

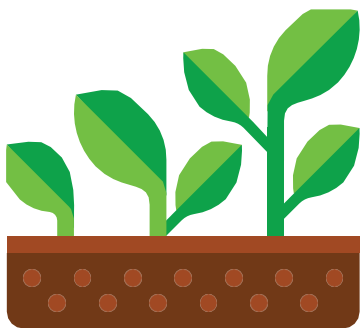
An illustrated guide for designing and managing

community seed banks and forest nurseries



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This guide explains, in a straight-forward manner, the steps to follow when designing and managing a community seed bank and a forest nursery; it demonstrates the main aspects to consider for tree selection, as well as the collection, processing, storage, and adequate documentation of seeds, in addition to the main considerations and recommendations for the establishment of small community forest nurseries.

Community forest nurseries are a strategy that allows the initiation and consolidation of participatory processes, while also giving a productive and economic alternative for producers, participants, and allies in landscape restoration initiatives across the region.

This **Illustrated Guide for Designing and Managing Community Seed Banks and Forest Nurseries** was developed as part of the Regional Program Against Illegal Logging. This is a cooperative project in which the Department of State and the U.S. Forest Service International Programs (USFS-IP) have joint their efforts to eliminate unlawful collection, processing and trafficking of the Dalbergia species and other commercially significant forest species in CAFTA-DR countries.

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Contents

Seed sources	6
Origin.....	6
Seed trees selection	8
Seed management.....	9
Collection.....	9
Characteristics of orthodox seeds and recalcitrant seeds	11
Processing.....	12
Cleaning.....	12
Drying	13
Seed banks	14
Basic requirements for establishing a seed bank.....	14
Documentation systems and cost calculation	15
Seed source code register	16
Certificate/Description of seed sources.....	16
Establishing a nursery.....	17
Considerations when establishing a nursery	17
Plant production	19
Seed pretreatments	19
Stages for seedling production.....	20
Container nursery production	21
Nursery plant management	22
Plant disease prevention and treatment	23
Forest nurseries control and management	24
Appendix.....	25
Cost matrix	26

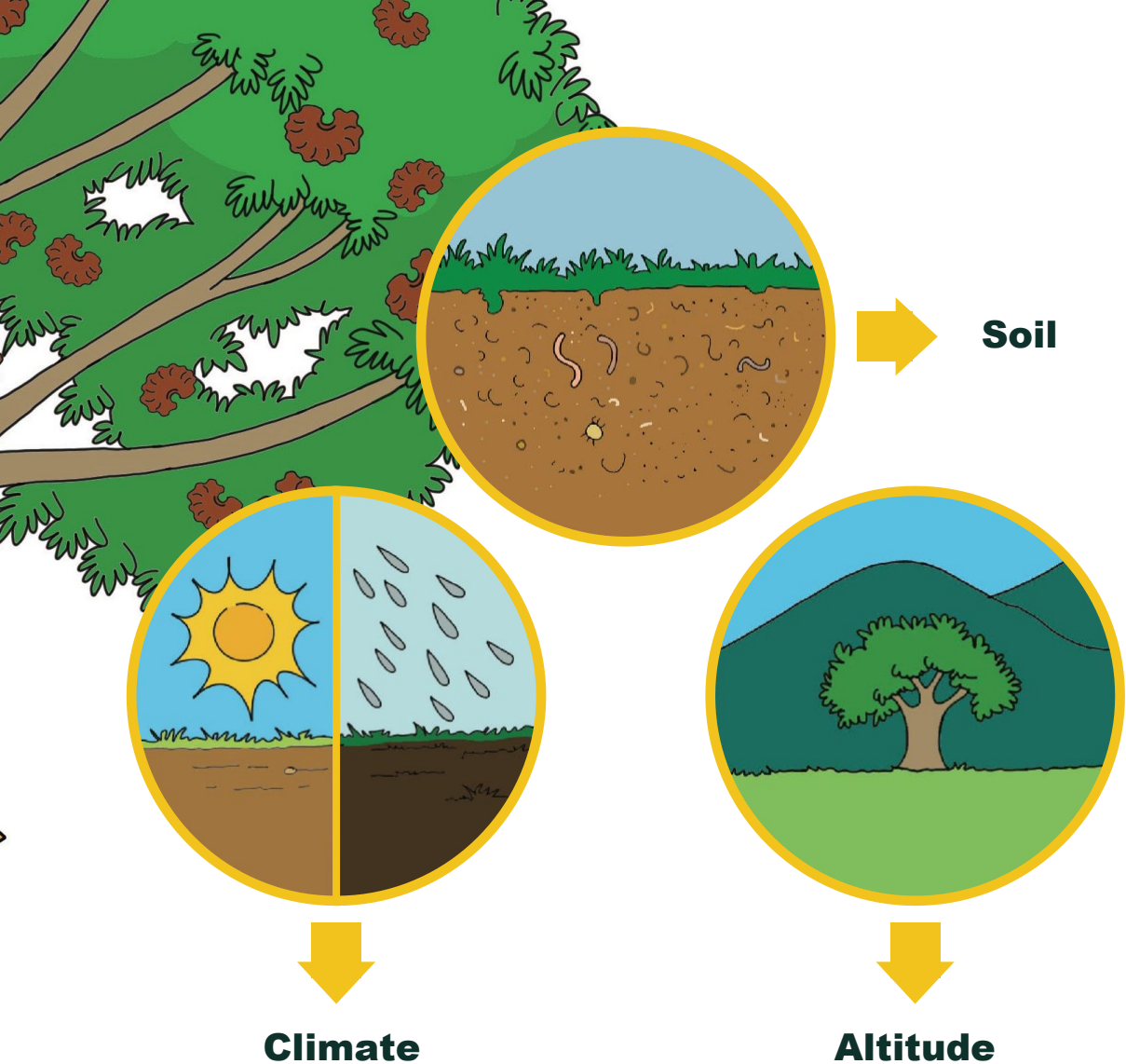


Seed sources



Origin

It refers to the place where the seed was collected.



Knowing the seed's **origin** will depend on the nursery's purpose; for example, whether it will be for commercial or reforestation purposes, as well as the type of climate, soil, and altitude that the seed needs.

Seed trees selection



When selecting trees, it is important to compare them with others of the same species that are growing around them and under similar conditions.

Number of seed trees to collect



Recommended distance among seed trees



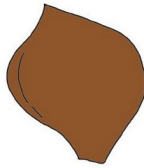
To begin with, it is advised that at least 30 trees be collected with a space separation of 328 ft (100 meters) among them; this recommendation may vary based on the species and number of trees to be located on a site.

Seed management

Collection

1

Reap seeds in a state of maturity.



Mature seed



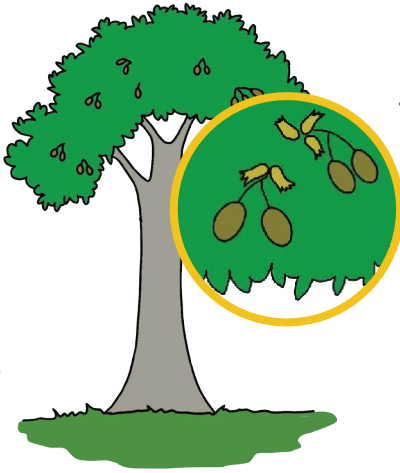
Immature seed



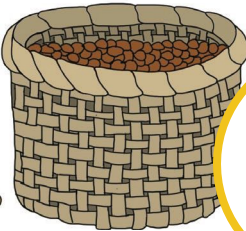
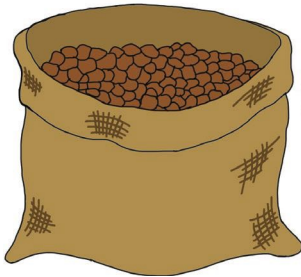
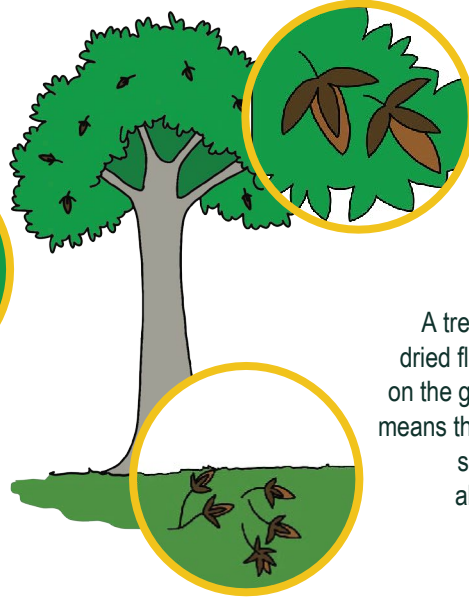
Preferably place them in jute bags or baskets.

2

A tree with
fruits and
flowers means
that the seed is
not mature yet.



A tree with
dried flowers
on the ground
means that the
seed is
already



3

Do not fill the bags to full capacity.



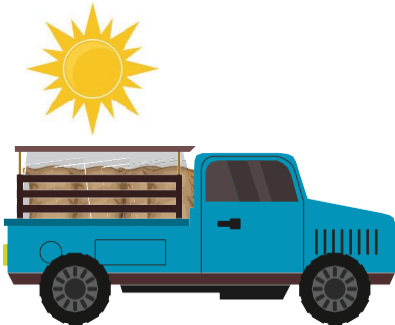
4

Keep them out of the sun while they're being collected.



5

Avoid the sun while transferring the seeds.



6

Keep the seeds in a well-ventilated area.



Characteristics of orthodox seeds and recalcitrant seeds

Orthodox/long-lived seeds

They are seeds that can withstand the drying and storage process in seed banks, in some cases, for up to more than **100 years**.

Examples of orthodox seeds:



Delonix regia

Write down the common name



Dalbergia retusa

Write down the common name



Hymenaea courbaril

Write down the common name

Recalcitrant/viable for a short time

They require other strategies since they cannot be stored for lengthy periods of time because they quickly lose viability.

Examples of recalcitrant seeds:



Calophyllum brasiliense

Write down the common name



Inga spp

Write down the common name

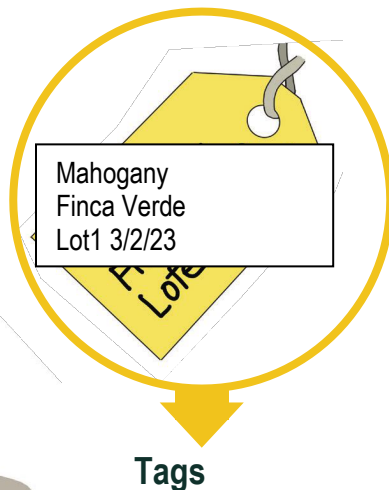


Vochysia

Write down the common name

Processing

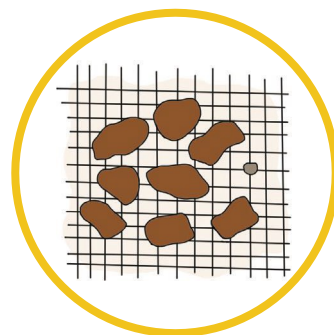
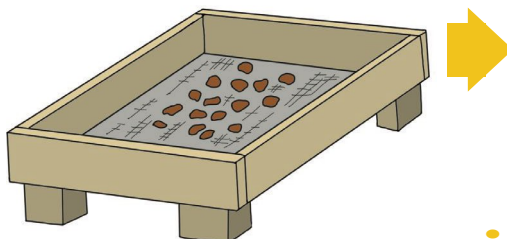
- Upon arrival at the processing site, the seeds should be unloaded immediately and placed on tarps with a proper separation or, preferably, in wooden crates with a raised sieve bottom.
- Label each seed lot appropriately with tags that do not deteriorate or fade.



Tags

Cleaning

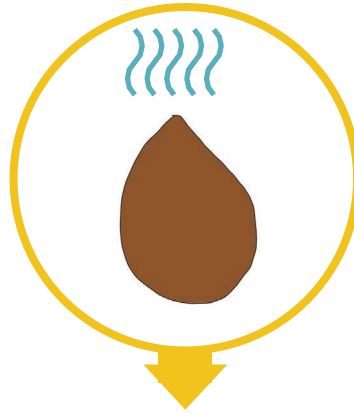
- There are several methods for cleaning the seed, depending on the initial extraction method.



- Using meshes of different opening sizes helps eliminate impurities.

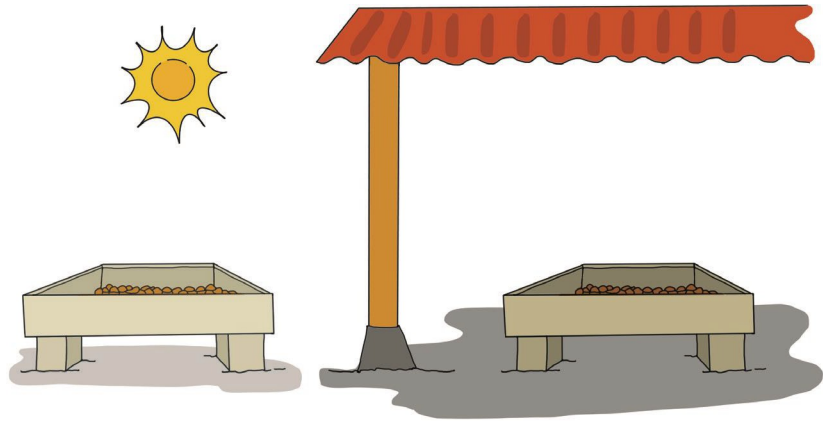
Drying

- It is important to properly dry the seeds in order to lower their humidity from 6% to 9%. There are several methods to determine moisture content; the most popular one is to compare the weights of a seed sample before and after drying it for several hours, since it is measured by the amount of water lost.



Reduce humidity from 6% to 9%

- It is important to know whether the species tolerates drying in the sun or if, on the contrary, it should be dried in the shade.



- They should be protected or stored in dry places overnight.

Seed banks

A seed bank performs a variety of jobs and activities, such as collection, cleaning, assessment, storage, exchange, and seed selling.

Basic requirements for establishing a seed bank

Storage area	To safely store the seeds, provide a clean, dry room or a basic structure in the nursery.
Containers	To store seeds and protect them from humidity, light, and insects, use repurposed containers such as glass jars, clean food cans, or paper bags.
Packaging material	Use low-cost materials for individually packing the seeds, thus facilitating their exchange, such as homemade envelopes made of recycled paper or paper bags.
Tags	Using discarded cardboard or bits of wood and a marker, make inexpensive tags to identify each seed sample with their scientific name and the name of the place where the seed were collected.
Collecting tools	Scissors, knives, and reusable bags.
Equipment	A scale, refrigerator, and work table, which can be made of reused materials, are used to clean and prepare the seeds.
Register	Keep a detailed log of the stored seeds in a notepad, field notebook, or on a computer.

Local knowledge

Make use of traditional and local expertise about seeds and seed preservation.

Community outreach

Conduct outreach and awareness campaigns to educate the community on the importance of the seed bank.

Collaboration with organizations

If possible, partner with non-governmental organizations (NGOs), institutions, or government programs to get technical assistance or additional resources.

Documentation systems and cost calculation

Seed sources description: a code must be assigned to each new seed source for:



- Quick reference
- Control, to prevent mistakes or inconsistencies in seed information



The code must be associated with the code of the seed source where the collection took place.

Seed source code register

All seed sources must be entered chronologically into a register.

Register sample:

Code	Species	Origin	Type of seed source	Altitude (masl)	Mean annual precipitation (PMA) (mm)	Mean annual temperature (TMA) (°C)	Latitude	Longitude
BSF001	<i>Cordia alliodora</i>	San Carlos, Costa Rica	Identified source (IS)	220	3318	26.9	10° 21' N	85° 32' W
BSF002	<i>Cedrela odorata</i>	Las Juntas, Costa Rica	Identified source (IS)	80	2274	26	10° 11' N	84° 04' W

Certificate /Description of seed sources

When the certificate is delivered to the client, it must include at least the following data:

- Botanical information of the species
- Site information
- Forestry information on the seed source
- Information on the physical quality of the seed lot

CERTIFICATE OF ORIGIN

I. BOTANICAL INFORMATION			
Common name:			
Botanical Name		Family:	
Source:		Origin:	
2 SITE INFORMATION			
District:	Canton:	Province:	Country:
Latitude:	Longitude:	Altitude:	
PMA:	TMA:	Life Zone:	
3. SOURCE FORESTRY INFORMATION			
Type of seed source:	Year established:	Height:	
Area:	Density:	Diameter at Breast Height (DBH):	
Degree of Intervention:	Thinnings carried out:		
Observations:			
4. PHYSICAL QUALITY INFORMATION			
Seed lot:	Weight/thousand seeds:	Humidity:	
Purity:	Germination:		
Last germination date:	Requires pre-germination treatment:		
Recommendations			

Certificate sample:

Establishing a nursery

Considerations when establishing a nursery

The area of a nursery will depend on the material to be produced, the permanence of the seedlings, the necessary infrastructure, and the access roads width. However, there are other factors to consider when starting a nursery:

1

Proper site selection.



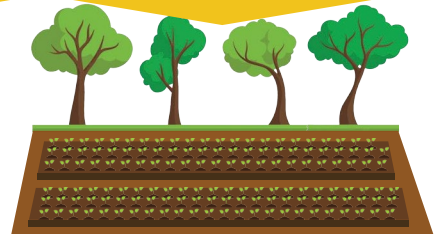
2

Access to a clean water source.



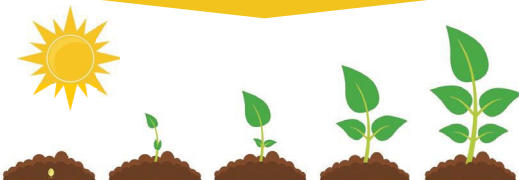
3

Land with a flat and well-drained area.



4

Site orientation preferably from east to west to take advantage of sunlight.

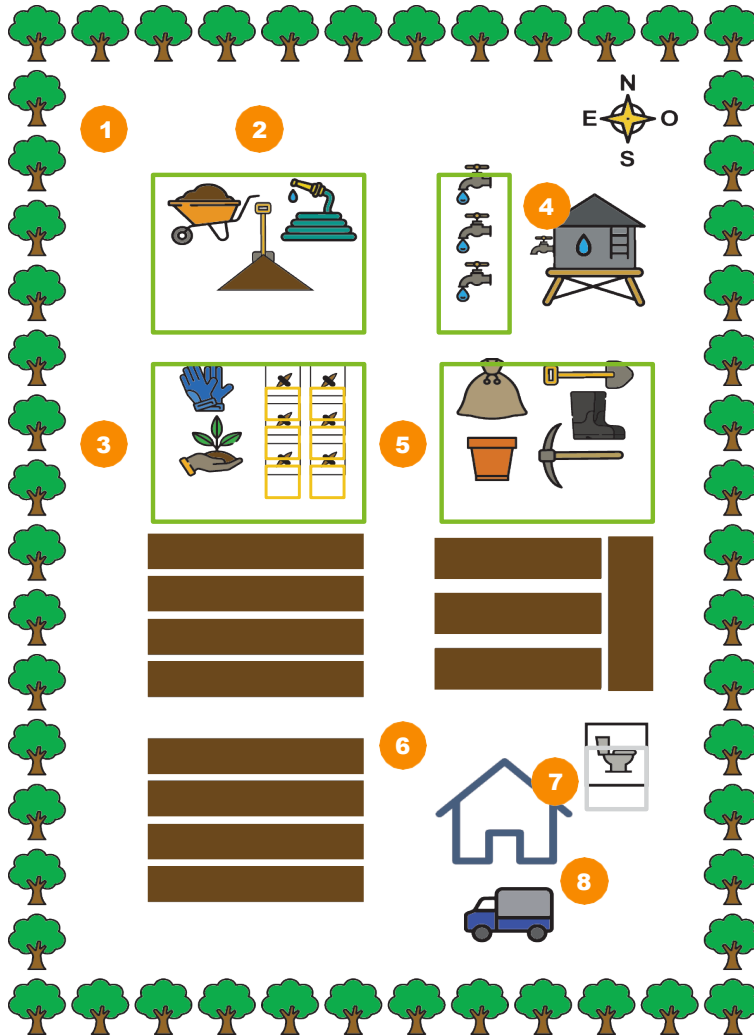


5

Easy access throughout the year for the entry of materials and the transfer of seedlings.



Basic example of design and layout of a forest nursery:



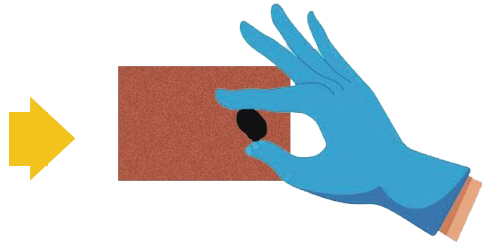
- | | | |
|--------------------------------|--|--------------------------|
| 1 Live fence | 4 Rainwater systems/irrigation system | 6 Threshing floor |
| 2 Substrate preparation | 5 Materials warehouse | 7 Bathrooms |
| 3 Seedbeds | 8 Office | |

Plant production

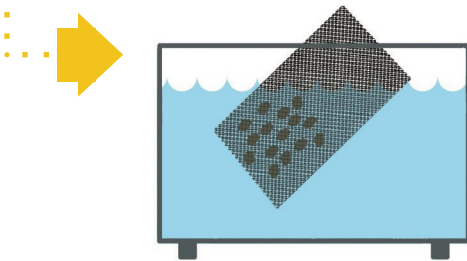
Seed pretreatments

Some seeds are able to block their germination as a strategy to preserve their viability for long periods. Here you will learn how to overcome these blockages or barriers when planting them.

Mechanical/Physical: They are applied to species with hard and/or impermeable seed coats and include the use of sandpaper or scraping elements, application of high temperature, hammer blows, among others.



- **Water Treatments:** Soaking the seed in cold water for 12-24 hours or in hot water for one to three minutes.



Combined treatments: Sometimes the use of two simultaneous treatments improves germination, usually including soaking them in water just before planting.

- **Chemical and hormonal treatments:** These are aimed at weakening the seed coat.



Note: Review the Appendix on page 25 of this guide to learn about the recommended treatments depending on the seed type.

Stages for seedling production

The steps of the process, as well as the equipment and operational and financial resources, are determined by the goals and production system of choice. Production sequence:

1

Substrates for germination

A good substrate must meet the following criteria: adequate moisture holding capacity, root penetration capability, and seedling development.



Example: Sand + silty soil in a ratio of 3:1

Other options to use: sawdust or charcoal

2

Substrate disinfection techniques

It can be done with boiled water or a fungicide with curative and preventive action, as well as solarization, a covering technique with plastics for several days.



3

Planting

The seed should be planted as shallow as possible, covering it just enough so that irrigation does not uncover it and so that, when it emerges, it does not use too much energy.



4

Light management

It is advisable to protect the germinator from direct sunlight and rain with materials that regulate the light intensity throughout the area.



5

Transplanting

When the seedlings are 1.2 to 2 in (3 to 5 cm) high and have the first true leaves, they are ready to be removed from the germinator and transplanted.



6

Substrate for transplant

It is possible to use soil, sand, rice husk, organic fertilizer or compost. The choice of the substrate and the possible combinations depends on the availability of the inputs, but quality in plant production must always be ensured.

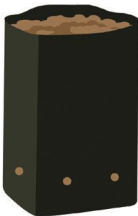


Container nursery production

There are different systems that allow seedlings to be reproduced and managed, such as:

1

Plastic bags
(traditional system)



2

Tubes



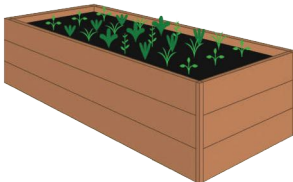
3

Jiffy trays, pellets, or tablets



4

Seedbeds



5

Bare root



Note: Systems such as plastic bags, tubes, and pellets will depend on the economic conditions at hand.

Nursery plant management

Regardless of the production system chosen, the nursery's final product must be a high-quality tree; sophisticated equipment is not required for this. Here are some recommendations:

✓ Irrigation

Should be in sufficient and uniform quantity, as well as at appropriate hours, preferably during the early morning or late afternoon.



✓ Weeding

Weed control requires special monitoring, and it is recommended to remove them by hand. Typically, weeding should be done after completing irrigation in the nursery so that the substrate is softer, facilitating the task.



✓ Shade

Generally, shade is provided using black shading nets or banana leaves at a height ranging from 1.6 to 6.6 ft (50 cm to 2 m). Their ends are supported by frames made of wood, iron, plastic pipes, bamboo, or other locally available materials. Shade removal is done gradually after 8 or 15 days.



✓ Fertilization

To grow healthy plants, various types of fertilizer can be utilized. To apply fertilizers in forest nurseries, several factors must be considered, including the plant's developmental stage, dosage, fertilizer type, method, and frequency of applications. This analysis should also take into account the species, the type of substrate, and the nursery management techniques.

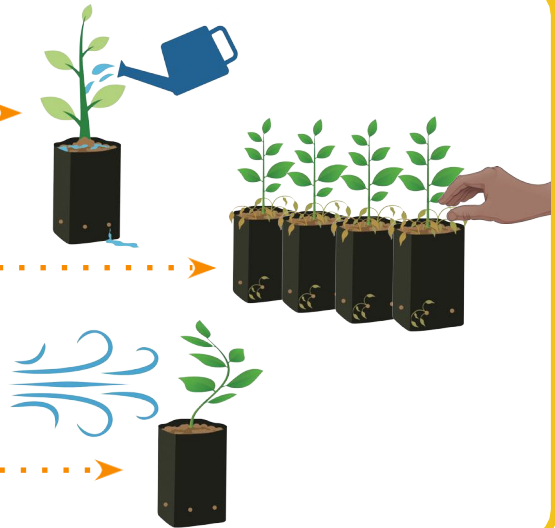


Plant disease prevention and treatment

These are the different types of management to address phytosanitary problems or diseases that may arise in the nursery during the plant development:

Preventive actions

- Training staff to recognize these diseases
- Avoiding excessive irrigation
- Regularly cleaning or removing diseased or dead material and dispose of it away from the nursery, such as weeds.
- Washing and disinfecting the tools used
- Preventing seedlings from coming into contact with winds and extreme temperatures that may affect their development



Curative actions

- Removing diseased plants
- Applying insecticides or fungicides
- Placing traps



Forest nurseries control and management

To assist in the management of a nursery's activities, it is essential to understand the daily chores, the necessary equipment, and the staff required based on the nursery's size and capacity:



Design a calendar or production schedule to keep a record of the tasks.

General production schedule model in nursery: Plant production schedules should be developed for each species or at least for groups of species that have the same production cycle. This aspect is important for setting the dates of material delivery.

Activities	Month									
	1	2	3	4	5	6	7	8	9	10
Seed collection										
Land preparation										
Nursery design and adaptation										
Seedbed preparation or adaptation										
Substrate homogenization, mixing and disinfection										
Pregerminative treatments										
Seeds planting										
Shade placement										
Shade removal										
Irrigation										
Preparation of substrate for bags										
Filling the bags										
Transplanting or pricking out										
Weeding										
Fertilization										
Phyosanitary inspection										
Growth and development										
Russification or hardening off										
Monitoring										
Plant delivery										

Appendix. Seeds pretreatment for some species

Species		Treatment
Common name	Scientific name	
Peru Balsam	<i>Miroxylon balsmum</i>	It is advised to immerse in circulating water for 24 hours or combined with a longitudinal cut in the seed. It has also been reported as satisfactory to immerse the seeds in water at 50 °C for five minutes.
Cedar, Cedarwood	<i>Cedrela odorata</i>	The seed germinates well without treatment, but a more uniform germination is achieved by soaking the seed in water for 24 hours before planting. Water should be changed every 3-4 hours; another option is to leave the container with the seeds under a tiny trickle of water.
Brazil Beauty-Leaf, Santa Maria	<i>Calophyllum brasiliense</i>	It is recommended to keep the seeds in circulating water for 24 hours before planting to soften the coat and accelerate germination.
Rain Tree, Monkey-pod, Saman	<i>Samanea saman</i>	With small batches, you can make a cut with scissors or sanding the coat on one side of the seed, to facilitate the entry of water. For very large batches, you can pour boiling water over the seed, leave it in this water for 2 minutes, and then in cold water for 12 hours. The water should be changed every 3-4 hours; another option is to leave the container with the seeds under a small trickle of water.
Cocobolo	<i>Dalbergia retusa</i>	If the seeds are freshly collected, it is recommended to immerse them in water for 12 hours. The water should be changed every 3-4 hours; another option is to leave the container with the seeds under a small trickle of water. If the seeds have been stored for a long time, it is recommended to place them in hot water (60 °C) for one minute and then leave them in cold water for 24 hours, also changing the water frequently.
Ear Tree, Guanacaste	<i>Enterolobium cyclocarpum</i>	With small batches, you can make a cut with scissors or sanding the coat on one side of the seed, to facilitate the entry of water. For very large batches, where the above becomes impractical, the seed can be immersed for 30 seconds in boiling water, followed by 24 hours in room temperature water. The water should be changed every 3-4 hours; another option is to leave the container with the seeds under a small trickle of water.
West Indian Locust	<i>Hymenaea courbaril</i>	It is recommended to soak the seeds in circulating water for 8-16 days, or make a notch on one side or sand them, and then soak them in water for 24 hours. The water should be changed regularly; another option is to leave the container with the seeds under a small trickle of water.
Panama Tree	<i>Sterculia apetala</i>	It is recommended to soak the seeds in circulating water for 48 hours. For small quantities, cuts or sanding of the seed coat are performed, followed by soaking in water for 48 hours to soften and remove a layer (or aril) surrounding the seed.
Bully Tree, Suradan Pilon	<i>Hyeronima alchorneoides</i>	Sanding is recommended, rubbing the seed between two boards to which sheets of sandpaper have been adhered, or submerging them in circulating water for 3-7 days, or changing it twice a day. Great uniformity of germination has been obtained by washing the seeds in soapy water, and then leaving them in circulating water for 24 hours.

Cost matrix

Production cost for a forest nursery



Activity	Daily wages	Unit cost	Total cost
Land preparation			
Leveling the ground			
Soil extraction			
Bagging			
Transport and arrangement			
Construction and preparation of germinators			
Seed planting			
Transplanting			
Shade			
Irrigation			
Weeding			
Fertilization			
Dispatch			
Subtotal			
Materials and inputs			
Substrate			
Agrochemicals			
Bags			
Equipment and tools			
Transportation			
Contributions			
Utilities			
Subtotal			
Unforeseen expenses			
Profit			
Grand total			

Notes





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CATIE

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