



# W I L H E L M F A R M F A C T S H E E T

## *A Summary of Agroforestry Systems for Connecticut and New England*

*Agroforestry intentionally combines agriculture and forestry to create integrated and sustainable land-use systems. Agroforestry takes advantage of the interactive benefits from combining trees and shrubs with crops and/or livestock.<sup>1</sup>*

Agroforestry systems are found in many world regions, including North America. We are rethinking the integration of agroforestry into agriculture and forestry production systems as our land management evolves with a stronger focus on sustainability and resilience in a changing world.

Industrial cropping systems have advantages of uniformity and control, and they are easier to mechanize as we substitute capital for labor. Plantation forests can produce more of what we want per acre. Thousands of acres of hybrid corn have amazing yields and reduce the cost of grain for human consumption, feed for animals and feedstock for many products. Animals raised in controlled settings produce more eggs, milk, and meat than free range systems. However, each of these has flaws and dangers when viewed as parts of larger ecological and social systems. Their very simplicity ignores the complexity of natural production systems, but the benefits lost are not easily measured. Environmental services, such as bird habitat and watershed protection, often are ignored by managers of industrial crops, livestock and forest systems.

Agroforestry is a mix of systems that take advantage of complexity to produce an integrated set of values. They are important illustrations of perennial plant mixes and are considered more today because we are taking a holistic view of our landscapes and their management.

The National Agroforestry Center's focus on agroforestry practices includes 5 common systems: alley cropping, forest farming, riparian forest borders, silvopasture, and windbreaks.

### **Alley Cropping**



In alley cropping, an agricultural crop is grown simultaneously with a long-term tree crop to provide annual income while the tree crop matures. Food, forage, nut or berry crops are common in the alleys.

High-value hardwoods, like walnut, oak, ash, and pecan, are favored tree species in alley cropping systems and can potentially provide high-value lumber or veneer logs. In the US South, New Zealand and other places, quality pines are the tree crop. Black locust for poles is grown in some NY alley cropping systems. Taller nut trees can be another intermediate product.

**Corn crop alley between rows of black walnut** (Photo: University of Missouri Center for Agroforestry.)

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<sup>1</sup> See Mason, Andy, Wallace, Douglas, and Straight, Richard. 2014. An Overview of Agroforestry, Agroforestry Note #1. USDA National Agroforestry Center, Lincoln, Nebraska.

## Forest Farming

Forest farming is the cultivation of high-value specialty crops under the protection of a forest canopy that has been modified to provide the correct shade level. The purpose is providing income while high-quality trees are being grown for wood products. Crops like ginseng, shiitake mushrooms, and decorative ferns are sold for medicinal, culinary, and ornamental uses. We are experimenting with mushrooms, ramps and fiddle head ferns.



**Wet site by stream where Ann Wilhelm planted fiddlehead fern plugs**



## Riparian Forest Buffers

Riparian forest buffers are natural or re-established streamside forests made up of tree, shrub, and grass plantings. They buffer non-point source pollution of waterways from adjacent land, reduce bank erosion, protect aquatic environments, enhance wildlife, and increase productivity. We will add trees and willow shrubs if stream banks erode.

**Protected riparian zone on Wilhelm Farm**

## Silvopasture

Silvopasture combines trees with forage and livestock production. The trees are managed for high-value sawlogs and, at the same time, provide shade and shelter for livestock and forage, reducing stress and sometimes increasing forage production. In plantations of conifers or hardwoods for timber or Christmas trees, managed grazing provides added products and income. Some nut and fruit orchards may also be grazed.



**Goats eating brush in Wilhelm Farm silvopasture**



**Live Snow fence to protect roads**

Photo: U. Minnesota Extension

## Windbreaks

Windbreaks are linear plantings of trees and shrubs designed to enhance wind-sensitive crop production, protect people and livestock, benefit soil and water conservation, and reduced snow accumulations of roads. We are adding more windbreaks to reduce heat loss from our home and barns, and to keep our long up-hill driveway free of drifting snow. We will use windbreaks to reduce livestock stress, feed consumption, and visual impacts and odors. Future windbreaks near our gardens will spread snow evenly, increasing spring soil moisture.

## Special Applications and Variations

Tree and shrub plantings may help solve special resource concerns. For example, some special applications include the utilization of wastewater or irrigation tailwater to produce a short rotation woody crop, and plantings to help stabilize streambanks and floodplains. Agroforestry practices can be designed to enhance wildlife habitat and to optimize carbon storage. Wilhelm Farm grows hybrid poplar in wet pastures to dry the soil.

### Hybrid Poplar (Photo: Fresno State University)



Variations of agroforestry systems are based on basic traits;

**Multi-level** – a distinguishing trait of all agroforestry systems is having two or more levels – e.g., trees or tall shrubs with shorter grass, crops or other woody plant vegetation.

**Multi-age** – similarly, almost all agroforestry systems involve at least one perennial species that lasts two or more growing seasons.

**Permaculture** – while some ideological views often are associated with this term, we define permaculture simply as the inclusion of one or more perennial plants in a system.

## Broad view – benefits and costs

Land management systems generally provide more financial and environmental benefits and incur lower costs if they imitate the original natural ecosystem. The most important biophysical benefits are improved soil health and productivity; for examples:<sup>2</sup>

- Control of runoff and soil erosion, reducing water loss, organic matter and nutrients.
- Maintenance of soil organic matter and biological activity needed for soil fertility.
- Trees contribute to more nutrient cycling and efficient use of nutrients than agriculture
- Trees reduce buildup of soil toxicities like soil acidification and salinization.
- Tree are usually effective in reclamation of eroded and degraded land.

Other benefits include:

- Agroforestry utilizes solar energy more efficiently than monoculture systems because different heights, leaf shapes and alignments capture more energy by photosynthesis.
- Mixed species systems often lead to reduced insect pests and associated diseases.
- Agroforestry provides more diverse farm household economies and stimulates rural economies, leading to more stability and lower risks by producing multiple products.
- Agroforestry provides effective protection of soil, which improves land conservation.

Benefits of an agroforestry alternative are determined on a case by case basis compared to the current system – would an agroforestry alternative produce more net benefits? For example, on Wilhelm farm the main land use systems in the past were vegetable production, hay, pasture and woods (which were either focused on white pine or on valuable hardwoods like red oak or sugar maple). Shifts toward agroforestry will be made when the benefits are clearly higher than the traditional land use.

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<sup>2</sup> See the references at the end of this Factsheet

Costs often are reduced as land use shifts from annual-crop systems to perennial vegetation. If coupled with increased early cashflows, agroforestry systems will have high benefit-cost ratios relative to systems being replaced (more on this point in our future Factsheets).

**Wilhelm Farm** is developing demonstrations of each agroforestry system, with its initial focus on silvopasture systems to enhance livestock production. Factsheets and videos will convey the storylines of the demonstrations for small ownerships and provide details on specific land-use technologies.

### **Prospective Factsheets and videos**

The Wilhelm Farm CIG project will produce several more Factsheets in 2018. The prospective list includes:

***Silvopasture Systems*** – reasons for considering, conversion from either pasture or trees (and brush), and low-cost methods of brush control.

***Agroforestry and Carbon Sequestration*** – Potential Impacts of climate change on Southern New England farms and forests; methods for estimating increases in carbon sequestration by various land use systems.

***Metrics for Agroforestry*** – Measures of simple, inexpensive information to guide management.

***Investment Templates and Guidelines for Agroforestry and Related Systems*** – tree and timber investments, price projections investments in integrated small farm land uses.

***Home Economics of Agroforestry and Other Small-Scale Farming Systems for Family Use.*** Looking at family goals and values in ways that integrate non-economic values into calculations.

***Forest Farming*** – ramps, fiddleheads, and other possibilities.

***Riparian Protection*** – reasons, methods, and potential forest farming crops (e.g., berries)

***Windbreaks*** – Protection of homes, barns, outbuildings and farm roads

***Alley Cropping*** – Focus on orchard crops with interplantings of vegetables or fodder crops

***Permaculture*** and/or ***Multilevel Perennial Systems*** – Systems of agroforestry, forestry, pasture and cropping on small-scale farms based on relatively simple metrics guiding land use change [using Wilhelm Farm as a case study].

Additional Factsheets or videos may be developed on other topics, like ***Adaptive Management Systems, Mushroom Production, and Other Specialty Crops*** that fit broadly into agroforestry systems.

### **References**

Jacobson, Michael; Shiba Kar. August 2013. Extent of Agroforestry Extension Programs in the United States. *Journal of Extension*. 51 (4).

Jose, S. 2009. Agroforestry for ecosystem services and environmental benefits: an overview. *Agroforestry Systems*, 76:1–10.

Mason, Andy, Wallace, Douglas, and Straight, Richard. 2014. An Overview of Agroforestry, *Agroforestry Note #1*. USDA National Agroforestry Center, Lincoln, Nebraska.

Tyrrell, Mary L. 2015, Understanding Connecticut Woodland Owners: A Report on the Attitudes, Values and Challenges of Connecticut's Family Woodland Owners. Yale School of Forestry & Environmental Studies. 92 p.

### **Webpages**

Association for Temperate Agroforestry - <http://www.aftaweb.org/> (Comprehensive source).

Agroforestry Trust (UK) - <https://www.agroforestry.co.uk> (Many innovative ideas described).

USDA National Agroforestry Center - <https://nac.unl.edu/> (Many notes and other publications of use).

USDA agencies - <https://www.usda.gov/topics/forestry/agroforestry> (NRCS and other excellent sources).

Wilhelm Farm Agroforestry Demonstrations - <http://wilhelmfarm.com> (Our gateway to demonstrations)

Angus Glen Farm: A Lesson in Silvopastures - <https://www.farmingmagazine.com/bits-and-pieces/farm-management/angus-glen-farm-silvopastures/>