
A Lesson in Agroforestry

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"The word "steward" derives from the old Norse word *sti-vadr*, meaning "keeper of the house." Within the field of conservation, stewardship generally means people taking care of the land. When a rural family takes good care of its farmland so that the soil will be healthy for generations to come, that's stewardship." (Marsh-Billings-Rockefeller National Historical Park)

Working at the Marsh-Billings-Rockefeller National Historical Site in Vermont as an intern a few years ago afforded me a valuable learning experience in the area of land stewardship. It is the only National Park in the United States that focuses on the evolving nature of land stewardship within America. I saw for the first time here in the United States an example of a piece of land which had been totally degraded through heavy logging, fires, overgrazing and erosion, now rejuvenated to a state of healthy, abundant production. I also saw an integration of farming and forestry in a sustainable and profitable way through creative, practical, and flexible techniques.

Mr. Billings bought the land in the 1860s and selected appropriate species to reforest the hillsides, combining them with pasturelands for an eventually thriving dairy farm while practicing sound forestry methods. He set a successful and sustainable standard of land stewardship now mimicked and studied by farmers throughout Vermont and across the United States.

So, what does this example have to do with ECHO and the seed bank? My time at this national park was my first exposure to agroforestry in action. The word "agroforestry" seems to have become a part of every agricultural development worker's daily vocabulary. Sometimes words can be misconstrued or confusing to individuals new to the field. Here is a quick review of the agroforestry concept before jumping into seed bank details:

Definitions:

Agroforestry: In its simplest definition (as quoted by ECHO's Technical Note "Agroforestry Principles (<https://www.echocommunity.org/resources/06c870a1-3fbb-47ec-9951-e8c0cb134582>)"), "agroforestry is the production of trees and of non-tree crops or animals on the same piece of land." It should be viewed more as a creative process than as a set technique because it is ongoing, dynamic, flexible, and practical.

Agroforestry involves deliberately using woody perennials (trees, shrubs, palms or bamboos) with crops and/or animals on the same piece of land. These can be cultivated on a piece of land at the same time, and/or in consecutive cropping

seasons. Trees are not just allowed or tolerated but planted, arranged, managed and utilized in conjunction with one or more other elements to allow a farm to function at a fuller capacity, making it more productive for a longer period of time.

Types of Agroforestry Systems:

Technically, agroforestry is a generic name for different types of agricultural systems. Here are a few of those:

- **Agrosilviculture:** Agricultural crops combined with forest crops.
- **Silvopastoral:** Trees and shrubs combined with pastures and animals.
- **Agrosilvipastoral:** Trees or shrubs combined with food crops, pastures and animals.
- **Alley cropping:** Trees and shrubs planted closely in a row with wide spaces (alleys) for food crops between the rows of trees.

Why Use a System of Agroforestry?

Use of Inputs:

The Nitrogen Tree Fixing Association (NTFA) highlights a few of the benefits of agroforestry which allow for a more efficient use of the limited resources that most small farmers face:

- **SUN:** Multi-storied crops allow for the absorption of sunlight at all levels.
- **SOIL NUTRIENTS:** Deep-rooted trees and shrubs may absorb nutrients that leach from the more shallow parts of the soil, where the roots of food crops are usually concentrated.
- **WATER:** Tree cover discourages water loss because trees shade crops, keeping them cooler, which results in less evaporation. Trees also cover more soil surface, discouraging loss of water from the soil to the air. Tree leaf mulch can help retain moisture near the surface of the soil. On the other hand, shallow-rooted trees may compete with crops for water.
- **LAND:** Erosion is reduced as trees hold the soil in place and feed the soil with organic matter. If trees are nitrogen fixing, the root microorganisms and the leaf litter will enrich the soil with much needed nitrogen.

Outputs:

The World Forestry Centre in Kenya highlights other production benefits:

- **SHADE:** Tall trees provide shade for food and cash crops, and for livestock.
- **ANIMAL FODDER:** Leaves or pods can be used as food for animals.
- **INCOME GENERATING:** Fruits and nuts can give added nutrition and extra income.
- **LIVING FENCES:** Closely planted trees form living fences around livestock enclosures, and around vegetable gardens to prevent incursions by livestock.
- **FUELWOOD/ENERGY:** Fast-growing trees provide fuelwood for family cooking and for increased income.
- **BUILDING MATERIALS:** Trees for these purposes (many of them slower-growing) produce timber for building and for furniture, as an investment for the future.
- **SOIL IMPROVEMENT:** Trees and shrubs are intercropped with other plants to improve soil quality and to control weeds and pests.

- **MEDICINAL:** Certain trees provide medicinal products from their bark, leaves, roots and fruit that can keep the family healthy and provide added income.
- **EROSION CONTROL:** Trees, shrubs and plants such as banana can be planted along the contour lines of sloping fields to prevent soil run-off in heavy rains, while at the same time supplying additional food and other products for improved nutrition and income. Cut branches left from animal feed can be used to make erosion control barriers.

Agroforestry systems allow for the production of both short-term and long-term products. For instance, in Nepal, cabbage and other Brassica species are grown in the shade of apple tree orchards. Cardamom is grown among Himalayan alder trees. Both native and exotic species have been used. For instance, *Faidherbia albida* (apple ring acacia; previously known as *Acacia albida*) is suited to and often indigenous to the hot dry tropics such as regions in Malawi, whereas *Calliandra calothyrsus* is more suited for the wet tropics such as parts of Nicaragua. For higher elevation tropics, *Sesbania sesban* var. *nubica* is more often recommended than other forms of *Sesbania*.

The overall creativity that these systems allow for is one of the most appealing attributes of agroforestry. Each farmer can develop a dynamic, adaptable, realistic and sustainable system suited to his or her particular circumstances. Agroforestry can be practiced by almost anyone, from the small-scale Zimbabwean farmer with under an acre to the large-scale commercial farmer as seen in the national park mentioned earlier. The main challenge in agroforestry is finding a strategy that fits your area, needs and resources.

If you are interested in further information regarding agroforestry, ECHO has a Technical Note available called "Agroforestry Principles (<https://www.echocommunity.org/resources/06c870a1-3fbb-47ec-9951-e8c0cb134582>)." The following websites are also excellent resources for information on this subject:



Acrocarpus fraxinifolius.
 Photo by Herbert Menendez,
 in Agroforestry Database
 (www.worldagroforestrycentre.org)

www.winrock.org (<http://www.winrock.org>)

www.agroforestry.net (<http://www.agroforestry.net>)

www.worldagroforestrycentre.org (<http://www.worldagroforestrycentre.org>)

We carry many different species of tree and shrub seeds in our seed bank. All are available in trial packets, and some can be purchased in small bulk quantities. A list of available seeds can be found on our web site (www.echotech.org). Below we highlight just a few of the species that we recently obtained from Agroforester (available in trial packets).

Acrocarpus fraxinifolius

Common names for this tree include acrocarpo, khang chang, cedro rojo, fresno hindú, Kenya shade tree, lazcar, mundani, pink cedar, and shingle tree.

Acrocarpus is native to the tropical regions of Asia. It is a fast-growing deciduous tree, which can grow 1.3 to 3 m annually and can attain heights of 30 to 60 m. The species grows in acid and calcareous soils, at elevations between sea level and 2000 m with annual precipitation between 500 and 3000 mm and temperatures between 15 and 26°C. It is very sensitive to frost. *A. fraxinifolius* is a pioneer and grows best with plenty of light, but tolerates slight shade when young. The wood of *A. fraxinifolius* is hard and strong. Because it physically resembles ash and walnut woods, it is used as a substitute for these two species. Although a legume, it apparently does not fix nitrogen. *A. fraxinifolius* is deep rooting, with roots up to 4.5 m into the soil.

Major uses for this tree include fodder, apiculture, fuel, and timber. Other benefits include:

- **Erosion control:** Due to its deep root system, it is recommended for holding soil in place on hillsides and along rivers.
- **Shade or shelter:** It functions as a shade tree on tea and coffee plantations in countries such as Kenya and Uganda.
- **Land Reclamation:** It is a good species for reforestation of open areas.
- **Soil improvement:** Leaves are suitable for mulching.

Faidherbia albida

Common names include anaboom, haraz, apple ring acacia, white-thorn, and arbre blanc.

This nitrogen-fixing acacia is best suited for arid and semi-arid regions. Best growth and production can be found in areas with a high water table, and loamy, sandy clay soils that drain well. The apple ring acacia can grow with mean annual rainfalls between 300 and 1800 mm and is able to survive extended dry periods. It grows at altitudes ranging from 600 to 1800 m. It is very thorny.

The apple ring acacia is unique because it provides shade for animals during the sunny dry season, and then loses its leaves at the beginning of the rainy season, just as farmers want full sun for their crops. Leaves can be used for mulch. The leaves and pods can also be used as fodder and are an important source of protein late in the dry season. While most other species flower before or during the rains, the apple ring acacia flowers and leafs out at the end of the rainy season. It is a main source of pollen and nectar for bees during this time. Since seeds are set later,

usually towards the end of the dry season, the edible seeds may provide food during times of famine. In West Africa, it is intercropped with sorghum and millet. It is deep rooted, thus not competing with shallow rooted crops. A spacing of 50-100 trees per hectare generally provides substantial nutrients for the season. Some other uses for *Faidherbia* include production of fuelwood or construction wood; windbreaks; and soil conservation.

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