

UF/IFAS Extension

The Journey to Sustainability Begins with Education



UF/IFAS Sarasota County Extension
6700 Clark Road
Twin Lakes Park
Sarasota, Florida 34241
(941) 861-5000



Fruit Tree-Based Agroforestry (aka Alley Cropping)

Robert A. Kluson

Agriculture/Natural Resources Agent II

UF/IFAS – Sarasota County Extension

Outline

- **Overview of Agroforestry**
 - Principles & concepts

- **Alley cropping**
 - Benefits and costs
 - Examples

What is agroforestry?

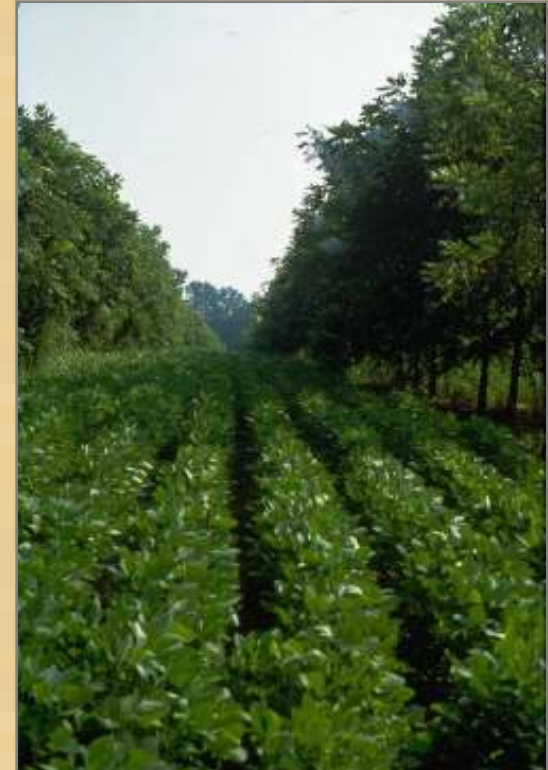


+



Agroforestry is...

... intensive land management that optimizes the benefits (physical, biological, ecological, economic, social) arising from biophysical interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock.



Agroforestry Benefits

Aesthetics	Promotion of wildlife and plant diversity and provision of recreational and leisure areas.
Animal Production	Improvement of health and weight and reduction of feed costs. Shielding of noise and odor.
<i>[continued from previous page]</i> Carbon Storage	Incorporation of large quantities of carbon in woody vegetation within the agricultural landscape.
Economic	Promotion of income from multiple products with steady cash flow. Reduction of input costs and improvement in quality and yield of crops.
Energy Conservation	Reduction of farm and household energy costs and inputs.

Agroforestry Benefits

Pest Management	Provision of barriers to reproduction and spread of pests, and habitat for beneficial insects and birds.
Soil Conservation	Reduction of loss of nutrients, organic matter and sediment erosion.
Streams and Wetlands	Interception of agricultural runoff and sediment, protection of banks from erosion and safeguarding of habitat.
Water Conservation and Quality	Reduction of water use by plants, filtering of chemicals from runoff, promotion of infiltration to groundwater, and treatment of waste effluent and salinization.
Wildlife Habitat	Provision of cover, food, nest sites, and corridors for movement.

Agroforestry is.....



Alley Cropping

Silvopasture

Forest Farming

Riparian Forest Buffers

Windbreaks

**... putting
the right plant,
in the right location,
for the right reason.**

Alley Cropping

Growing an annual or perennial crop simultaneously with a long term tree crop. The agricultural crop generates annual income while the longer-term tree crop matures.



Alley Cropping Benefits



- Diversify farm enterprise
- Reduce erosion
- Improve water quality
- Protect crops
- Improve utilization of nutrients
- Enhance wildlife habitat
- Improve aesthetics
- Store carbon

Alley Cropping

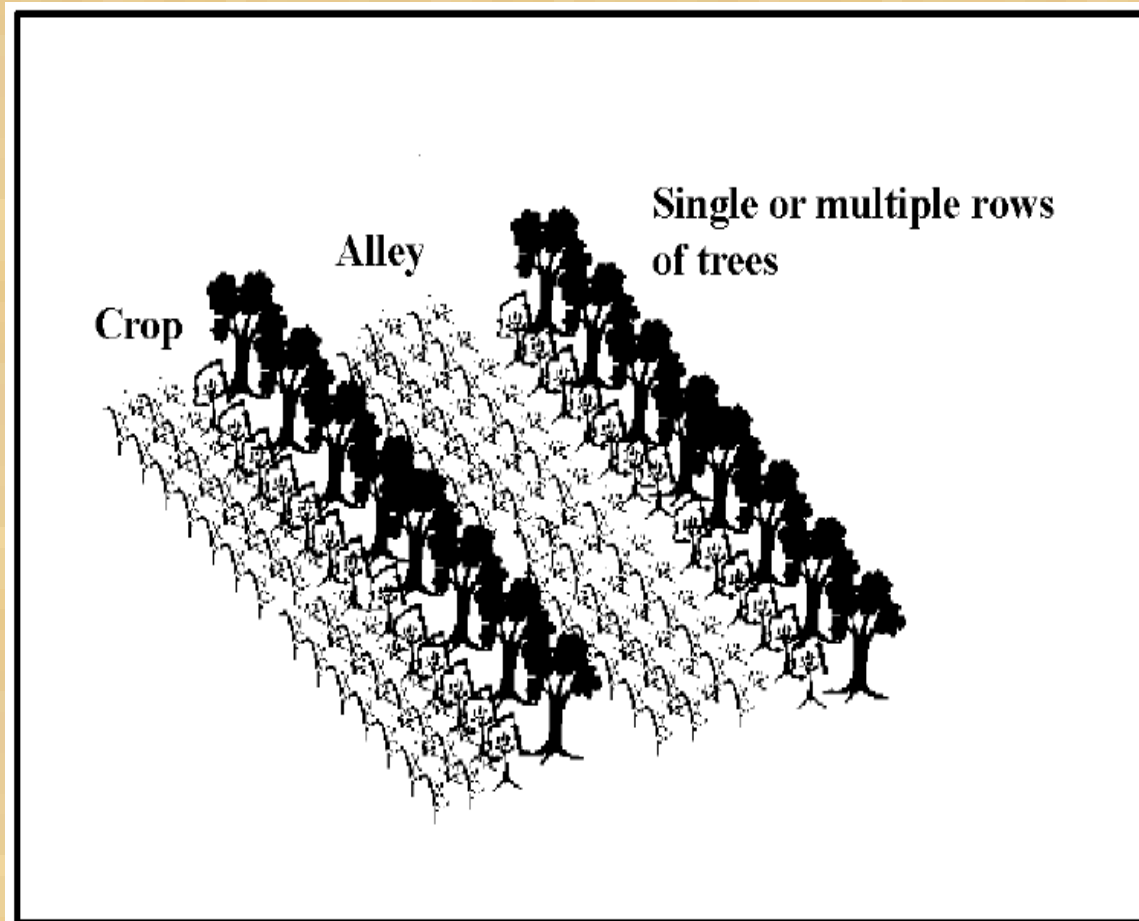
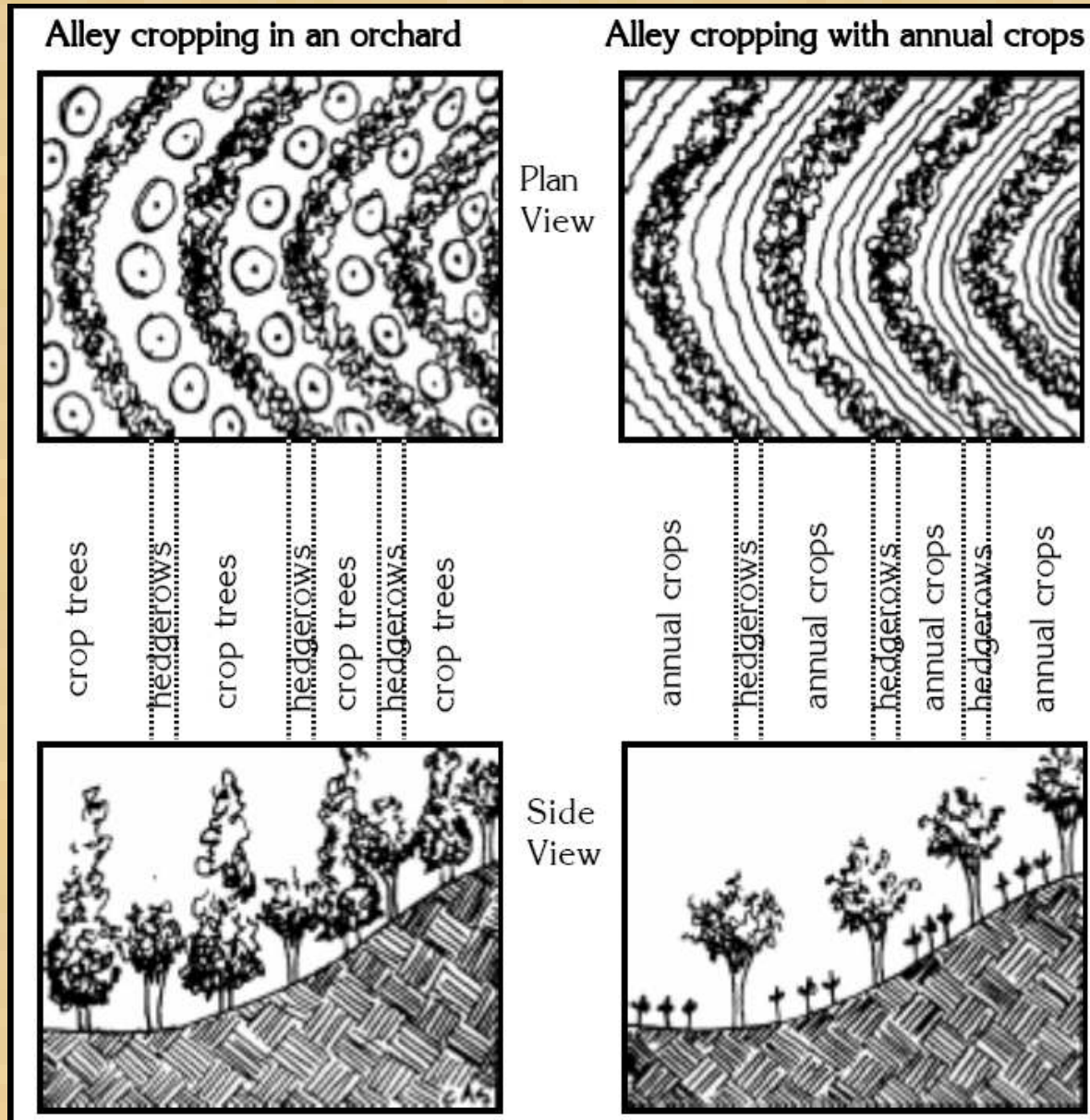


Figure 1. Alley cropping can combine a wide variety of tree and crop species, depending on the age of the trees, the light and water requirements of the crop, and the goals of the landowner.

Alley Cropping - Spatial Design



Alley Cropping - Temporal Design



While trees mature, crops provide income.

Alley Cropping Alternative Enterprises

Hay



Vegetables



Fruits & Berries

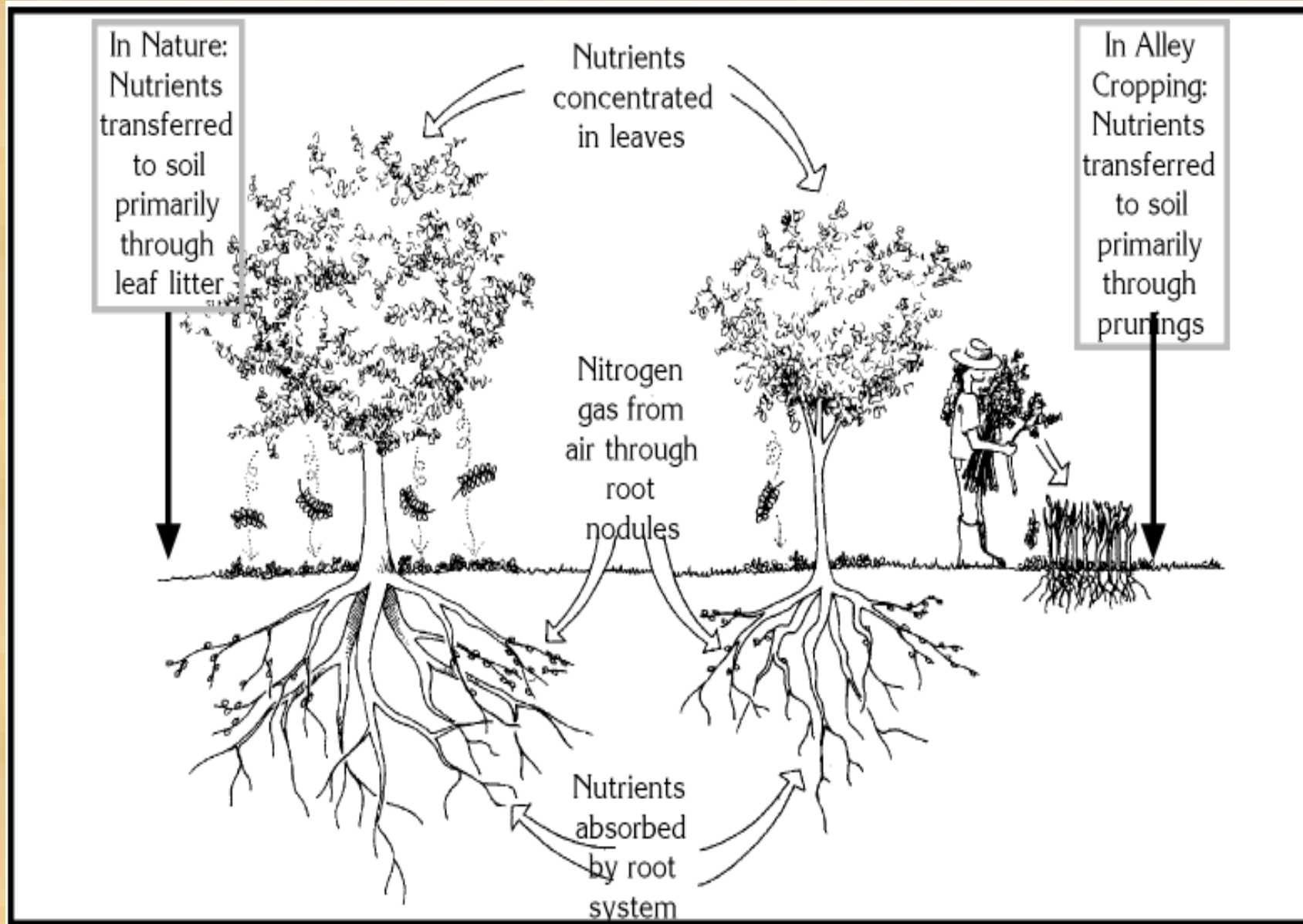


Pros and Cons of Orchard Alley Cropping

Studies throughout the tropics have shown that the practice of alley cropping has the potential to provide large amounts of nutrients to the crops, often similar quantities of nutrients to those normally applied to crops in chemical form. However, it is important to weigh some of the main costs and benefits to decide if this practice might work for your situation.

Benefits/Returns:	Costs:
Fertility improvement—natural source of nitrogen	Substantial up-front investment to plan and install
Organic matter—high quality nutrient rich mulch essential to farm fertility. Mulch also aids in weed suppression and water conservation.	Risk of competition with crops for light, water and nutrients if not installed or managed properly (correct spacing, regular pruning, etc.)
Erosion control—for long-term farm viability	Hedgerows require a certain amount of space on the project, occupying area that could be devoted to crops.
Increased farm self-sufficiency—reduced dependence on outside sources of nitrogen fertilizer or mulch	Labor intensive rather than capital intensive—could be problematic if labor is in shorter supply than cash

Alley Cropping Fertility Benefits



Alley Cropping Example “Fruit Tree & Perennial Herbs”

Knoll Organic Farm, Brentwood, CA



Alley Cropping With Vegetables

- Fairview Gardens Farm, Goleta, CA -



Alley Cropping Example “Grapes & Annuals”



Grapes

Vegetables/
Herbs

Wildflower Seed

Agroforestry Diversity Example

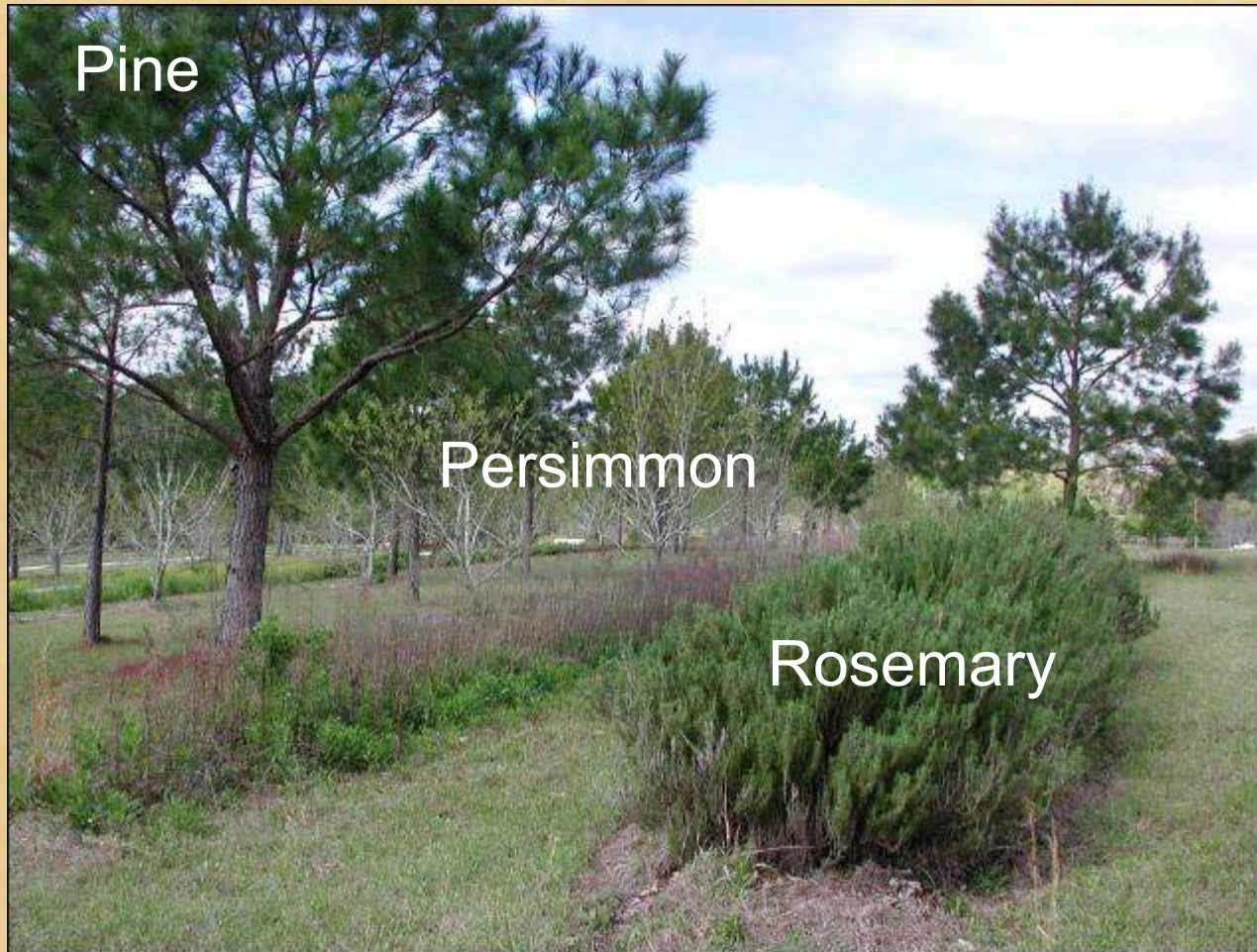


Table 1. Trees Used in Agroforestry Designs.

Alder	Mimosa
Ash	Oaks
Basswood	Ornamentals (various)
Birch	Paulownia
Black Locust	Peach
Chestnut	Pecan
Christmas Conifers	Persimmon
Cottowood	Pines
Dogwood	Poplars
Hazelnut	Sycamore
Honey Locust	Walnut
Maples	Willows

Some Temperate Fruits That Can Be Grown In SW FL

- Citrus
- Blueberries
- Stone Fruits- Peaches, Plums, and Nectarines
- Muscadine Grapes
- Pecans
- Persimmons
- Blackberries



Some Subtropical Fruits That Can Be Grown In SW FL

- Avocado
- Carambola
- Guava
- Canistel
- Jackfruit
- Lychee
- Mango



Things to Consider Before Planting

- How much time do you want to devote?
- What type of marketing opportunities exist?
- Start up costs
- Production costs
 - Pruning
 - Labor
 - Freeze protection
 - Pests management

Crowley Training Center

Old Miakka, Sarasota County, FL

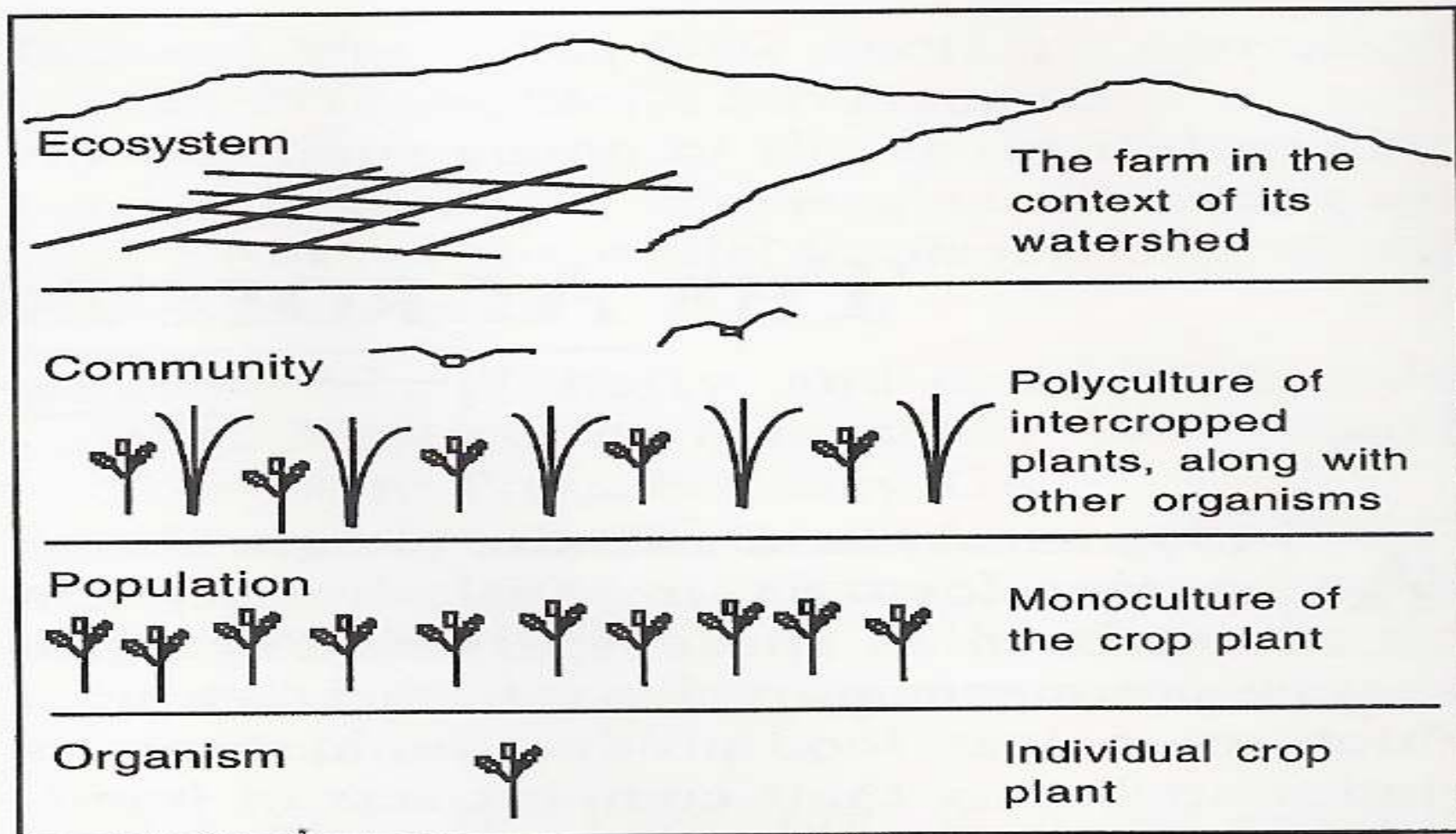
Partnerships:

- Crowley Museum & Nature Center
- FAMU Center for Viticulture and Small Fruit Research
- UF/IFAS Grape Genetics and Pathology Research Program
- FL Grape Growers Association
 - Manasota Chapter
- FAMU Meat Goat Program
- UF/IFAS Low Chill Peach Breeding Program
- Fairchild Tropical Botanical Garden
 - Tropical Fruit Program
- UF/IFAS/FAMU Small Farm & Alternative Enterprise Program

Fruit Tree-Based Agroforestry Project Goals

- **Fruit and vegetables can add value to small farm production systems resulting in diversified, profitable agriculture**
- **Alley cropping is a practice of intercropping for sustainable agriculture systems or agroecosystems**

Farm As An Agroecosystem



Hierarchical Scale

Agroecosystem Concept

TABLE 17.3 Desirable ecological characteristics of agroecosystems in relation to successional development

Characteristic	Successional stage of greatest development			Benefit to agroecosystem
	Early	Middle	Late	
High species diversity				Reduced risk of catastrophic crop loss
High total biomass				Larger source of soil organic matter
High net primary productivity				Greater potential for production of harvestable biomass
Complexity of species interactions				Greater potential for biological control
Efficient nutrient cycling				Diminished need for external nutrient inputs
Mutualistic interference				Greater stability; diminished need for external inputs

Early
Succession
Stages



1. Bare soil



2. Annual monoculture



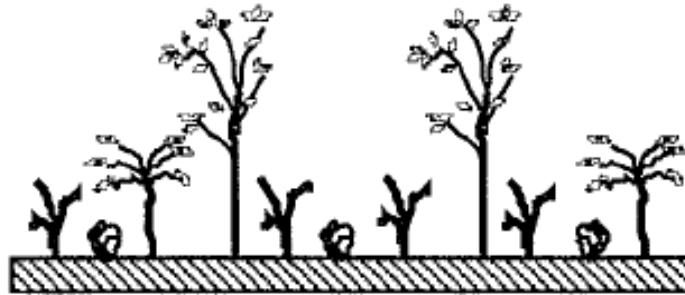
3. Annual polyculture



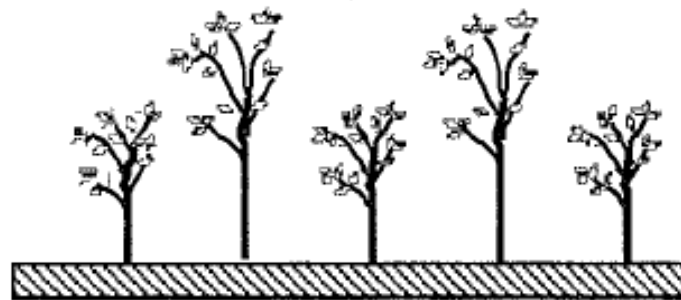
4. Polyculture of mixed annuals and short-lived perennials



5. Annual/perennial polyculture with tree seedlings



6. Agroforestry



7. Tree crop agroecosystem

Late
Succession
Stages

Agroecosystem Concept

TABLE 16.2 Dimensions of ecological diversity in an ecosystem




Dimension	Description
Species	Number of different species in the system
Genetic	Degree of variability of genetic information in the system (within each species and among different species)
Vertical	Number of distinct horizontal layers or levels in the system
Horizontal	Pattern of spatial distribution of organisms in the system
Structural	Number of locations (niches, trophic roles) in the system organization
Functional	Complexity of interaction, energy flow, and material cycling among system components
Temporal	Degree of heterogeneity of cyclical changes (daily, seasonal, etc.) in the system

Agroecosystem Concept

TABLE 16.3 Methods of increasing ecological diversity in an agroecosystem

Dimensions of ecological diversity affected

Method	Species	Genetic	Vertical	Horizontal	Structural	Functional	Temporal
Intercropping	Direct or primary effect	Indirect, secondary, or potential effect	Direct or primary effect	Direct or primary effect	Direct or primary effect	Direct or primary effect	Indirect, secondary, or potential effect
Strip cropping	Direct or primary effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect
Hedgerows & buffers	Direct or primary effect	Indirect, secondary, or potential effect	Direct or primary effect	Direct or primary effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect
Cover-cropping	Direct or primary effect	Indirect, secondary, or potential effect	Direct or primary effect	Direct or primary effect	Direct or primary effect	Direct or primary effect	Indirect, secondary, or potential effect
Rotations	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect
Fallows	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect
Minimum tillage	Direct or primary effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect	Indirect, secondary, or potential effect
High inputs of organic matter	Direct or primary effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect	Indirect, secondary, or potential effect
Reduction of chemical use	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Indirect, secondary, or potential effect	Direct or primary effect	Indirect, secondary, or potential effect

-  Direct or primary effect
-  Indirect, secondary, or potential effect
-  Little or no effect

Agroecosystem Concept

TABLE 11.2 Summary of interference interactions

	Creator of interference (A)	Receiver(s) of interference (B)	Type & identity of interference	Location of interference	Effect on A*	Effect on B*
Competition	Roles interchangeable	Roles interchangeable	Removal of resources	Shared habitat	—	—
Parasitism	Parasite	Host	Removal of nutrients	Body of host	+	-
Herbivory	Herbivore	Consumee	Removal of biomass	Body of consumee; shared habitat	+	- or +
Epiphytism	Host	Epiphyte	Addition of habitat surface	Body of host	0	+
Proto-cooperation	Roles interchangeable	Roles interchangeable	Addition of material or structure	Shared habitat or body of A/B	+ {0}	+ {0}
Mutualism	Roles interchangeable	Roles interchangeable	Addition of material or structure	Shared habitat or body of A/B	+ {-}	+ {-}
Allelopathy	Allelopathic plant	Potential habitat associates	Addition of active compound	Habitat of organism A	+ or 0	+, -, or 0

*Symbols in parentheses refer to effect when the organisms are not interacting

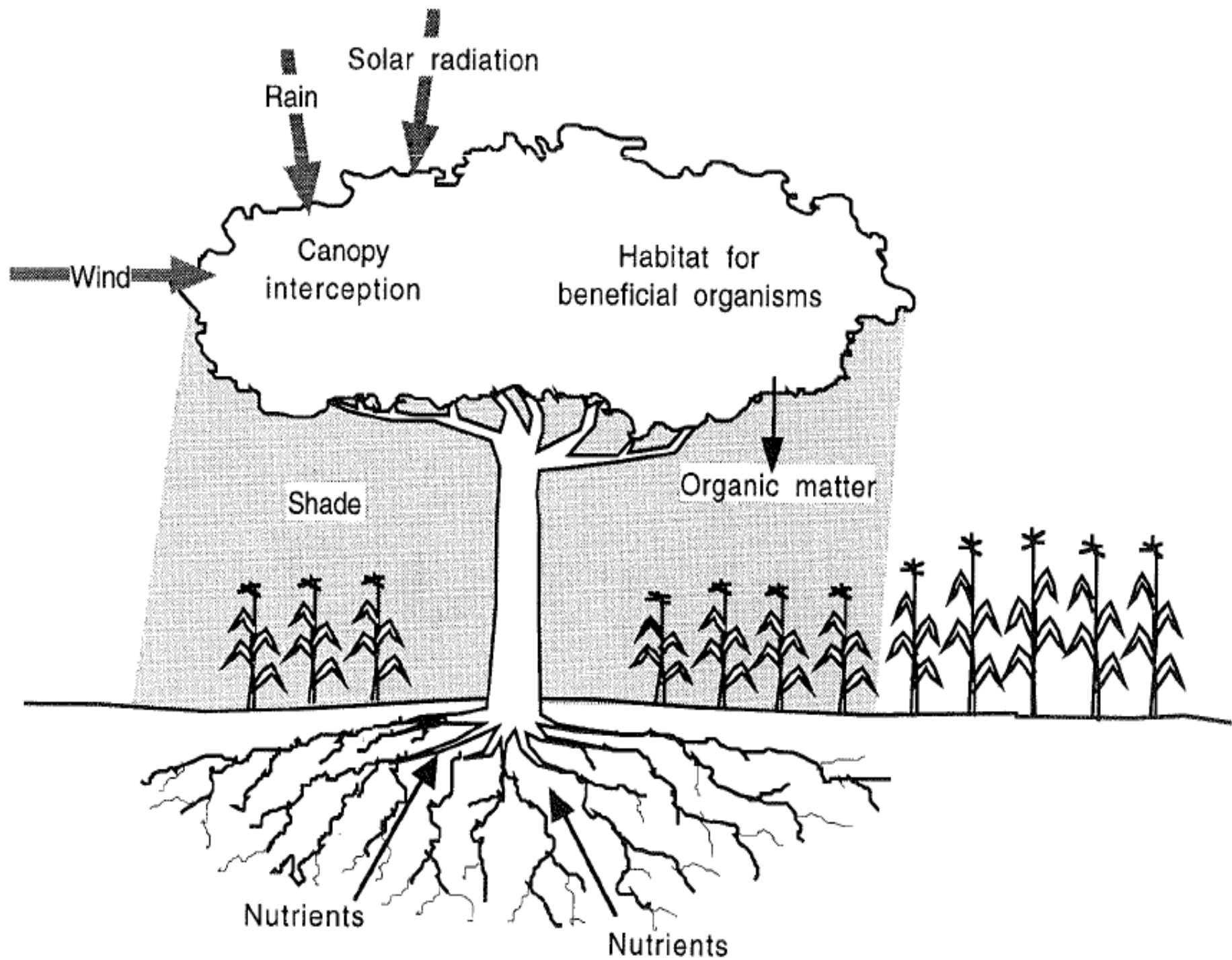
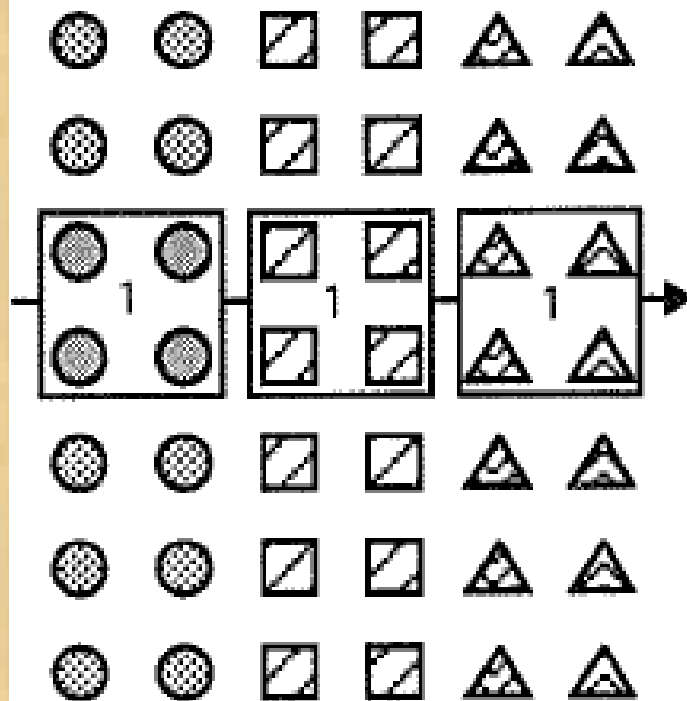


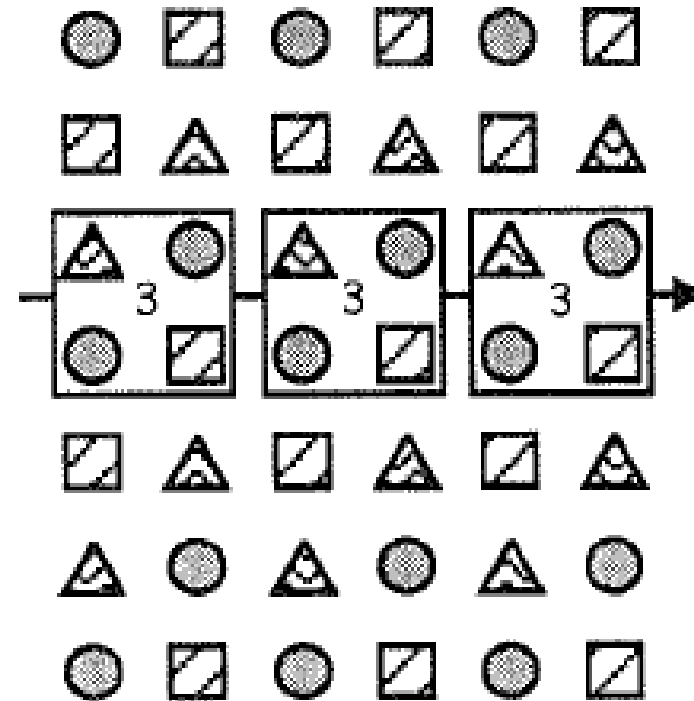
Table 1: Examples of Potential Tree Species for Alley Cropping

Tree Species	Generalized Effects on Companion Crops						Special Remarks
	* Shade Produced			** Root Competition			
	Low	Medium	High	Low	Medium	High	
Black Walnut	X			X			High value. Contains growth inhibitor that affects some companion crops.
Pecan		X			X		High value both nuts and wood.
Chestnut			X		X		Some varieties susceptible to chestnut blight.
Ash		X			X		Can be susceptible to borers and ash yellow disease.
Oak			X		X		White oaks most valuable. Slow growing.
Pine			X		X	X	Several suitable species.
Poplar		X				X	Lower value but fast growing.
Nut/Fruit Shrubs	X			X			Several suitable species. Good in combination with trees.
Paulownia			X	X			Asian market. Susceptible to insect, disease, and cold.

Agroforestry Diversity Examples

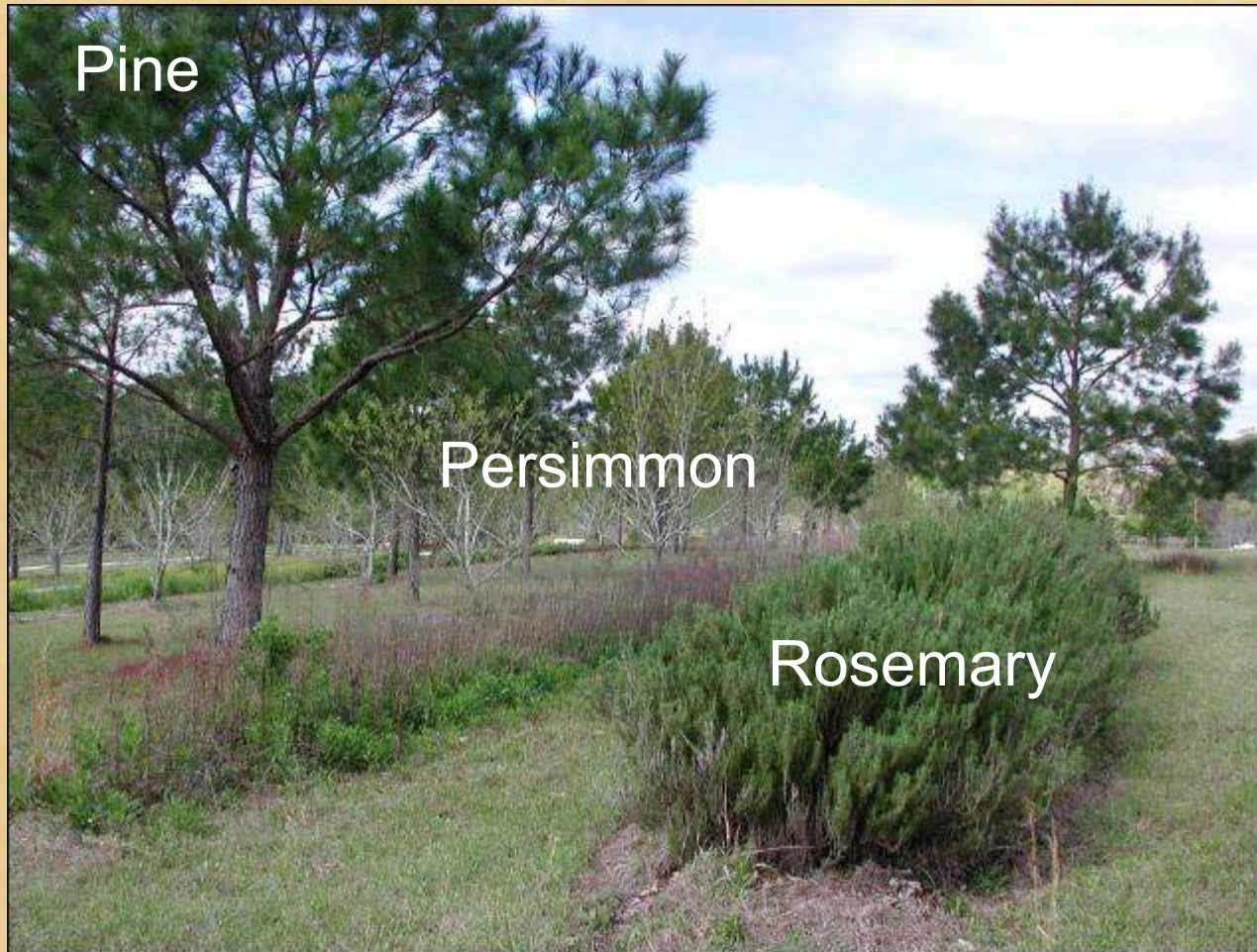


1 species per box =
low alpha diversity
3 types of boxes =
high beta diversity



3 species per box =
high alpha diversity
1 type of box =
low beta diversity

Agroforestry Diversity Example “High Alpha, Low Beta Type”



For more information

Center for Subtropical Agroforestry

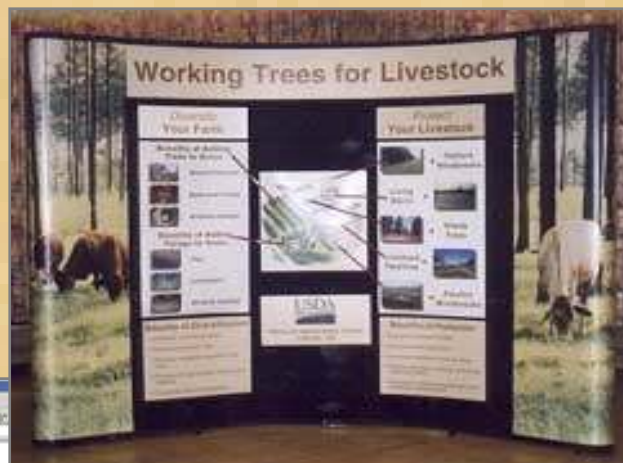
Gainesville, FL

<http://cstaf.ifas.ufl.edu/index.htm>



For more information, **contact**

USDA National Agroforestry Center
Lincoln, NE 68583-0822
www.unl.edu/nac



ACKNOWLEDGMENTS

- Roy Beckford, UF/IFAS Lee County Extension, “Non-timber Forest Products for Forest Landowners”
- S. R. Gliessman, 1998, Agroecology: Ecological Processes in Sustainable Agriculture, Sleeping Bear Press

Online Resources

- Agroforestry Net
<http://www.agroforestry.net/index.html>
- Atlas of Florida Vascular Plants
<http://florida.plantatlas.usf.edu/>
- Association for Temperate Agroforestry
<http://www.aftaweb.org/>
- A.T.T.R.A. Agroforestry
<http://www.attra.org/>
- Center for Agroforestry, Univ. of Missouri
<http://www.centerforagroforestry.org/index.htm>
- E.C.H.O. Agroforestry
http://www.echotech.org/mambo/index.php?option=com_weblinks&catid=42&Itemid=23
- EDIS publications on agroforestry and alley cropping
<http://edis.ifas.ufl.edu/>
- Elevitch, C. & K. Wilkinson. A Guide to Orchard Alley Cropping For Fertility, Mulch and Soil Conservation.
<http://www.scribd.com/doc/6693883/Orchard-Alley-Cropping>
- UF/IFAS Fruitscapes
<http://trec.ifas.ufl.edu/fruitscapes/>
- USDA Agroforestry Center
<http://www.unl.edu/nac/>