# Silvopasture:

*Managing Your Woodlands and Livestock in a New-Old Way*

WOODLAND STEWARDS

A Regional Extension Program for Landowners

**WEBINAR SERIES**

**TUESDAYS:** Jan. 30th to March 5th

**1pm ET / 12 pm CT**

| | |
|---|---|
| **Jan. 30** | Silvopasture: An Introduction and Overview |
| **Feb. 6** | Establishing Pine Silvopasture: from Pastures or Plantations |
| **Feb. 13** | Establishing Hardwood Silvopasture: from Pastures or Plantations |
| **Feb. 20** | From Forage to Livestock: Managing Animals in a Silvopasture system |
| **Feb. 27** | Moving Towards a Silvopasture System: Getting Started & Finding Help |
| **Mar. 5** | Silvopasture producers share their stories and Answer Questions: A Panel Discussion |

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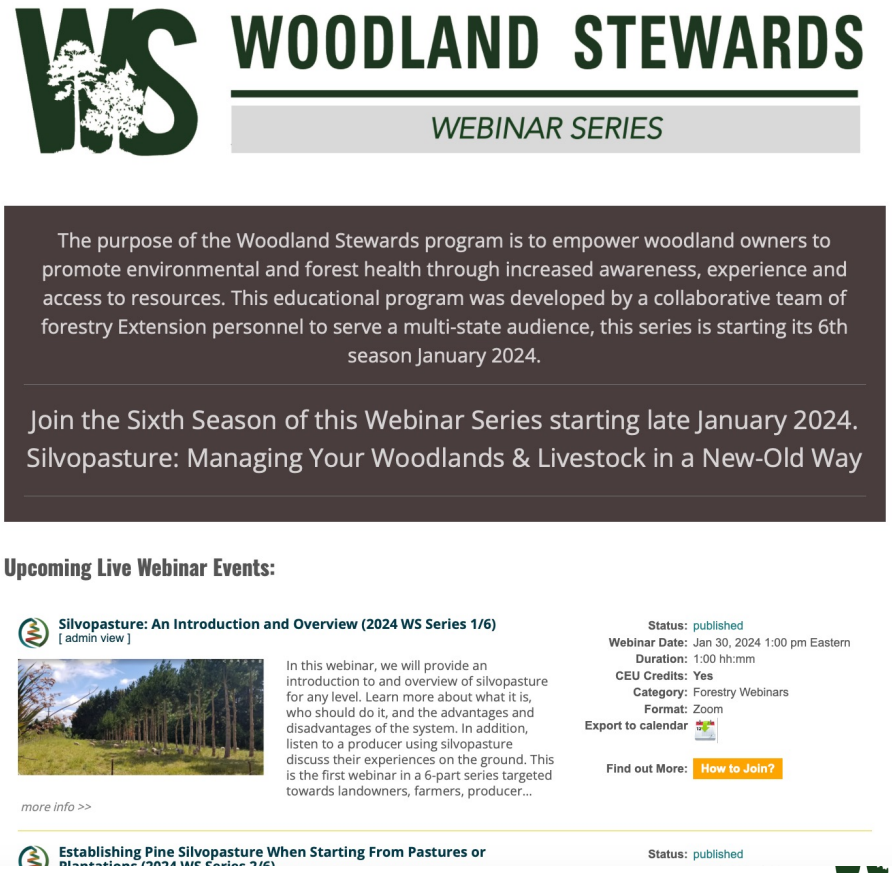
https://forestrywebinars.net/sponsor-pages/woodland-stewards/



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# *Introduction to Silvopasture*

Ashley Conway-Anderson, Ph.D., PAS

Center for Agroforestry
University of Missouri

January 30th, 2024

Woodland Stewards Webinar Learning Series

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A Regional Extension Program for Landowners

# Five Common Agroforestry Practices

- Windbreaks
- Forest farming
- Riparian forest buffers
- Alley cropping
- **Silvopasture systems**


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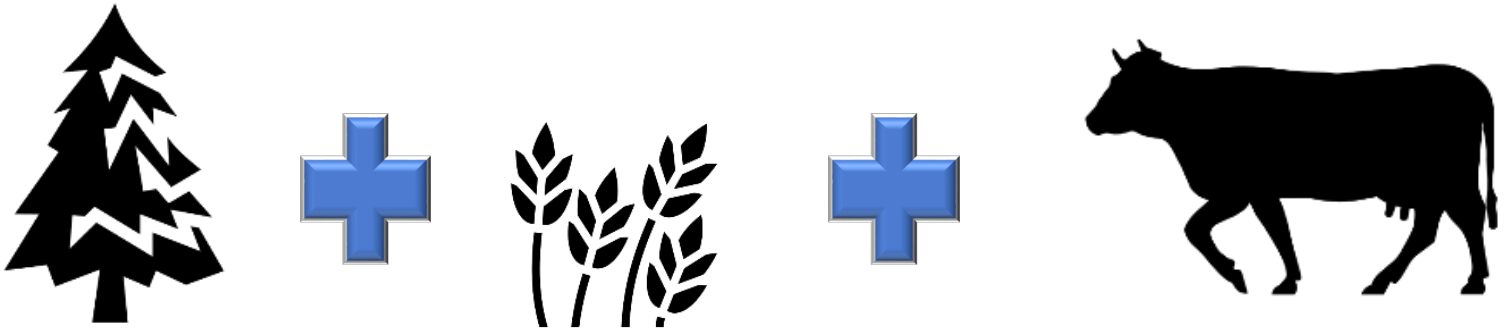
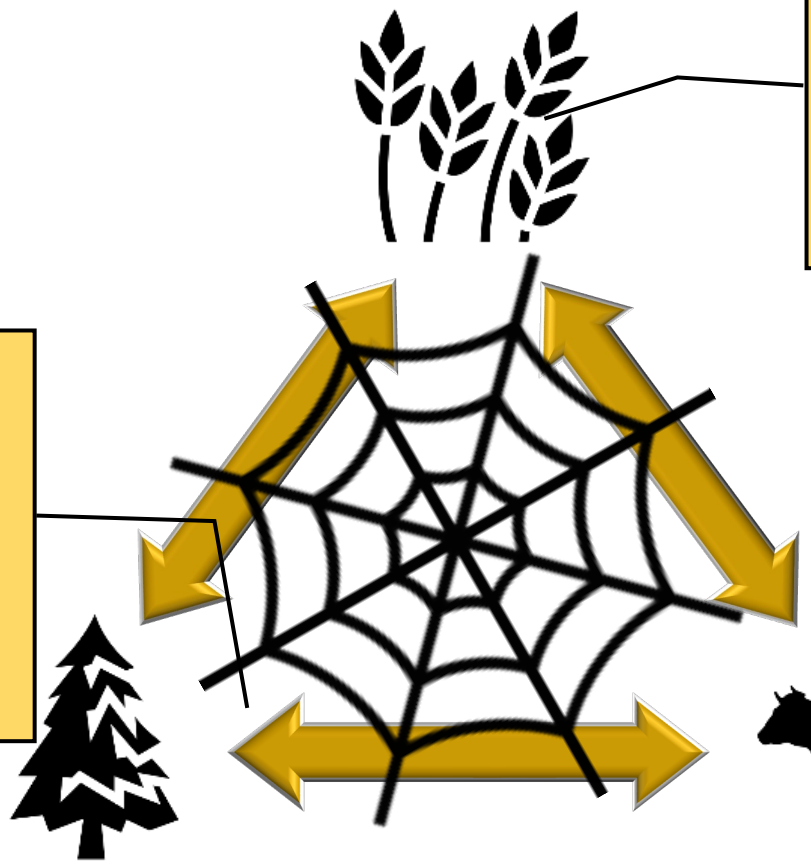
# Silvopasture Systems

- Intentional integration and management of:



# “A la carte agriculture….”



-Cool season grasses
-Warm season grasses
-Legumes
-Brassicas

-Timber
-Specialty Crops
-Habitat
-Windbreaks
-Fodder

-Cattle
-Small Ruminants
-Swine
-Poultry
-Pollinators

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"Harvesting acorn to feed swine"; detail of a miniature from the Queen Mary Psalter (BL Royal 2 B VII), 1310-1320 A.D. Held and digitized by the British Library.

***Silvopasture (and agroforestry) is a globally indigenous land management food production system.***

Aborigines using fire to hunt kangaroos by Joseph Lycett, approximately 1775-1828. (NLA nla.pc-an2962715-s20)

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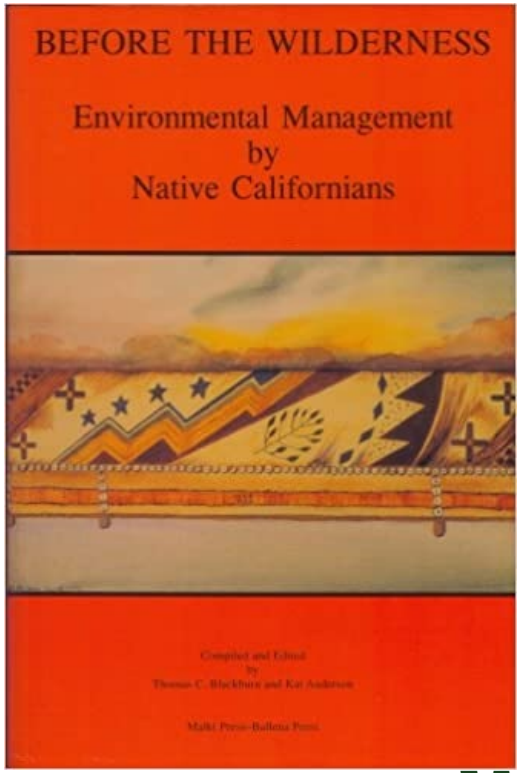
# “The most important outcome of fire use was the intentional creation of a mosaic of habitat patches that promoted food security by ensuring a diverse and productive landscape” (Lewis 1985; Williams 2000a)

- R.W. Kimmerer, F.K. Lake. The Role of Indigenous Burning in Land Management. *Journal of Forestry*, Volume 99, Issue 11, November 2001, Pages 36-41 https://doi.org/10.1093/jof/99.11.36

- Before the Wilderness: Environmental Management by Native Californians.

  Thomas C. Blackburn and Kat Anderson (compilers and editors).

  MenloPark: Ballena Press Anthropological Papers No. 40, 1993

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# Traditional systems

## Spanish dehesas & Portugese montados

- Pollen cores in Spain date the earliest records of dehesas to the Copper Age (c. 2500 BC)
- Oak/pine forests were replaced by scattered oaks and herbaceous vegetation
- Scattered oaks yield more acorns than woodland trees
- Understory grazing creates a high quality pork (Smith, 2010)

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# Traditional systems

MARY ANNE MURRAY

The end of the grape harvest is depicted in a Sixth-Dynasty tomb (No. 14 in Zawiyet el-Meitin) where the trellised vines have been stripped of their fruits and foliage by harvesters with filled baskets (Lutz 1922: 52). Other scenes allegedly show goats foraging on the vines after the harvest, as in the Twelfth-Dynasty tomb of Amenemhat at Beni Hasan (BH2; Newberry 1893). It seems doubtful, however, that livestock would be deliberately allowed to graze on viable grape vines (e.g. Rathbone 1991: 251; Olmo 1995a: 37; Singleton 1995: 73). It has also been noted that the bushes on which the goats are grazing in tomb scenes may not represent vines (Baum 1988; Lerstrup 1992: 66).

Ancient Egyptian Materials and Technology, Nicholson and Shaw, 2000

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# Why silvopasture? Why now?

- IPCC Special Report: Climate Change and Land (2019)

**Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security**

| | Response options based on land management | Mitigation | Adaptation | Desertification | Land Degradation | Food Security | Cost |
|---|---|---|---|---|---|---|---|
| Agriculture | Increased food productivity | L | M | L | M | H | — |
| | Agro-forestry | M | M | M | M | L | ● |
| | Improved cropland management | M | L | L | L | L | ●● |
| | Improved livestock management | M | L | L | L | L | ●●● |
| | Agricultural diversification | L | L | L | M | L | ● |
| | Improved grazing land management | M | L | L | L | L | — |
| | Integrated water management | L | L | L | L | L | ●● |
| | Reduced grassland conversion to cropland | L | — | L | L | - L | ● |
| Forests | Forest management | M | L | L | L | L | ●● |
| | Reduced deforestation and forest degradation | H | L | L | L | L | ●● |

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# Silvopasture: Starting point matters

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# A complicated history…

- "Farm Woodlands Should Not Be Grazed"
  - Journal of Forestry, October 1945
  - Daniel Den Uyl

- Provides convincing and robust evidence against woodlot grazing
  - Lower forage production
  - Reduced animal performance
  - Forest ecosystem damage

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# Silvopasture ≠ Woodland Grazing

- 34% of Midwest forested farmland is grazed
- Only 6.6% of total forest land in Midwest is grazed (Garret et al., 2004)

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# “Forested Farmland”

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# Intentional Management

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# Livestock require management too!

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# Silvopasture potential

*Agroforestry Systems* **61:** 21–33, 2004.



**Hardwood silvopasture management in North America**

H.E. Garrett[1,*], M.S. Kerley[1], K.P. Ladyman[1], W.D. Walter[1], L.D. Godsey[1], J.W. Van Sambeek[2] and D.K. Brauer[3]

[1]*Center for Agroforestry, University of Missouri, Columbia, MO 65211, USA;* [2]*US Forest Service, North Central Research Station, Columbia, MO, USA;* [3]*Dale Bumpers, Small Family Farm Research Center, Booneville, AR, USA;* **Author for correspondence: e-mail: GarrettH@missouri.edu*

- Soil characteristics
- Nutrient retention
- Water quality
- Biodiversity

**Environment**

- Livestock performance
- Forage quality
- Tree growth
- Health

**Production**

- Revenue diversity
- Increased income
- Land efficiency

**Economics**

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# What can silvopasture do?

- Kallenbach et al., 2006
  - Reduced forage biomass but equivalent heifer performance
- Buergler et al., 2005
  - Integrating trees in pasture  “positively altered botanical composition”
- Clason,1999
  - Forage management improved pine timber growth and production
  - System was financially competitive with “ungrazed” timber
- Haile et al., 2008
  - 20-39% increase in soil organic carbon compared to open pasture

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# Impact of managed woodland grazing on forage quantity, quality and livestock performance: the potential for silvopasture in Central Minnesota, USA

Madeline M. Ford · Diomy S. Zamora · Dean Current · Joe Magner · Gary Wyatt · W. D. Walter · Sophia Vaughan

Agroforest Syst (2019) 93:67–79
DOI 10.1007/s10457-017-0098-1

- Forage production was greater in Silvopasture compared to Woodlands
- Forage quality was greater in Silvopasture compared to Open
- Similar cow ADG among all systems
  - Average calf ADG was greatest or Silvopasture
- More research is needed for long-term effects

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# Melding tradition with the present

*How do we do it?*

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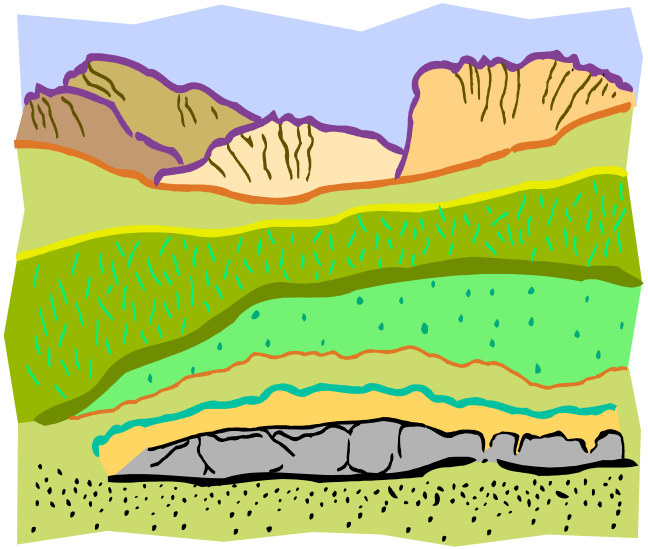
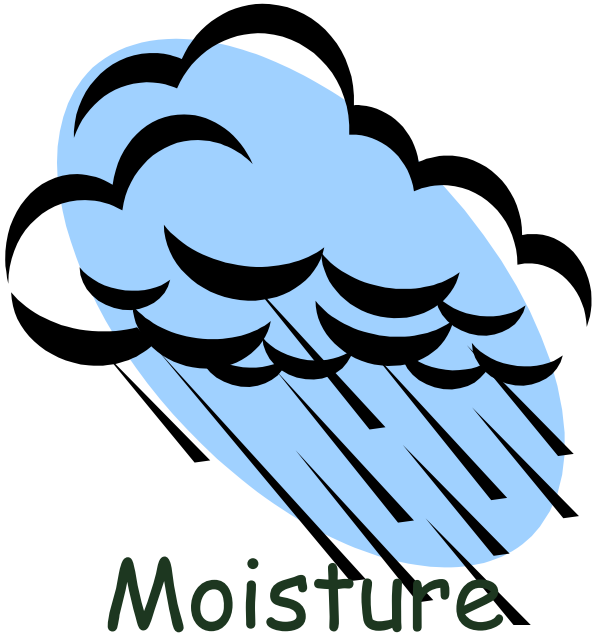
# Managing resources in silvopastures

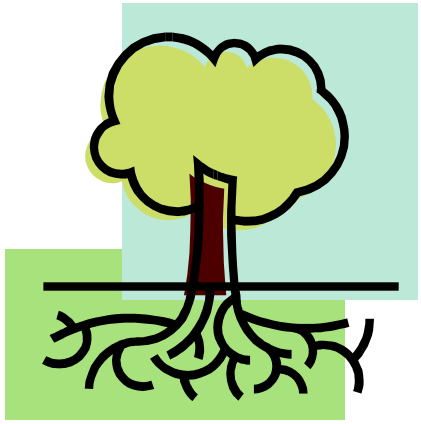
Light



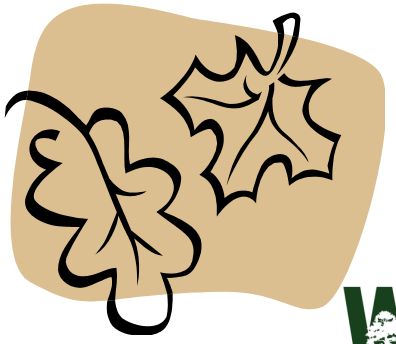
Soil nutrients



Moisture



Nutrient returns



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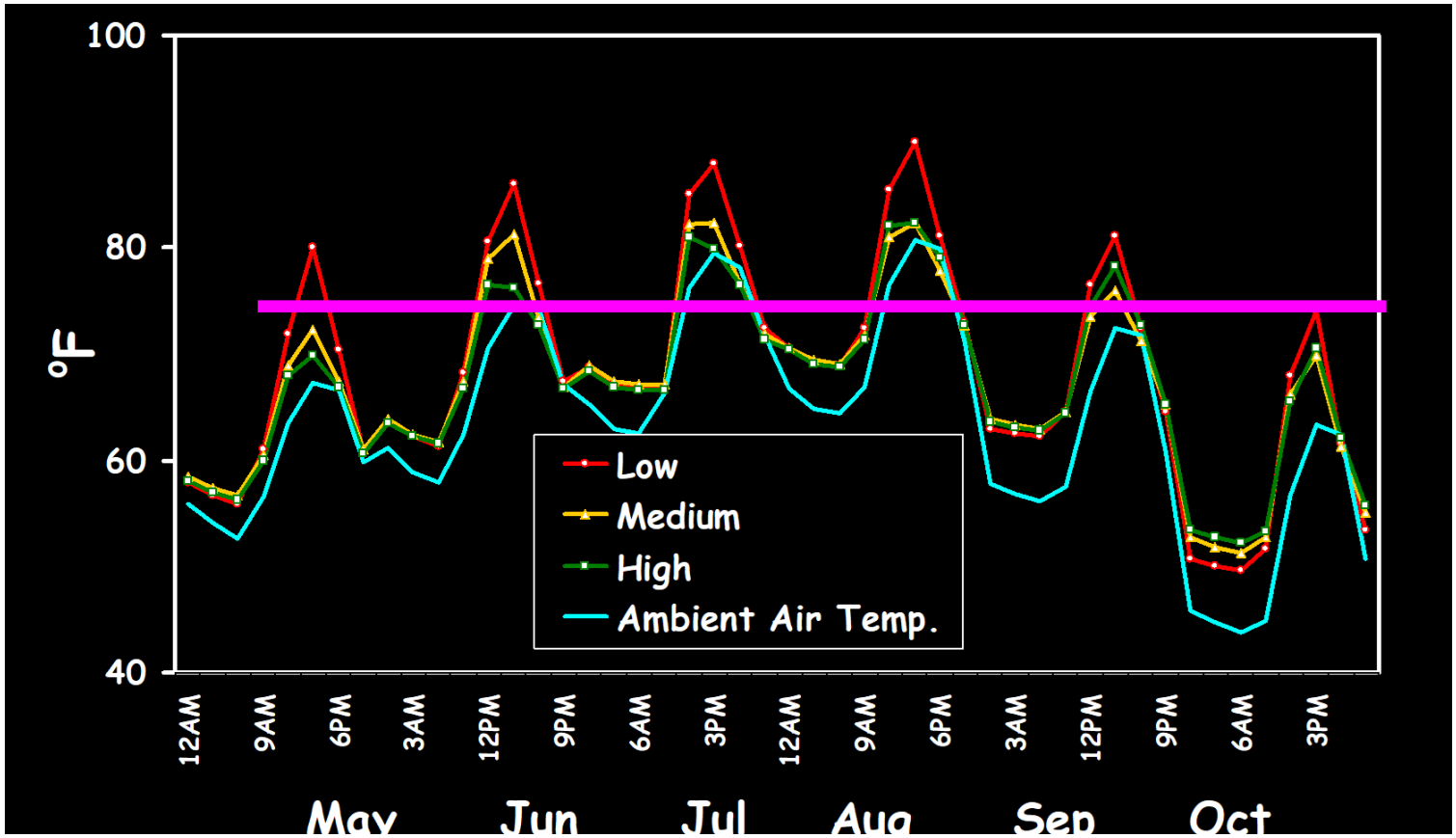
# Light

- $C_3$ plants light saturated at 50% full sun
- More leaf growth (at expense of roots) for grasses under reduced light
- Diffuse light used more efficiently than direct beam
- Light quality/quantity differ by tree species

# Lower Soil Temperature (benefits C3s)

Diurnal soil surface temperature averaged within months in response to tree density in 2003

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# Moisture

- Literature mixed; in deciduous silvopastures, often no difference
- Trees can benefit moisture conditions by reducing evapotranspiration losses
- Response likely varies across the range of conditions

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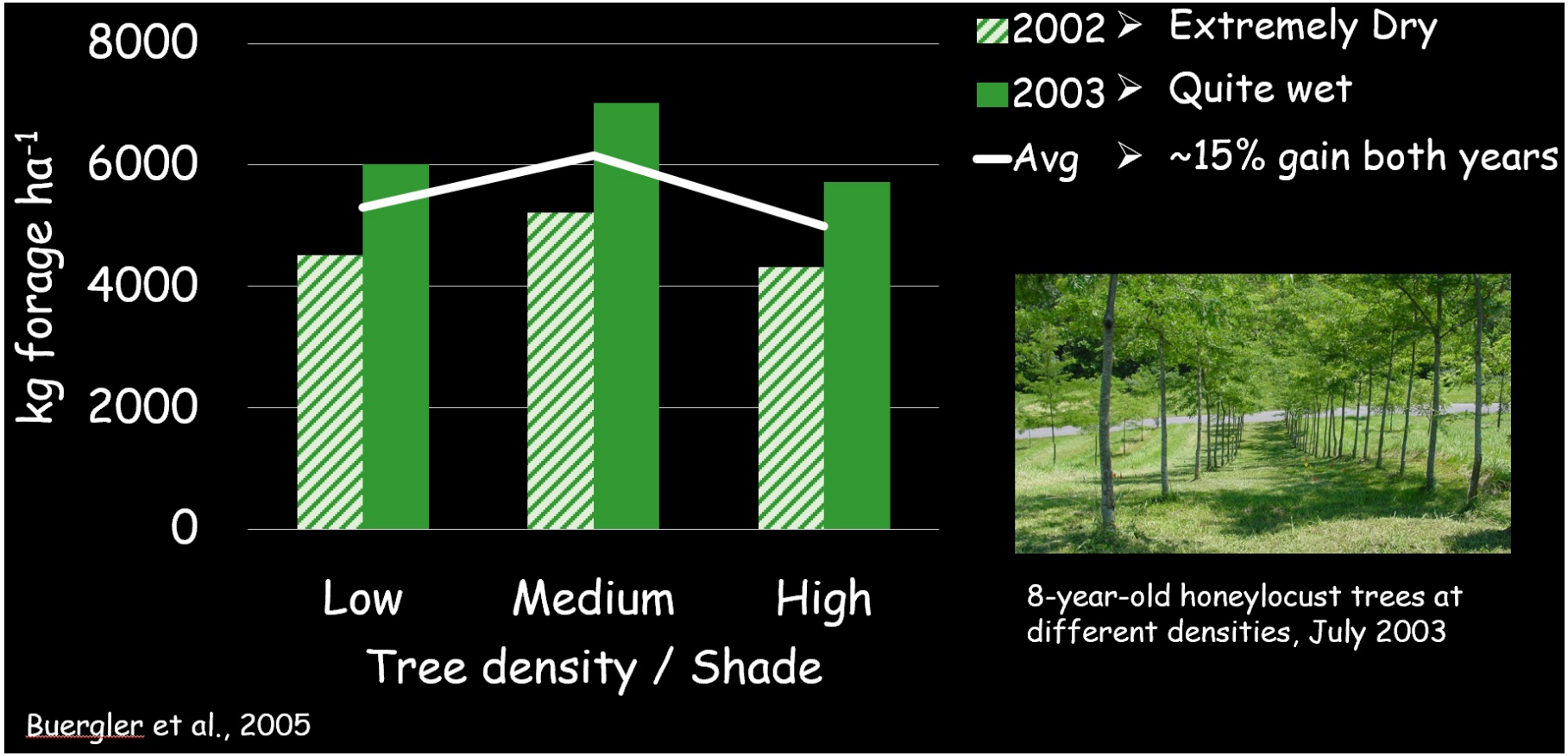
# Herbage accumulation (7-8 yr post plant)



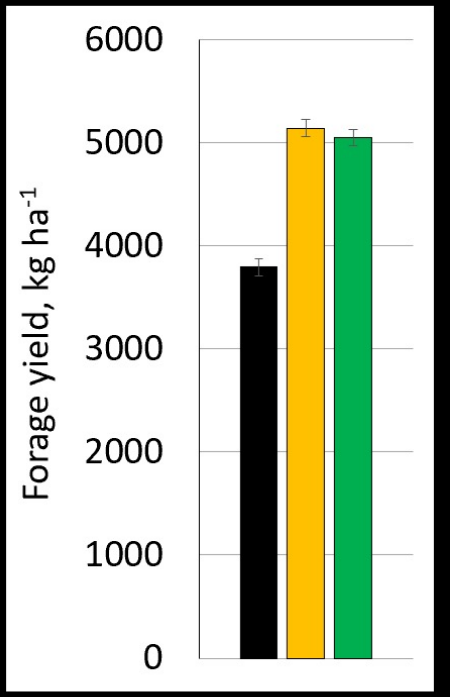
# Herbage composition and accumulation
## (17-19 yr post plant)

Visual estimate of species presence based on a 5-point scale

| Species | Open | Black walnut | Honey-locust |
|---|---|---|---|
| Tall fescue (*Festuca/Schedonorus* ) | 5.00 | 4.00 | 4.50 |
| Kentucky bluegrass (*Poa perenne* ) | 2.83 | 4.08 | 2.78 |
| Orchardgrass (*Dactylis glomerata* ) | 2.92 | 2.67 | 2.92 |
| White clover (*Trifolium repens* ) | 0.75 | 1.50 | 0.83 |
| Red clover (*T. pratense* ) | 2.17 | 0.83 | 3.41 |
| Broadleaf weeds | 0.17 | 1.17 | 0.25 |
| Sweet vernalgrass (*Anthoxanthum oderatum* ) | 0.00 | 0.42 | 0.00 |
| Nimblewill (*Muhlenbergia schreberii* ) | 0.00 | 0.42 | 0.00 |
| Hop clover (*T. campestre* ) | 0.17 | 0.92 | 0.42 |
| Honeylocust (*Gledtisia* ) | 0.00 | 0.00 | 0.17 |
| Cheatgrass (*Bromus tectorum* ) | 0.00 | 0.50 | 0.08 |
| Quackgrass (*Elymus repens* ) | 0.17 | 0.00 | 0.58 |

Fannon et al., 2017

3-yr pregraze herb-age accumulation




Pent et al., 2020

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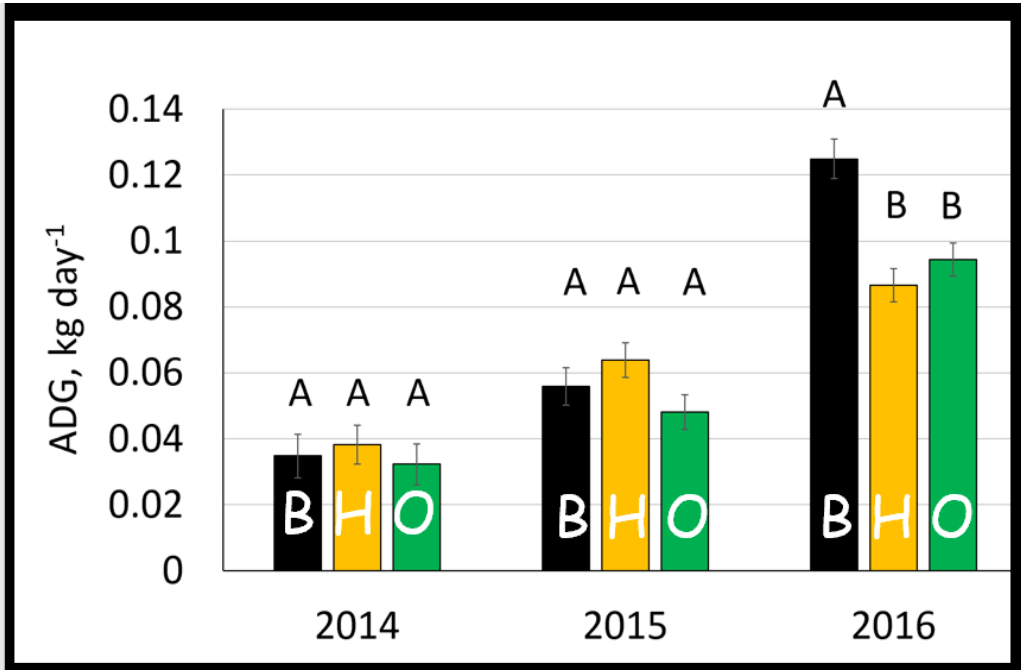
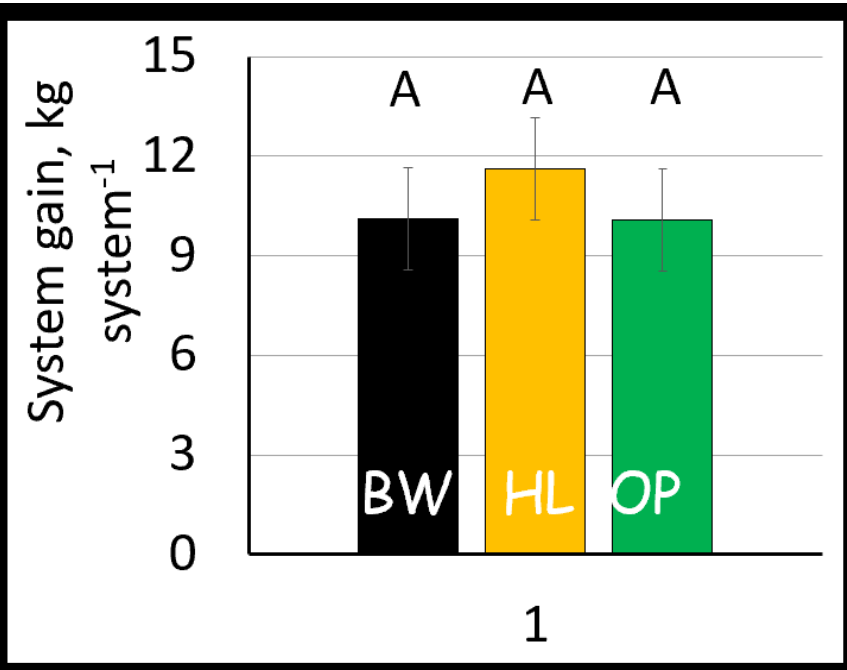
# Average daily gain by system and year




# Total gain across treatments




Pent et al., 2020



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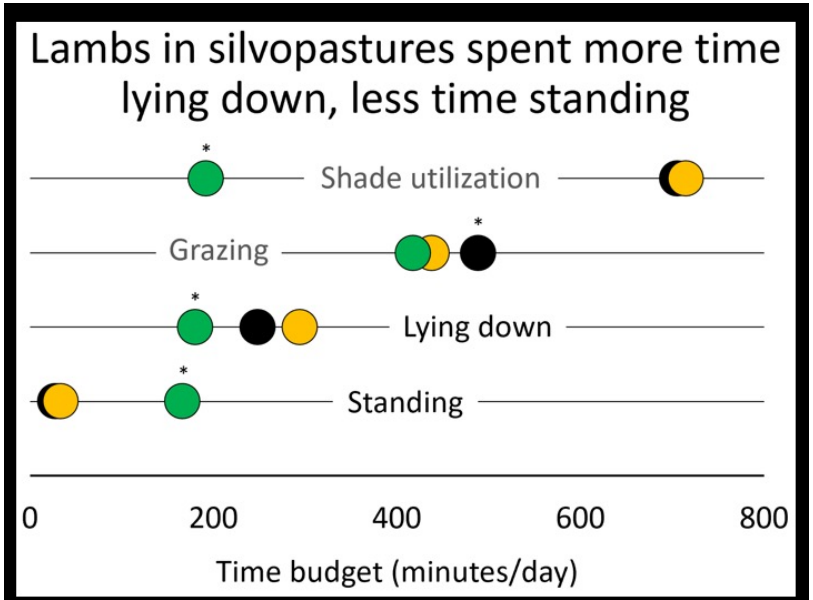
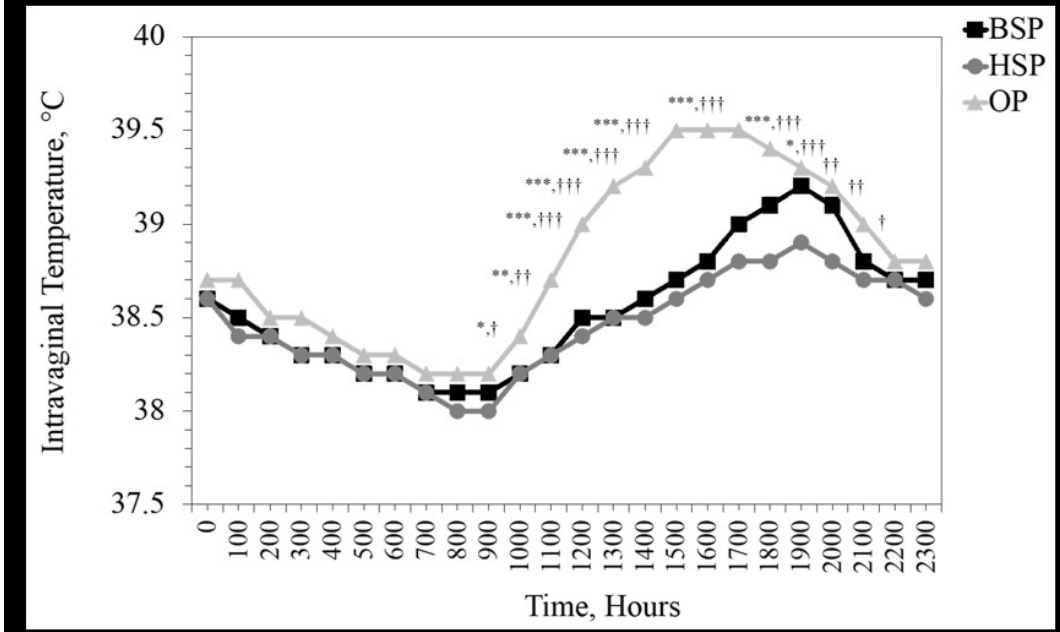
# Animal time budgets, body temperatures, stress responses




Pent et al., 2020




Hair cortisol level (pg $mg^{-1}$) of Katahdin ewes in silvopasture and open systems

| | -----Treatments[1]----- | | | | ------Tukey's adjusted P-value----- | | |
|---|---|---|---|---|---|---|---|
| Year | BW | HL | OP | SE | BW vs HL | BW vs OP | HL vs OP |
| | -- Hair cortisol level[2], pg $mg^{-1}$-- | | | | | | |
| 2020 | 21.5 | 22.0 | 38.9 | 2.06 | 0.8642 | <0.0001 | <0.0001 |
| 2021 | 24.6 | 33.0 | 51.1 | 2.95 | 0.0236 | <0.0001 | <0.0001 |

[1]Treatments: BW - Black Walnut Silvopasture; HL- Honeylocust Silvopasture; OP- Open Pasture

Poudel et al., 2022

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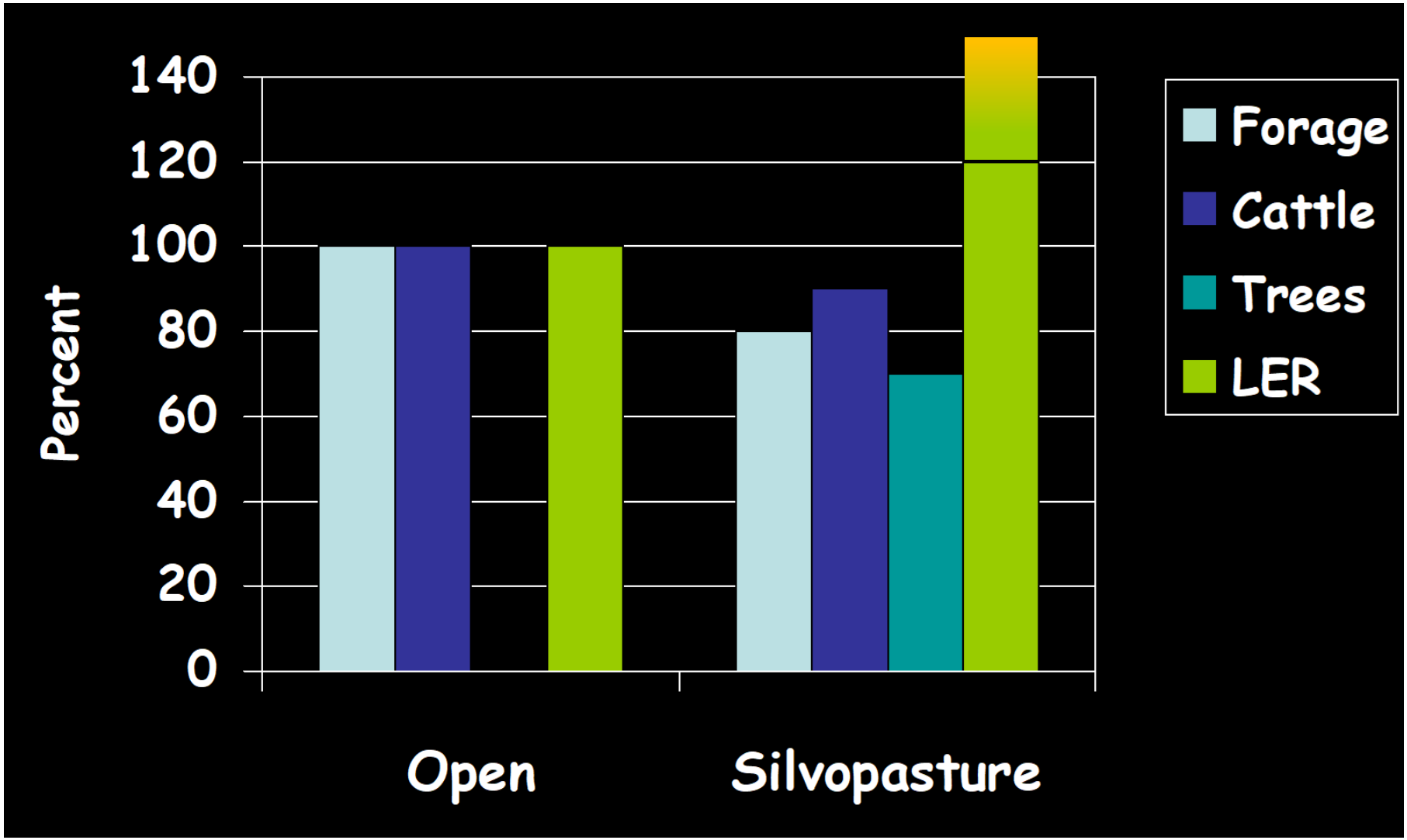
# Land equivalency ratio



# Why (and how) producers do it

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# Hunting / Beef cattle

# Aesthetics

# Second career
# Intergenerational land transfer

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# Two-story agriculture: appreciate land vs depreciate barn

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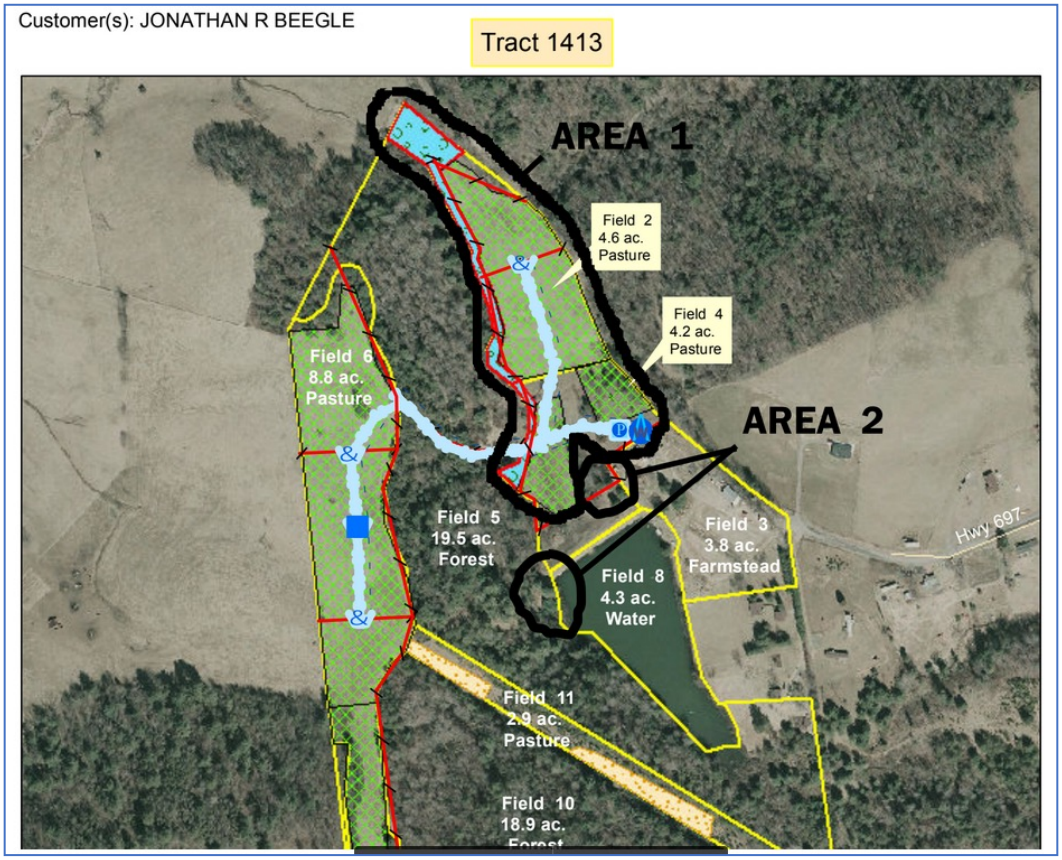
# Species & product diversity
# Wetland protection
# Community engagement

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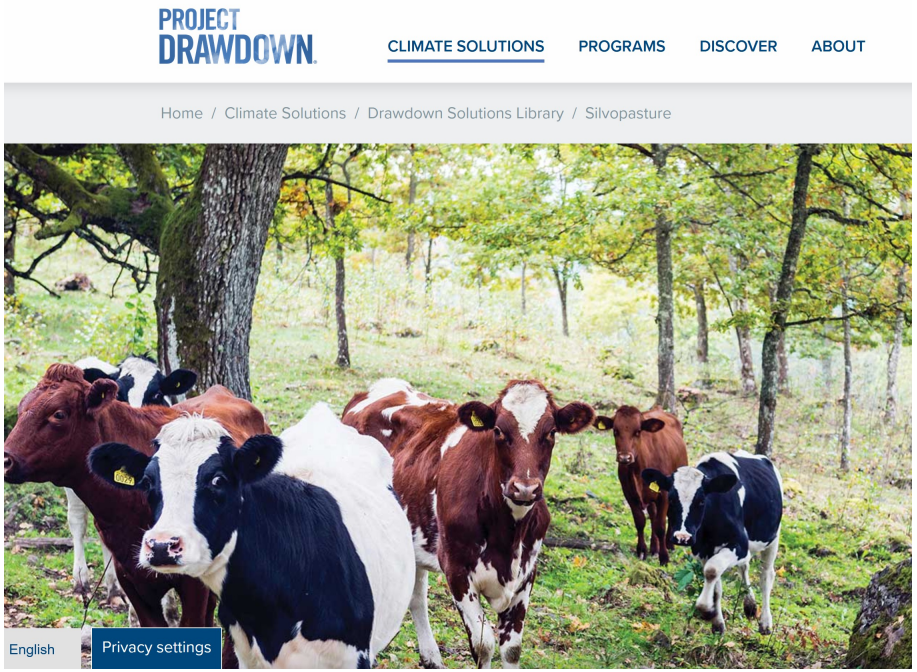
# Heat Stress Abatement

*Producers engaged with silvopastures (video series)*

https://www.youtube.com/playlist?list=PLsPrMF2hUwAZvIp87cm-UNEtzkJIBJJ2


Hot wire at top of tube
Hot wire down the tube

# New opportunities, support and markets




Propagate

SAVANNA INSTITUTE

Trees For Graziers

Taking Grazing to New Heights

WorkingTrees

Edwards Mother Earth Foundation

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# New opportunities, support and markets


WorkingTrees

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# Silvopasturing

## 30 years of experiences from our family's grazing farms


Brett Chedzoy

Cornell Cooperative Extension
Schuyler County

*bjc226@cornell.edu*


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A Regional Extension Program for Landowners

Cornell University Cooperative Extension

South Central New York Agriculture Team

# Argentina

Estancia Rincon Grande

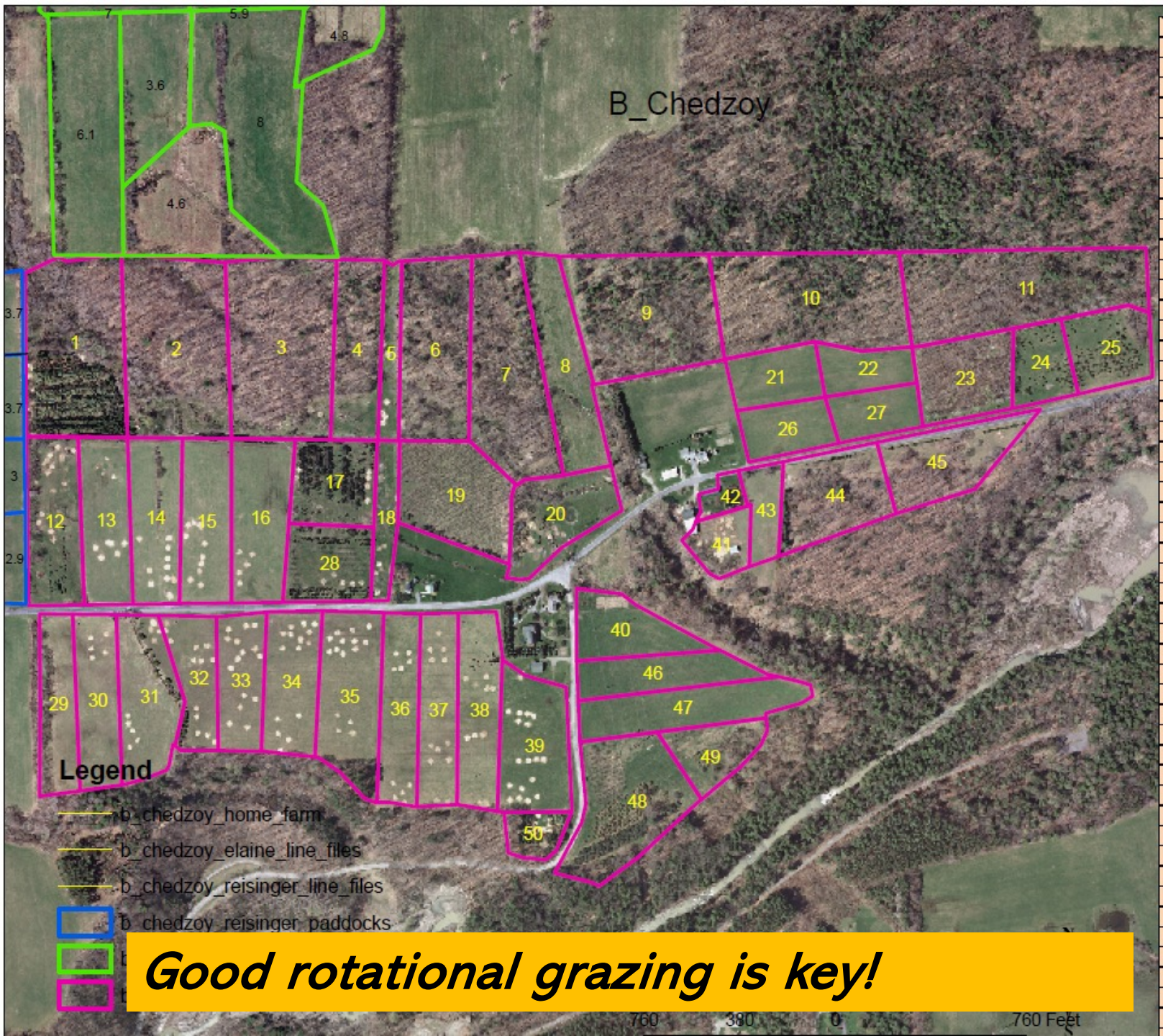
# New York

## Angus Glen Farms

Photo credit: Heather Ainsworth

adding woods to pasture…

… or pasture to woods




| | |
|---|---|
| 1 | 6.2 |
| 2 | 6.6 |
| 3 | 6.8 |
| 4 | 3.0 |
| 5 | 1.2 |
| 6 | 4.5 |
| 7 | 5.4 |
| 8 | 3.4 |
| 9 | 5.9 |
| 10 | 6.5 |
| 11 | 6.6 |
| 12 | 3.2 |
| 13 | 2.9 |
| 14 | 3.0 |
| 15 | 2.9 |
| 16 | 3.4 |
| 17 | 2.5 |
| 18 | 1.2 |
| 19 | 3.8 |
| 20 | 2.8 |
| 21 | 1.8 |
| 22 | 1.4 |
| 23 | 2.7 |
| 24 | 1.6 |
| 25 | 2.2 |
| 26 | 1.6 |
| 27 | 1.5 |
| 28 | 2.3 |
| 29 | 2.3 |
| 30 | 2.6 |
| 31 | 3.2 |
| 32 | 2.0 |
| 33 | 2.3 |
| 34 | 2.8 |
| 35 | 3.7 |
| 36 | 2.6 |
| 37 | 2.7 |
| 38 | 2.9 |
| 39 | 3.3 |
| 40 | 2.2 |
| 41 | 1.2 |
| 42 | 0.5 |
| 43 | 1.1 |
| 44 | 3.2 |
| 45 | 3.0 |
| 46 | 2.2 |
| 47 | 3.1 |
| 48 | 4.6 |
| 49 | 1.7 |
| 50 | 0.9 |

***Good rotational grazing is key!***


Livestock = workforce

# Good vs. Bad Impacts

*"Bale Bombs"*

*> 1 M lbs/acre of density!*

***Grow forages or firewood?***

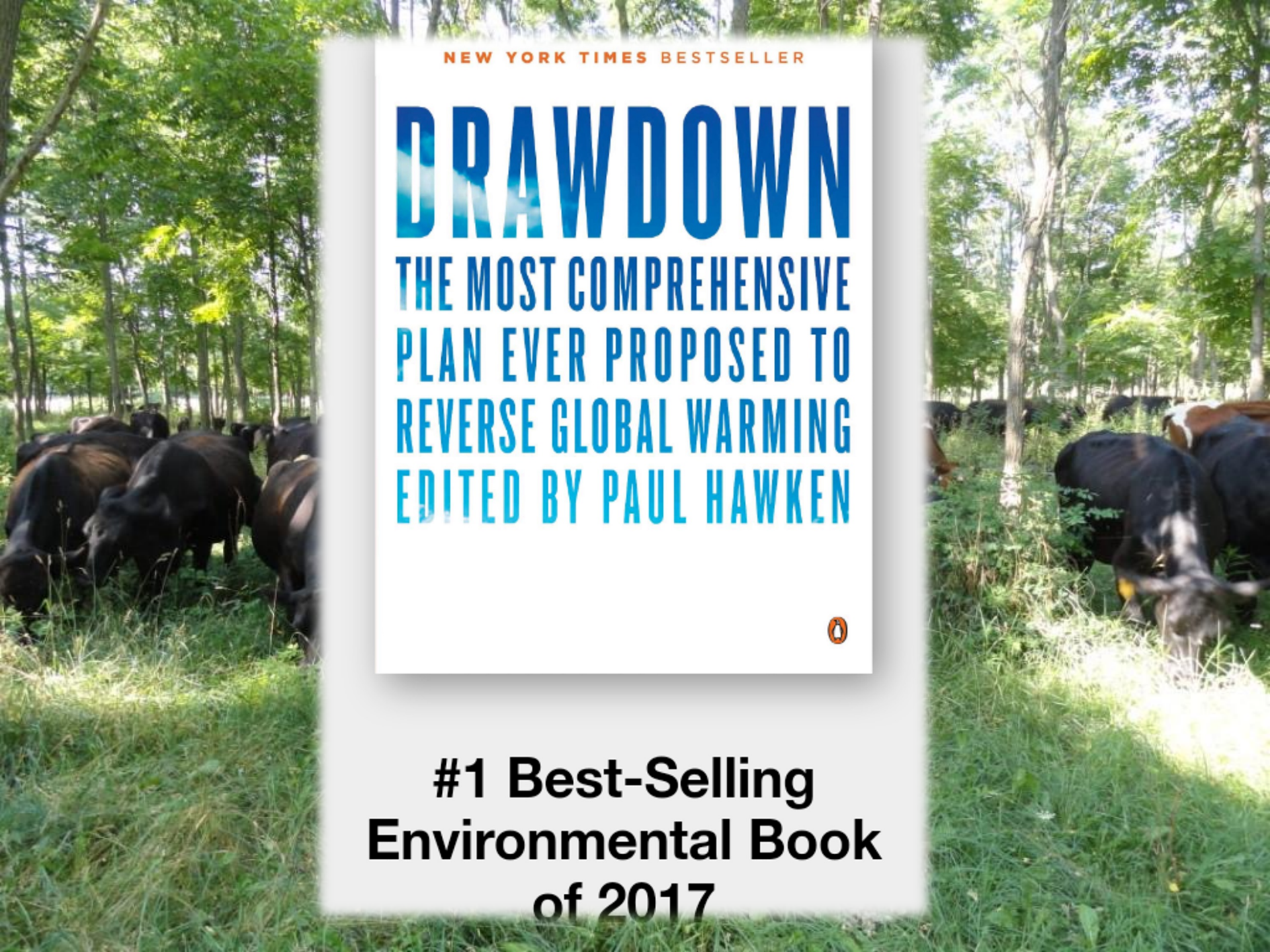
***Goal: about 50% canopy closure***

# Some of the ways silvopasturing benefits our farm:

- ✓Increase productivity of underutilized land
- ✓Rehabilitate degraded woodland areas
- ✓Property tax abatement programs
- ✓Stimulate forest regeneration
- ✓Control problematic plants
- ✓Animal comfort and welfare
- ✓Enhanced wildlife habitat
- ✓Nutrient and hydraulic lift
- ✓Improved system resiliency
- ✓Mast crop utilization
- ✓Ecosystem services

***Diversified Nutrition***

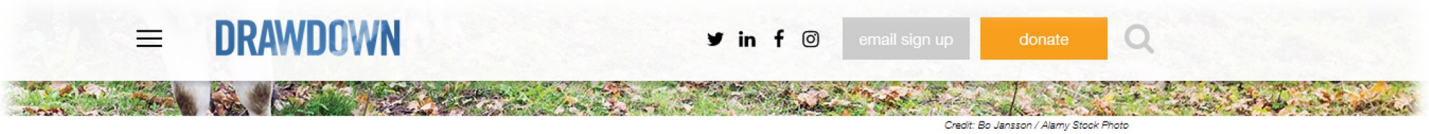

Multiple Crops




**#1 Best-Selling Environmental Book of 2017**

*"… far outpaces any grassland for sequestering carbon…"*

*"… sequester five to ten times as much carbon…"*




Credit: Bo Jansson / Alamy Stock Photo

FOOD
## SILVOPASTURE

#9

RANK AND RESULTS BY 2050

31.19 GIGATONS
REDUCED CO2

$41.59 BILLION
NET IMPLEMENTATION COST

$699.37 BILLION
NET OPERATIONAL SAVINGS

Silvopasture is an ancient practice that integrates trees and pasture into a single system for raising livestock. Research suggests silvopasture far outpaces any grassland technique for counteracting the methane emissions of livestock and sequestering carbon under-hoof. Pastures strewn or crisscrossed with trees sequester five to ten times as much carbon as those of the same size that are treeless, storing it in both biomass and soil.

Carbon aside, the advantages of silvopasture are considerable, with financial benefits for farmers and ranchers. Livestock, trees, and any additional forestry products, such as nuts, fruit, and mushrooms, generate income on different time horizons. The health and productivity of both animals and the land improve. Because silvopasture systems are diversely productive and more resilient, farmers are better insulated from risk.

Silvopasture often runs counter to farming norms and can be costly and slow to implement. Peer-to-peer education has proven effective for spreading it. As the impacts of global warming progress, appeal will likely grow, because silvopasture can help farmers and their livestock adapt to erratic weather and increased

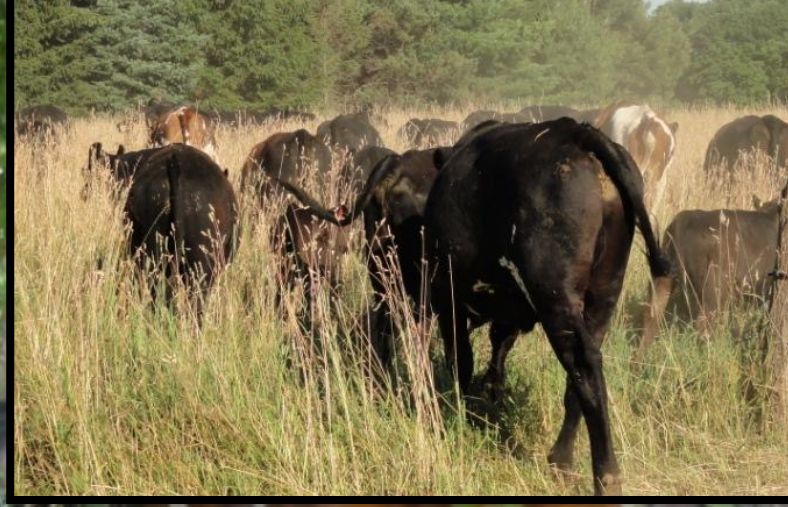
**IMPACT:** *We estimate that silvopasture is currently practiced on 351 million acres of land globally. If adoption expands to 554 million acres by 2050–out of the 2.7 billion acres theoretically suitable for silvopasture–carbon result of the high annual carbon sequestration rate of 1.95 tons of carbon per acre per year in soil and biomass. Farmers could realize investment of $42 billion to implement.*

REFERENCES

ERRATA

*"… more resilient & better insulates farmers from risk…"*

*"… can help farmers & their livestock adapt to erratic weather…"*



*"… more resilient and better insulate farmers from risk…"*

# “Living Barns”

***“… can help farmers and their livestock adapt to erratic weather…”***

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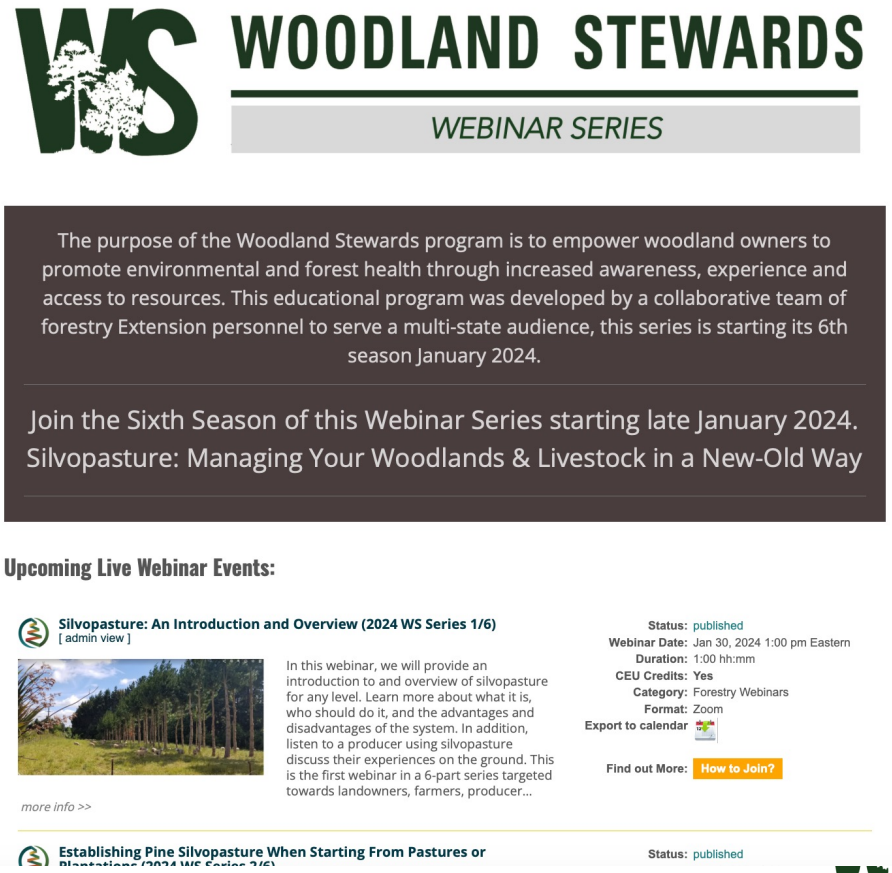

# Silvopasture:

*Managing Your Woodlands and Livestock in a New-Old Way*

WOODLAND STEWARDS

A Regional Extension Program for Landowners

**WEBINAR SERIES**

**TUESDAYS:** Jan. 30th to March 5th

**1pm ET / 12 pm CT**

| | |
|---|---|
| **Jan. 30** | Silvopasture: An Introduction and Overview |
| **Feb. 6** | Establishing Pine Silvopasture: from Pastures or Plantations |
| **Feb. 13** | Establishing Hardwood Silvopasture: from Pastures or Plantations |
| **Feb. 20** | From Forage to Livestock: Managing Animals in a Silvopasture system |
| **Feb. 27** | Moving Towards a Silvopasture System: Getting Started & Finding Help |
| **Mar. 5** | Silvopasture producers share their stories and Answer Questions: A Panel Discussion |