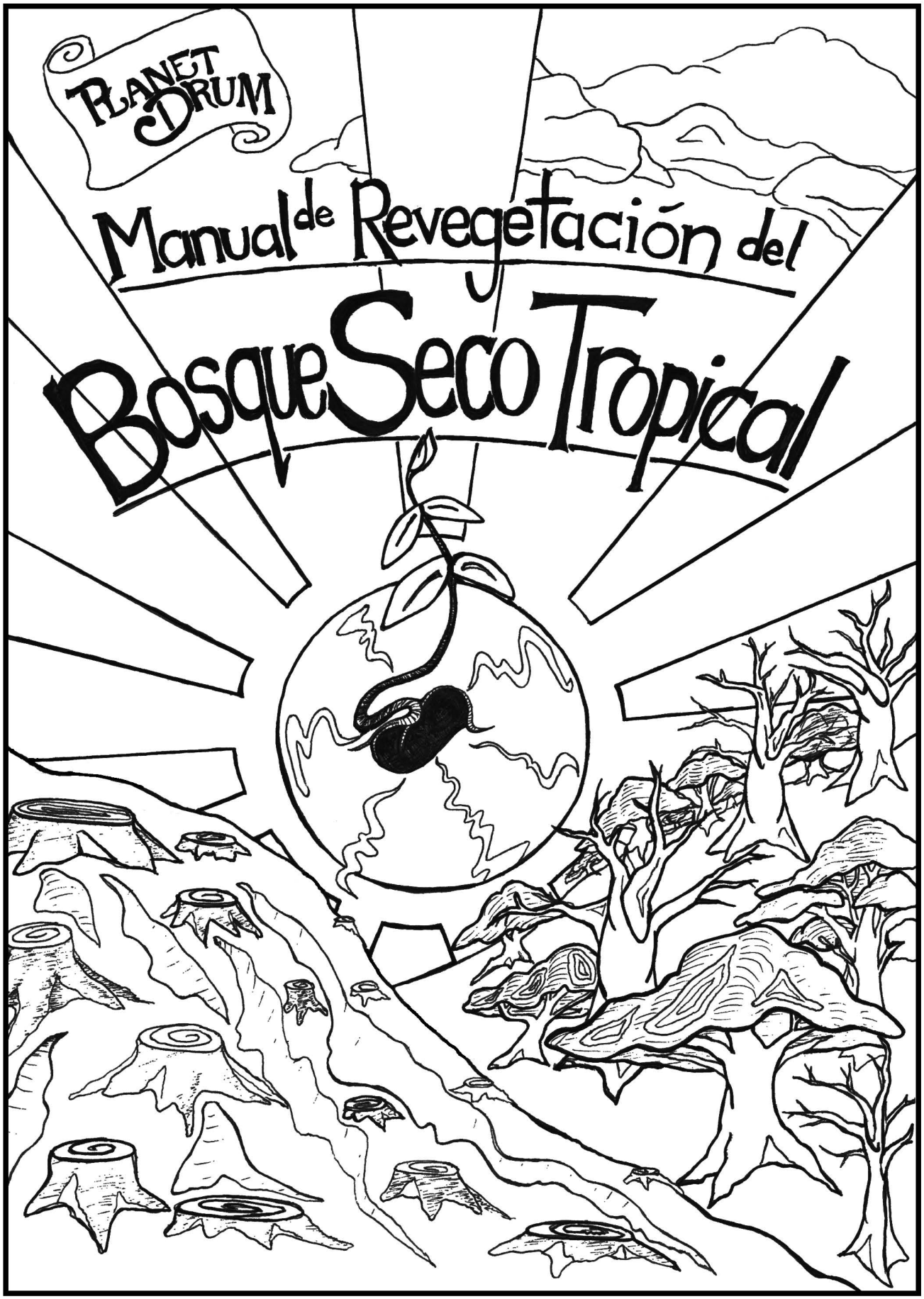
Planet Drum
Manual de Revegetación del
Bosque Seco Tropical

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1st Edition – © Planet Drum Foundation, January, 2013

Dedicated to

Peter Berg

Founder of Planet Drum

Father of the Bioregional Movement

Publishing Made Possible by

The Rufford Small Grants Foundation

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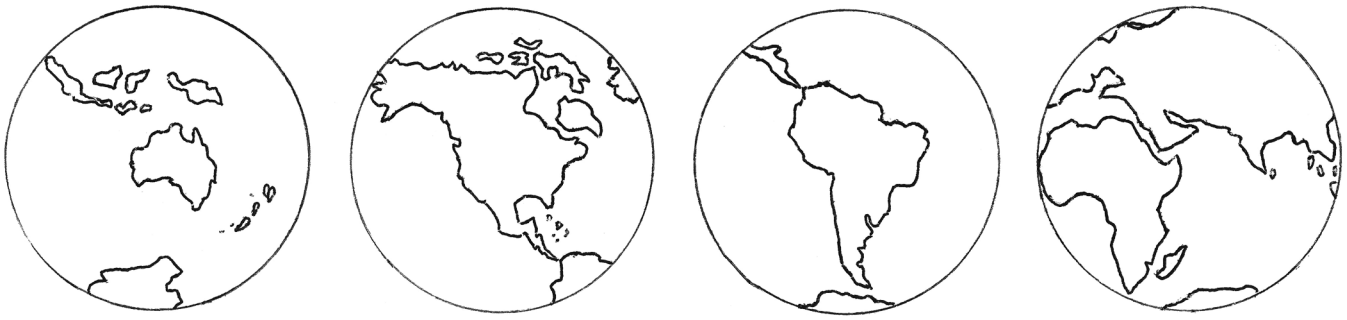
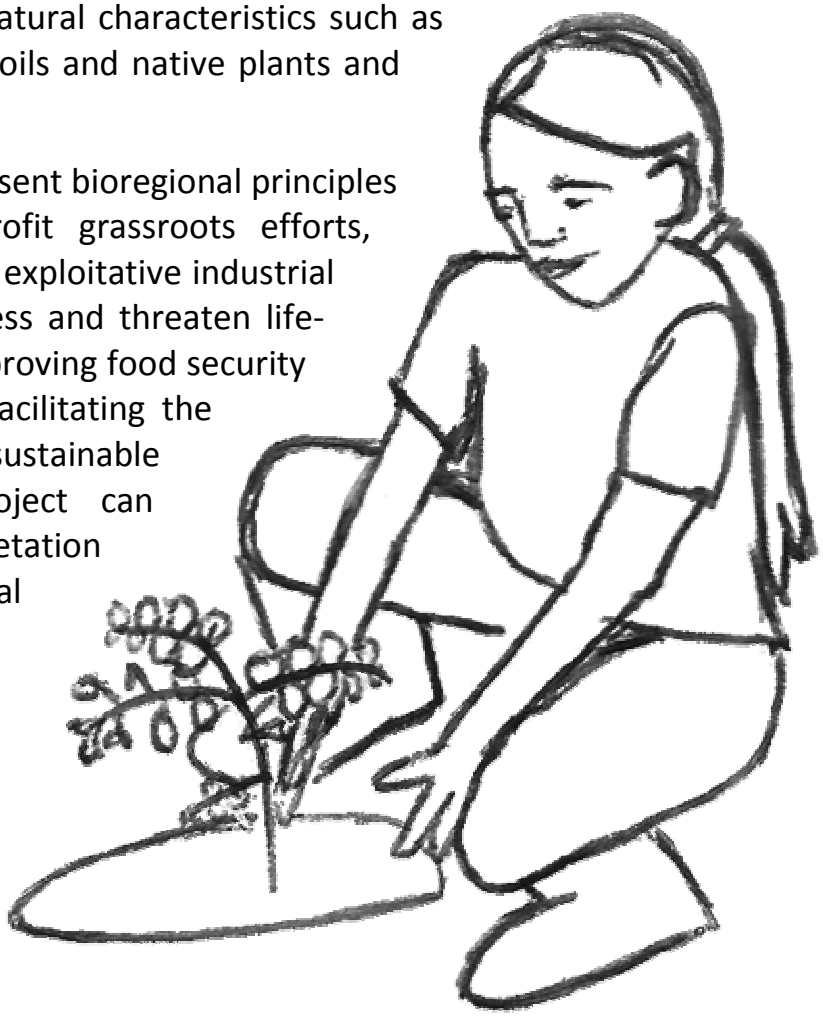
History of Planet Drum Foundation

Planet Drum Foundation (PD) is a San Francisco, California based non-profit organization founded on promoting bioregional principles. In 1999, PD founder Peter Berg was invited to work on ecological issues with the city of Bahía de Caráquez, Ecuador. He observed that one of the greatest but least talked about threats to Bahia's Rio Chone watershed was deforestation and its effects such as erosion (the entire estuary is threatened by siltation) and habitat loss. The "Revegetation Project" began as a way of fulfilling a PD objective of restoring damaged ecosystems. By engaging the community in the process, PD raises the residents' awareness of local ecology. Since beginning its work PD has established a greenhouse on the Universidad Católica campus in Bahía de Caráquez. The greenhouse has produced more than 20,000 trees, representing over thirty different species of native Dry Tropical Forest trees. With the help of numerous volunteers, kids, adults, schools and other organizations, trees have been planted at dozens of sites in and around the Bahía de Caráquez bioregion.



What is Bioregionalism?

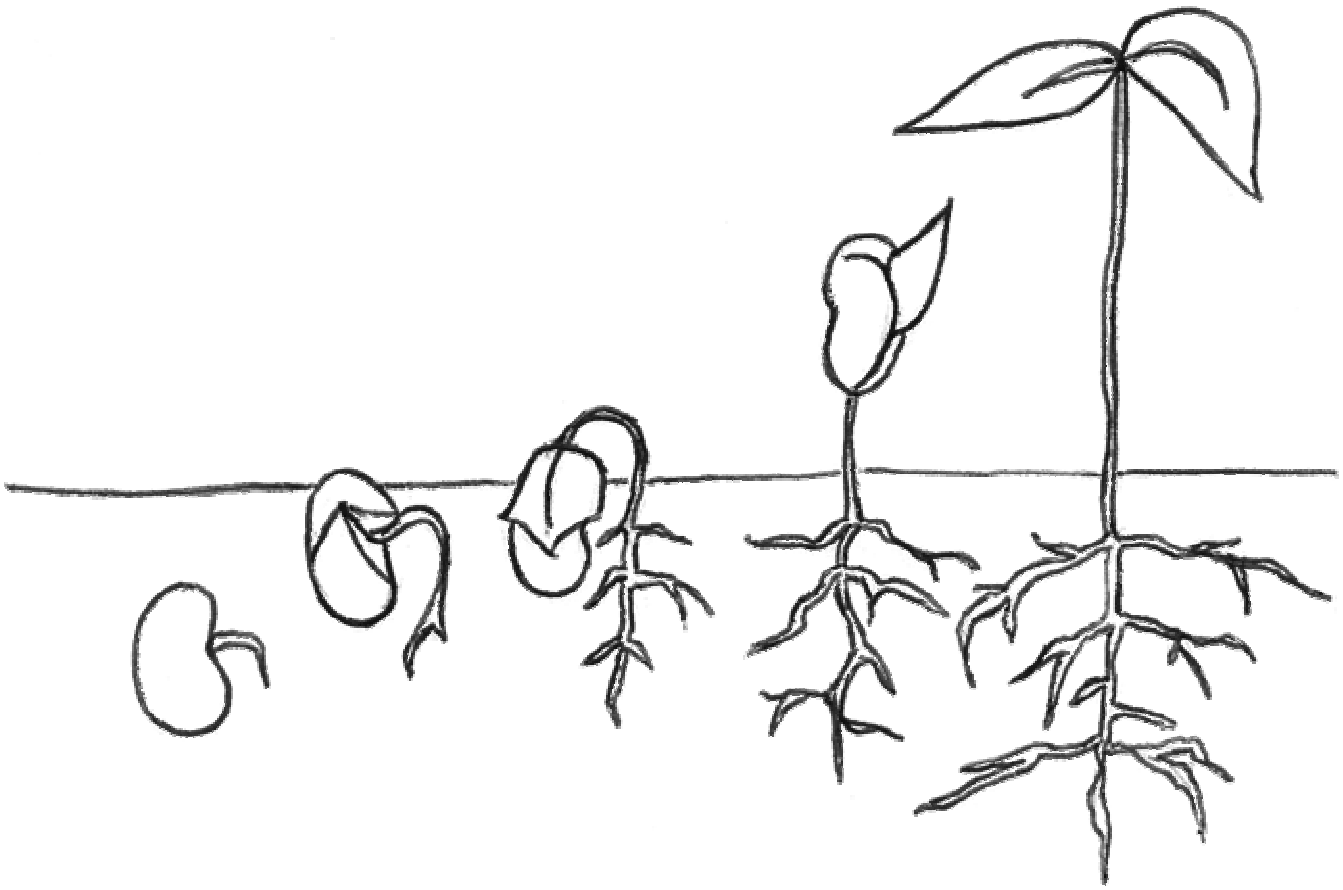
Bioregionalism is a philosophy that seeks to harmonize human activity with the life-places we inhabit by developing local understanding, action and culture rooted in one's distinct location. Bioregionalism is a reaction to global monoculture. It calls for the reinhabitation of the land and the reclamation of distinct cultural and environmental heritages. These arise from the identity of one's "bioregion," a geographic area or terrain defined by its particular natural characteristics such as climate, landforms, watersheds, soils and native plants and animals.



Revegetation projects represent bioregional principles in practice. As local, not-for-profit grassroots efforts, revegetation projects counter the exploitative industrial processes that commodify wildness and threaten life-sustaining natural systems. By improving food security from fruit producing trees and facilitating the emergence of locally beneficial, sustainable economies, a revegetation project can transform a community. Revegetation projects encourage global ecological transformation through restoring and maintaining the functioning of healthy natural systems that regulate life on planet Earth.

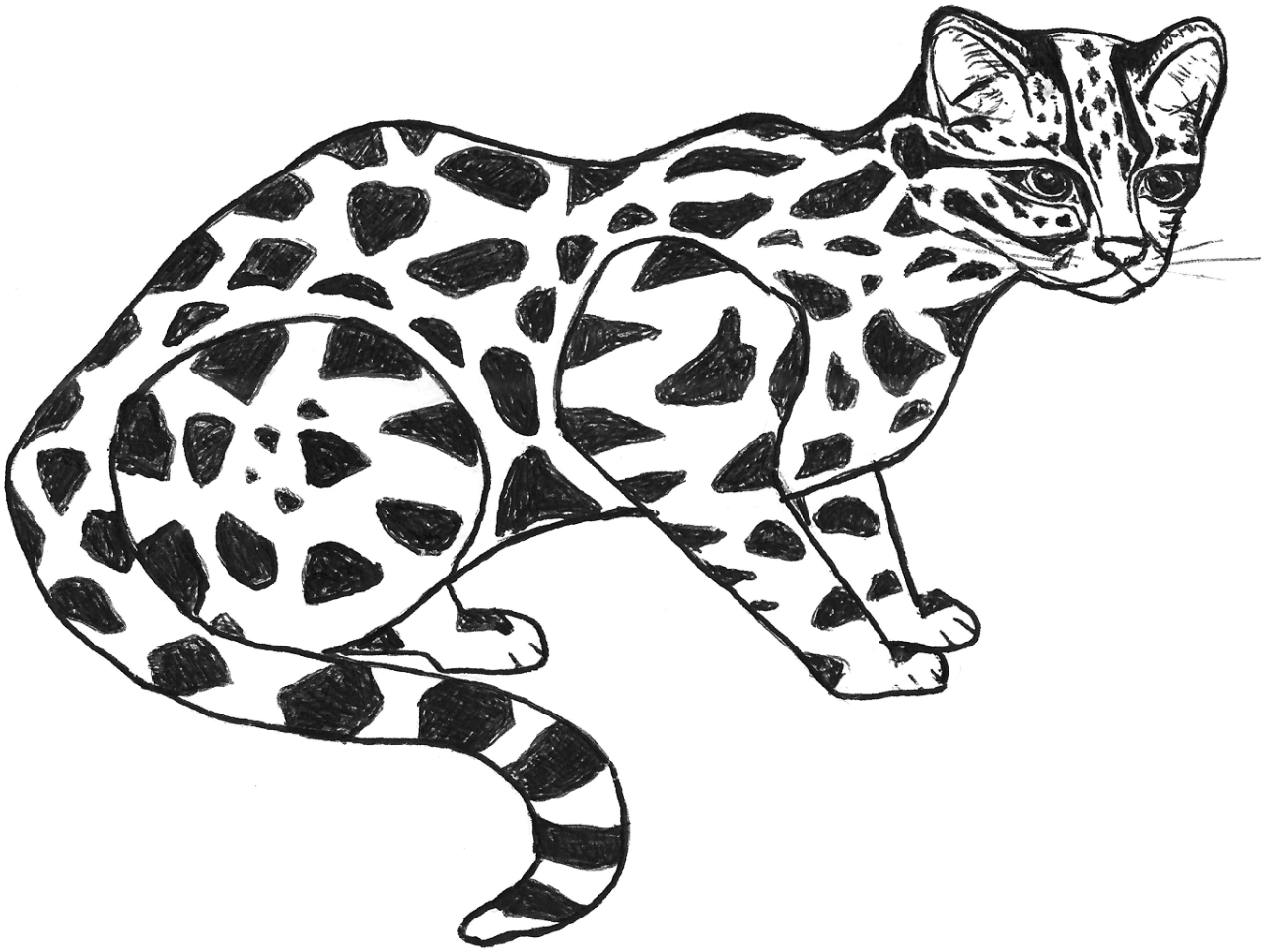
Goals of a Bioregional Approach

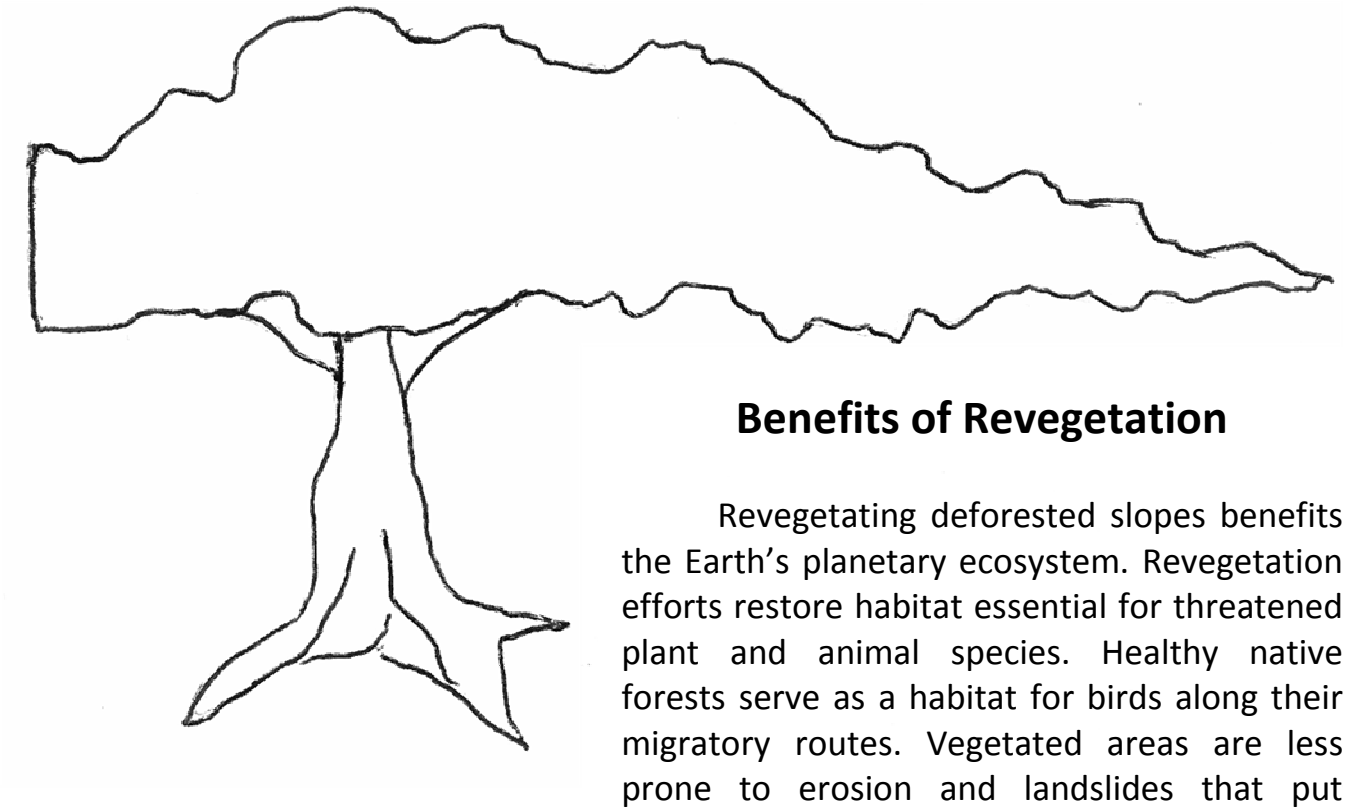
- Maintain and restore local natural systems.
- Develop sustainable means for satisfying such basic human needs as water, food, shelter, energy, and mobility.
- Create and support reinhabitory activities which make it possible for people to fit better into their life-place.
- Find ways to allow the wildness of nature to coexist with human activity.



Revegetation vs. Reforestation

"Revegetation" differs from "reforestation" in that it seeks to recreate the lost habitat through plantings of the same native trees that were present in the primary forest environment. While reforestation is often commercially oriented, profit driven, may use non-native species, and may employ damaging monocultural practices, revegetation efforts seek to work exclusively with native plant species in an effort to heal damaged ecosystems, encourage natural cycles, and reestablish the complete forest habitat. Revegetation always works with a variety of different native species. By contrast a monoculture is a large area of land planted with only one species. Monocultures most often are weak and unstable plant communities, which are more vulnerable to pests and plagues, and require chemical inputs. In revegetation the inter-mix of native plant species encourages the flourishing of diverse native animal species and helps maintain the natural, wild cycles of the ecosystem.





Benefits of Revegetation

Revegetating deforested slopes benefits the Earth's planetary ecosystem. Revegetation efforts restore habitat essential for threatened plant and animal species. Healthy native forests serve as a habitat for birds along their migratory routes. Vegetated areas are less prone to erosion and landslides that put human settlements at risk. A healthy, mature forest absorbs carbon dioxide and produces oxygen, which humans need to breathe.

In 2007, Ecuador popularly elected a Constitutional Assembly to draft a new constitution for the country. When approved by 64% of the voting population in 2008, it became the first constitution ever to enumerate the rights of nature and the responsibility of the government towards encouraging biodiversity and protecting natural systems. Ecuador's constitution recognizes the role of revegetation projects and the importance of native plant cultivation as integral to environmental stewardship. "In areas affected by processes of degradation and desertification, the State shall develop and promote forestation, reforestation, and revegetation projects that avoid single-crop farming and preferably use native species adapted to the area" (Section 5, Article 409).

The constitution further recognizes the importance of food sovereignty, which can be achieved in part through the cultivation of native fruit orchards as a part of revegetation initiatives. "The State shall provide farmers and rural communities with support for soil conservation and restoration, as well as for the development of farming practices that protect and promote food sovereignty" (Section 5 Article 410).

Why use Native Plants?

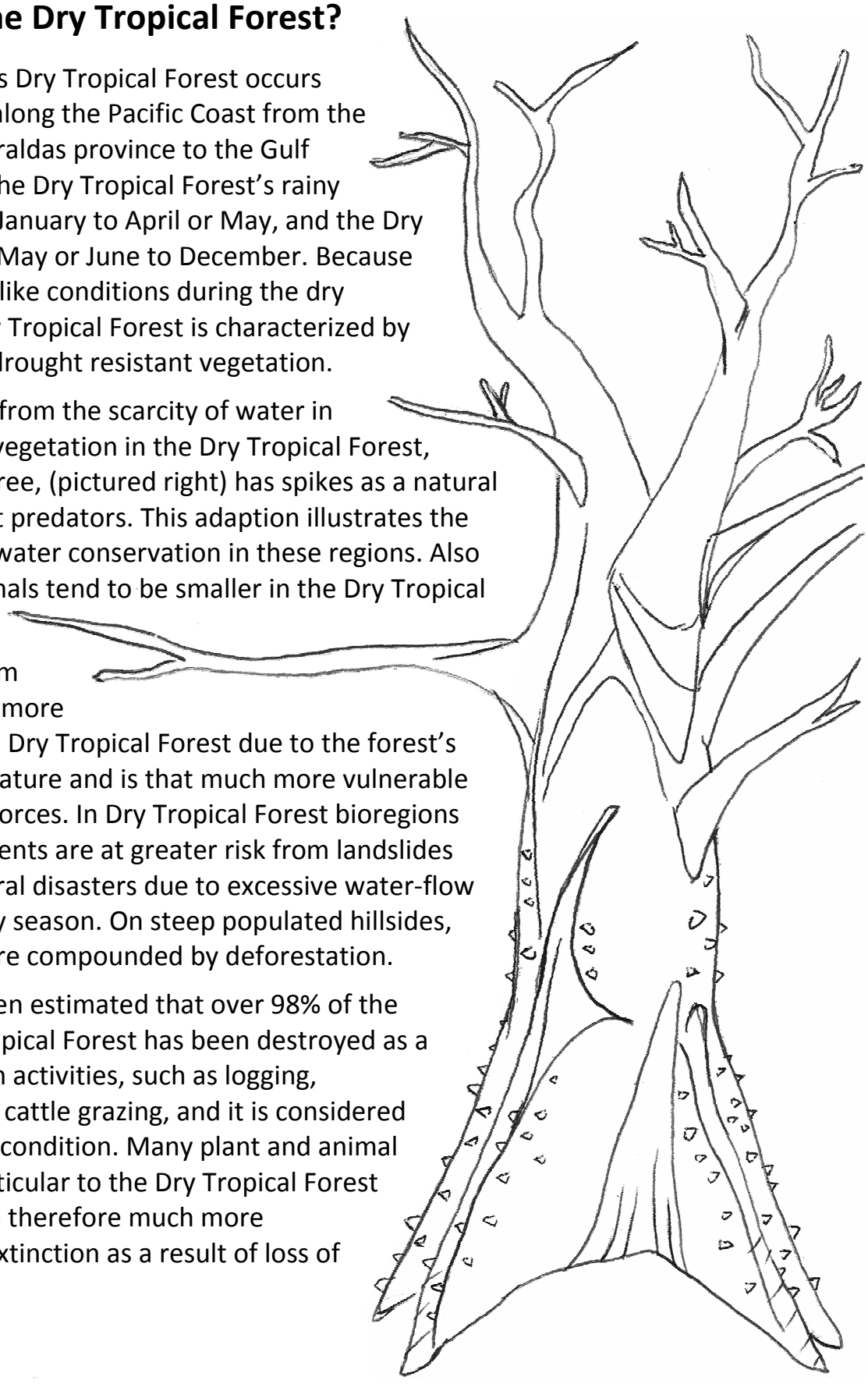
It is essential to use native plants in the revegetation process. Native plants are easier to work with because they are already adapted to the local ecosystem and require less maintenance to stay healthy. They provide food and habitat for native animal and insect populations. Certain non-native plants are invasive, out-compete native plants for nutrients, and disrupt the balance of ecosystems. Native plants encourage the continuation of healthy natural cycles in the area and have symbiotic relationships with other elements of their natural surroundings.

There is a huge potential to develop harvestable, organic products from native Dry Tropical Forest plants, such as Pechiche jam, or medicinal Sangre de Drago, as well as Ceibo cotton pillows, Moyuyo hair jell, and soap from Jaboncillo. These products already exist – or used to. Other natural remedies might still be discovered and could be lost forever if the forest is destroyed.

What is the Dry Tropical Forest?

Ecuador's Dry Tropical Forest occurs intermittently along the Pacific Coast from the southern Esmeraldas province to the Gulf of Guayaquil. The Dry Tropical Forest's rainy season is from January to April or May, and the Dry season is from May or June to December. Because of the drought-like conditions during the dry season, the Dry Tropical Forest is characterized by slow growing, drought resistant vegetation.

Evolving from the scarcity of water in these regions, vegetation in the Dry Tropical Forest, like the Ceibo tree, (pictured right) has spikes as a natural defense against predators. This adaption illustrates the importance of water conservation in these regions. Also plants and animals tend to be smaller in the Dry Tropical Forest.



Ecosystem revegetation is more challenging in a Dry Tropical Forest due to the forest's slow-growing nature and is that much more vulnerable to destructive forces. In Dry Tropical Forest bioregions human settlements are at greater risk from landslides and other natural disasters due to excessive water-flow during the rainy season. On steep populated hillsides, these threats are compounded by deforestation.

It has been estimated that over 98% of the original Dry Tropical Forest has been destroyed as a result of human activities, such as logging, agriculture and cattle grazing, and it is considered to be in critical condition. Many plant and animal species are particular to the Dry Tropical Forest climate and are therefore much more vulnerable to extinction as a result of loss of habitat.

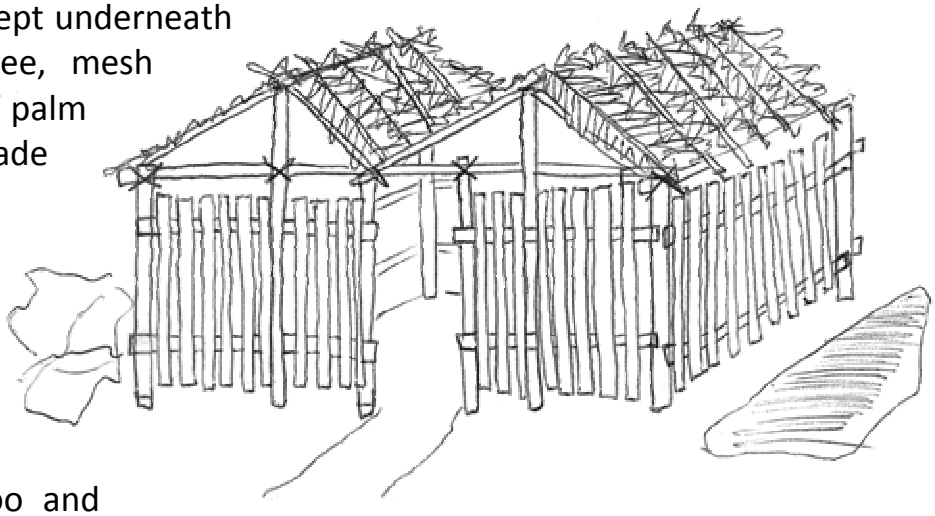
The Revegetation Process

Even without a huge budget or extensive technical expertise, efforts to revegetate the Dry Tropical Forest can make a significant impact on the ecology and natural systems of the surrounding area. This guide aims to provide information garnered from PD's experience in revegetating areas of the Rio Chone Estuary.

Resources Needed

Shade/Greenhouse

Seedlings will grow healthier and require less watering if they are kept underneath partial shade from a tree, mesh netting, or a roof made of palm fronds. Aim for 50% shade protection.



A greenhouse is highly recommended for protecting fragile seedlings. Always build with sustainable materials such as bamboo and recycled building materials. Save on expenses by avoiding cement, metal, plastic and other inorganic materials. The PD greenhouse is built almost entirely out of bamboo and palm fronds which are ideal building materials because they are all natural, easy to work with, inexpensive and readily available locally.

The shade of a large tree can be turned into a makeshift greenhouse instantly and doesn't require any construction.

Accessible Water Source

Be sure to locate the revegetation base near an accessible water source. Make sure the water hasn't been treated with chlorine within 24 hours. Try to collect rainwater, which has a lower pH than treated water and is better for the seedlings. Seedbeds need water 3x week and small trees need water 2x a week. Make sure there is ample water for the size of the operation.

Gathering Seeds

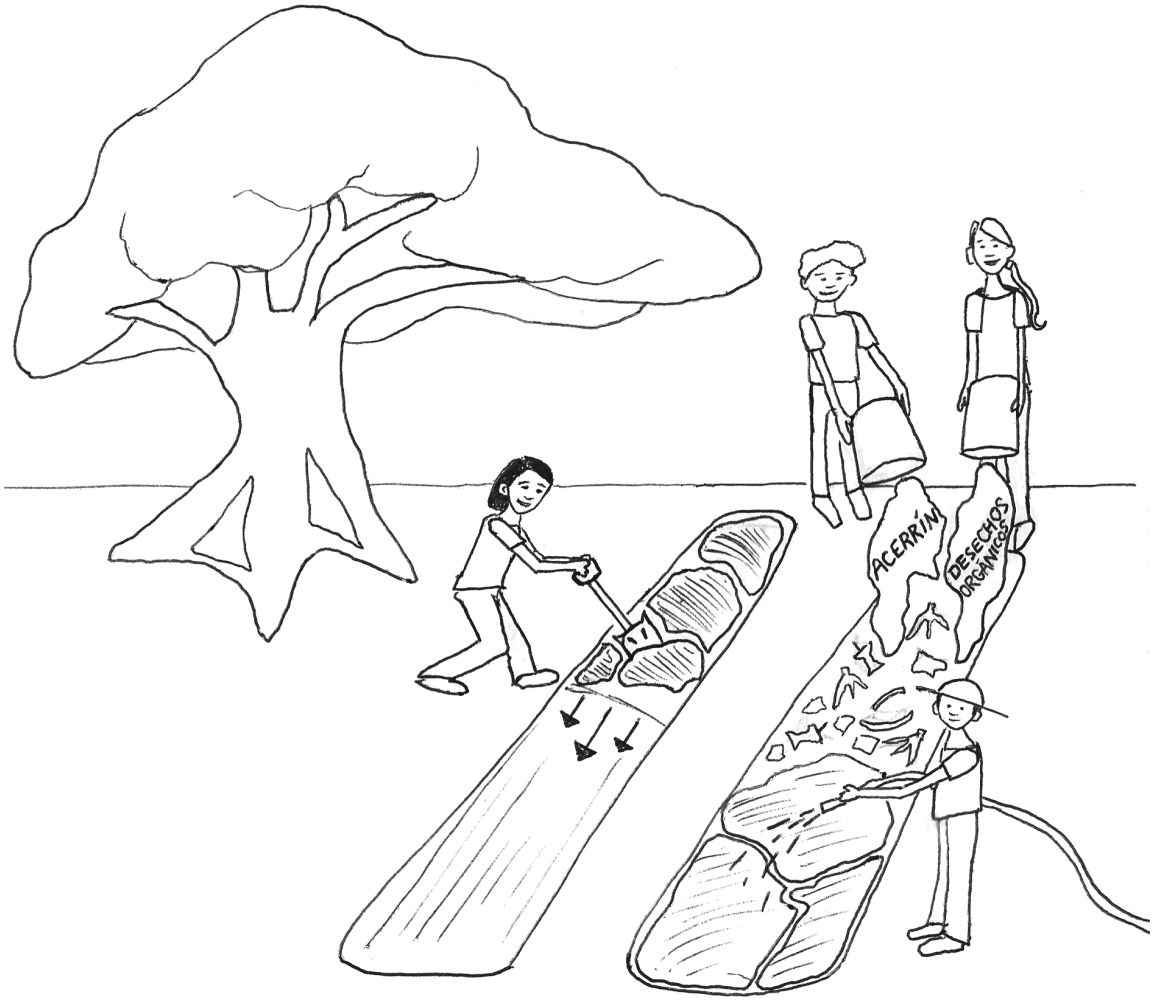
All seeds for a revegetation operation can be collected from a healthy, adult tree that has flowered and produced mature seeds. Different species of trees drop their seeds at different times. Pay attention to local species in order to know when to collect. All plants flower before producing harvestable seeds. If a tree is flowering, it will produce seeds within a few months. Seeds may drop to the ground when ready, or they may need to be collected directly from the tree. To ensure high germination rates, collect seeds as soon as they are mature. If seeds are in a pod like the seeds of Algarrobo, Dormilon, and Guachapeli, they should rattle when ready and still healthy.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Algarrobo					x	x	x	x	x			
Bototillo								x	x			
Cedro							x	x				
Cascol					x	x	x	x				
Ceibo								x	x			
Chirimoya					x	x						
Dormilon					x	x	x					
Ebano											x	
Guachapeli										x	x	x
Guasmo								x	x			
Guayaba			x	x								
Guayacan				x								
Jaboncillo									x	x		
Jaile							x	x				
Pechiche			x	x								
Seca					x	x	x					
Tierramonte						x	x	x				

How to Make Compost

Collect food scraps and/or animal manure preferably chicken, pig, cow and donkey manure. Do not use cat or dog waste. Almost all kinds of food scraps can be composted. Avoid using limes, which slow the decomposition process due to high levels of acidity. Meat scraps can attract animals and may produce nasty odors. Do not add used cooking oil to compost.

In a pile, windrow or bin combine one part food scraps or manure and one part dry leaves or sawdust. Mix and water thoroughly. Maintain humidity by watering occasionally (about once a week). Turn once or twice during a six-month period to accelerate decomposition. Compost must be produced in the shade.



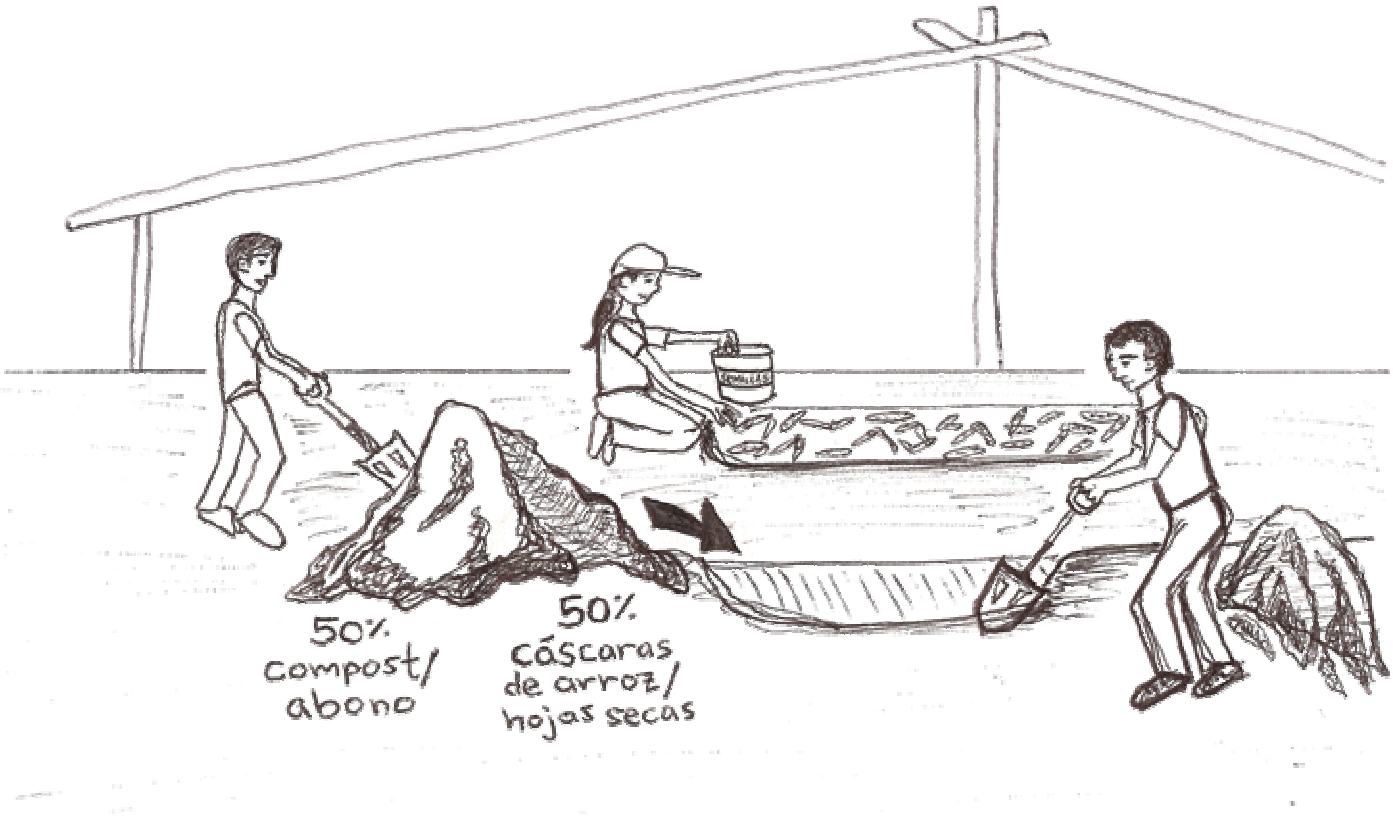
Decomposition causes compost to heat up. Check the temperature inside of the compost periodically by sticking a machete into the pile. Within a few minutes the machete should be very hot to the touch. The hotter the compost, the faster it is decomposing. Compost is ready once it no longer produces heat or bad odors. It should look like nice, dark soil and will be full of nutrients for plants to absorb.

Seedbeds

Seedbeds are helpful to germinate large quantities of seeds at the same time. Seeds and small trees need partial sun, lots of water, and aerated soil to develop properly. Completed compost mixed with dry leaves or rice hulls (approximately 50/50) makes excellent soil for seedbeds.

Dig a trench about 20-30 cm deep in the ground. A large seedbed, which could germinate anywhere from 500 to 1000 trees, is 1 m x 2 m. The dirt from the trench can be used to mix soil for transplanting the seedlings later on.

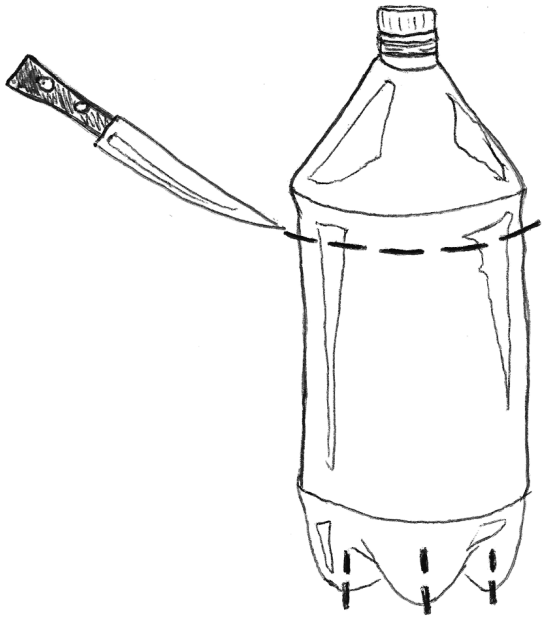
- Replace the dirt with light, fluffy seed germination soil—a mix of about half compost and half dry leaves or rice hulls.
- Thoroughly moisten the soil.
- Toss the seeds on top and mix gently into the soil. Add a light layer of extra leaves and light soil on top to cover the seeds. Plant seeds during neap tide for better germination rates.
- Water seedbeds heavily (3x a week)—simulate rain during the rainy season.
- Expect to see seeds germinating within 2-4 weeks.



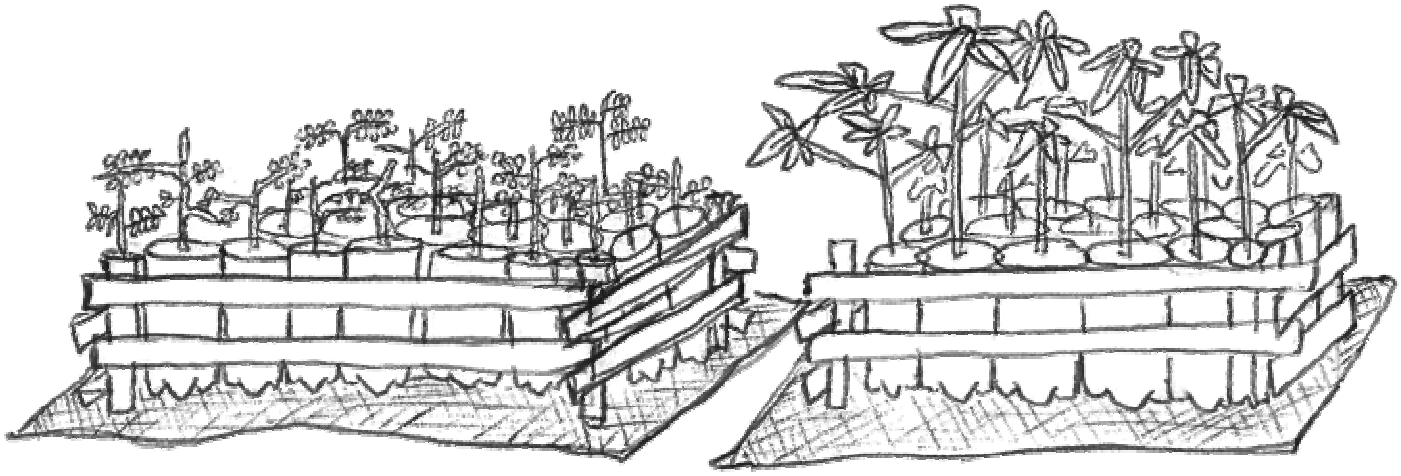
Transplanting the Seedlings

Within one to two months of germinating, seedlings should be about five to ten cm tall and ready to be transplanted out of the seedbeds into individual containers.

Plastic bottles and plastic bags are two commonly used containers for transplanted adolescent trees. PD highly recommends reusing plastic bottles for containers because they can be collected from local communities and recycled after use. This avoids creating new plastic waste and incurring additional costs. Plastic bottles are also much sturdier than plastic bags and the trees will be more likely to survive. 3-liter plastic bottles are ideal because they are much larger than typical plastic planting bags, allow trees to mature longer in the greenhouse, and will promote faster growth rates once the trees are transplanted to the field.



To create a container for transplanting trees, cut the top part off of the bottle and make three slits in the bottom of for drainage.

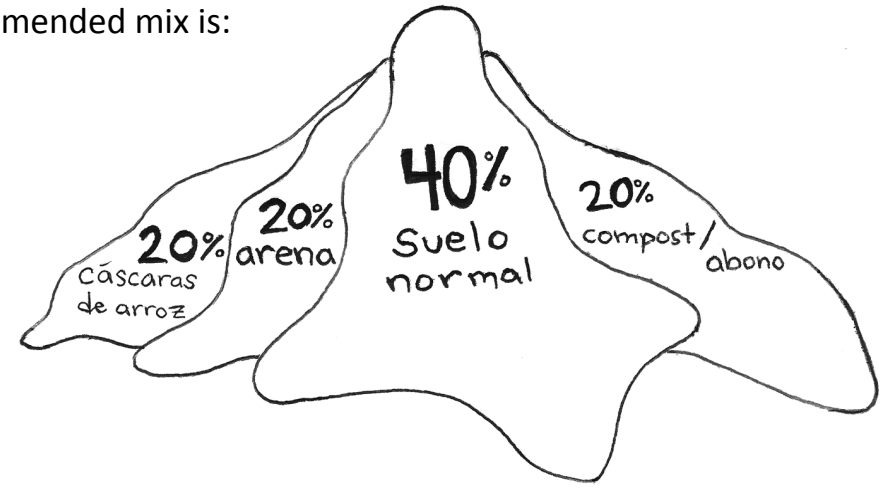


The PD greenhouse uses pieces of bamboo to organize the transplanted trees by species and generation. A plastic sheet is necessary to prevent roots from growing through the bottle and getting stuck in the ground. Handle the sheets carefully and they can last for multiple seasons.

Soil for Transplanted Seedlings

The consistency of the soil for transplanted seedlings should be somewhere between the light, fluffy seedbed soil and the hard natural soil that is found everywhere.

- Mix the ingredients thoroughly and moisten before transplanting. A recommended mix is:

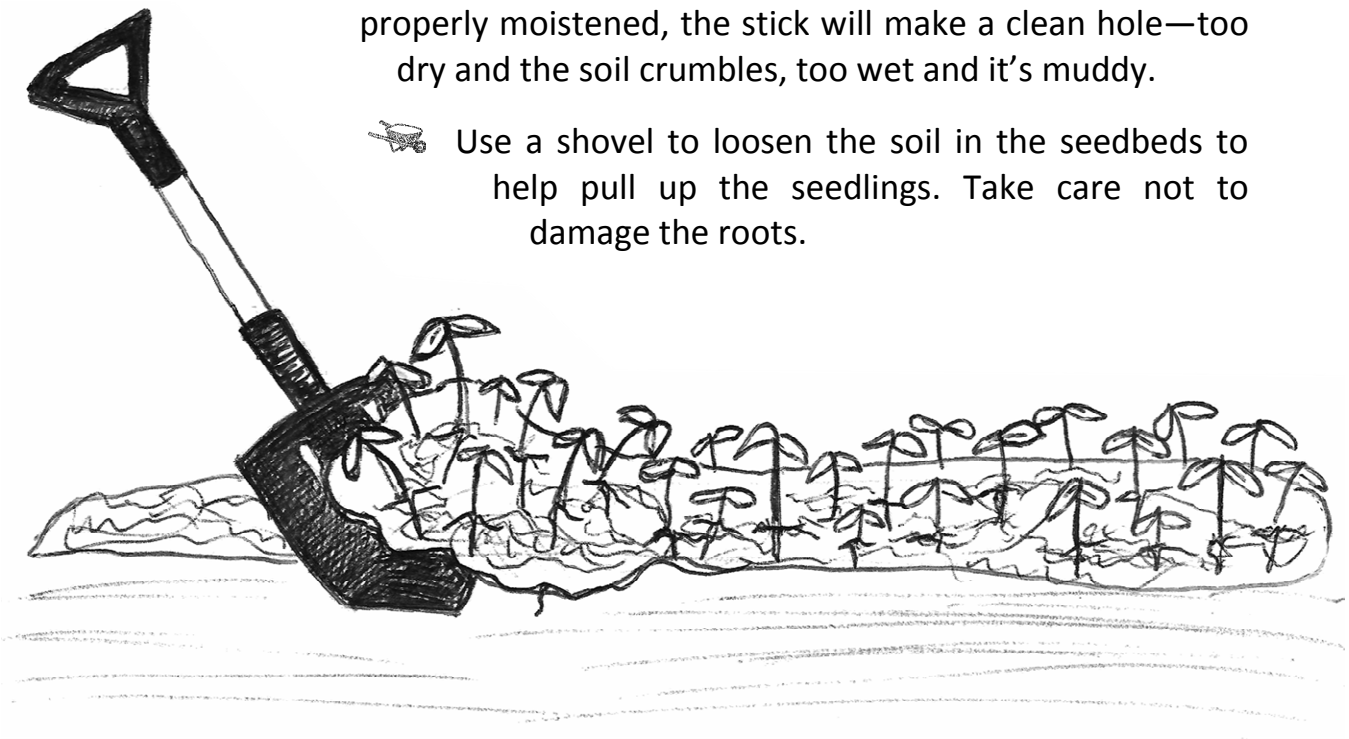


Cáscaras de arroz = rice hulls, arena = sand, suelo normal = normal soil

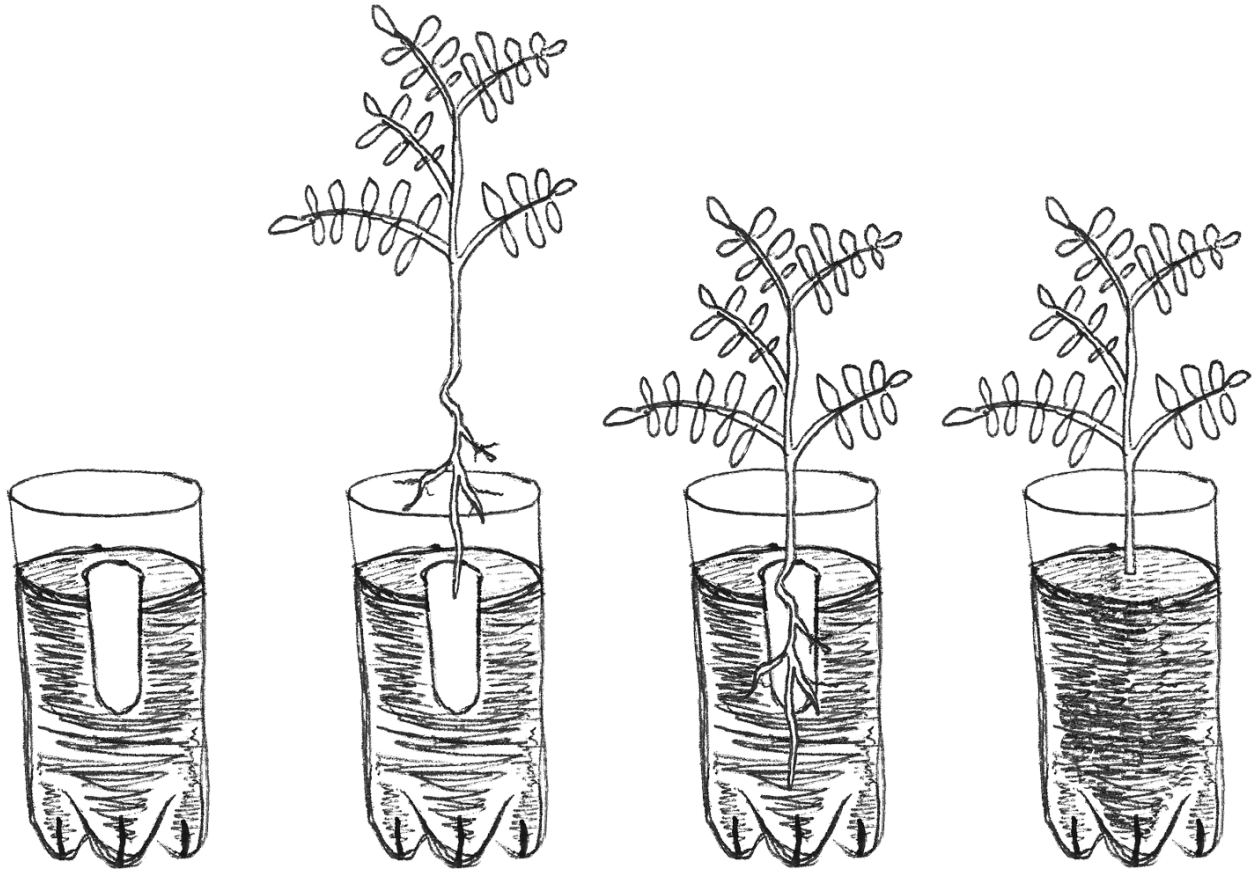
If the materials for this mix can't be found, try 70% normal soil / 30% dry leaves. Soil removed when making the seedbeds can be used as the normal soil in this mix.

- Tightly pack plastic bottles with damp soil. Using a stick, make a hole in the center about 10-15 centimeters deep. If the soil is properly moistened, the stick will make a clean hole—too dry and the soil crumbles, too wet and it's muddy.

- Use a shovel to loosen the soil in the seedbeds to help pull up the seedlings. Take care not to damage the roots.

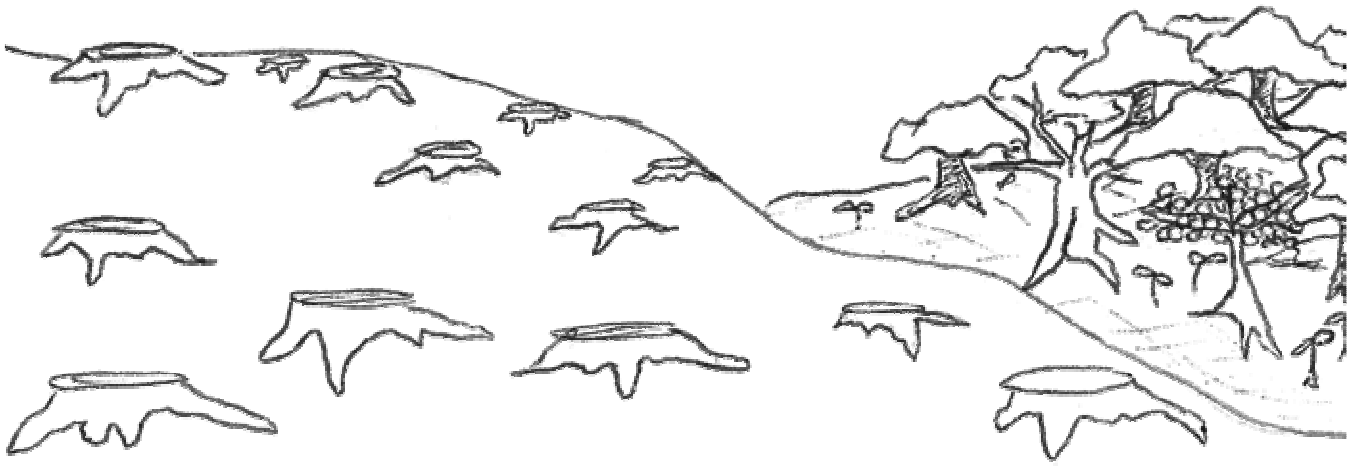


- Put individual, healthy seedlings in prepared bottles and pack hole with dirt. Exposure to fresh air and sunlight is damaging to roots so transplant the seedlings as quickly as possible—transplant in smaller batches at a time rather than larger. Make sure there are enough prepared bottles for the all of the trees that are dug up!
- After transplanting, remove any large leaves from the seedlings. These heavier leaves can weigh the seedlings down and hinder their development. The seedlings will adapt to the transplant faster with fewer "mature" leaves on their trunks.
- Water lightly immediately after transplanting and 2-3x a week thereafter.
- Allow trees to grow under partial shade until they are up to one meter tall after 2-8 months, depending on the species, and ready to be planted at the revegetation site. Weed saplings as necessary.
- Trees that are between 50-100 cm will be more successful in the field than smaller trees. Trees over 1 meter may be root-bound which can hinder growth. Trees under 50 cm will require more maintenance in the field and without sufficient watering may grow slowly.



Choosing a Revegetation Location

An ideal revegetation site is a devegetated area that will be dedicated to recreating the forest rather than be used for traditional commercial purposes. Areas that were originally cleared and used for the production of cattle or corn whose yields may be dwindling are ideal revegetation sites. Sites that are severely devegetated with loose soil or steep slopes are at immediate risk of erosion and should be given priority.

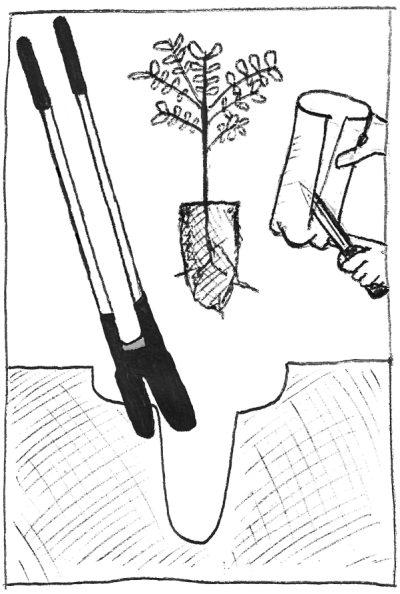


Choose a revegetation location and which plant species to use based on the following considerations:

- **Erosion Control**
  - Choose faster growing, drought resistant species.
  - Plant trees more densely to mitigate erosion.
- **Forest Conservation** (habitat restoration)
  - Choose slower growing, hard wood species that face extinction due to over-logging.
  - Trees may be spaced intermittently depending on existing vegetation.
- **Native plant orchard** (fruit production and wild farming)
  - Choose fruit producing trees.
  - Choose a location near a reliable water source.

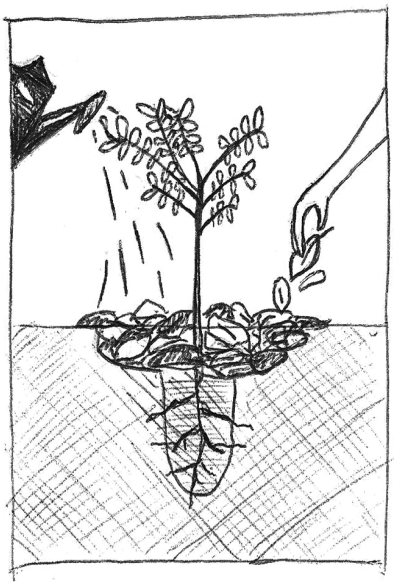
Make trails as necessary for the site. Follow the terrain, plant around existing natural vegetation and/or any unnatural obstacles (power cables, for example).

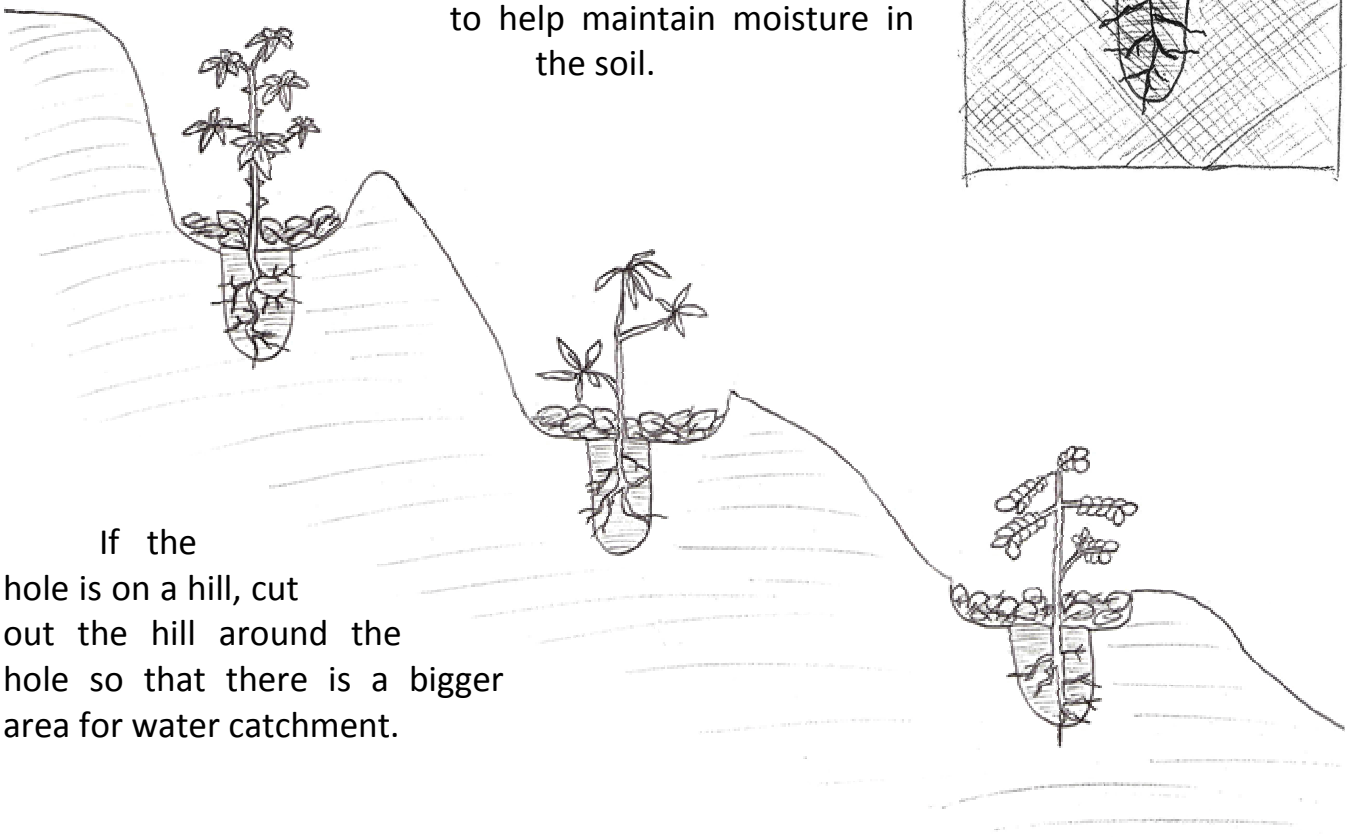
Planting the Trees



Depending on the terrain, trees should be planted between three and six or more meters apart (more densely if aiming to mitigate erosion, less densely if there is existing vegetation). Plant trees during the rainy season to take advantage of nature's watering.

- Dig holes for the trees. It is very important to dig deep holes, especially when there is scarcity of water. Each tree should be planted in a hole that is within a larger, shallower hole which will catch the water when watering or raining. Water catchment is particularly important when planting on a hill.
- Cut away the plastic bottle, place the tree in the hole and fill in the hole up to the wider water catchment area with soil.
- Unless it has been raining and the ground is wet, water the tree after planting.
- Mulch: Place dry leaves around the base of the tree (in the wider water catchment hole) to help maintain moisture in the soil.

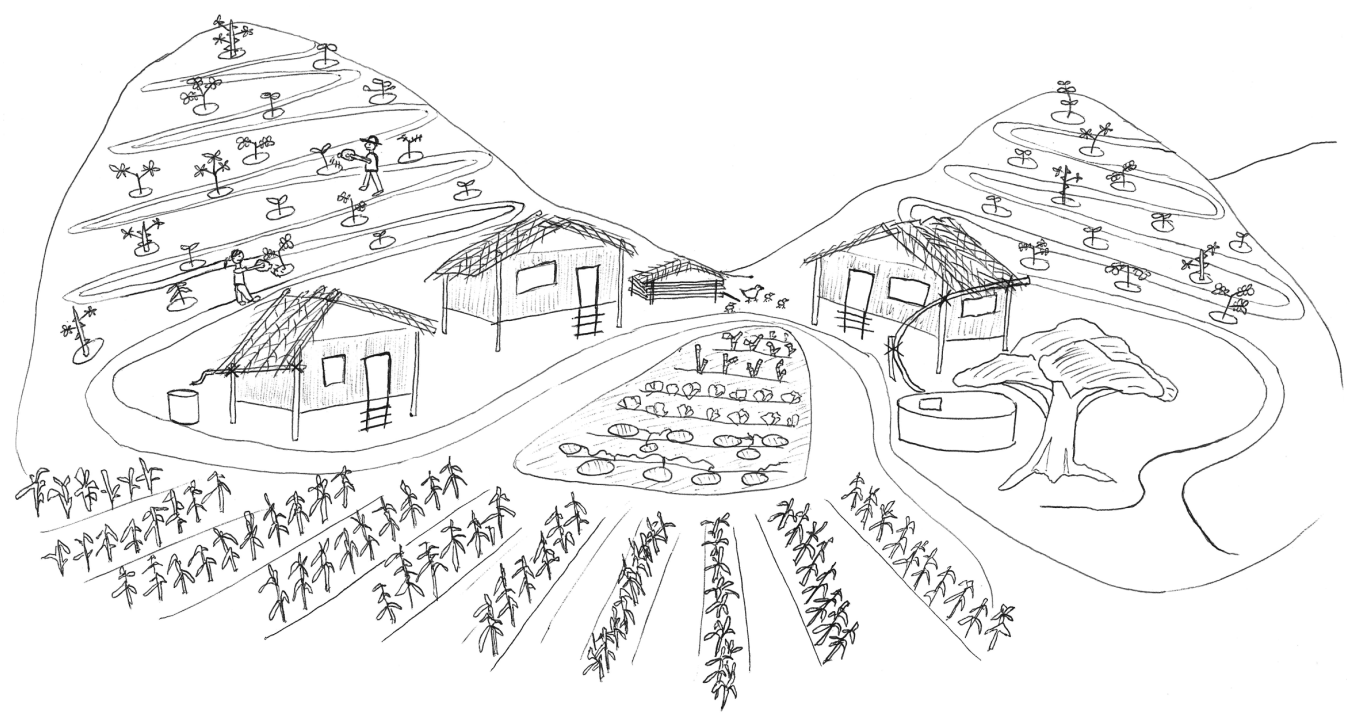




If the hole is on a hill, cut out the hill around the hole so that there is a bigger area for water catchment.

Maintaining the Revegetation Site

Throughout the first dry season water the trees once or twice a month using about one-third to one-half a gallon of water per tree. Fruit trees (except Pechiche) need to be watered once a week. Be sure to cover the surface around the tree with dry leaves to help conserve soil moisture.



PD uses recycled gallon jugs connected with old bicycle tire tubes to transport water at revegetation sites.

2013 Index of Recommended Trees for Revegetating the Dry Tropical Forest

Algarrobo (Prosopis pallida)

- Fast growing, drought resistant
- Complex, very deep root system
- Exceptional for erosion control on steep hillsides prone to landslides
- Produces seedpods that can be used as animal fodder
- *Algarrobina*, a syrup made from seedpod pulp, is used in Peruvian cuisine and is high in protein and vitamins

Bototillo (Cochlospermum vitifolium)

- Very fast growing and drought resistant
- Good for soil stabilization

Cedro (Cedrela oderata)

- Good for species conservation and habitat creation

Cascol (Caesalpinia paipai)

- Slow growing, hearty tree that needs very little water
- Great for habitat creation and species conservation

Ceibo (Ceiba trichistandra)

- Fast growing and drought resistant, great for soil stabilization
- When mature, its large trunk helps it conserve water during the dry season
- Green bark allows for photosynthesis through the dry season despite losing its leaves
- Spikes on young trunks and branches prevent predators from eating it
- Buttressed roots and large branches can house many diverse animals and makes it ideal for habitat creation

Chirimoya (Annona cherimola)

- Produces a delicious fruit that can be sold in local markets
- Fruit has powerful antioxidants that have anti-cancer and anti-malarial properties
- Grows more like a shrub than a tree, great for smaller spaces

Ebano (Zizipus thirsiflora)

- Drought resistant
- Great for species conservation and habitat creation

Guachapeli (Albizia guachapeli)

- Fast growing and very drought resistant
- High survival rate, adapts very well to a wide variety of soil conditions

Guasmo (Guazuma olmifolia)

- Hardy, fast growing species
- Good for soil stabilization
- Branches can be harvested for stakes (similar to Moyuyo)

Guayaba (Psidium guajava)

- Fruit produced is rich in Vitamin C and can help reduce high blood pressure
- Leaves and bark can be used as a disinfectant and antiseptic for wounds and can treat toothaches and digestive disorders like diarrhea and vomiting
- Flowers can be used to treat bronchitis
- Needs regular watering

Guayacan (Tabebuia chrysantha)

- Extremely over-logged for its valuable wood
- Excellent conservation species
- Very drought resistant
- Resin has medicinal properties such as helping coughs and arthritis

Jaboncillo (Sapindus saponaria)

- Drought resistant
- Good for soil stabilization
- With their high saponin levels the fruits were traditionally used for soap

Pechiche (Vitex gigantean)

- Needs relatively small amounts of water considering that it produces fruit
- Grows large
- Fruit can be made into jam and juice

Seca (Geoffrea spinosa)

- Produces edible fruit for deer, squirrels, and other animals
- Rare, slow-growing tree
- Good for species conservation

Tierramonte (Pithecellobium excelsum)

- Grows like a shrub, but can attain heights of over 8m and can be very wide
- Leaves are collected for their excellent mulching qualities
- Drought resistant and somewhat slow growing