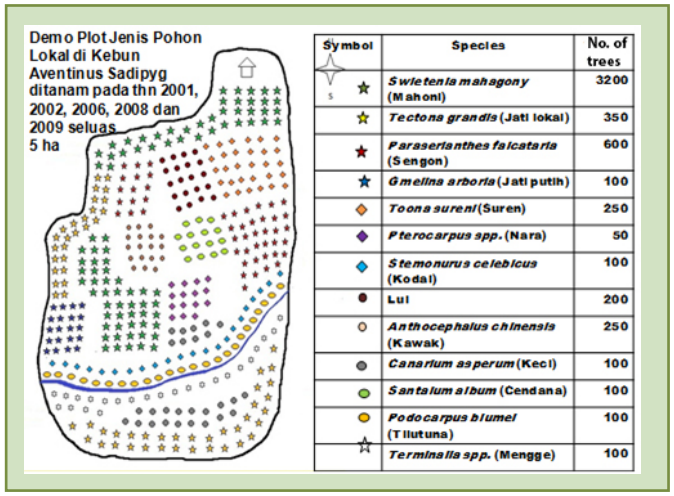
5. Arboretum Design

West Manggarai Regency Government has planned to establish three different arboretums, they are:

1. A lowland arboretum located in the center of Labuan Bajo City, with the purposes of: i) species conservation, education and research; and ii) recreation/tourism and as a breathing space for the city. The size of the area is 30 ha. Before development of the arboretum starts, the Local Government will draft a master plan for the Batu Cermin area, which is where the arboretum will be located.

2. A highland arboretum located in Puar Lolo, Sub District of Mbeliling will focus on conservation, education and research. Similar to the first category, the Local Government will draft a master plan for restoration of Puar Lolo forest area. Exotic tree species such as mahogany (*Swietenia mahagoni*) are widely grown in this specific location and will be gradually replaced with native tree species from Mbeliling Forest.

3. An arboretum or '*tree-species-demo-plot*' at village level organized by community group or individual farmer. See chapter 7 for further explanation.



The following guideline is for use at Batu Cermin Area (lowland) and at Puar Lolo forest (highland):

5.1. Facilities in the Arboretum

These arboretums will have a number of facilities:

- Tree planting blocks
- Inspection road or access for visitors
- Shelter
- Information board
- Main gate
- Label or name board of trees and planting block or compartment
- Nursery
- Water reservoir
- Fence
- Interpretation Board
- Sign board for guiding the visitors
- Control tower
- Offices for the Management Unit

5.2. Establishment of Tree Planting Blocks

The tree planting blocks can be layed out based on the following groupings

- Plant taxonomy group
- Product purpose group such as: timber, fruits, multi-purpose tree species, medicinal plants, bamboo, palm trees, etc.
- Based on distinctness of plant species – how threatened the species are.
- Ornamental tree species can be planted along the road from the main gate and as a border for each planting block.

5.3. General Guideline and Spacing

- Each species will be represented by 5-10 individual trees at each planting block.
- The spacing is recommended at 3 m x 3 m or 2,5 m x 2,5 m depending on the characteristics of the tree species.
- After 20 years the number of individual trees of each species will be reduced by up to 40%.

6. Information Material

Information Boards (right)**:**

- Welcome Board for visitors
- Information board about the Arboretum and the Management Unit Organization
- Information Board for Planting Blocks
- Information Board for any special tourism spot inside the arboretum (eg. Batu Cermin cave)

Leaflets (right)

- General guidelines for the arboretum and map of location
- Short information about each planting block
- Short information about medicine plants
- Short information about endangered tree species
- Short information about special areas of interest for tourism inside the arboretum (eg. Batu Cermin cave)

Examples of Information Board and Leaflets

Arboretum can be used for research

7. Location of Arboretum in West Manggarai Regency

7.1. Lowland

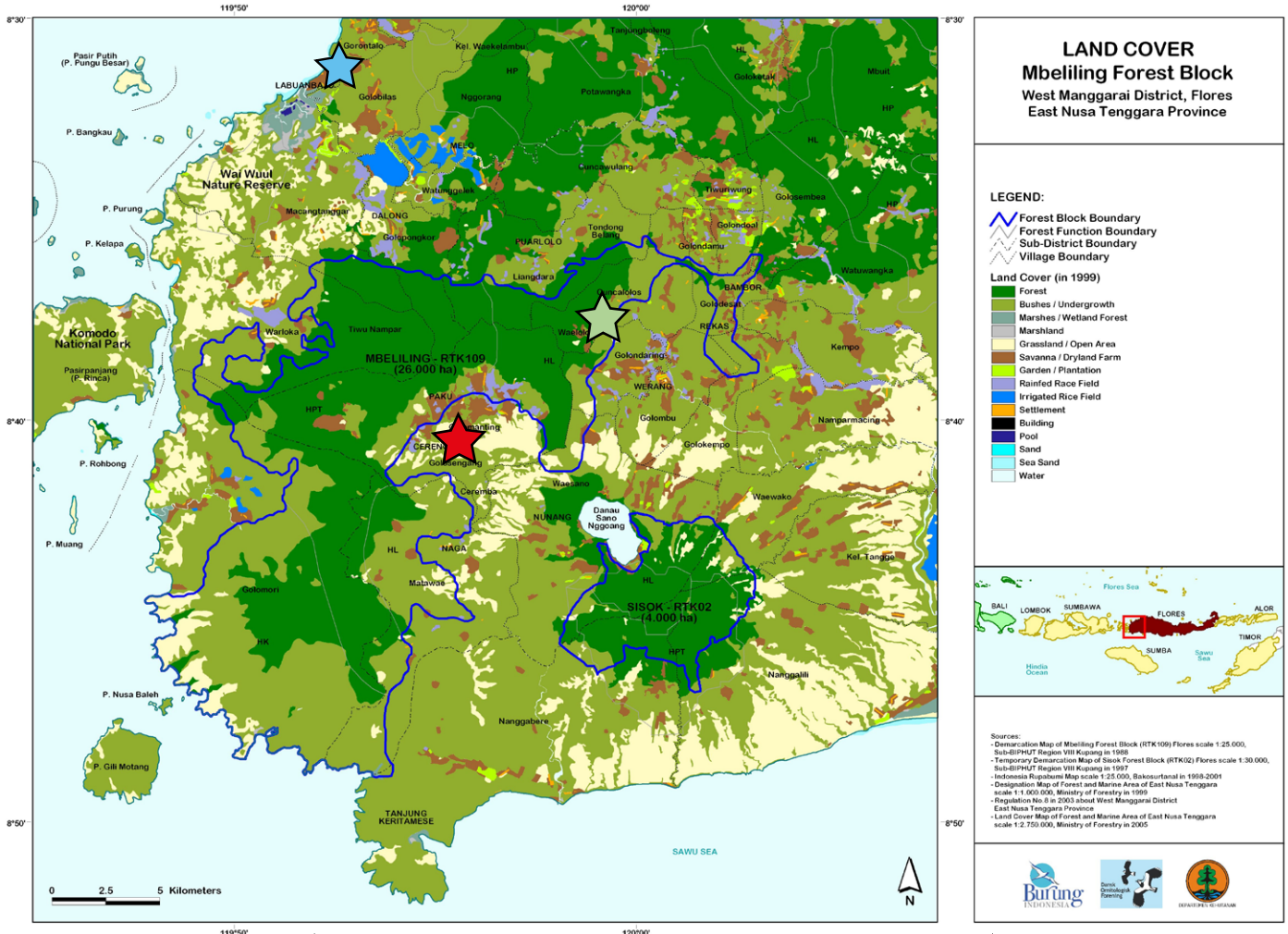
The arboretum for the lowland area will be located around the tourist site of interest, the cave of Batu Cermin.

- It is located in the centre of Labuan Bajo City
- Total area is around 30 Ha
- The land belongs to the local government
- The land is managed by the District Office for Tourism and Culture
- There is a tourist spot inside the area named Batu Cermin Cave
- The existing vegetation is dominated by yellow bamboo, bidara cina, pohon kupu-kupu, kesambi and also mahogony (exotic species).

7.2. Highland

The arboretum for the highland area will be located at Puar Lolo forest area, Mbeliling.

- The size of the area is around 40 Ha
- It is secondary forest dominated by shrubs and some trees including mahagony stands planted for reforestation purposes.
- The location is a hot spot for bird watching as a number of endemic bird species of Mbeliling are found in this area.
- The location is normally used as resting point by people travelling between Labuan Bajo and Ruteng.



Community arboretum ★ Highland arboretum ★ Lowland arboretum ★ 5 km to the north, inside Labuan Bajo City

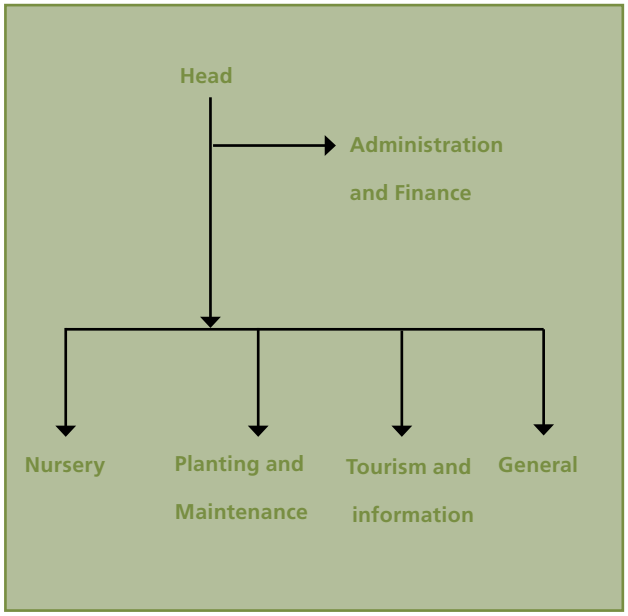
7.3. Community arboretum in the village

The arboretum or '*tree-demo-plot*' establishment for the village level will be implemented by village government and community groups or individual farmers with some support from Regency Government or other parties. Besides the arboretum establishment by community group or individual farmers, the economic and ecological benefits for the community should also be considered. For this purpose it is recommended to apply an agroforestry model.

The following tree planting model could be used as an example for arboretum establishment at village level.

A demo-plot of tree planting is established by Aventinus Sadip in Desa Golo Manting, Kecamatan Sanonggoang – West Manggarai Regency. The area is around 5 Ha and he has planted 14 tree species during a period of 10 years (from 2001 onwards).

8. Organization



Below is presented an arboretum administration model designed for West Manggarai District.

An Arboretum Management Unit (AMU) will be lead by a head, assisted by 5 heads of division and a number of staff.

The 5 divisions are: 1. Administrative and Finance, 2. Nursery, 3. Tree Planting and Maintenance, 4. Tourism and 5. General.

The Administrative and Finance Division will be responsible for administrative and financial works including HRD, correspondence and filing systems. This division will consist of maximum 4 people.

The Nursery Division will be responsible for producing seedlings required for arboretum establishment including seed/wildling collection and nursery establishment and maintenance. This division will consist of 5 people.

The Tree Planting and Maintenance Division will be responsible for tree planting, block design and management. This division will consist of 5 people.

The Tourism and Information Division will responsible in preparing information and guidance for visitors including: 1) produce leaflets, brochures, sign boards etc.; 2) manage the data base of the arboretum and herbarium laboratory; 3) management of visitors.

The General division will be responsible for procurement and maintenance of the arboretum.

Kolofon

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