

Importance of Mixed Crop Farming Systems and Agroforestry Trees for Improving Sustainability, Resource Conservation, and Profitability on Farms and Ranches

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systems and agroforestry
May 16, 2006


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Definition: Mixed crop farming



A farming system
where two or more
crops are raised in the
same area at the same
time, and which may
include animal
husbandry (livestock,
poultry, etc.) and/or
aquaculture.


Mixed coffee farm, Kona, Hawai'i

There are many different definitions for mixed crop farming. I am using a very simple definition for this talk.

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Definition: Agroforestry

“Agroforestry is a dynamic, ecologically based natural resources management system that, through the integration of trees in farms and in the agricultural landscape, diversifies and sustains production for increased social, economic, and environmental benefits for land users at all levels.”
—R. Leakey




Mixed coffee farm, Kona, Hawaii

There are also many definitions for agroforestry, a modern term that describes agri- and horti-cultural systems that integrate trees in beneficial ways. This is Dr. Roger Leakey’s definition.

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Traditional PI agriculture



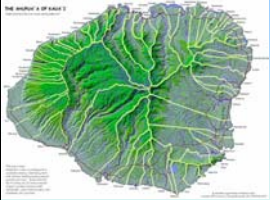
“Traditional Pacific Island agricultural and land use systems were agroforestry systems built on a foundation of protecting and planting trees. These traditional agroforestry systems once made Pacific Islanders among the most self-sufficient and well-nourished peoples in the world.”—R. Thaman

Tongan farmer, Tongatapu

Traditional Pacific Island agriculture was mixed crop farming incorporating trees and other crops. These systems were very diverse in their products: food, building and craft materials, medicines, fuelwood, fodder, etc, and sustained large healthy populations for many centuries.

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Example: Hawaiian ahupua‘a



Land divisions arranged from mountain to ocean and usually ridge to ridge that contained virtually all resources required for survival.

Map: Ho'okipa Network

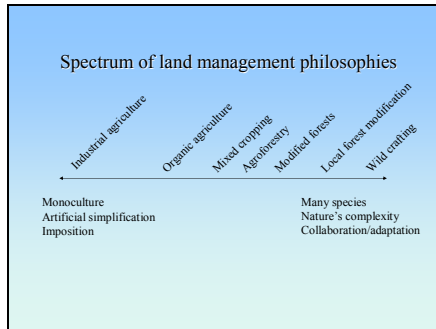
The Hawaiian system of land divisions was very advanced, resembling modern ridge-to-ridge watershed maps used today for conservation of soil resources. By managing land in mountain-to-ocean divisions, the people of each division had access to many different types of ecosystems for growing different types of crops.

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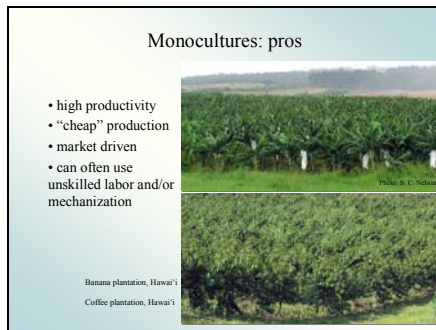
Hawaiian resource management was based on a philosophy of caring for agricultural, wild, and aquatic resources. Their agricultural systems were sustainable, supporting Hawaiians for hundreds of years with very little or no imports.

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One way to compare agricultural systems is to look at them on a spectrum from monoculture to natural ecosystems. Pacific islanders' diverse agroecosystems were on the opposite end of the spectrum from today's monocultural systems.

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Monocultures have many advantages, which is why they have largely replaced diverse traditional systems worldwide over the past 100 years. These advantages are primarily economic, and do not account for the intangible costs to society and the environment.

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Monocultures: cons

- reliance on fossil fuels & high technology
- low energy efficiency (cal out/cal in)
- collateral costs to environment & culture
- catastrophic failure due to diseases/pests
- replaces local crops

Eradication of banana bunchy top virus, Hawaii¹



Sugarcane field, Hawaii¹

The costs to society of monocultures fall largely outside the market economy. They include vulnerability to fuel shortages, environmental and cultural destruction, and susceptibility to crop failures.

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Mixed cropping/agroforestry: pros

- multiple crops and markets
- short, medium, and long term crops
- food and resources for home and local use
- innovative products
- spatial efficiency
- makes use of natural fertility cycles



Homegarden, Apia

Mixed cropping systems provide a wide variety of crops for both home use and market, make efficient use of land, and distribute labor over several seasons.

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Mixed cropping/agroforestry: cons



Fruit orchard, Kona, Hawaii¹

- management complexity
- knowledge intensive
- labor intensive: difficult to mechanize
- more "expensive" to operate

Mixing cropping systems require much more skill, knowledge, and labor to manage effectively.

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Benefits of mixed cropping/agroforestry

- ✓ Increase income by reaching add'l markets
- ✓ Decrease expenditures by providing farm materials
- ✓ Diversify farm "portfolio"
- ✓ Increase resilience to market fluctuations
- ✓ Provide household needs for food, medicine, materials, etc.

Let's look at the benefits of mixed crop farming with trees, and then see how trees can be integrated into farms and ranches.


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Benefits of mixed cropping/agroforestry

- ✓ Reach specialty markets ("bird friendly," locally grown, etc.)
- ✓ Make use of difficult or marginal lands
- ✓ Generate income during the off-season
- ✓ Create "bank account" for the next generation

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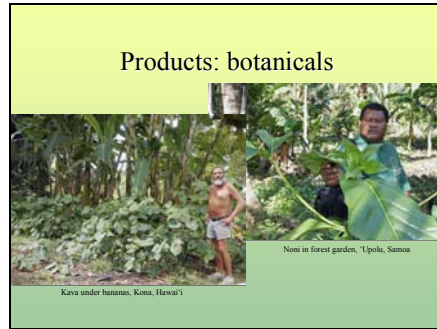
Products: commercial



Coffee and macadamia nuts, Kona, Hawaii's

Commercial crops such as coffee and macadamia nuts can be grown together, as the smaller coffee trees can tolerate moderate shade. The combination of these two crops spreads the labor over the year and helps cushion price falls in one or the other crop.

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Many botanical plants are low-growing and can tolerate the shade of other tree crops, thereby growing two or more vertically stacked crops.

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Plants that occupy understory niches also often can fill niche markets.

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Timber and wood products, which often take many years to grow, can be grown on the same land area as much shorter term crops. The short-term crops can produce income for many years until the timber/wood crop can be harvested.

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Trees can be grown for the purpose of producing organic matter, which serves as fertilizer and saves the farmer the expense of buying and transporting fertilizer from off-site.

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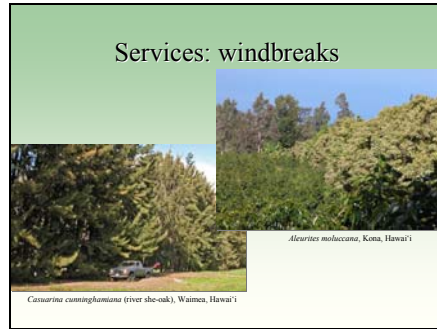
Trees can be used to grow fodder for direct foraging or cut and carry. Waste products or surpluses can also be fed to animals.

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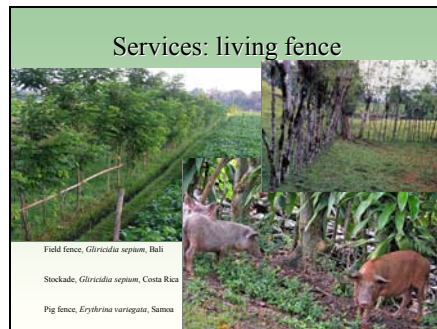
A farm can produce commercial crops as well as a multitude of products for household needs. These household products can offset expenses.

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Switching now to services, there are many services trees can provide. Trees commonly provide a service as windbreaks.

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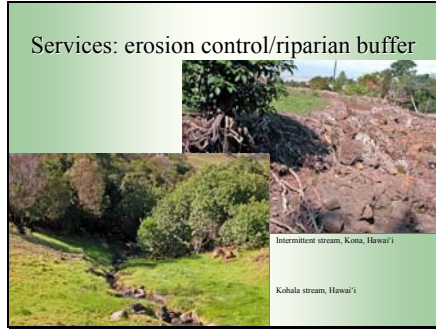
Trees are used throughout the tropics for living fence posts. The trees can provide other services such as windbreak and shade, as well as products.

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Trees can make acceptable visual barriers, particularly useful in urban areas.

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Trees lining streams and intermittent waterways can control soil erosion.

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Many tropical fruit and other trees prefer shade, particularly when they are young. Some trees such as coffee thrive when there is moderate shade in certain environments.

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Animals can graze until many types of trees, deriving sustenance while maintaining the understory growth.

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Trees make an excellent trellis for vines such as vanilla, pepper, yam, and passion fruit.

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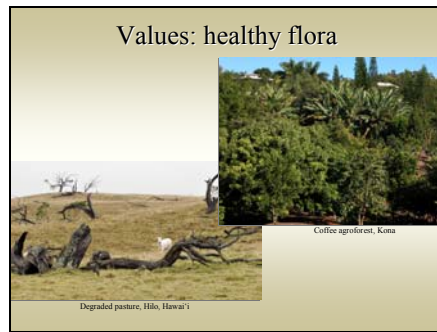
Trees can often establish themselves on harsh sites, or sites that are difficult to utilize for annual crops.

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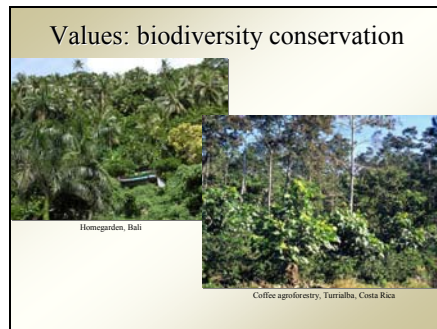
Now let's look at how integrating trees into agricultural environments affects human values.

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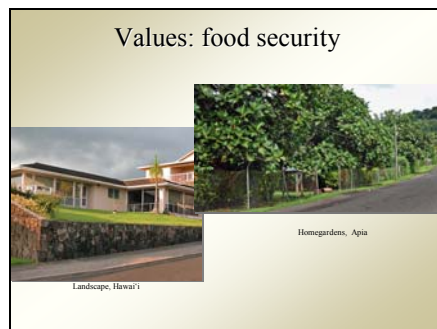
A vibrant environment is something we all appreciate. Removing trees, or not allowing them to reproduce, begins a process of land degradation that can lead to desert.

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We now know that diverse agroforestry systems support biodiversity whereas monocultures do not.

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Diverse agroforestry systems can provide food security, whereas western landscapes do not.

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A legacy of a healthy environment is something we all would like to leave behind.

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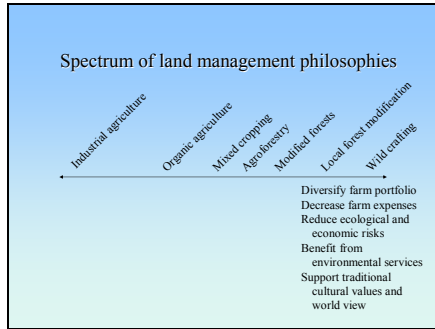
Diverse agroforestry and forestry systems create the kind of restful beauty many people appreciate.

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Many people are not aware that trees are associated with some of the most important meeting places and landmarks.

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Same spectrum of agricultural systems as previously shown, with some benefits of mixed crop farming and agroforestry listed.

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Traditional Tree Initiative
www.traditionaltree.org

Species covered:



Acacia spp.
Agave *macrophylla*
Albizia *melaleuca*
Albizia *rooseae*
Alnus *cordata*
Artocarpus *alatus*
Artocarpus *camansi*
Artocarpus *heterophyllus*
Artocarpus *marianensis*
Barringtonia *procera*
Brosimum *spyzifera*
Bruguiera *gynerioides*
Calophyllum *inophyllum*
Cananga *odorata*
Cassipouira *indica* (C. harveyi)
Cinnamomum *zeylanicum*
Citrus *sp.*
Cocos *nucifera*
Cordia *alliodora*
Endospermum *modifolium*
Erythrina *variegata*
Fagraea *bertonioides*
Ficus *sp.*
Grevillea *sp.*

Gleichenia *galeata*
Hibiscus *hibiscus*
Inocarpus *flagellifera*
Isaria *sp.*
Mangifera *indica*
Mimosa *sp.*
Mimosa *polytricha*
Mitrasacme *sp.*
Musa *sp.*
Pandanus *lucidus* (other *P.* species)
Pongamia *pitavata*
Psidium *indicum*
Rhizophora *sp.*
Rhizophora *sp.*
Santalum *sp.* (other *S.* species)
Santalum *sp.*
Syzygium *malaccense*
Terminalia *sp.*
Terminalia *sp.*
Thespesia *sp.*
Tournefortia *argentea*