The benefits and applications of integrating trees into northeast agriculture

Joseph Orefice, PhD
Director of Forest & Agricultural Operations
Yale School of Forestry & Environmental Studies
also: Hidden Blossom Farm, Union, CT

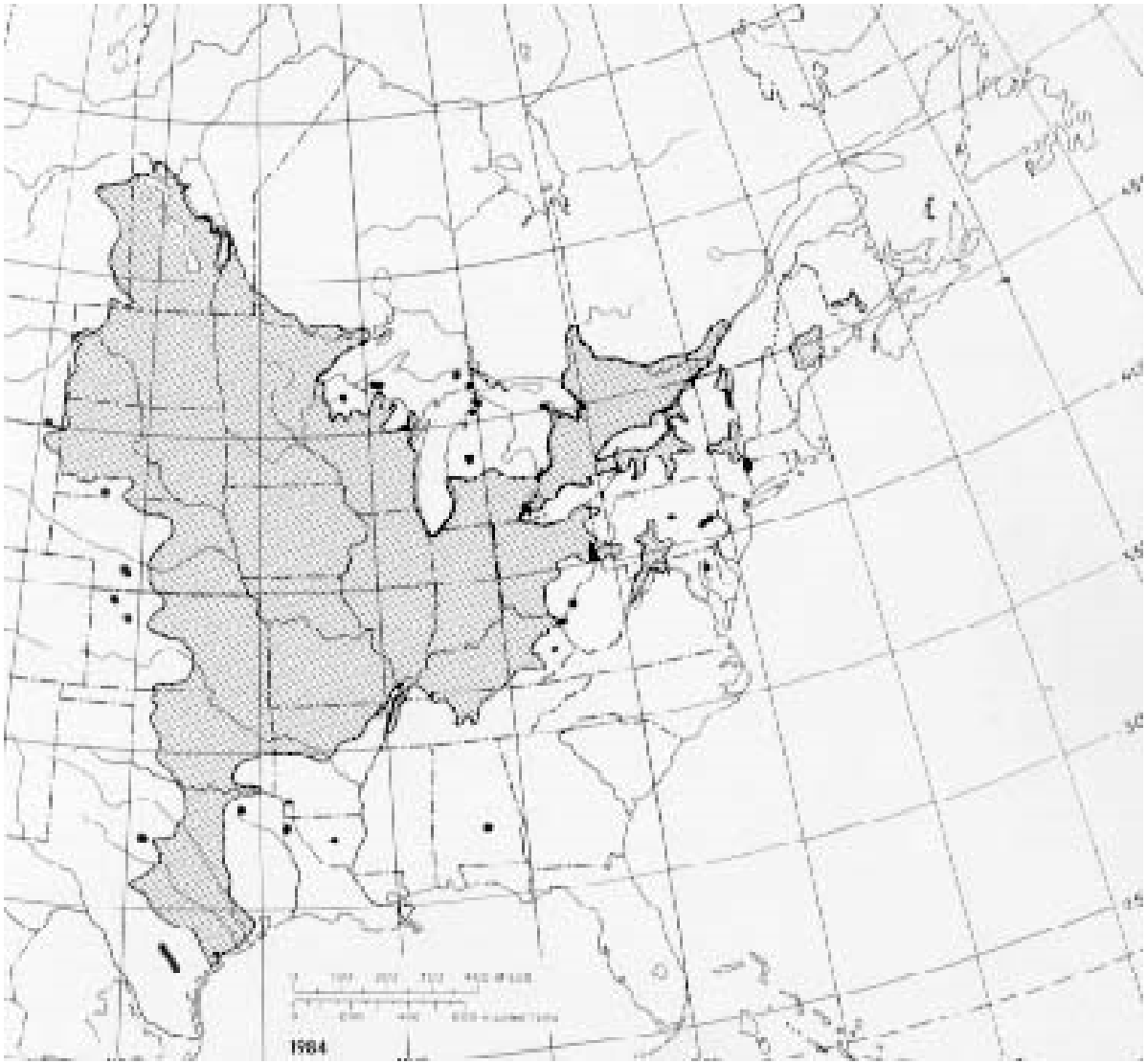
October 13, 2018

Trees and agriculture go back a long way:

- Gynodioecious: Hermaphrodite and Female individuals
  - Hermaphrodite trees (Capri figs): male and female flower in the fig
  - Female trees (what we eat): female flowers only
- Evidence of fig cultivation from 11,400ybp*
  - before cereal grains!
- Parthenocarpic: Abnormality of female plants that do not abort fruit when not pollinated
  - Cultivated fig trees, no wasps (must be grown from cuttings)

*Krislev, M.E., Hartmann, A. and O. Bar-Yosef. 2006. "Early Domesticated Fig in the Jordan Valley." Science 312 (5778): 1273-1275. 2 June 2006

Burr Oak



http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/quercus/macrocarpa.jpg

And of course, maple syrup!

Agroforestry Practices

Alley Cropping

Windbreaks

Silvopasture

Most Common Practice in North America

Riparian Forest Buffers

Forest Farming

http://ec.europa.eu/research/rtdinfo/43/article_1656_en.html

http://www.forestry.ok.gov/windbreaks-shelterbelts

http://www.unl.edu/nac/riparianforestbuffers.htm

Benefits of agroforestry and perennial cropping systems

- **Carbon Storage:** also reduced fossil fuel use related to tilling and planting
- **Soil Conservation**: Reduces loss of soil organic matter, nutrients, and soil particles.
- **Streams and Lakes:** Protects water quality by intercepting sediments and agricultural chemicals. Reduces streambank erosion and improves aquatic habitat.
- **Wildlife Habitat:** Provides food, cover, nesting sites, and travel lanes.
- **Economic Benefit:** Provides income from trees and their products, while allowing for annual income from crop and livestock production.
- **Livestock:** Protects livestock from harsh climate, improves animal health, and lowers feed costs.
- **Aesthetics:** Provides plant diversity, wildlife habitat, and recreational corridors.
- **Energy Conservation:** Reduces energy costs associated with farm operations.

Use of Riparian Forest Buffers

https://www.fs.fed.us/rm/pubs/rmrs_gtr203.pdf

Chesapeake Bay example

Algae and debris on the surface of the Susquehanna River, which flows into the Chesapeake Bay

https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-fact-sheet

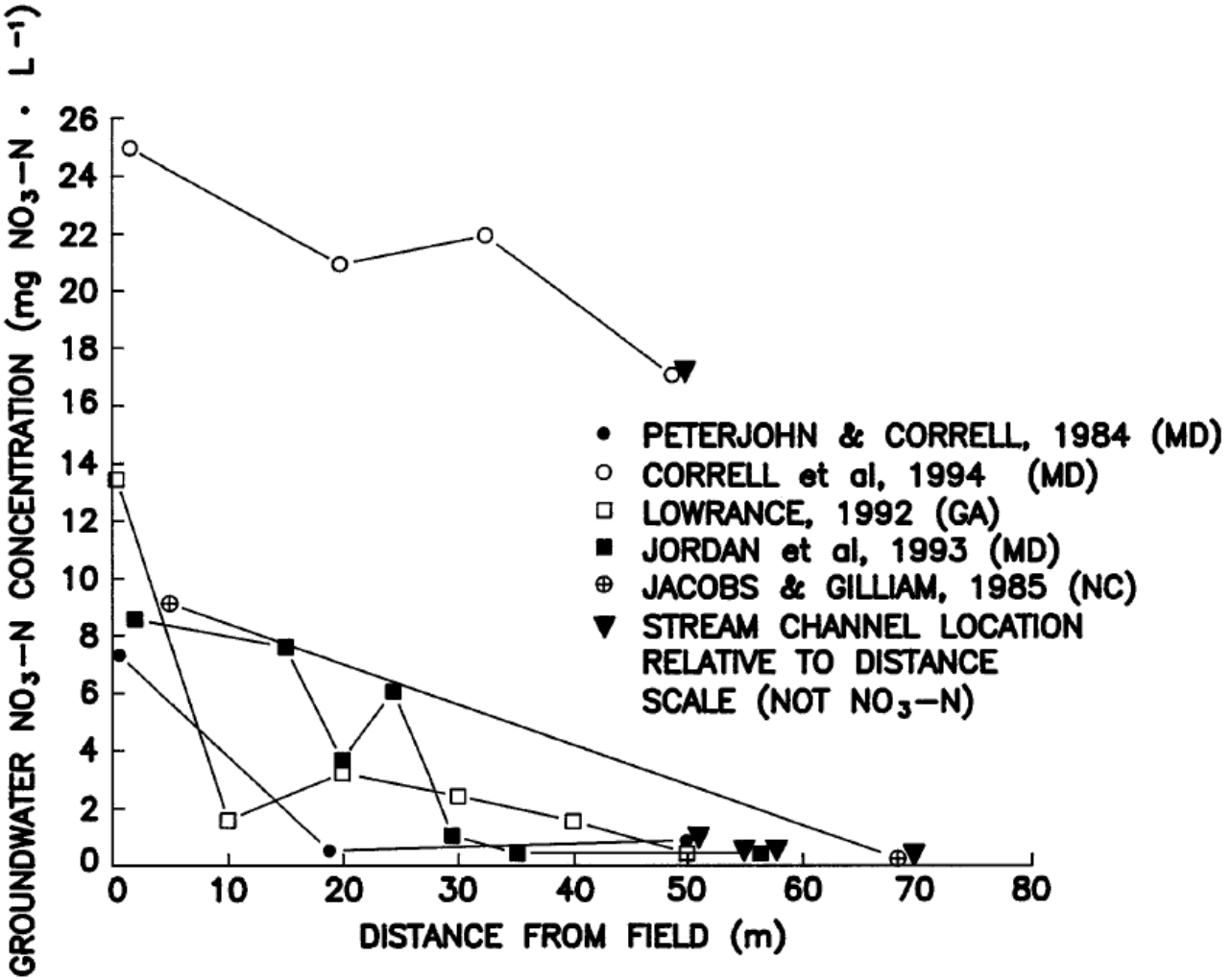


Figure 7. Nitrate concentrations in groundwater beneath riparian forests from five Coastal Plain sites.

Lowrance et al. 1997. Water Quality Functions of Riparian Forest Buffers in Chesapeake Bay Watersheds. Environmental Management Vol. 21, No. 5, pp. 687–712

CHESAPEAKE BAY FOUNDATION

Saving a National Treasure

http://www.cbf.org/

Windbreaks

http://www.forestry.ok.gov/windbreaks-shelterbelts

Windbreaks work…

GIS approach to estimate windbreak crop yield effects in Kansas–Nebraska

Raúl J. Osorio · Charles J. Barden · Ignacio A. Ciampitti

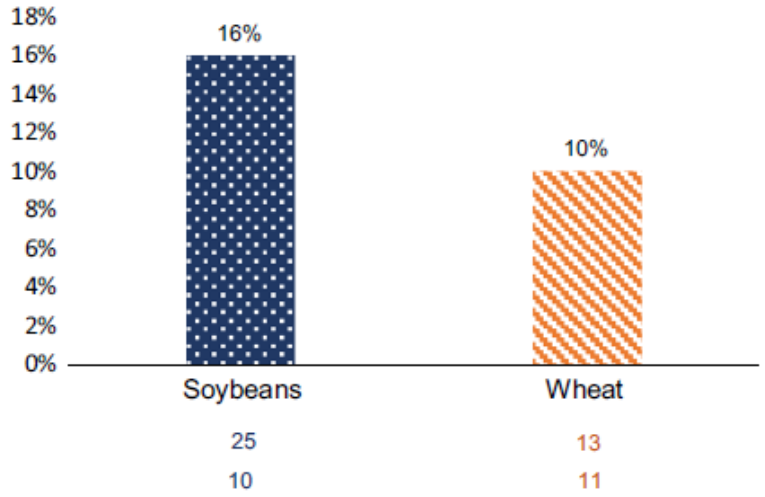
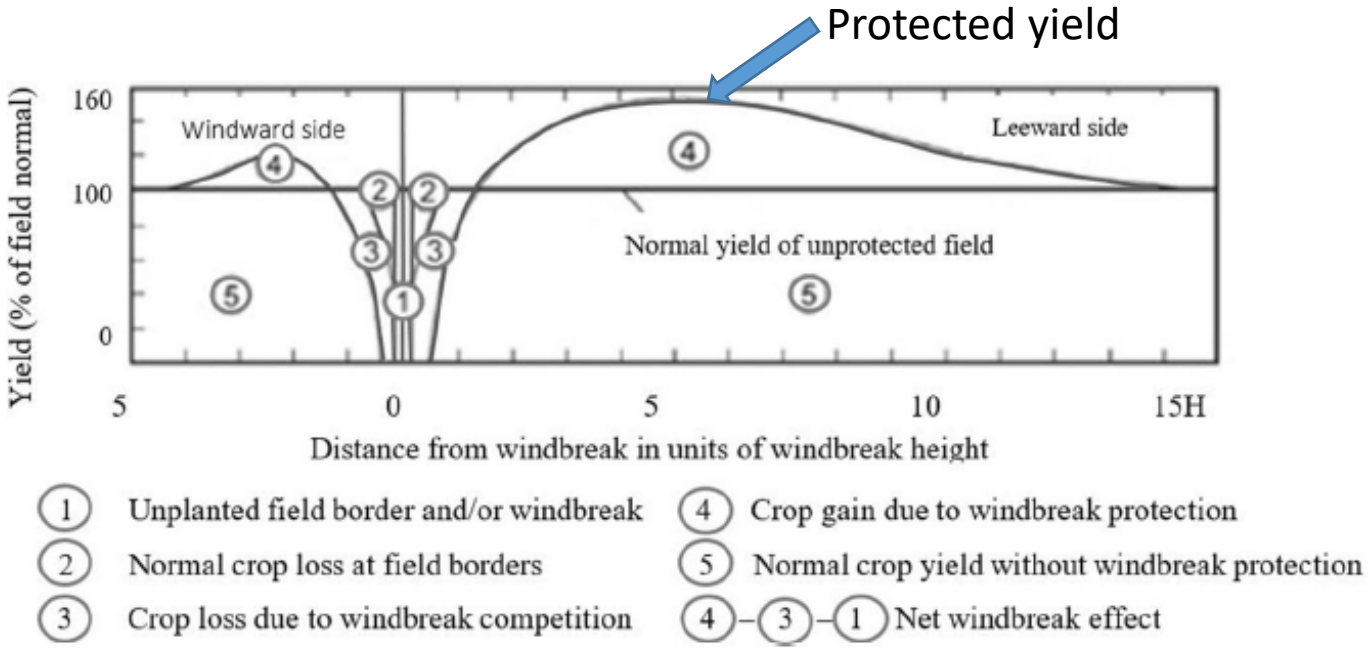


Fig. 3 Mean yield increase (%). Number of crop field/years analyzed and protected area (1–20 H) average size (hectares) is shown for each crop, respectively

Fig. 1 Crop yield response for a field windbreak. Modified from Read (1964) and Helmers and Brandle (2005)



Aesthetics matters on farms and trees are pretty

What about silvopasture?

- Well… it's complicated

Forest conversion to silvopasture

Treeless field conversion to silvopasture

Legacy of livestock, deer, and high grading in northeastern United States forests

Woodland Pasture (Managed?)

Table 1. Distribution of woodland pasture in New York and New England.

State	Land in pasture	Woodland pasture	No. of farms using woodland pasture*	% of total pasture acreage that is woodland pasture
	(ac)			
Connecticut	72,018	21,081	1,056 (24)	29
Massachusetts	85,760	17,837	1,093 (59)	21
Maine	118,980	27,105	1,103 (58)	23
New Hampshire	46,446	12,447	706 (54)	27
New York	985,494	146,995	5,286 (186)	15
Rhode Island	10,098	2,281	198 (7)	23
Vermont	195,000	37,100	1,184 (68)	19
Region	1,513,796	264,846	10,626 (456)	17

Of total pastureland in the region, 1 in 6 acres (17%) is woodland pasture. In the New England states, the proportion of woodland pasture to total pasture area is more than 1 in 5 (22%). These data are from the Census of Agriculture, but the management of these pastures was not addressed (Vilsack and Clark 2014).

* Number of farms self-identifying as practicing alley cropping or silvopasture.

Orefice, J., and J. Carroll. 2016. Silvopasture, it's not a load of manure: differentiating between silvopasture and wooded livestock paddocks in the northeastern United States. *Journal of Forestry*: 2017.


Wooded
Livestock
Paddocks


AKA: Feedlots with Trees

Undisclosed northeast US farm

Wooded Livestock Paddocks

1: Root Compaction

2. Girdling from Livestock

3. Soil Degradation

4. Parasite problems

These problems are inherent to CONTINUOUS grazing, NOT silvopasture

Rooting is NOT the same as traditional systems

Be cautious of wonderful claims…

#9

RANK AND RESULTS BY 2050

31.19 GIGATONS
REDUCED CO2

$41.59 BILLION
NET IMPLEMENTATION COST

$699.37 BILLION
NET OPERATIONAL SAVINGS

IMPACT: *We estimate that silvopasture is currently practiced on 351 million acres of land globally. If adoption expands to 554 million acres by 2050–out of the 2.7 billion acres theoretically suitable for silvopasture–carbon dioxide emissions can be reduced by 31.2 gigatons. This reduction is a result of the high annual carbon sequestration rate of 1.95 tons of carbon per acre per year in soil and biomass. Farmers could realize financial gains from revenue diversification of $699 billion, on investment of $42 billion to implement.*

https://www.drawdown.org/solutions/food/silvopasture

Very short periods, long rest, or else:

Two definitive characteristics of silvopastures are:

1) Management of livestock type, timing, and impact <u>maintains forage and tree health</u> and rooting zones that stabilize soil in silvopastures
2) <u>Trees are actively cultivated</u> in silvopasture systems and stem density is controlled to encourage forage and tree vigor.

Our job as FARMERS is to MANAGE livestock; and TIME is our #1 tool

Value of polywire and managed grazing

Silvopasture:

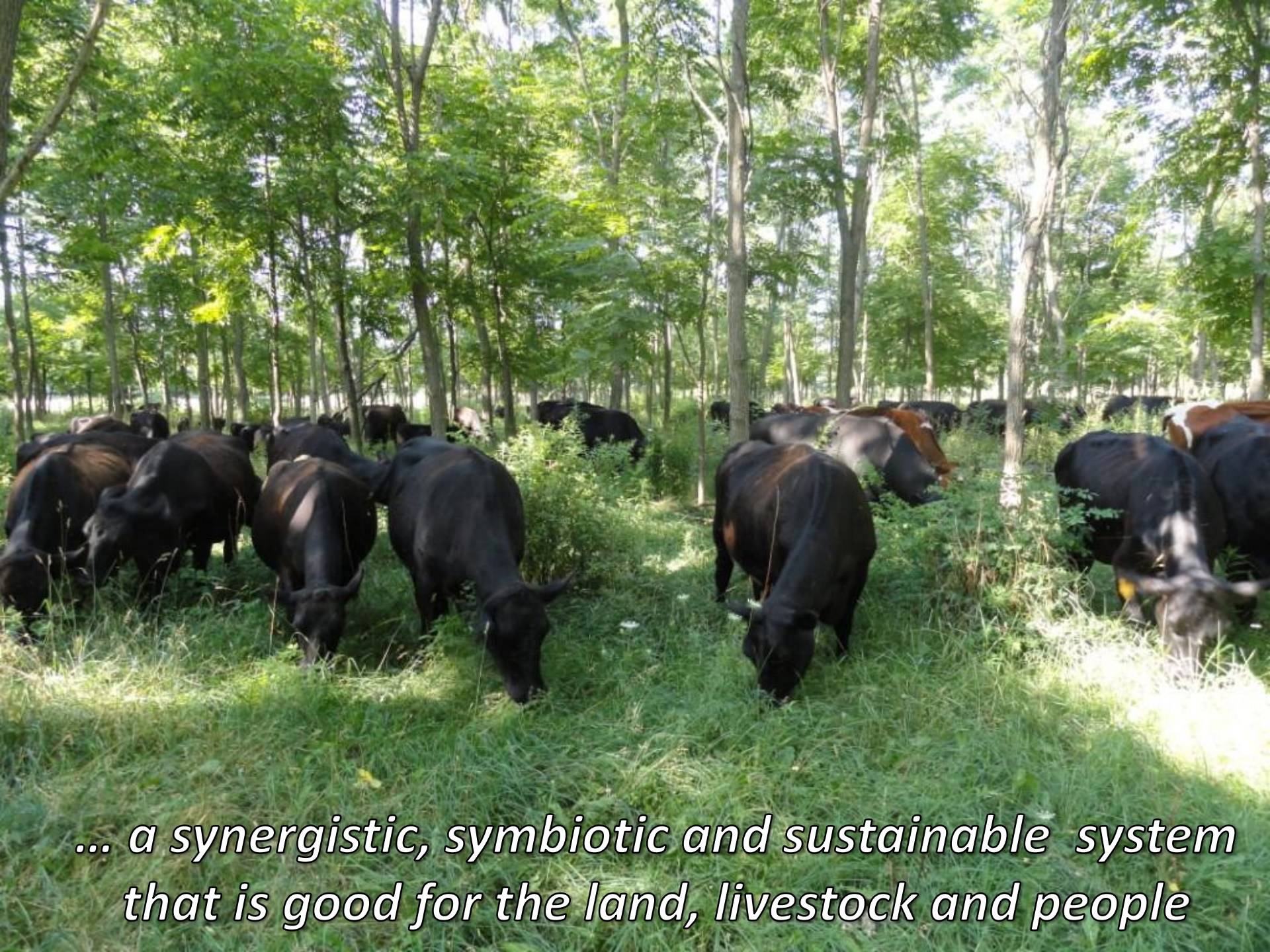
The sustainable production of livestock, trees, and forage on the same unit of land

Additional Confusion

Livestock as a form of vegetation management


May be a stage of silvopasture establishment
from forestland but care must be taken


Silvopasturing integrates longer term
production of quality timber and grazing


... a synergistic, symbiotic and sustainable system
that is good for the land, livestock and people

Challenges

- Not a system that can work with continuous grazing
- Requires knowledge of livestock, trees, and pasture management
- A slow process to establish
- Tree regeneration will be periodic
- Toxic plants
- Forest conversion to silvopasture is not a carbon sequestration practice

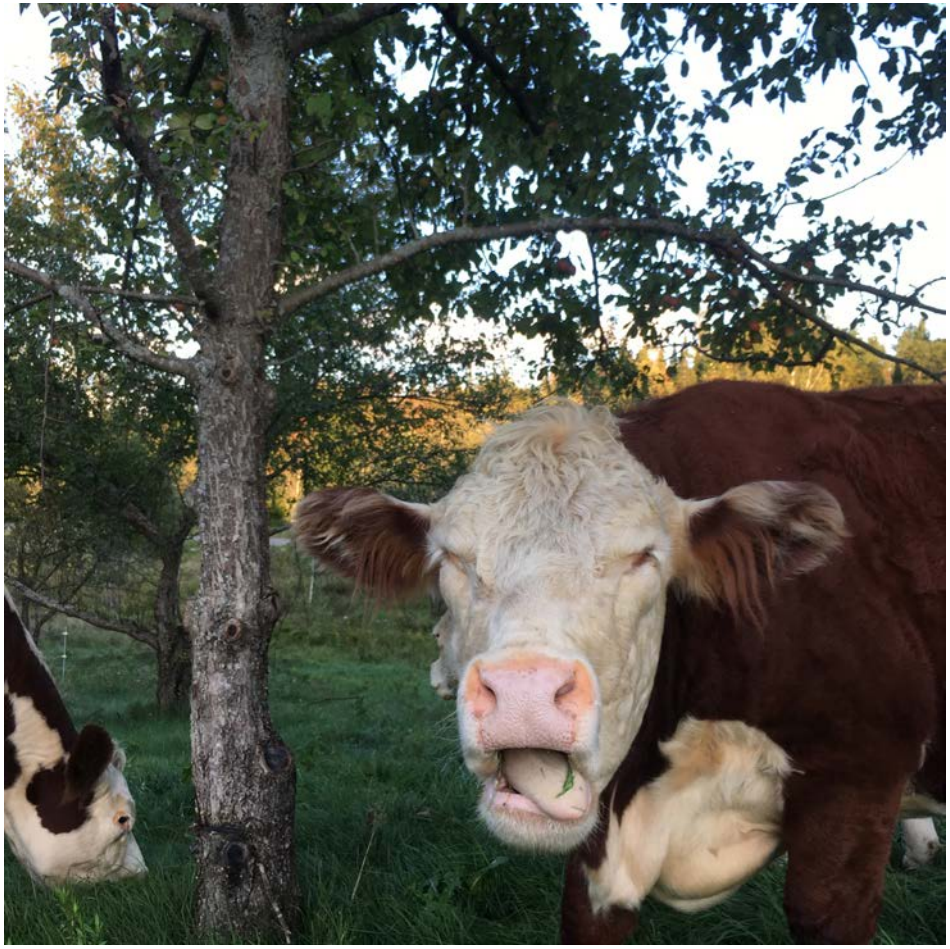
Silvopastures are managed systems and must be carefully planned

Benefits

- Reduced heat and cold stress on livestock
- Multiple use, multiple revenue
- High quality forage
- Summer slump forage availability
- Incentive to manage farm woodland
- Vegetation Management
- Greater carbon capture when compared to treeless pasture

Trees, grass, and moisture...

Questions?



Joseph Orefice, PhD joseph.orefice@yale.edu

www.hiddenblossomfarm.com