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Arboretum

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Arboretum

Introduction

An arboretum refers to a collection of different tree species within a defined and relatively small area, usually < 50 hectares. The oldest arboreta were established more than 100 years ago as a combination of scientific-, recreation- and public education purpose. Arboreta have traditionally been established and administrated by universities and other higher educational institutions, hence often established near those institutions. One of the oldest tropical arboreta is the Botanical Garden in Bogor, Indonesia, which, in addition to the tree collection ('arboretum') also includes a number of herbal species.

The roles of arboreta have extended during time. In addition to their former roles, they are now also seen as part of conservation programmes for forest genetic resources. Arboretum establishment has become an integrated activity for several projects. They range from mere species diverse public parks with name tags on trees to large forest-like areas with local as well as introduced trees. Arboreta linked to forest restoration activities is a new concept. Harapan forest is located far from public areas, so the recreational value will serve only a small number of visitors. The reasons for establishing an arboretum in Harapan are mainly scientific and educational.

Objectives of local arboretum

The arboretum serves several purposes:

1. Educational, e.g. plant identification, fruit and seed morphology and basic ecology
2. General information on local species for occasional visitors, e.g. the unique flora and affiliated fauna of lowland Sumatra forests.
3. Conservation of samples of species, including possibly endangered species in other areas of the forest.
4. Research that do not require large populations e.g. flowering, fruiting and pollination research.
5. Phenology indicators. Trees growing in the arboretum will often be indicators of flowering and fruiting of the same species in more diverse populations suitable for seed collection.
6. Recreational area for staff and visitors.

Location of an arboretum

An arboretum is established as a permanent stand of trees requiring continuous maintenance. Land tenure must thus be very clear. The recreational and scientific objectives of the arboretum make a central location close to a science centre and public essential. Since the arboretum will include a wide collection of trees with different ecological requirement, the allocated area should preferably contain a variation of soil types and hydrology, which represents the requirement of the species to be planted. Streams, swamps and hilltop areas represent major ecotypes in Harapan; - these being present make a suitable planting habitat for most species.

Since the whole design of the arboretum should be done from an educational and scientific objective, all trees should be planted. Already present trees may be maintained temporarily until new ones have grown up. Some unique and valuable trees may be maintained, if they do not interfere with the overall design. Otherwise the area should be cleared meaning that an arboretum area should preferably be established in a degraded area where restoration is to be undertaken.

Genetic material of an arboretum

The plant material will include a level genetic diversity that ensures representation of substantial within-species variation. This is important in order to ensure a genuine conservation function, and allow phenological and other

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similar studies. For each species to be planted in the arboretum, seeds should be collected from 10 individuals in Harapan forests. Although an arboretum is not diverse enough to be used as a large scale seed source, the aim should be to assure as high genetic diversity within species as possible. That implies that the 10 mature trees used for seed or seedling collection should as far as possible not be related (plant material collected from different mother trees and preferable not closer than 50 meter from each other). When possible, seeds rather than seedlings should be collected since proper identification of seedlings to species is often unreliable, and possible error will only be apparent after many years, when the trees start to flower; seeds can usually be linked directly to a mother tree from which documentation material can be collected; - that is more difficult for seedlings. It would be pertinent to do herbarium collection in connection with all species collections, and other information regarding seed collection should be recorded.

Arboretum design

The arboretum will be established with a network of paths so all areas can be reached easily. A main path will connect to a main entrance into the arboretum.
Species will be planted according to the taxonomic system: Family, genus, species. This will be important in relation to educational purposes and especially to increase the use as reference for plant identification, because related species can be observed next to each other and unique criteria for species identification can then easier be demonstrated /explained.
Large family groups may be split up into several plots e.g. if there are different requirement to soil conditions or soil moisture, that can be met within the arboretum area. Although the taxonomic system is the main baseline criteria, other criteria may be used for specific sections of the arboretum, for example use of the species, such as an area with fruit trees and an area with Non Timber Forest Products (NTFP) trees and other agroforestry species (*Aquillaria* sp., Dragonblood etc.).

The arboretum is expected to be established over a number of years, and continuously developed. Continuous maintenance and management thus have a time frame of decades, although most intensive during the first 10 years. It is therefore important that the ambition and plans are based on realistic expectations for short and long term funding options.

General guidelines on spacing

The plan is to have on average 10 mature, unrelated trees of each species representing the diversity of the Harapan Rainforest. Planting will in general consist of blocks of 9 plants per species (S-nr.). These will be planted in a block of 3 x 3 seedlings (spacing 2.5 m x 2.5 m) and 10 such blocks will be planted for each species.

9 tree plots per S-nr with spacing 2.5 x 2.5 m corresponds to 6.25 m^2 per plant; 56 m^2 per S nr. If each species is represented by minimum 10 S-nr, one species will occupy on average 560 m^2. With an excepted 400 species, this will require 225,000 m^2 or 22.5 ha. Only the best growing (most healthy) of the 9 trees per S-nr are expected to be maintained for maturity.

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A thorough site study and mapping should be prepared as the first step of the planning. Native species already growing in the arboretum should be included, documented and labeled since some of them may be maintained for recreational or other purposes.

Documentation and data handling

The arboretum will serve multiple functions including reference for species identification and basis for research activities. Therefore documentation is very import.
All mother trees selected for seed or seedling collection should be documented by herbarium specimen collected, species identify verified and the sample kept in the Harapan rainforest Herbarium. If uncertain about species, only the genus is stated, but effort should then be made to identify species afterwards.

Each seed lot/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 that 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 and so on.
Besides taxonomic information, detailed information on collection site, mother trees, and collection date will also

be registered. Additional information can be added as comments as required. If a seedling lot is collected from an area, where the mother tree is not easily identified, then the GPS coordinates from the collection site is recorded.
All information is entered into a database and a procedure for regular back-up is implemented.

DOCUMENTATION

ID nr:	**Sx.-y** (x= number of seed(ling) lot ; y=trees within seed(ling) lot
Taxonomy:	**Family genus species**
Collection site:	**Location name** (with GPS) and **Seed tree** (with GPS and herbarium no)
Collection type:	**S**=seed collected from identified single tree; **WS** = seedlings collected under identified single tree; **W** =seedlings collected with no obvious seed tree identified; **SB =** seed collected from several identified single trees, but bulked; **WB** = seedlings collected under several identified single trees and bulked
Size of seedling/seedlot	Total **N**umber of seedlings or weight of seedlot entering the nursery
Collection date:	**dd-mm-year**
Planting date:	**dd-mm-year**
Comment:	Any relevant info

Labeling of trees

As the aim is to do thinning in a way that maximizes the diversity, each seedling needs to be labeled individually with a number that can be referred back to information on species and mother tree number. The labels need to be attached for at least some years until the plants are large enough to be provided with a permanent sign giving botanical information. It is recommended to use metal labels with punched-in numbers or letters. Initially the labels are attached by wire, later by screws that can be loosened as the trees grow larger. Trees in the arboretum will later be labeled with a permanent sign providing key information for both visitors and professional users. A small group of trees planted next to each other (see below) can be documented by a single sign. An outline for a label is presented below.
The choice of material is to be decided depending on costs, but it is important to choose a sign resistant to sun, heat and rain.

Figure 1. Label types. Numbered metal labels are suitable for tagging seedlings in the nursery. Durable tags with visible information are attached to a visible site for visitor information

Harapan Rain Forest Project Arboretum
Family

ID nr Local name

Scientific name

Natural distribution:

Traditional use:

Conservation status:

Collection site Collection type
Planting year

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