

# Agroforestry and Soil Health:

## Silvopasture



Maryland Department of Agriculture  
Soil Health Committee  
March 1, 2021

# Outline

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- Introduction to USDA National Agroforestry Center
- What is Agroforestry?
- Introduction of Silvopasture
- Discussion and Questions





# USDA National Agroforestry Center

## Current NAC staff:



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Landscape Planner



Matthew Smith  
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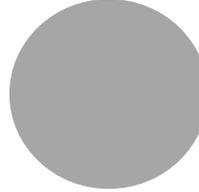
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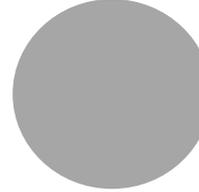
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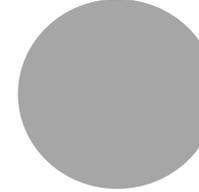
Kate MacFarland  
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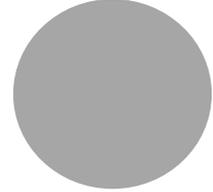
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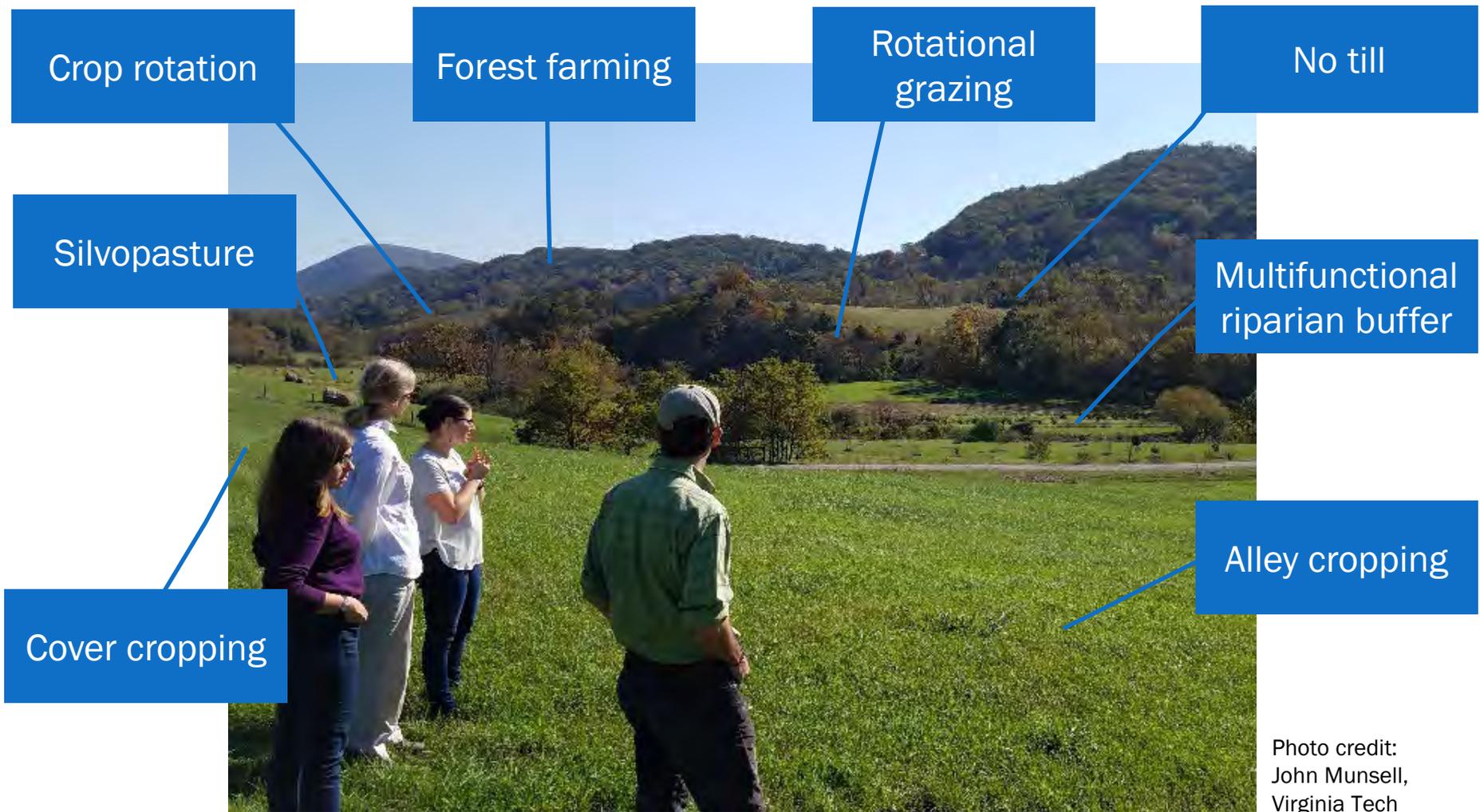
Natural Resources Conservation Service



## What is agroforestry?

Agroforestry is the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic, and social benefits.

# Agroforestry can complement other soil health practices.



# Agroforestry & Soil Health Principles

Minimize disturbance

Maximize soil cover

Maximize biodiversity

Maximize the presence of living roots

Integrate animals

# Most Common Temperate Agroforestry Practices - NRCS Conservation Practice Standards



Silvopasture (381)



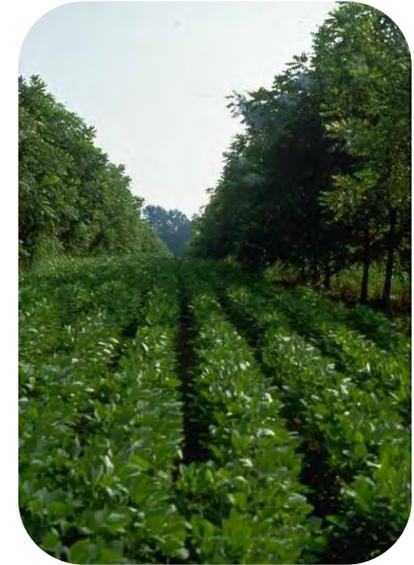
Windbreaks (380)



Riparian Buffers (391)



Forest Farming (379)



Alley Cropping (311)

... putting the right plants, in the right location, for the right reason.

# Silvopasture Establishment Definition (381)



*Establishment and/or management of desired trees and forages on the same land unit. Silvopasture can involve adding trees to pastures or bringing pasture into trees.*

[https://efotg.sc.egov.usda.gov/references/public/HI/381\\_PI\\_Standard.pdf](https://efotg.sc.egov.usda.gov/references/public/HI/381_PI_Standard.pdf)

# Silvopasture Systems

- Adding trees
  - Trees into pasture
  - Shade trees
  - Fodder trees
  - Integration with tree crops
- Removing trees
  - Seeding/supporting forage
  - Degraded woodlands
  - Invasive species control
  - Hazardous fuels reduction



# What Silvopasture is Not

- Single trees in pastures
- Turning livestock into the woods
- “Feedlots with trees”
- Why not? Problems with root compaction, girdling, soil degradation, parasite problems



Photo by Dusty Walter,  
University of Missouri



Three photos by Joe  
Orefice, Yale University



# Silvopasture Examples

- Introduce trees to a pasture
- Introduce or enhance forage in a timber or tree crop system
- Most people using silvopasture have some silvopastures and some pastures without trees: it's not all or nothing
- Different kinds of livestock: cattle, goats, sheep, poultry, etc.



Photo by Joe Orefice, Yale University



Photo by Charlotte Clifford-Rathert, Lincoln University

Thanks to Joe Orefice for giving permission to share photos and examples from *Guide to Silvopasturing in the Northeast*.



## Sheep with black walnut and honey locust





## Oak trees and cattle



**Sheep on a forest edge**



## Trees added to pasture



## Sheep in an orchard



## Hazelnuts and poultry

Photo credit: Reginaldo Haslett-Marroquin, Main Street Project

# Silvopasture NRCS Conservation Purposes

- Provide forage, shade, and/or shelter for livestock.
- Improve the productivity and health of trees/shrubs and forages.
- Improve water quality.
- Reduce erosion.
- Enhance wildlife habitat.
- Improve biological diversity.
- Improve soil quality.
- Increase carbon sequestration and storage.
- Provide for beneficial organisms and pollinators.

# Silvopasture Economic & Social Benefits

- Reduce animal stress
  - Heat and cold stress
  - Increased weight gain
  - Increased milk yields
- Diversify income: annual (grazing, hay) and long-term income (timber or tree crops)
- Adding trees to pasture: carbon sequestration
- Adding grazing to the woods: potential managing invasive plants, etc.



Working Trees

## Info

### Mitigating Heat Stress in Cattle

**What causes heat stress?**

Heat stress in cattle causes a reduction in feed intake, weight gain, milk production and breeding efficiency. Ideal conditions for beef and dairy cattle include a temperature range between 45° and 77° F. Higher temperatures begin to cause stress in cattle, depending on environmental factors such as shade, access to water, relative humidity, diet, surrounding vegetation and terrain.



Livestock crowd together in the shade of a lone tree. ©NAC Photo

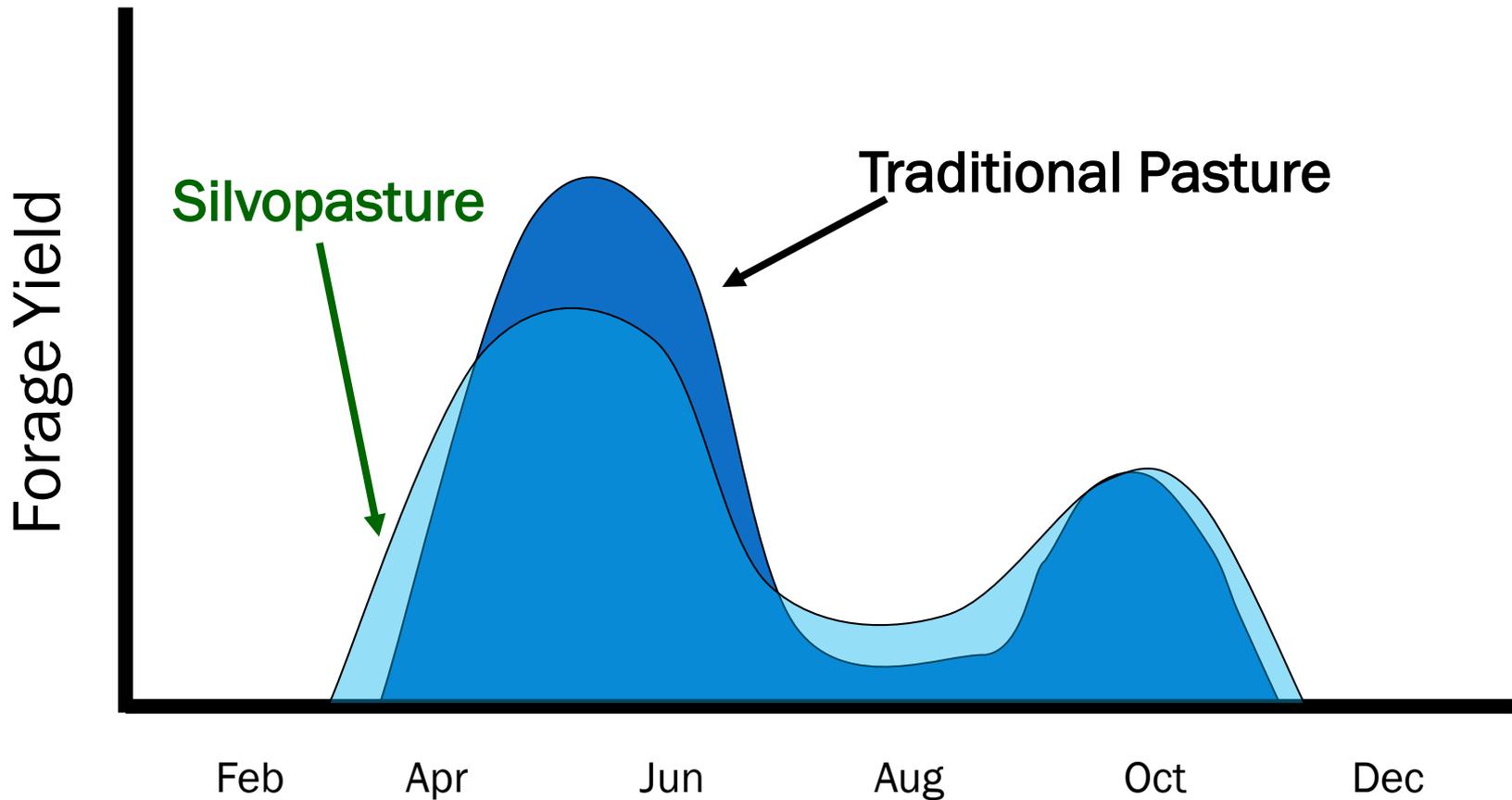
There are also internal physiological issues that contribute to heat stress. For example, greater amounts of fat in heavier cattle cause them to suffer from heat stress more and, similarly, lactating cattle have more internal heat to dissipate than non-lactating animals. Some forage plants such as tall fescue and perennial ryegrass can be endophyte infected, producing alkaloids that raise deep body temperature in cattle. All of these factors contribute to heat stress.

Heat stress can even result in greater calf mortality and increased veterinary costs. Moreover, it causes livestock to drink more water, and lose more sodium, magnesium, and potassium in their urine.

**Management strategies for coping with heat**

Shade and water for cattle is paramount! Therefore, management strategies must include provision of shade, providing adequate water, improving ventilation in barns, providing more high quality forage and reducing work necessary to access food, minerals and water. Livestock shading can be employed with trees, buildings, or portable structures, but cattle generally prefer natural shade. Trees on the grazing landscape usually have an advantage over barns and temporary structures because of the cooling effect that evapotranspiration provides, better ventilation and reduced radiation of solar rays. What producers are unable to manage grazing through rotational systems, block plantings of trees protected with fencing will provide shade on the north and east sides of the planting. However, producers that employ rotationally grazed systems with silvopasture achieve maximum benefits. Silvopastures provide shade throughout the pasture which benefits the cattle whether walking, loafing or grazing. An ample supply of water is another important tool for coping with heat. A rise in the ambient temperature from 70° to 90° F results in a 38% increase in drinking water requirements for beef cattle. Whether utilizing block plantings of trees or silvopastures, it is also important to provide continuously available mineral supplements and salt. In rotationally grazed silvopastures, moving livestock to new pastures more frequently will provide higher quality forage. Better quality forage requires less fermentation, which can result in reduced rumen heat.

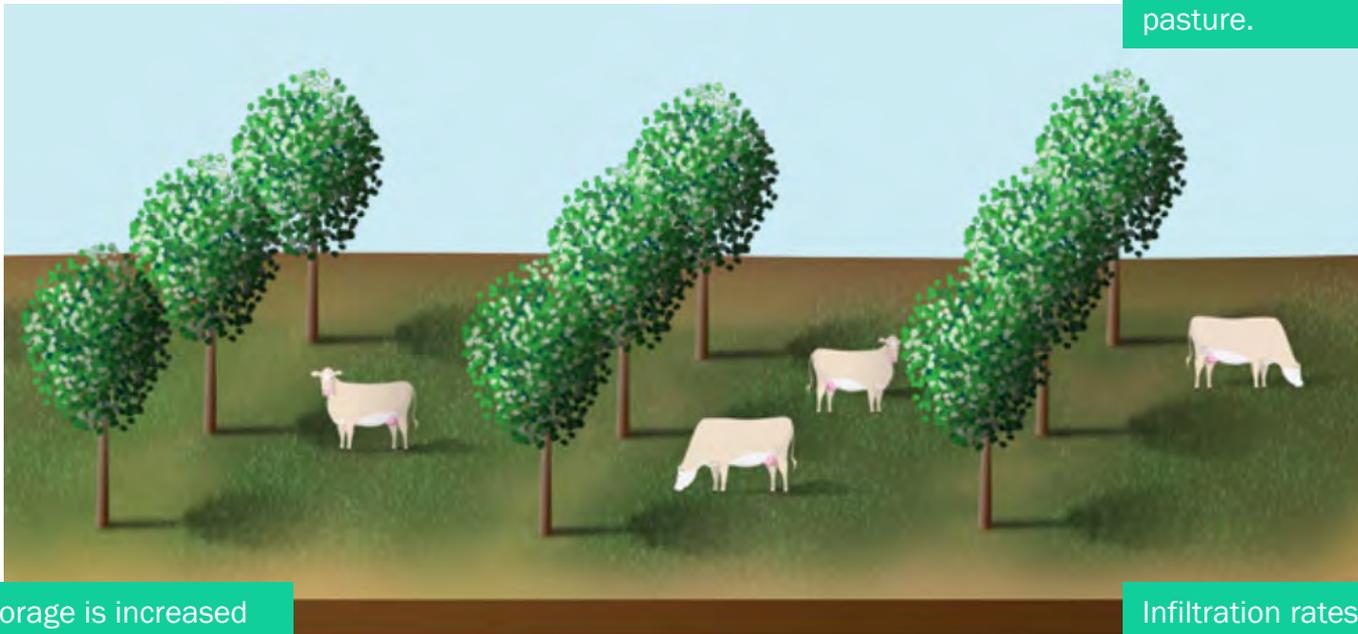
- Forages start growth earlier in spring, continue later in fall
- Forage yields higher in heat of summer



# Silvopasture Benefits to Soil Health

- Minimize disturbance
- Maximize soil cover
- Maximize biodiversity
- Maximize the presence of living roots
- Integrate animals

Silvopasture can enhance nutrient cycling and reduce phosphorus loss and nitrate leaching when compared to open pasture.



Soil carbon storage is increased at various soil horizons and depths when converting from open pasture to silvopasture.

Infiltration rates are similar or slightly higher in silvopasture than open pasture.

# Silvopasture Challenges

- Need to practice rotational grazing before you use silvopasture
- Protecting trees from livestock
- Need the right site, especially for forest conversions to silvopasture
- May receive less income from livestock and timber (but greater income overall)



# To learn more about agroforestry:

- Publications: download or request print publications
  - Working Trees Information Sheets: 1 page front and back basics
  - Inside Agroforestry: examples
  - Agroforestry Notes: how-to information
- Webinar library
- SARE project index: what can agroforestry look like
- Join Chesapeake Bay Agroforestry Working Group and/or Northeast/Mid-Atlantic Agroforestry Working Group

## Info

# Working Trees

**Can windbreaks benefit your soil health management system?**



Soil health management systems can include single or multiple conservation practices that contribute to the four basic soil health principles:

Use plant diversity to increase diversity in the soil	Keep plants growing throughout the year to feed the soil
Manage soils more by disturbing them less	Keep the soil covered as much as possible

The most common practices include conservation crop rotation, cover crop, no-till, mulch tillage, nutrient management, and pest management. Implementation of other conservation practices, such as field windbreaks, can also improve soil health and provide long-term environmental and economic benefits.

Windbreaks are strips of trees and/or shrubs planted and maintained to slow wind flow and microclimate, thereby protecting a specific area. Field windbreaks can protect a variety of wind-sensitive crops, control wind erosion, and increase fuel penetration and pesticide effectiveness. It has long been known that while establishment of windbreaks requires taking some land out of crop production, the result is typically a net increase in crop production. It is important to note that windbreaks also have the potential to positively influence soil health on the protected cropland area.

Field windbreaks reduce wind erosion by providing a zone of wind reduction on the leeward side of the trees and shrubs. The size of the area protected is determined by windbreak height and density. Windbreaks topsoil can contain high levels of organic matter which plays a key role in providing nutrients to plants, improving soil structure, increasing available water capacity and feeding soil microorganisms. Windbreaks with properly-spaced trees and shrubs also reduce runoff across the field and keep organic matter on field when a benefit loss the crops and soil biology.

Windbreaks also improve water-use efficiency by lowering soil evaporation rates across protected areas.

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USDA National Agroforestry Center

# Inside Agroforestry

VOLUME 07 ISSUE 03



## Creating Healthy Soils

The agricultural community is paying more attention to the importance of soil health in moving toward supporting our individual and collective ecological and economic goals. For decades soil conservation has largely focused on keeping soil in place, a very important step. More recently, increasing soil organic matter and biological activity have taken center stage. Agroforestry practices can help improve soil health in a variety of ways. Learn how people are improving soil health through agroforestry.

USDA United States Department of Agriculture

12 Alley Cropping #1

# AGROFORESTRY NOTES

## Alley Cropping: An Agroforestry Practice

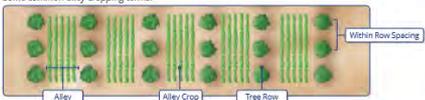
Kate MacFarland / Assistant Agroforester / USDA National Agroforestry Center  
Published March 2017

**Definition**  
Alley cropping is defined as the planting of rows of trees and/or shrubs to create alleys within which agricultural or horticultural crops are produced. The trees may include valuable hardwood veneer or lumber species, nut or other specialty crop trees/shrubs, or desirable softwood species for wood fiber production.

**Introduction**  
Alley cropping is an agroforestry practice that places trees within agricultural cropland systems. This system is sometimes called intercropping, especially in tropical areas. It is especially attractive to producers interested in growing multiple crops on the same acreage to improve whole-farm yield. Growing a variety of crops in close proximity to each other can create significant benefits to producers and help them manage risk. Alley cropping systems change over time. As trees and shrubs grow, they influence the light, water, and nutrient regimes in the field. These interactions are what sets alley cropping apart from more common monocropping systems.

Some producers plan alley cropping systems to provide additional functions that support and enhance other aspects of their operation. For example, a livestock producer might grow crops that supply fodder, bedding, or mast crops for their livestock. Other producers may want to produce biomass for on-farm use. Organic producers may choose tree species that fix nitrogen. Like all agroforestry systems, alley cropping systems should be considered as part of the whole farm operation.

**Figure 1**  
Some common alley cropping terms:



1

<https://www.fs.usda.gov/nac/>

# Questions?



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