# SUSTAINABLE TREE FARMING

## A GUIDEBOOK

Forest Foundation Philippines

Let's grow together.

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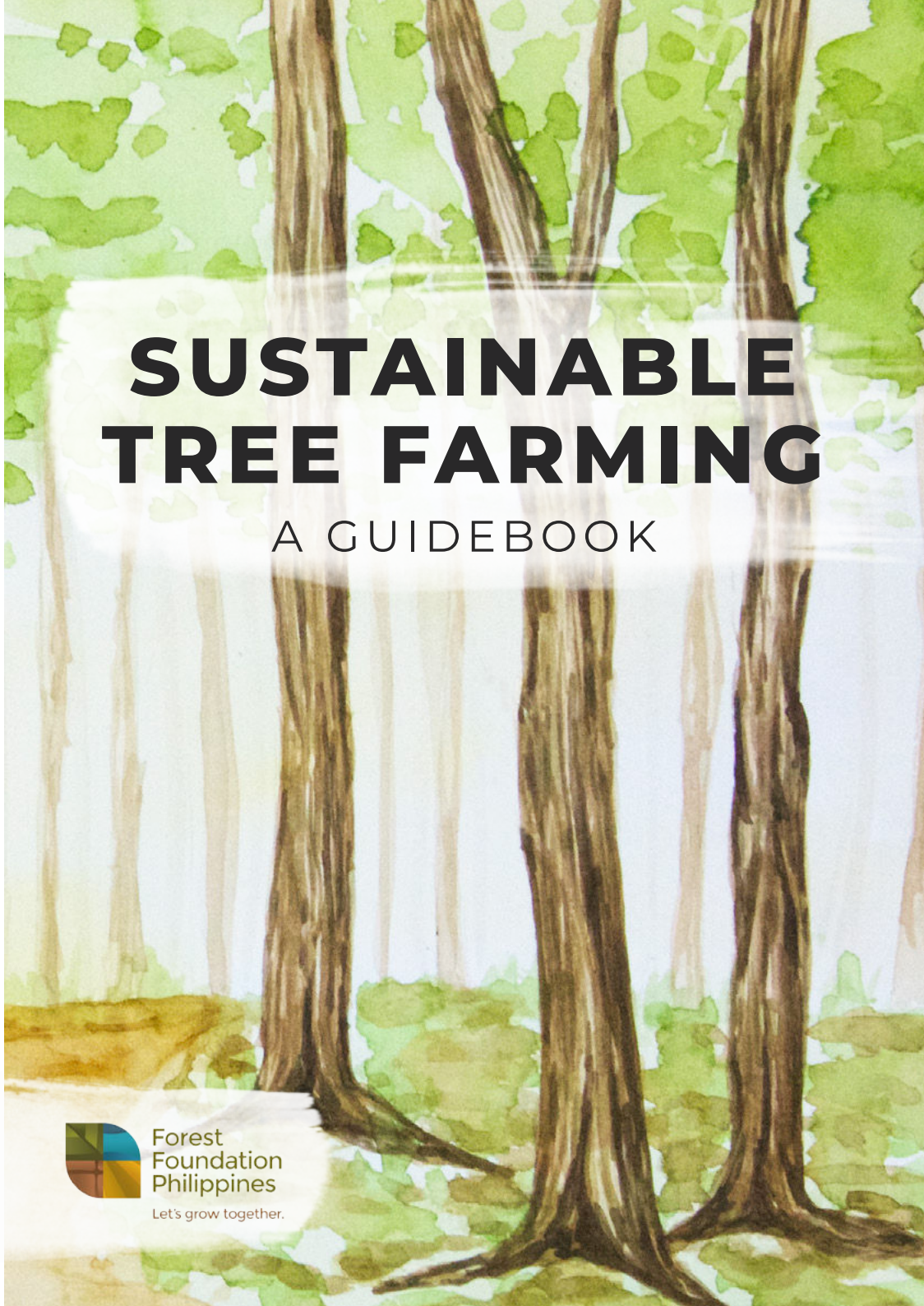

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# ABOUT FOREST FOUNDATION PHILIPPINES

Established in 2002, under two bilateral agreements between the governments of the United States of America and the Philippines, the Forest Foundation Philippines (formerly known as Philippine Tropical Forest Conservation Foundation or PTFCF) is a non-profit organization that provides grants to organizations that empower the people to protect the forests.

Since its inception, the Forest Foundation Philippines has supported over 450 forest- and community-related projects. With the Foundation's support, the country has seen an improvement in the management of 1.5 million hectares of forest lands; restoration of approximately 4,200 hectares of forests through the reintroduction of appropriate native species; establishment of over 40 community-conserved areas; and creation of over 60 community enterprises.

Today, the Forest Foundation Philippines' work continues as the forests still face threats. Guided by the Forest Foundation Philippines Program Plan, 2017-2021, the Foundation has allocated around Php 480 million to protect the country's most critical forest landscapes: Sierra Madre, Palawan, Samar and Leyte, and Bukidnon and Misamis Oriental.





# PREFACE

Thank you for picking up this book and for being part of a growing number of individuals taking action to conserve forests. We have achieved significant progress in the past years, from planting native trees to guarding our watersheds. However, we still need to put more effort into fostering multi-scale forest conservation and restoration strategies. This includes encouraging our many small landholders to be part of our advocacy. These small landholders can be catalysts in developing small-scale sources of wood, and developing other timber products and services away from protected areas and recovering forest lands. Creating and enhancing small tree farms or pocket forests will benefit our biodiversity, provide ecosystem services, and nurture human well-being.

At the outset, we need a simple and easy-to-read material that will serve as a guide for starting, maintaining, and sustainably harvesting tree farms. We would like to thank Jose Ma. Lorenzo Tan, former Chair of the Forest Foundation, who suggested the initial concept of this guidebook. We envisioned a "forestry cookbook" of the basic ingredients and steps for small landowners to transform their lands into a sustainable tree farm. We drew from the experience of MARSSE Tropical Timber Plantations in running their sustainable tree farm in Pangasinan. We are thankful for the partnership with MARSSE and the Sustainable Tree Farmers Group of the Philippines in the writing of the guidebook.

We hope that more landowners follow the steps in this guidebook and venture into sustainable tree farming whether for wood production, orchard establishment, biodiversity sanctuaries, or tree havens. This guidebook also provides an initial list of resources and partners to encourage more people to start conserving forests, their way. We look forward to engaging with individuals, organizations, and communities who have the passion and will take action to conserve forests.

**Atty. Jose Andres Canivel**
Executive Director
Forest Foundation Philippines

# BEFORE WE START
## CHAPTER 1

Every community—from booming cities to tiny villages—needs trees, and the goods and services they produce, to function. Trees can provide paper, furniture, food, and the very air we breathe. Well-run tree farms can help provide all of these to communities without putting natural forests and ecosystems at risk of degradation. In fact, a tree farm is uniquely suited to contributing to sustainability and conservation efforts.

This guidebook serves as an introduction to starting a tree farm. It shows the different practices that will help ensure that the farm is sustainable and environment-friendly. This means running it in a way that will allow the land to be able to sustain the farm for decades to come, protecting and strengthening local biodiversity and ecosystems, and reducing the waste generated by the farm as much as possible by recycling and making smart use of natural resources.

While running a tree farm can be a big investment in terms of time and resources, it can also be a very rewarding business. There are many stages of processing that harvested trees must go through to become finished products, so operating a tree farm opens up other areas of business to explore, such as processing timber, and creating and selling wood-based products.

If starting a tree farm is not the most suitable choice, there are still many other forestry projects to undertake. From working with agroforestry to starting a tree park, there are several ways to contribute to revitalizing Philippine forests. These ways will be discussed further in Chapter 7.





## LEARNING ABOUT THE LAND

There is no easy way to characterize the land we have. This is a process that will require expert knowledge and data-gathering procedures such as topographical surveys and soil testing. Thus, it is very important to have a forester, environmental scientist, or other experts look over the land because it will play a big role in determining how to lay out the farm, what trees to plant, and what possible risks we may encounter and need to prepare for.

To get in touch with an expert, we can reach out to a local branch of the Department of Environment and Natural Resources (DENR). Universities or scientific institutions may also be able to provide personnel to perform the tests.

The Department of Agriculture's (DA) Bureau of Soils and Water Management offers a wide range of soil maps for different provinces, which can give an idea of the type of soil in our land. They also provide laboratory analysis and land surveying services.

# THE LAND

Knowledge of our land is key to successfully growing our trees. There are many factors that need to be considered like the topographical features of the land and the characteristics of its soil, which is extremely important as different trees will thrive in different types of soil.

One soil characteristic to take into account is its texture:

**Clay** soil is made up of the smallest particles, retains water well, and is usually very fertile.

**Sandy** soil is made up of much larger particles, retains less water, and is generally less fertile than clay soil.

**Silt** soil is made up of particles that are bigger than clay soil but smaller than sandy soil. Its ability to retain water and nutrients is between that of clay and sandy soils as well.

**Loam** soil is a combination of clay, sand, and silt. This is the best soil texture as the benefits of each component contribute to plant growth.

The soil's texture will affect how to care for our trees. Silt and sandy soils, for example, will need more water since they drain more quickly than clay soil. Rotting organic matter (discussed in detail in Chapter 2) will help improve any soil type.

The pH of the soil is also an important factor. It can be either acidic or alkaline, depending on the nutrients and chemicals that are present in it. Certain trees will grow better at certain pH levels. The Department of Science and Technology (DOST) and some state universities offer soil analysis and other tests that would help assess the type of soil.





# DIFFERENT TYPES OF TREES

After determining the characteristics of the soil, we can select the different tree species that will thrive best in our land. For example, Teak grows very poorly in sandy or acidic soils as the tree is known to need a lot of calcium to develop properly. Honduran Mahogany, on the other hand, is best suited to clay and loam as the tree flourishes in moist types of soil.

Teak Tree

Honduran Mahogany

Government policy should also be considered in the choice of trees. The Revised Forestry Code of the Philippines (Presidential Decree No. 705) identifies the policies and general processes that we will need to take note of to make sure that the trees we plant can be legally harvested later on. A tree plantation registration done at the outset with the DENR will secure clearance for harvesting and transporting timber. In general, a cutting permit is required regardless of tree species.

# FUNDING

One challenge of starting a tree farm is that it requires a significant initial investment. Procuring land, seeds, equipment, facilities, and manpower requires money, and much of the potential returns on these investments will not be seen until the grown trees can be harvested, more than a decade after the farm is started.

The following section will present an overview of possible sources of funding to procure land, equipment, or anything else that may be needed for the tree farm.

## FINANCIAL ASSISTANCE

### Government programs

The Philippine government, through the DENR, DOST, and DA, periodically offers grants and other programs that help fund startup businesses or environment-oriented projects, like tree farms. It is advisable to reach out to these government agencies, as well as Local Government Units (LGUs), to see if they can provide funding, equipment, or other assistance that can help start the farm.

For example, the DOST Small Enterprise Technology Upgrading Program (SETUP) provides equipment that will help small businesses improve their operations.





### Non-governmental organizations

Non-governmental organizations (NGOs) may also provide seed money or other forms of financial and technical assistance for starting the farm. Best to look for organizations focused on helping startup businesses or organizations concerned with the environment and conservation of natural resources, like Forest Foundation Philippines.

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### Bank loans

Similar to other business ventures, getting a loan from the bank is another option. However, tree farmers have noted that they have had difficulty securing loans because, unlike crops or other items, many banks do not consider trees as an asset.

The Development Bank of the Philippines offers a Tree Plantation Financing Program, which offers loans for tree plantations that have standing trees which are at least four years old. If there is enough capital to fund the first few years of the farm, this program may be tapped for maintenance or expansion activities, among others.

## SOURCING SEEDS AND SEEDLINGS

Finding a source of seeds or seedlings is an important initial step in establishing our farm, especially if there are only a few pre-existing trees on our land.

Similar to finding funding, this can come from different sources, like government programs or NGOs. Government-sponsored nurseries, like the joint DENR-DOST clonal nursery in Taguig City, are an option in procuring seedlings.

It is also possible to obtain or purchase seeds or seedlings from other farms in the area or farms that grow the tree species we want to cultivate. The Rain Forest Restoration Initiative (*www.rainforestation.ph*) can help source the seeds of many tropical trees. Its website provides a list of nurseries all over the country, including the types of trees they cultivate.

Once the land for our farm has been secured, we need to survey the area to check if the tree species we want to grow is already present. If so, those trees can be a source of seeds. We can also ask neighboring landowners for permission to survey their land and obtain seeds from their trees.

A large number of seeds or seedlings is important for any tree farm, especially in the beginning stages. To effect an outcome of roughly 2,500 trees for one hectare of land, we will need to plant about 10,000 seeds in that area since not every seed planted will grow and thrive.





## GOVERNMENT REGULATIONS AND CLEARANCE

Before we start our farm, it is important to secure all the legal requirements that will allow us to operate. Having all these clearances and requirements at the very start will make dealing with government offices much easier throughout the years we will be operating.

On some occasions, we may have to deal with the DA as well as the DENR. If we plan for agriculture to be a part of our development, or if we will be using public land, both our farm and nursery must be accredited with the DA. This accreditation can be obtained through the DA's Bureau of Plant Industry. Otherwise, the DENR is the main agency we will need to work with.

The DENR is more concerned with conservation and sustainable management, especially when it comes to dealing with native tree species. To operate, our farm must also be certified by the DENR. Our trees should also be well-documented, so that we will be allowed to harvest, transport, and/or sell them. A more detailed look at this process is presented in Chapter 2, under Registration and Documentation.

Depending on whether we are simply supplying timber or lumber, or are selling our finished products, we will need to register our operation with the Bureau of Internal Revenue (BIR) and the Securities and Exchange Commission (SEC). If we also plan to develop and sell products, we will also need to register with the Department of Trade and Industry (DTI).

Aside from these national regulations, we also need to comply with any local laws or ordinances where the farm is located. We have to consider local land use plans to see if our area is zoned for industry, agriculture, or other purposes. Thorough research must be done before putting up our farm to ensure that it follows city, municipality, and barangay regulations.

A more detailed look at the different clearances and permits that we will need can be found in Chapter 2.

# LAND PREPARATION
## CHAPTER 2

In the previous chapter, we talked about how proper planning and goal setting are essential to a successful and sustainable tree farm. Once we have decided on the goals and direction for the farm, it is time to start preparing the land for planting and farming.

The type of land that we will be using for the farm is one of the most important things to consider in this process. The type of soil that makes up our land, its topographic and geographic features, as well as the flora and fauna present, will all affect how our farm should be divided, the types of trees that we should be growing, and even the legal and financial requirements for operating.

This chapter will go into more detail about how to plan the layout of our farm, as well as how to prepare the land for the initial stages of tree planting.





## PLANNING THE FARM

### WHAT TO HAVE ON THE FARM

There are many different types of areas and structures that should be present on our farm to make sure that all the needs of our trees and operations are met. It is important to allocate enough space for each of these. The exact amount of space that we will need for each will vary depending on our goals and the particular conditions of our land and trees, so knowing all the different things we will need to allocate space for is vital. The following are a few standard areas that we should have on our farm:

#### Nurseries

Nurseries are the sections where seeds or seedlings should initially be planted, before being moved to the main plantation area. Especially during the beginning stages of the farm, a dedicated nursery is important. This is because the trees will be more sensitive during the early stages of growth and need to be monitored and cared for more closely. The area allocated for this should be much smaller than the main plantation, since only young trees will be grown here.

## Plantation land

This will make up the bulk of the farm. Once they have sufficiently matured, the seedlings, wildlings, and saplings will be moved from the nursery to the main plantation area, where they will remain until harvesting.

Everyone working on the farm, ourselves included, must become familiar with the lay of the land. Hands-on maintenance of the trees in the plantation areas will have a significant effect on the quality of the timber.

As a general rule, trees should be planted in a grid formation, with each tree having a 2 meter by 2 meter area to itself. This ensures that each tree has enough access to water, nutrients in the soil, and sunlight. It will prevent trees that are near each other from competing for resources. Moreover, this spacing will help the trees grow with as few branches as possible, to ensure a straight bole (the trunk of the tree that is turned into lumber), which is favorable for selling.

This rule may change depending on what species, or combinations of species, we are planting. But this is a useful guide for estimating how many trees we will be able to fit in our plantation area, or how much space needs to be allocated for growing a certain number of trees.

A more detailed discussion of the grid formation can be found in the next chapter, while a closer look at some of the best practices for maintaining our land, as well as our trees, can be found in Chapter 4.





To conserve as much of the integrity of the natural environment of our farm as possible, certain rules should be followed when laying out the plantation land. A standard practice for sustainable farms is that no trees should be planted within ten meters of the natural waterways on our land. This is to prevent too many leaves from falling in, and affecting the water and the animals that live in it. Aside from planting no trees within the first ten meters, none of the trees planted within 20 meters of the waterway should be harvested. This is to help provide a more stable ecosystem for local species that live near the waterway. These rules are extremely important because the amount of water that trees have access to is one of the main factors that affect how fast they grow.

## Preserved area

Though not a requirement, another general rule of thumb states that 10 percent of the trees we plant should be planted for preservation, meaning that they should not be harvested. This is to help preserve local trees and support biodiversity.

This 10 percent can be made up of different species of trees that we harvest. If we are planting exotic species, this is a good way to incorporate native trees into our farm, and cultivate an area that is conducive to hosting wildlife.

Depending on the number of existing trees and plants on our land, we could also take measures to not cut down existing trees, especially native ones, when planting our own trees. Allocating some space for existing native trees on our land, and planting our trees around them, will also help promote biodiversity.

## Buildings and structures

We will need several structures on our farm, as well as space for larger pieces of equipment.

Generally, bunk housing or a residential building should be provided for the people working on the farm. This is important since farm land can be found in remote locations, and far away from most residential areas. The particular size of each house, or the number of houses we will need, depends on the number of people working on the farm.

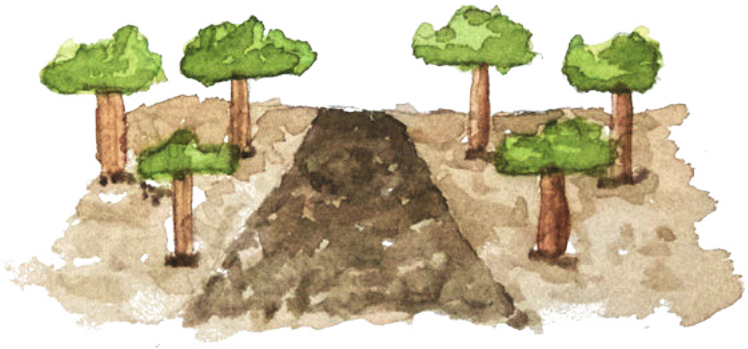
These can be simple buildings made mainly for workers to rest and sleep in. Depending on accessibility to surrounding areas, facilities to provide food might also be necessary, especially if there are long-term workers, or workers who live on the farm full-time. Many farm owners also have their own houses on their farms, and live there, or use them as weekend residences.

If we intend to process timber and lumber on our farm, it is also important to map out where the equipment that will be used for the processing, as well as the structures housing them, will go. These might include kilns for drying wood, sawmills, and areas set aside for woodworking. An area for the storage of wood should also be designated.





## Roads and trails



The road structure of our land also requires careful consideration and planning. An efficient network of roads will allow workers to move quickly through the farm, and allow the transportation of equipment as well as harvested trees or branches.

Roads and trails are also important because they will serve as firebreaks. Firebreaks are gaps in a farm where no plant life grows. A fire will not be able to cross this gap easily, because there will be less fuel for it to burn. If a fire starts, these firebreaks are essential to keep it from spreading too rapidly, and allowing it to burn out instead of engulfing the entire farm.

Trails that are 4 to 6 meters wide should serve as effective firebreaks. Wider roads for vehicles will also serve this purpose. A wide road around the perimeter farm can also serve as a main road, a boundary line for our property, as well as a main firebreak, which will stop a fire from spreading to other farms.

## STRENGTH IN BIODIVERSITY

Monocropping is the practice of planting only one type of crop on the land. In regular farms, this can be avoided by rotating crops: planting different kinds of crops on the same piece of land once the previous crops have been harvested. However, in a tree farm, where crops take much longer to mature, the only way to avoid monocropping is to grow various tree species in the same area.

Different species of trees sharing the same space also goes a long way toward increasing the biodiversity of the area. From a conservation perspective, this helps make our farm a more well-rounded ecosystem, capable of supporting a wider variety of plant and animal life. Helping to cultivate this type of ecosystem can make the land not only a farm, but a thriving, natural space as well.

Having a more well-rounded ecosystem can help our farm in different ways. A monocrop is extremely vulnerable to pests and diseases. If a disease or pest that affects a certain species of tree appears in a monocrop, then that entire crop is in danger. This risk is greatly mitigated by maintaining a variety of species. A healthy ecosystem can also potentially attract natural predators that would keep pests in check.

Different trees and plants can also have favorable interactions with each other. Some plants can promote the presence of nutrients like nitrogen in the soil, which is necessary for most trees to grow.





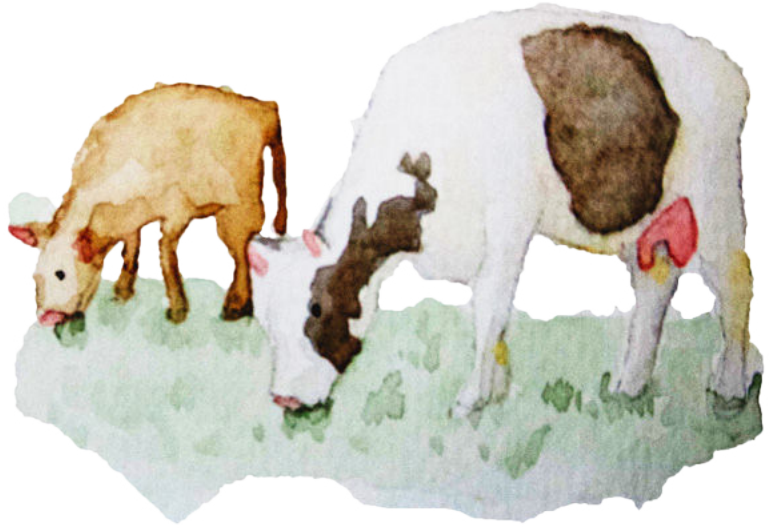
## SMALLER OPERATIONS

Because of the large investment required to start a tree farm, and the long period between starting the farm and having harvestable crops, allocating some of our land for other purposes might help keep the farm financially viable.

A portion of the land could be used to plant food crops and other fast-growing crops that could be sold to market. This can help us raise funds that we will need to keep our farm running.

The type of crops we plant in a side operation will depend on the land and the environment of the farm, but their marketability can help us start getting our investment back.

Aside from raising alternative crops, the land could also be used to tend livestock. Depending on the financial setup, this could be the only way to make money from both land and farm during the decade or more that our first generation of trees is growing.



# BASE CROPS AND SECONDARY CROPS

Once we have determined the trees we want for our land, we must also establish the order in which to plant them, considering the factors that will affect their continued survival (e.g., soil-conditioning characteristics, ability to attract pollinators or self-pollinate, growth rate, height of the tree at full growth, etc.). It is important to research not only about each species of tree we will be planting, but also the possible ways they will interact with each other, either beneficially or adversely. Understanding these relationships will give us an idea of which trees to plant near each other, which would serve as the best initial crop (or base crop) to plant, and which would be best suited to being secondary crops.

A base crop usually refers to a plant species that can grow easily in less favorable environments. It also makes conditions more favorable for other plants, usually referred to as secondary crops, to grow later on.

For example, Honduran Mahogany can serve as an effective base crop. This is because it grows relatively quickly, reaching maturity after 25 years. It is a pioneer species, meaning it is able to survive even in less ideal conditions.

For a commercial tree farm, it is also good to take into consideration the marketability of the mix of prospective tree species when selecting base crops and secondary crops. Select tree species that are both market-friendly and suited to the location; this will ensure the best return on investment. This is why fruit trees are commonplace as secondary crops in timber-growing farms. Furthermore, farms with multiple tree species usually have a carefully curated selection of exotic trees that will thrive alongside native trees, with conservation in mind. In the case of MARSSE Tropical Timber Plantations Inc., apart from fruit-bearers, the ideal tree crop includes Teak, Mahogany, Gmelina, Narra, Kamagong, and Molave.





# PREPARATION FOR PLANTING

Once we have mapped out the structure of the farm, we can begin preparing the plantation for our trees. We should begin by clearing all the grass and smaller plants from our plantation areas. This will reduce competition between our trees and other plant species. The cuttings from the cleared grass and plants can then be left on the land to rot, which will infuse organic matter into the soil, fertilizing it. This will also soften the soil, and make digging and planting easier.

The process of infusing organic matter can take up to a year, so other preparations can be made while this process is ongoing, including starting to grow seeds in our nursery.  After the year is over, we can start digging holes for our trees.

## THE GRID FORMATION


When it comes to spacing, keep this in mind: closer spacing encourages fast growth and height increment, while wider spacing encourages crown development (referring to the tree's leaves and branches).

Planting the trees in a grid is an efficient way to arrange our trees. To do this, simply divide our plantation land into a grid of squares that measure 2 meters on all sides, planting one tree in the center of every square. Each piece of land surrounded by roads, trails, or firebreaks should be arranged with its own grid.

This will help ensure that each tree has room to grow, with enough access to nutrients, water, and sunlight. It will also make it much easier for us to monitor our trees, and navigate around our plantation.

After we start maintaining the plantation, and thinning out and harvesting trees, the farm will most likely lose its grid formation and become less orderly. This is natural, and the grid does not necessarily have to be maintained. The chapter on Maintenance will cover this in more detail.

To start, a rule of thumb to remember is that one hectare of land can support 2,500 young trees. This is a good number to keep in mind when planning the distribution of our land and our trees. But as the trees mature, some will need to be thinned out. The Maintenance chapter will discuss this as well.

## REGISTRATION AND DOCUMENTATION

To get started on our tree farm, we need to secure several permits and clearances. These general steps are outlined below:

1) Set the farm up as a legal entity by registering it as a business, be it as a sole proprietorship, partnership, or corporation. This will involve getting clearances from the following government entities:
   a) Barangay/local government;
   b) Mayor's office;
   c) Securities and Exchange Commission; and
   d) Bureau of Internal Revenue.
2) Depending on local regulations, we may need to file a Land Use Plan for larger farms.
3) Local regulations may also require a permit to dig wells or use natural waterways, which may be useful for the farm.
4) After planning out the buildings we will need, we should file permits for these with the local government.
5) The DENR requires that we register our tree farm as a plantation by obtaining a Certificate of Tree Plantation Ownership (CTPO). This will allow us to legally harvest, transport, and process our trees.





To obtain the CTPO, an application needs to be sent to the DENR, which includes:

- a copy of the land title;
- a certification of ownership from the barangay, city, or municipality;
- a map of the plantation;
- inventory of the trees; and
- photo documentation of the trees.

Once this application is submitted, an inspector from the Community Environment and Natural Resources Office (CENRO) will perform an inspection of the property and issue the certification. For more details on this process, visit the DENR website (www.denr.gov.ph). Take note that this process can take a total of two weeks after completing the paperwork and inventory.

These permits should be applied for once the first plantings have been made, and amended every season as our inventory changes.

Depending on where the farm is located, we may also need to comply with certain local government requirements to plant or harvest trees. It is best to contact local barangay, municipality, or city offices to determine if this is the case.

## COST CONSIDERATIONS

The actual costs of a tree farm will vary greatly, depending on a number of factors. Here are some that we can expect to spend on for the farm, including costs for labor:

- Land
- Equipment
- Planting stock
- Clearing, digging holes, staking
- Outplanting (including organic fertilizer application)
- Initial year maintenance
- Yearly maintenance (brush cutting and weeding)

# INITIAL PLANTING STAGES

## CHAPTER 3

Once the preparations for the farm have been made, the initial steps to actually planting our trees can be carried out. This chapter will talk about the different steps necessary to establish a mature plantation. This will include preparing seeds, creating and caring for a nursery, and moving saplings to the main planting area.





## SEEDS

When we have obtained the seeds to start the farm (an overview of where to source them can be found in Chapter 1), and the land has been set up (which has been covered in Chapter 2), we can start treating our seeds and planting them.

### PRE-PLANTING TREATMENT

The seeds of different species will need to be treated and planted in different ways. We should thoroughly research the best methods for treating our seeds before planting them, and the best conditions to plant them in. Let us take a look at the pre-planting treatments for Mahogany and Teak, which are two of the most commonly farmed trees due to their marketability in local and foreign markets.

Mahogany

1

Plant seeds with the heavy curved side facing downwards

2

Should be planted in the shade, under a roof or net, or under taller trees

3

Seeds should sprout after two weeks

## Teak

1

Put seeds in a container of water for 24 hours, and plant the ones that sink to the bottom

2

Plant seeds stem up

3

Should be planted in direct sunlight

4

Seeds should sprout after two weeks

Some seeds, like Gmelina seeds, are very hardy and require no treatment before planting, and will grow in a variety of conditions.





# ESTABLISHING A NURSERY

A tree nursery is an area distinct from the main plantation. This is where seeds will first be planted. To give our seeds the best chance of growing, nurseries must be monitored more closely than the main plantation. All the seeds or saplings need to be provided with a lot of care because they are very fragile at this stage.

## Seedling bags

After treatment, seeds should be planted in seedling bags. Generally, not all the seeds will grow; thus, it is best to plant two of each type of seed in a large (12 inches x 10 inches) seedling bag, not too deep in the soil.

To help ensure that as little waste as possible is produced, seedling bags can be recovered and reused for the next set of seeds after the initial batch of seedlings have been planted directly in the ground.

## Seed bed

A seed bed, which is a raised enclosure made specifically to help seeds germinate, can be used as an alternative to seedling bags. While this may take more time, it can also give our seeds a better chance to germinate and grow.

A seed bed can be as simple as an enclosure created with pieces of timber. The enclosure can then be filled with very fine soil, and topped with 3 to 4 inches of manure or fertilizer. Seeds can be planted directly in the seed bed in small holes (roughly 1 inch in diameter), no more than half an inch deep in the soil.

Some practitioners find it more cost-efficient to plant seeds directly in the seedling bags (and germinating the seeds there) as it reduces the double-handling of seeds. It also lessens the risk of root shock or root damage that can occur during transplanting from the seed bed to the seedling bags.

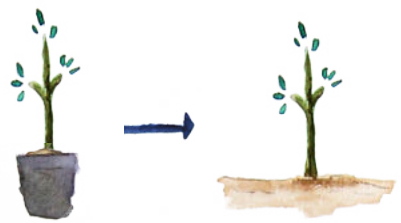
### Coco coir

A third option is coco coir, which is made of natural fiber found inside coconut shells. Long used for making ropes, mats, and carpets, it is now considered a sustainable and ideal means of growing seedlings as it is renewable and retains moisture well, while still allowing water to drain and air to circulate—leading to healthy root systems.

Coco coir comes in various forms: similar to soil, in bricks, or shaped into pots. Coco coir pots, in particular, are great for reducing root shock since there will be no need to remove the seedling from the biodegradable pot during outplanting. However, we must take note of how long our seedlings will stay in the nursery as coco coir pots can typically hold up from four months to around a year, after which they start to gradually break down.

Take note that Mahogany trees stay in the nursery for approximately two years, growing 5 to 6 feet in height. In this case, big seedling bags might be more appropriate.

## OUTPLANTING



Eventually, our seedlings will need to be moved from the nursery to the main plantation area. This process is called outplanting.





The time that our seedlings should spend in the nursery will vary depending on the species of tree, as well as the growing conditions. In the case of Mahogany, the seedlings are outplanted when they are 5 to 6 feet tall. They are grown in big seedling bags for two years to increase their chances of survival out in the land. As for Teak, it is recommended that the seedlings are outplanted while still small (i.e., below 5 to 6 feet in height). Take note that the outplanting of teak seedlings should be done during the rainy season.

In general, we should allow the seeds to grow in the nursery for at least six months. One year before our trees are due to be outplanted, we should slowly reduce the water and nutrients given to the seedlings. This will help prepare them for the conditions in the main plantation area. Many seedlings—sometimes almost half of the population—will not make it to the outplanting stage, whether through death or selection. This is an important step as it ensures that only the hardiest individuals are planted on the land.

## PRECAUTIONS DURING EARLY STAGES

Seedlings in the nursery, or even seedlings that have been newly moved to the plantation, are much more vulnerable to harsh conditions. These young trees will not be able to withstand strong winds and rains as well as older trees, and they will be more vulnerable to pests and diseases. It is important to take measures to protect them so that they are able to mature properly, such as placing the nursery in an area that is protected from strong winds or other conditions. Natural pesticides, like sprays incorporating oil, garlic, or chili pepper, can be used to combat pests. Fertilizer can also be utilized in the initial outplanting stage to stimulate root growth.

# MAINTENANCE
## CHAPTER 4

The bulk of work we will be doing on the farm is maintaining the main plantation as our trees grow to maturity. This chapter will go over the many aspects of our farm, and the trees that we will have to observe and maintain to ensure the best harvest possible.





## MONITORING GROWTH

Keeping track of how well our trees are growing is essential. Closely monitoring the growth of our trees will allow us to consistently make adjustments and end up with the best trees for our end goal.

### TREE SIZE

One of the indicators we should take note of is the size of the trees. If the trees are not growing as fast as expected (based on research or previous observations), it might be indicative of a disease or pest, or an issue with the soil or environment.

Keeping track of how well the trees are growing compared to surrounding trees is also important, as the size of the trees relative to each other will help determine which trees should be thinned out.

## TREE SHAPE

The shape of our trees is also a factor that we should keep an eye on. It is best if trees grow straight up, without bending in any one direction. This is because straight logs are the most desirable for processing, and are the easiest to sell.

Measures like evenly spacing our trees and pruning tree branches will help ensure that they grow straight and tall.

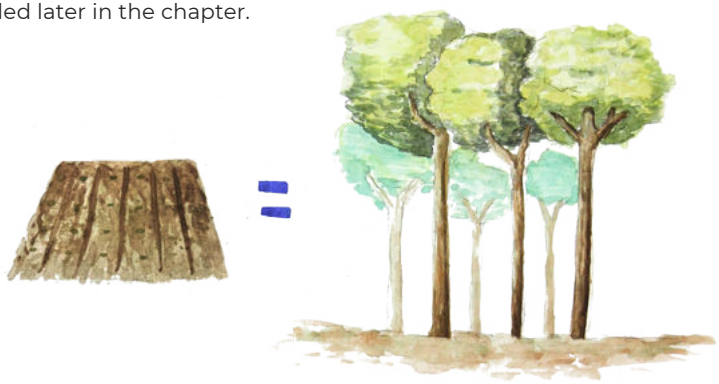
## NUMBER OF TREES

As our trees grow, their numbers will have to be consistently reduced. This is because the bigger and more mature trees get, the more resources they will require.

One hectare of land will initially be able to support roughly 2,500 seedlings; and that same area of land will only be able to support 500 to 800 mature trees.

In general, we will want to maintain the same wood volume while our trees are growing. This means that, as they grow, their numbers should consistently be reduced.

This process is called thinning out, and will be detailed later in the chapter.







# SILVICULTURAL TREATMENTS

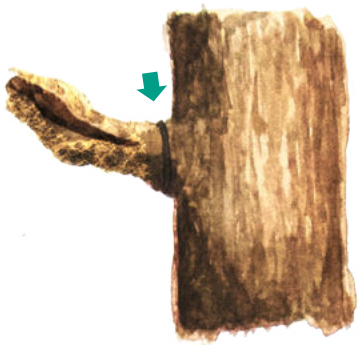
"Silviculture deals with the methods for establishing and maintaining healthy communities of trees . . . ." (Nyland, 2016). This includes the treatments of pruning and thinning.

## PRUNING

Pruning refers to the process of selectively removing certain branches of trees. Every tree in the plantation should be regularly pruned to ensure that the tree grows straight and as tall as possible, giving us the most usable or sellable wood per log.

### What to remove and when

Pruning should always be done at nodes. Nodes are the spots on the trunks or branches of trees where new branches grow from. As the plant grows, everything below the forking of the trunk should be pruned. As the tree grows, 25 to 50 percent of the canopy above the first forking can be left untouched. This is so that the tree will have a straight trunk, with few branches.

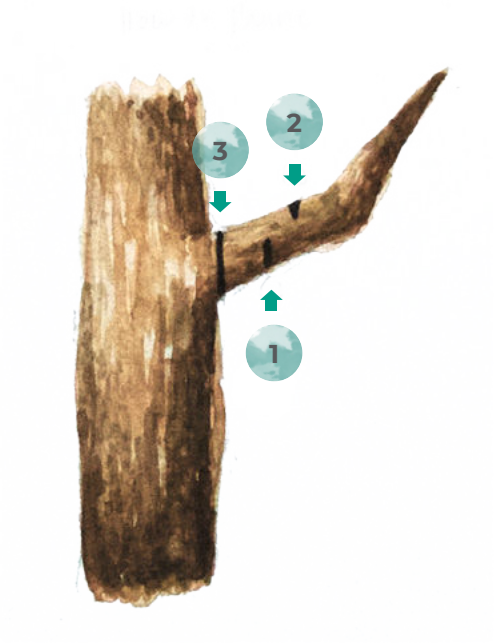


For many trees, the best time for pruning is during the summer season. It is important that it is done consistently and regularly, alongside the maintenance routine of thinning out trees.

## How to prune

Smaller branches can simply be cut with pruning shears. The cut should be made just before the collar (or intersections), so that the cut is flush with the main trunk or branch. This prevents infections, helps the tree heal the wound, and preserves the quality of the wood once harvested.

When cutting larger branches, the three-cut method is best to prevent the branch from splintering.




1. An initial cut on the bottom side of the branch should be made—a short distance away from the node.
2. A second cut can then be made on the topside, 1 or 2 inches from the first cut, until the branch breaks away.
3. The short remaining part of the branch can be removed in a single cut, flush with the trunk, taking care not to cut beyond the collar.

# THINNING OUT

Thinning out is the practice of regularly removing trees that are growing more slowly than the other trees, or trees that are growing improperly. It also improves the trees' diameter growth. Thinning out should be done starting in the fifth year of each generation of trees, so that we will be able to accurately tell which trees should stay and which should be removed.





## Competition

Thinning out is necessary because of the principle of competition.

Competition occurs because different organisms, whether from the same species or differing species, will tend to compete with each other to get a share of the available resources in an ecosystem. For example, two trees planted very close to each other will compete with one another for the water in that area.

Regularly removing certain trees from our plantation will help reduce competition, ensuring our trees will be able to grow properly. This adheres with the principle of carrying capacity wherein our land and its resources can only support a maximum number of trees.

### Which trees to cut

It is best to keep roughly the same wood volume the entire time our trees are maturing. This means that we will have to consistently fell trees as they grow.

Selective harvesting should be followed, which means we should only cut down a few trees at a time, at regular intervals, such as during our monthly maintenance period. We need to make sure that the trees we cut down are not too close together, as this could impact the ecosystem of our farm.

Usually, trees that are smaller or not growing as fast as the others in the area are the ones felled. This means that only the strongest growers will be able to reach full maturity.

However, in some cases, trees that are much bigger than their surrounding trees could also be cut down. This is because larger trees will compete with smaller ones, and cutting the bigger tree down will allow a greater number of trees to grow. Depending on what we will use the tree for, it may be better to allow the larger tree to grow, and cut down the smaller ones surrounding it instead.





## USES FOR SMALLER TREES AND BRANCHES

Pruned branches and thinned out trees can be used to reduce waste, and maximize the financial gains of our farm. Even if we mainly intend to sell timber or lumber, these could offer another source of income. Branches can be turned into fuelwood, processed into charcoal, or used for small crafts. Smaller trees can also be used for small wood component parts, and those closer to maturity may still also be sellable.

## MANPOWER AND RELATIONSHIPS

Aside from knowing our land and our trees, it is also important to get to know the area that our farm is in, and try to build good relations with local communities. Having a good relationship with the locals is the responsible and sustainable course of action. Their support may help the farm operate more smoothly (through local labor), and/or establish good ties with the local government.

## LABOR FOR OUR FARM

Particularly in areas that are far from big towns and cities, farms represent an important source of livelihood for many people.

We may talk to locals or the local government to find manpower for the maintenance of our farm, especially if it is too big to personally oversee or for a few people to maintain.

This will allow locals to make a decent wage—which should take into account their circumstances, as well as national and local policies—and help establish a relationship with the local community. These workers will be good for our farm because they will be familiar with the land and the area. The presence of a new source of livelihood and employment will also give a boost to the local economy.

Besides wages, we should follow national and regional laws in providing benefits for the workers. These benefits will usually include contributions to PhilHealth, Social Security System (SSS), and Pag-IBIG.





## MAINTAINING RELATIONSHIPS

Apart from hiring local workers, there are many other things we can do to help local communities, thereby strengthening our relationship with them.

This can include things as simple as allowing locals to pass through the land, or even giving them some access to useful plants that may grow in the plantation (aside from our trees, of course).

It is important to get to know the community that our farm is a part of, be conscious of their most pressing needs, and try to come up with ways in which we can help improve their situation. We can consider providing donations or other services for local institutions like schools, or even helping other local farms by sharing extra tools or seeds.

# MINIMIZING RISKS

Though trees take a long time to mature, once they are old enough, they will be much more resilient against risks like natural disasters. However, there are still many things that can damage or kill our trees. It is important to be aware of these, so that we can be prepared to deal with them.

Fires are one of the greatest dangers to a farm. If a fire breaks out, it will be very difficult to put out, especially during dry months. Firebreaks (detailed in Chapter 2) are important, so that in case a fire breaks out, it will be contained to one area. Most fires are started because of human activities, like careless disposal of cigarettes, or campfires that get out of control or are not extinguished properly. The workers on the farm should be properly educated on how to prevent fires, and what to do if one starts. This is another reason why a good relationship between our farm and the local community must be established. Structures like watchtowers or even thermal sensors deployed throughout our farm can help catch fires before they spread.

Strong winds and rain can also pose a threat to crops. While trees will be much more resilient to these than smaller crops, they can still get damaged, especially during typhoons. It is best to keep updated with severe weather warnings for the area around the farm. This will give us time to make preparations, like trimming branches which could catch the wind and damage entire trees, or even tying trees down.





While a thriving ecosystem is great for our farm, not all animals are beneficial. Pests and diseases can harm or kill a large number of our trees. These can include insects and other small animals, as well as bacteria and parasites. We should familiarize ourselves with common pests in the area, and diseases that our crops are usually vulnerable to. It is best to take preventive action early, rather than wait for an outbreak to occur. One example of this is Integrated Pest Management (IPM), where instead of using pesticides or other chemicals, we can identify a pest's natural predators (like bats or frogs that prey on insects) and promote their growth.

People can also pose a threat to our trees. This could take the form of vandals, or even poachers or loggers who might cut down trees, or take other plants and animals from the farm without permission. Contacting the local government may help in these cases. While maintaining good relationships with the locals is important to the operations of the farm, we should be vigilant in monitoring the land for vandalism or theft, and reporting any offenders to the proper authorities.

# HARVESTING
## CHAPTER 5

This chapter will deal with harvesting our trees when they are mature. This will give guidance on when to harvest, how to know which trees to harvest, and how to cut down mature trees.

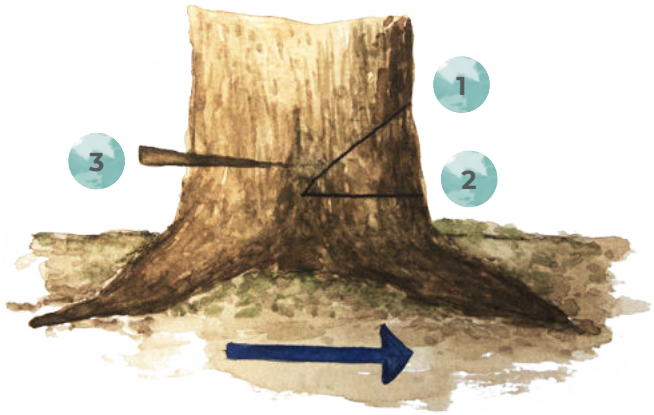




## WHEN AND HOW TO HARVEST

Generally, the best harvesting season starts in January and lasts until summer. The drier weather and drier soil will make it easier to harvest trees and transport them. Though, like with most other things, exceptions to this rule can come up. If we are selling lumber or timber, we may need to adjust our harvesting to coincide with the needs of our buyers. If we are using the wood to create crafts or furniture, we might need to adjust the harvesting schedule to fill large orders and higher demands, and compensate for periods of lower demand.

Trees should be cut down using a method similar to the one presented for pruning in Chapter 4.




Three cuts should be made: the first two to create a wedge in the direction the tree should fall, and a third from the opposite direction to actually fell the tree.

This ensures that the tree falls in the intended direction and that the wood does not splinter, damaging a large part of the wood or bark.

To ensure that the maximum amount of timber is harvested, the cuts should be made as close to the ground as possible.

## HOW MUCH TO HARVEST

One of the most important ways to remain sustainable is knowing the rate at which we can harvest trees. Harvesting too many trees at one time, or in a certain area, can be harmful to the ecosystem that will have been established in the farm (the advantages of biodiversity and a healthy ecosystem are mentioned in Chapter 2). Cutting and replanting large numbers of trees can also quickly deplete the nutrients in the land and decrease its capability to hold water.

The exact rate of trees to harvest, or number of trees to harvest per year, will depend on our total tree population, the land and the local ecosystem, as well as what we will use the wood for. We also need to take into consideration the maturity of the trees, together with customer need or urgency of demand.

For some tree farms, selective harvesting is preferred over block harvesting (also known as clear-cutting). With the former, only select trees from different sections of the tree farm are harvested, making sure that the logged portion remains green and fertile. Block harvesting, on the other hand, clears an entire block of the land. Although this is considered the simpler and more efficient method, it is perceived to have a more significant impact on soil erosion in the area and on the wildlife living there.





# POST-HARVEST
## CHAPTER 6

Once we have started harvesting trees, we can start selling our wood and making money from the tree farm. One of the biggest advantages of harvesting trees is that there are several ways that we can make money from selling them—whether it is by selling raw timber, processed lumber, or woodworking products.

# ZERO-WASTE

Every part of a tree can serve a purpose after it has been harvested. Making sure no part goes to waste is an essential aspect of keeping our farm sustainable. This is an important point to keep in mind while determining what to do with our trees.

While the bulk of the wood will be sold or processed, even the smaller limbs can also be used. They can be turned into smaller products, used as firewood, or converted into charcoal, which can also be sold. Even the leaves of felled trees have a purpose. They infuse beneficial organic matter into the soil as they rot.

# TIMBER AND LUMBER

Timber (unprocessed logs) can be sold to a number of buyers: local wood traders, sawmills and other wood processors, carpenters and craftsmen, commercial or industrial operations, and even wood artists, architects, and interior designers.

Lumber (logs that have been processed and cut into boards or other forms) can also be sold to most of these buyers. This will require having equipment for wood processing, though, such as bandsaws, table saws, and planers, which cut and shape the wood. Lumber can generally be sold for more than timber because they have already been processed.





If we are processing timber, smaller wood cuttings can also be turned into fuelwood and charcoal, or incorporated into woodworking products. Even sawdust from cutting raw wood can be turned into briquettes (for grilling) or used as spore beds in growing mushrooms.

# WOODWORKING

Selling finished wood products can open up a whole host of possibilities. There are limitless products that we can make and sell with our wood, including furniture, doors and windows, utensils, and other functional or decorative pieces. Not only does this broaden the type of products that we can offer, it also increases the customers we can sell to. Instead of the relatively limited buyers for timber and lumber, we can sell wood products directly to consumers and clients.

The zero-waste mindset is also important here. While it is easy to use the larger logs and branches for products, cuttings and branches should also be utilized to create decorative figures and the like, to get the most sellable items out of every harvested tree.

Before harvesting any tree, it is best to already have an idea of what products can be made out of each part. Even imperfect parts can be used to create unique pieces that can be sold for even more.

# SELLING PRODUCTS

In the current market, people's awareness of the concept of sustainability is growing, along with their demand for sustainable products. Now more than ever, customers will consider these factors when thinking about what they will buy, often preferring environmentally friendly, ethically sourced, and non-wasteful products. This means that excellently made, sustainably sourced wood products can sell well.

Keeping the farm operating sustainably, and letting our target market know that this is the case, will be an advantage for our business.

## Places to sell

There are many good places to start selling our products. These include:

- Trade fairs and other conventions like design and craft fairs, hotel and restaurant fairs, wedding fairs, and similar events. It is through these places that retailers, resellers, or export buyers source bulk quantities of products they can offer in their stores.
- Bazaars, pop-ups, trunk shows, and other marketplaces. These are more affordable options for retail selling our products to a more general audience.
- Selling online. This is an easy-entry sales channel that is simple to set up and costs little to manage.





To know which sales channel is best for our products, we need to clearly identify our target market/s:

- Will the products appeal to the mass market or to the more upscale crowd?
- Do we want to solely do retail selling or venture into business-to-business?
- Are we looking at the local or export market, or both?

Connections with other farms or sellers will also go a long way in helping establish our network. Other farmers in the area might be able to recommend local places where we can sell. Similar farms (other tree farms, or sustainable farms) may be able to alert us to events that will suit our needs.

## MANAGING SUPPLY AND DEMAND

As we start to make a name for ourselves, grow our network, and sell more products, it may become more difficult for the farm to supply the amount of wood that we need to meet the growing demand.

It is important that we manage the number of products that we make and sell with the number of trees that we can sustainably harvest every year.

Because trees take much longer to grow than other crops, it is more difficult to expand the farm at the same pace as increasing demand. To make up the difference, we can source wood from other sustainable farms, or even team up with them and other crafters, to fill a very large order.

It is our responsibility to know how much the farm and the trees can handle in order to remain ethical, environmentally friendly, and sustainable.





# OTHER FORESTRY PROJECTS

## CHAPTER 7

Sustainable tree farms, which are ecologically responsible and profitable in the long term, are a great use of our land for almost any situation. However, there are many other ways we can turn our land into forest land, helping to strengthen Philippine forests and protecting our country's ecosystems. They also directly contribute to the greening of the country, through the DENR's Enhanced National Greening Program, which seeks to reforest 1.2 million hectares between 2017 and 2022.

This next section will go over a few of these forestry projects to help us decide if one of these might be suitable for our land. An overview of each project, the pros and cons, and a rough guide to getting started will be given.

# AGROFORESTRY

Agroforestry is an emerging alternative to traditional tree farms and agricultural farms. Instead of using the entire piece of land for planting trees or crops, or raising livestock, an agroforestry operation will combine these.

For example, in an agroforestry operation, a small patch of crops will be planted in between a row of trees, or trees can be planted throughout a field of crops. Livestock like cattle can also be raised on the land. Having different types of plants and animals together can leverage several natural beneficial interactions, promoting a healthy ecosystem.

There are countless interactions that can be taken into account when developing an agroforestry plan, like tall trees protecting smaller crops from flooding, strong wind and rain, and landslides. For example, a row of tall coconut trees can help block strong winds from damaging smaller crops like corn.

The presence of trees can also help condition the soil and make it more suitable for other plants. Livestock can graze on smaller plants and find shelter under trees, while being used for labor, or raised for meat and other products.

By combining different types of crops and trees, agroforestry can create a better environment for the plants growing there, making it more effective, environment-friendly, and sustainable overall. Because of this, many see agroforestry as the future of farming and agriculture.



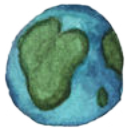


# BENEFITS AND CHALLENGES

## BENEFITS

**Effective**
The interactions between trees, crops, and animals can all work together to create a thriving ecosystem for our farm. This means better harvests and better products.

**Profitable**
A functional agroforestry system will allow its owners to sell not only different kinds of crops, but also wood and tree products, and livestock products as well. This gives operators a diverse, constant supply of goods to sell.



**Promotes the environment**
By creating healthy ecosystems, agroforestry systems can be home to a wider variety of species than a regular farm.

**Sustainable**
Agroforestry systems rely on healthy ecosystems and natural interactions to provide food and money for the people managing them. This means that they will be able to get the resources they need while having a minimal impact on the environment.

## CHALLENGES

**Challenging to plan**
Agroforestry systems are generally much more challenging to plan and design than traditional farms. Instead of being concerned with only a few separate crops, we will need to plan for how different plants and animals will interact, and the best way to lay out our farm to leverage positive interactions and reduce negative ones.

**Requires resources and expertise**
An agroforestry system has a wide variety of components, including crops, trees, animals, and the necessary equipment to take care of them. This can make starting an agroforestry operation more expensive than a regular farm. The many different aspects might also require more farmers or experts to be involved in the farm's operations and planning.





# SETUP AND MAINTENANCE

## 1) Get to know the area

There is no strict formula that can be followed to begin planning an agroforestry development. Each development is unique, and must take into account the particular features of the locale it is in. Generally, this will include the types of trees, crops, and animals that thrive in the area, as well as the climate and topography.

It is best to start this process by getting to know the area of our farm. Pay attention to the plants and animals that live on the land we will be using, and the weather conditions there. If there are other farms in the area, we must take note of what they grow, how they grow them, and how effective they are.

Aside from physical conditions, we also need to take into account factors like government regulations and the needs of the surrounding community. If a community relies on a particular crop for food or for turning into sellable products, we should consider prioritizing that crop during planning.


## 2) Think about our goals

When we have a good grasp of the area we will be working in, it is important to consider the goals for our agroforestry development. Mainly, this means deciding what kinds of products we want to produce, and how much of each. Because there are so many ways of approaching agroforestry, having clear, defined goals is essential to making the project successful.

## 3) Categorize our farm

Once we have determined the main products we want to focus on, we can start designing the farm. A good way to start is by identifying the type of agroforestry operation we will run. There are many types of agroforestry operations, but we can focus on three main ones in the initial stages of planning.

Silvoarable projects combine crops and trees; silvopastoral operations combine trees and livestock; and agro-silvopastoral combine crops, trees, and livestock. Keep in mind that the choice made here should be the best for when we start out. It does not have to be the final choice, as we can always expand later on.

## 4) Sketch out the farm

After deciding on the different components we will be including in our farm, start sketching out possible maps of general plans that can be followed. For example, trees can be spread evenly throughout a field of crops, or bordering a patch of crops. Trees and crops can also be planted in alternating rows.

When thinking about this, make sure that each area for each plant has enough access to water, nutrients, and resources. Also, carefully research the particular plants we will be working with, and the interactions between them. We need to ensure the arrangement maximizes positive interactions and minimizes negative ones.





## 5) Test and adjust

When starting out, we should test our ideas for interactions and land plans on smaller scales. Divide the land and create small-scale versions of different layouts and plant combinations in each section. Monitor how they develop over the first year or two, and take careful notes of what works well and what does not. If there are other nearby farms getting involved in agroforestry, we can involve them in this process as well, and share observations. This will give us more information about the best plan for the entire farm.


## 6) Get it up and running

After testing and determining the best setup, we can start rolling out the plan to the rest of the land. After establishing the initial plan, we can then start slowly expanding and adding new components as we go along.

# TREE PARK

A tree park, or forest park, is a forested area which is intended to serve as a recreational green space for nearby communities. Rather than growing trees for the purpose of harvesting them, a tree park will grow trees for the purpose of creating a place where people can rest, play, and interact with nature.

Tree parks can be located near residential areas, or even in big cities. There is evidence for a wide variety of benefits that tree parks can bring to surrounding communities, especially near urban spaces. These include improving physical and mental health, boosting biodiversity, as well as many other social and environmental effects.





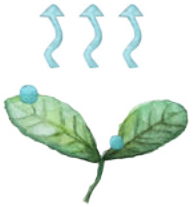
# BENEFITS AND CHALLENGES

## BENEFITS

**Good for people**
Tree parks—especially ones close to big cities, where people have less access to nature and green spaces—can have a significant effect on the physical and mental health of people living nearby. Evidence shows that tree parks can reduce stress and improve mental health by providing a recreational space. Tree parks can also function as an area for physical activity, helping people stay fit and healthy.

**Improves communities**
Aside from having benefits for individuals, tree parks can also improve entire communities. Especially in a large, crowded city, a green space can attract people from surrounding areas to it, bringing attention to the community and boosting the local economy. This effect can be increased if the park has enough space for people to hold gatherings and larger events.

**Increases biodiversity**
Parks do not only provide a space for people, they provide a home for flora and fauna to thrive as well. Evidence has shown that a larger number of species will usually be present in urban parks compared to residential areas, peri-urban forests (or forests immediately surrounding or adjoining a town or city), and other urban green spaces. Tree parks are also good areas to preserve and protect native trees, where the public can go to learn about and appreciate them.



**Better for the environment**
Tree parks can contribute greatly to sequestering carbon released by human activity. This is especially important near cities, where carbon emissions are much greater. Aside from carbon dioxide, other airborne pollutants like sulphur dioxide and nitrogen dioxide can be reduced with the help of tree parks. This helps improve the overall air quality near the park, and helps reduce an area's carbon footprint. Water evaporating from trees and plants can also help cool the air, lowering temperatures nearby.

**Low maintenance**
A tree park can be easier to maintain compared to other forestry projects. While a certain degree of maintenance will still be required, we will not need to monitor the trees or other aspects of our land as closely as we would have with a farm or other project. For a less technical project that still brings a wide array of benefits to the community, this is the best option.

**Educational**
Aside from giving the public a space to enjoy nature, tree parks can also give them a place to learn about it. Tree parks can be used as an effective venue to teach children and adults about nature by allowing them to have first-hand encounters with trees (especially native ones) and animals.

## CHALLENGE

**Space**
Many of the benefits of a tree park are more pronounced when it is established in or very close to a large city. However, because cities tend to be more crowded, it may be more difficult to find enough space for a park.





# SETUP AND MAINTENANCE

## 1) Determine objectives

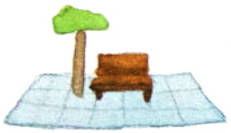
The objectives for our park will guide every decision made regarding it, including the planning, layout, and the species of trees we will be planting. The objectives should be clear so that we can be sure that the park we design will be beneficial for the community. While parks generally serve as public spaces, there are other related objectives that we may want to consider as well. These include making the park an area for sports and recreation, a venue for gatherings and community events, or a more educational space to help people learn about local flora and fauna.

## 2) Start the project


A tree park is a project for the local community. It should provide a suitable space for rest and recreation, and allow people to interact with nature. As such, the community should be involved in planning and establishing the park. To do this, we can call a meeting with local schools and organizations that might have an interest in it. We can also coordinate with the city or municipal government to hold a meeting, and get ideas and feedback from members of the community.

The discussion should include the objectives and location of the park, as well as its size, delineation, and layout.

## 3) Design and layout



Unlike other forestry projects, the aesthetic value of a tree park is an important consideration. We will not have to worry too much about making sure our trees grow quickly or in a particular way. However, we will want to entice people to go to the park by making sure it is beautiful and peaceful. Its layout must be conducive to accomplishing our objectives. Make sure to consider different needs for different objectives, like walking or jogging paths for recreation, benches and shady areas for rest, and open spaces for public events.

Smaller parks (less than one hectare) will usually benefit from simpler layouts that are targeted toward only a few objectives, while bigger parks (more than one hectare) can accommodate more complex layouts and spaces for more types of activities.

## 4) Prepare to plant

Once we have decided on a design, we can start procuring the seeds or seedlings that will be needed for the park. These can be obtained from local or commercial nurseries. The local DENR office can help determine the best tree species to plant for the project. Seedlings can also be requested from local branches of the Provincial Environment and Natural Resources Office (PENRO) or Community Environment and Natural Resources Office (CENRO). It is recommended that we already have the seeds or seedlings sourced 12 months before our desired planting date.

At this point, we can also start land preparation activities, which include clearing grass and vegetation near spots where we will grow trees, and leaving grass and leaves to rot to nurture the soil.





## 5) Plant and maintain

When the land is prepared and the seedlings are ready, we can start planting the actual trees for the park. At first, the seedlings should be monitored very closely and watered up to once a week. When the seedlings are roughly double their starting height, we can start to lessen how much they are watered. Organic fertilizer can also be used to enhance the trees' growth.

As the trees are growing, especially while they are very young, make sure to keep an eye out for pests, disease, or the threat of grazing animals. Even though trees get more and more resilient as they grow, make sure to check on them every once in a while.

## 6) Other considerations


Once the trees are established, we can start working on the other aspects of our park. These can include tables and chairs for public use, restrooms, trash cans, playgrounds, signs, and other items and structures needed based on our objectives.

We can also begin to cultivate other plant species to further enhance the biodiversity of the area.

# MAXIMIZING BIODIVERSITY

No matter what type of development we decide to undertake, we are helping revitalize forests by planting trees and by creating a stable habitat for a variety of birds, insects, and other animals. We are also helping to stabilize ecosystems, especially in urban environments with few green spaces.

One of the most important ways to encourage biodiversity is by carefully choosing the types of trees that we will plant on our land. A project like a tree park will give us numerous options to work with, attracting the widest variety of species possible. Nevertheless, even with projects like tree farms and agroforestry developments—where there are many other factors going into the decision about what trees we will be planting—there are still things we can take into account to make our land friendlier to many different species.

## BIRDS AND BUTTERFLIES

Drawing birds and butterflies to our land can provide a number of benefits. They can help make it more beautiful and lively (which will help draw people to tree parks, for example). Birds and butterflies also contribute to creating healthier ecosystems as some birds eat insects, which can help control possible pest problems, while butterflies help pollinate flowering trees and other plants (which benefits not only parks, but even tree farms and agroforestry developments).

A good starting point to attracting birds and butterflies is planting trees which can provide them with shelter or food.





| Plant... | To attract |
|---|---|
| *Aristolochia* vines, like the *Barubo* plant | Swallowtail and birdwing butterflies |
| *Cassia* trees and plants, like *Karagain* | Pierid butterflies |
| *Passiflora* plants, like passion flower and passion fruit | Hesperid butterflies |
| Oleander plants* | Hawk moths |

Birdwing

Swallowtail

*While oleander is a common garden plant, take note that the plant itself is poisonous, so extra care should be taken when planting them.

Birds are much less particular about the trees and plants that they can take shelter in. Native trees to consider planting are the Kamagong, Banaba, and Bignay. Ficus trees are also a good source of food for birds. In general, the more tree coverage, the more birds we will be able to attract.

Here are a few common urban birds to keep in mind when selecting our tree species:

- *Pycnonotus goiavier,* the yellow-vented bulbul, is a common city bird that eats fruits and berries. Making sure that there are fruit-bearing trees or plants that produce berries could help draw these birds to the land.
- *Nectarinia jugularis,* the olive-backed sunbird drinks nectar from heliconas (commonly known as the false bird of paradise plant) and gumamela (or hibiscus) flowers.
- *Oriolus chinensis,* the black-naped oriole likes to perch on treetops, so having tall trees with many branches can provide them with shelter.
- *Halcyon chloris,* the white-collared kingfisher is a beautiful blue bird that can be found in cities. Insects are one important food source for these birds, so having grasshoppers and other bugs might help attract them. They are also drawn to water, so having fountains or bird baths can help as well.

Aside from considering the types of trees and plants we grow on our land, we can also construct bird baths, bird houses, or feeders to make the place even more bird-friendly.

Black-naped Oriole
*(Oriolus chinensis)*

Olive-backed Sunbird
*(Nectarinia jugularis)*





## OTHER CONSIDERATIONS

While the type of trees being planted is important, it is not the only factor that should be considered in maximizing biodiversity and helping to create healthy ecosystems. For example, we should not only focus on one or two species of trees. An assortment of tree species should be planted to attract a wider variety of animal life.

Native plant and tree species should also be prioritized when planning for biodiversity. Planting these trees will be more effective in attracting local birds, butterflies, and other animals. It will also help preserve the rich biodiversity of our local flora.

Applying this in a tree park will be easy, but it will prove more difficult in agroforesty developments, tree farms, or coastal defense areas. In these cases, we can always set aside a portion of our land away from the main plantations to create an area for birds and other animals.

# MANGROVE REHABILITATION

Mangroves are trees that grow in coastal areas, in brackish waters between saltwater and freshwater areas.

If our land, or part of it, is in a coastal area that includes sections where mangroves grow (called mangrove swamps, mangrove wetlands, or mangrove forests), it may be worth considering supporting these ecosystems.

Mangrove forests are important because, aside from hosting a wide variety of life forms, they sequester more carbon than tropical forests, and play a major role in protecting our shores from the potential effects of natural disasters like storms and even tsunamis. They also help reduce erosion in coastal areas, helping ensure the longevity of nearby communities.





## BENEFITS AND CHALLENGES

### BENEFITS

**Effective defense against natural disasters**
Mangrove trees are specifically adapted to resist and absorb much of the force from powerful waves. Some studies show that one kilometer of mangrove forest can reduce storm surge by half a meter (Spalding et al., 2014) and reduce surface wind waves by 75 percent (McIvor et al., 2012). Investing in rehabilitating mangrove forests can help protect the rest of our property, as well as nearby communities, preventing damage from natural disasters that could cost even more.

**Protects biodiversity**
Mangrove forests are one of the most threatened types of ecosystems in the world. The Philippines has an important role to play in protecting these unique ecological communities. It is home to 33 true mangrove species and 23 associate species out of the 50 to 60 known globally. Mangrove forests are known to host a wide variety of animal species, including shellfish, fish, turtles, birds, and insects.

### CHALLENGE

**Highly location-dependent**
While helping to rehabilitate mangrove forests is an essential forestry activity, many landowners will not be able to do so. Mangroves are highly specialized to be able to thrive in coastal areas. Factors like the elevation at which they are planted, the location and conditions of the land, and the saltiness of the water should be considered. We need to keep in mind that different species of mangroves can tolerate different salinity—from coast, to estuary, to rivers.

# SETUP AND MAINTENANCE

## 1) Select the species

There are many environmental factors that dictate which species of mangrove will grow best in our area, including tidal and flooding patterns, water salinity, rainfall, and elevation. A survey of our land can help provide the needed information. Local tidal patterns should also be determined since the tides tend to change continuously throughout the year.

There are roughly 33 true mangrove species and 23 associate species in the Philippines, so we should be able to find at least a few species that are suitable to the area. A good starting point can be to determine the indigenous species of mangrove that are already present. The rule of thumb in the Philippines follows the concept of distribution in zones, or zonation. The Sonneratia mangrove species (among them 'pagatpat' and 'pedada') and the Avicennia mangrove species (locally known as 'bungalon,' 'apiapi,' and 'miapi') should be planted in or nearest to the shore, followed by the Rhizophora mangrove species (locally known as the 'bakhaw lalaki,' 'bakhaw babae,' and 'bakhaw bato').

## 2) Set up a nursery

Coastal areas and shorelines can be harsh environments for young plants, due to the constant force of waves. To give our mangroves the best chance to mature, they should initially be planted in a nursery where they are allowed to grow in a more controlled environment for at least six months.

A nursery should be relatively flat, with firm soil, in an area that naturally floods during spring tide. It should also be close to a freshwater source, protected from extreme weather events like storms, and preferably in the shade near other mangroves or other trees. Once established, the nursery will need to be constantly monitored and maintained (at least 2 to 3 times a week) to ensure that the young plants are still standing, and to combat potential pests.





## 3) Outplant

Mangrove seedlings should be kept in the nursery until the seedlings mature at least 6 months to 1 year. The signs of maturity are different for each species but can include changes to the color or shape of seeds, changes to the color of the hypocotyl (area of the stem below the first leaves), or the appearance of a ring-like mark on the fruit.

Outplanting should be done when the waves in the area are least active, to allow the trees to acclimatize with as little stress as possible. Barriers made of rocks or bamboo can be constructed to further shield the growing mangroves from dangerous waves. The bamboo T-fence, in particular, can also reduce erosion and stimulate sedimentation.

## 4) Monitor and maintain

Newly planted mangroves are extremely vulnerable to outside stresses for up to two years. These stresses can include damage from waves; pests like algae, barnacles, and insects; and damage caused by human activities like fishing and boating.

The area should be regularly maintained and monitored during this initial period. Maintenance should include fortifying and repairing the mangrove barriers; removing algae, barnacles, and other pests; and ensuring that boatmen and fishermen are not damaging the plants. The growth and general health of the plants should also be closely monitored so that anything affecting their health can be addressed as soon as possible.

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# RESOURCES

Bureau of Internal Revenue
https://www.bir.gov.ph/

Department of Agriculture
http://www.da.gov.ph/

- Bureau of Soils and Water Management
  http://www.bswm.da.gov.ph/

Department of Environment and Natural Resources
https://www.denr.gov.ph/

- Biodiversity Management Bureau
  http://www.bmb.gov.ph/
- Environmental Management Bureau
  https://emb.gov.ph/
- Forest Management Bureau
  http://forestry.denr.gov.ph/
- Land Management Bureau
  http://lmb.gov.ph/

Department of Science and Technology
http://www.dost.gov.ph/

- Forest Products Research and Development Institute
  http://www.fprdi.dost.gov.ph/
- Industrial Technology Development Institute
  http://www.itdi.dost.gov.ph/index.php/divisions/standards-and-testing/contact-us

Department of Trade and Industry
https://www.dti.gov.ph/

Development Bank of the Philippines – Tree Plantation Financing Program
https://www.devbnkphl.com/devbanking.
php?cat=216$fcf4dc50bd696e7446cae848c23b7258

Forest Foundation Philippines
http://www.forestfoundation.ph/

MARSSE Tropical Timber Plantations
www.marssetropicaltimber.com

Rain Forest Restoration Initiative
http://www.rainforestation.ph/

Securities and Exchange Commission
http://www.sec.gov.ph/

Sustainable Tree Farmers Group of the Philippines, Inc.
https://treefarmers.com.ph/

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**DISCLAIMER.** The Forest Foundation advocates for the use of appropriate native tree species that are suitable in areas for all tree-growing efforts. However, for this book, we intend to provide initial idea on how to establish a tree farm, by drawing from the experience of MARSSE Tropical Timber Plantations and Sustainable Tree Farmers Group of the Philippines who have lessons in tree farming by planting mahogany and teak. We hope that with this guidebook, tree farming will be encouraged and lead to the eventual review and enactment of policies related to tree farming.

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Let's grow together.

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