

# *HARDWOOD SILVOPASTURE*

## Challenges and Opportunities

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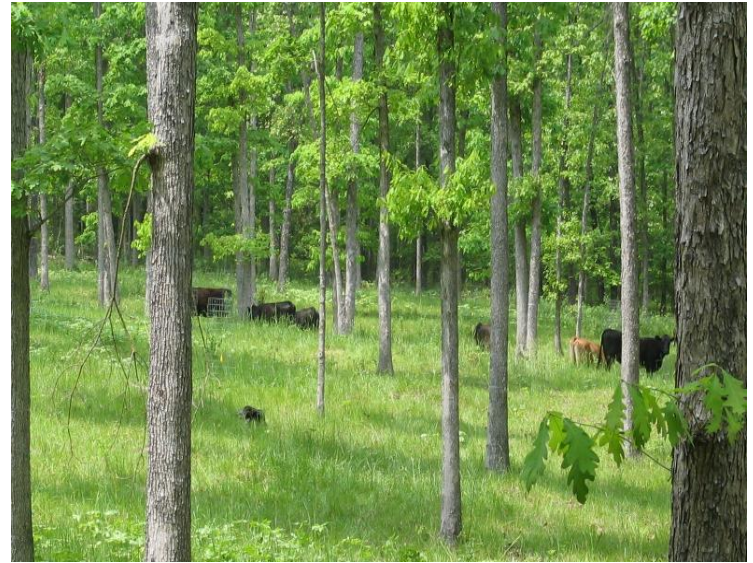
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# Silvopasture is:

Combinations of trees, forages, and grazing principles which are integrated and managed to promote broader resource utilization and enhanced farm productivity.





## Silvopasture is NOT:

Grazing unmanaged woodlands is NOT silvopasture!

One or two trees in a pasture ... is NOT silvopasture.



# Silvopasture

- A. Silvo – from the word “Silviculture”
  - the art and science of tending and producing a forest
  
- B. Pasture – plants grown for grazing
  - selective production of quality forage for grazing by livestock

*Integrates Forestry, Forage, & Livestock practices:  
managed intensively*

# Historical Successes



*The dehesa system has persisted for millennia, and exists today, because of its versatility (diversity); because it has been, and it is now, the most efficient system to satisfy the changing demands of the human society within that difficult natural environment*

Opening paper. XXIst General Meeting. European Grassland Federation. Badajoz (Spain) April 2006

Source:

Prof. Leopoldo Olea-Márquez de Prado. School of Agricultural Sciences. University of Extremadura

Prof. Alfonso San Miguel-Ayanz. School of Forestry. Polytechnic University of Madrid



# Historical Successes

Southern Silvopasture has successfully integrated pine production and grazed forage



## From A Pasture to A Silvopasture System

There is potential to diversify a grazing operation and improve economic or environmental benefits on many acres through conversion of pasture to silvopasture. Silvopasture is the integration of trees with livestock grazing and forage operations. Research has demonstrated that, if managed properly, forage production can be maintained while producing high value timber.

**Considerations** Southern pines (loblolly, longleaf, and slash) have been found to be compatible with forage production and livestock grazing when properly managed. This technical note provides several options for establishment of southern pines in existing pasture systems for the production and management of both forest and forage products. The following are planning considerations to convert from pasture to silvopasture.

**Soils** Determine the soil suitability of the area for establishing pine trees. If the soil is not suited to southern pine species do not convert to a pine silvopasture system.

**Tree Planting** Determine the desired row spacing for the pine planting. Planting rates from 100 to 400 trees per acre are typically recommended for planting a silvopasture system. Trees may be grown in single rows or in aggregate rows called sets with wide alleys for for-

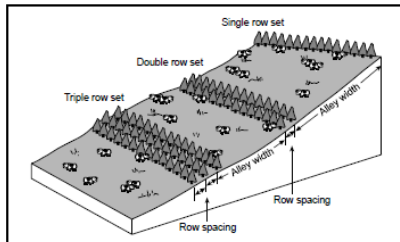


Figure 1: Typical layout diagram showing alley width, row spacing, and tree sets for establishing a silvopasture system in existing pasture.



<http://www.unl.edu/nac/>



# Historical Successes

Midwest Silvopasture has demonstrated short-term success associated with rotationally grazed cool-season forages grown in intensively managed upland oak forests.



# Components of Success





# Do cattle (and wildlife?) need shade?

- ▶ It depends!
  - Are cattle grazing endophyte infected fescue?
  - Is the Temperature–Humidity Index (THI) over 72?
  - Have the cattle been selected for short hair coats and heat tolerance?
  - Is plenty of good quality water present?
  - What is the overall condition of the animals?
  - What are the animals accustomed to?

# Shade – When it is probably needed

- Shade is probably beneficial any time Temperature–Humidity Index (THI) is above 72.
  - Especially if livestock are grazing endophyte infected fescue

Figure 1. Temperature Humidity Index (THI)<sup>1</sup> for Dairy Cows. Modified from Dr. Frank Wierama (1990), Department of Agricultural Engineering, The University of Arizona, Tucson, Arizona.

DEG	RELATIVE HUMIDITY																				
F	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
75																					
80																					
85																					
90																					
95																					
100																					
105																					
110																					
115																					
120																					

NO STRESS

MILD STRESS

MEDIUM STRESS

SEVERE STRESS

<sup>1</sup>THI = (Dry-Bulb Temp. °C) + (0.36 dew point Temp., °C) + 41.2)

If more than two cows out of 10 have respiratory rates exceeding 100 breaths per minute, then immediate action should be taken to reduce heat stress.

# Shade – good and bad ?

- When shade is isolated in only a few areas of a paddock there is nutrient transfer from the grazing area to the shade, eventually killing the trees and lowering productivity of the paddock.



# Shade – good and bad ?

- Cattle tend to congregate under shade even when they don't need it
  - Time spent under shade reduces time spent grazing
  - Less grazing time results in less intake and reduced performance

# Rotational Grazing is Essential !!!

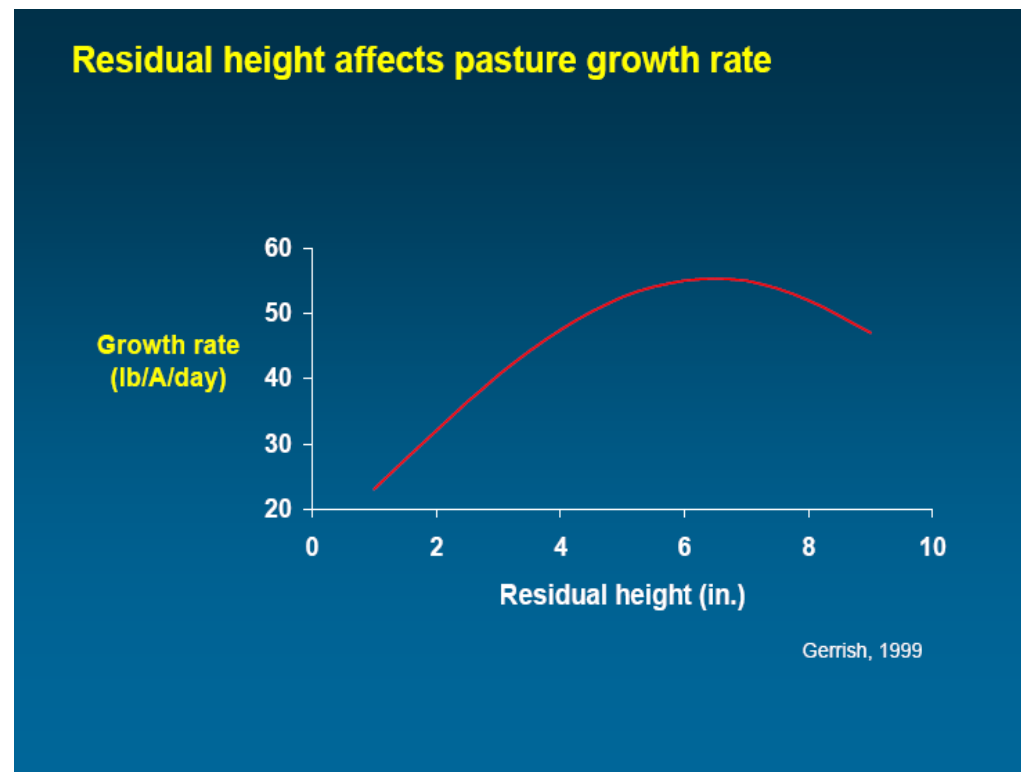
- ▶ The amount of residual left in a pasture after each grazing affects:
  - Root system
  - Health and vigor of plants
  - Photosynthesis / rate of plant regrowth

<b>% Leaf Removed</b>	<b>% Root Growth Stopped</b>
10	0
20	0
30	0
40	0
<b>50</b>	<b>2 to 4</b>
60	50
70	78
80	100
90	100



# Designing Silvopastoral Systems

1. Grazing Periods less than 5 days
2. Rest periods 20 – 45 days or longer depending on grass growth rates
3. Grazing Heights:
  - Cool Season:
    - In @ 8 – 10”
    - Out @ 3 – 4”
  - Warm Season:
    - In @ 12 – 18”
    - Out @ 6 – 8”
4. Monitor and Evaluate – soils, forage, trees, animals
5. Make adjustments as needed



# Designing Silvopasture Systems



Thinning the Forest & seeding forages



Planting pines in the Pasture

- In most cases, plan to create and maintain:
- 50% light for cool-season forages
  - 50–70% light for warm-season forages.
  - Thin every 5–7 years

# Incorporating native plants for wildlife habitat



Native grasses, forbs & shrubs  
Growing between tree rows



Close up of herbaceous and woody  
plants between tree rows, providing  
vertical structure, food and cover,  
in this case, for quail



# Adding wildlife habitat to Silvopasture



A portion of the alleyway between tree rows is disced & the seed bank allowed to naturally regenerate native grasses and forbs

# Existing Forest Managed for the Silvopasture Practice

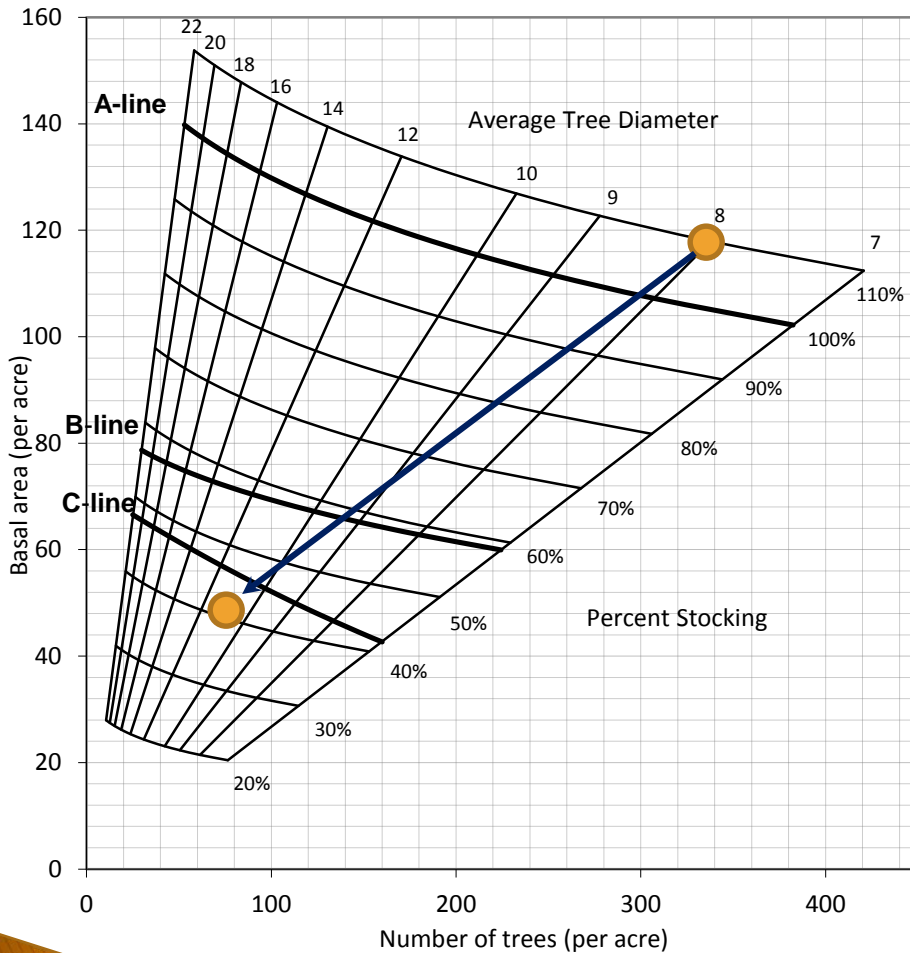
## Considerations

1. Select appropriate sites
2. Select the highest quality trees to retain as crop trees
3. Manage for appropriate light levels
4. Rotationally graze to minimize adverse effects



Native hardwoods BEFORE thinning


# MU Wurdack Farm Silvopasture Demo



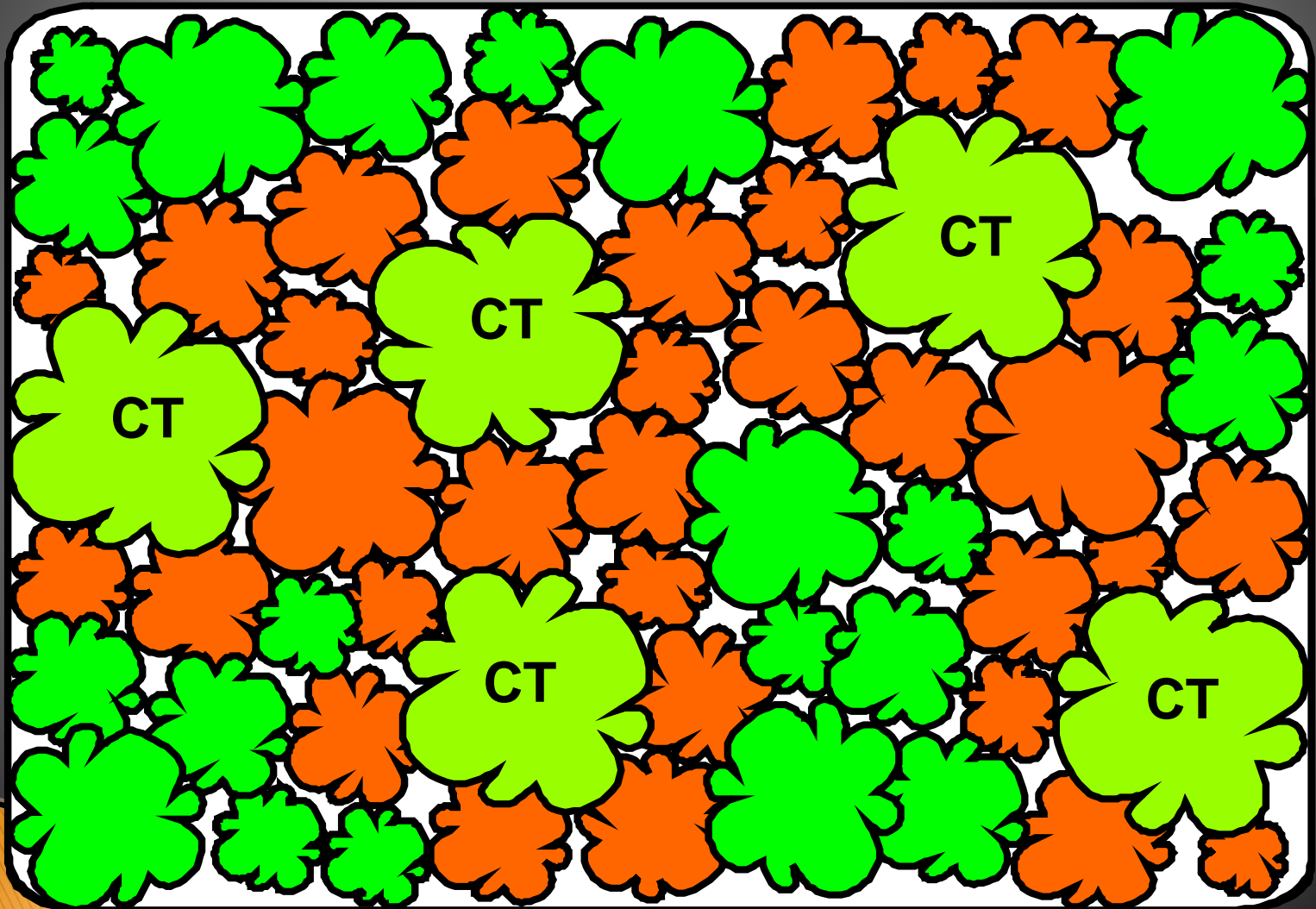
## Thinned Treatment Summary

- ❖ Overstory Tree count per acre reduced by ~60% to 67 tpa
- ❖ Residual basal area reduced by 60%, from 112 to 45 ft<sup>2</sup>/ac
- ❖ Stocking reduced from approximately 110% to 40%
- ❖ White oak 70% of residual
- ❖ Black oak 20 % of residual

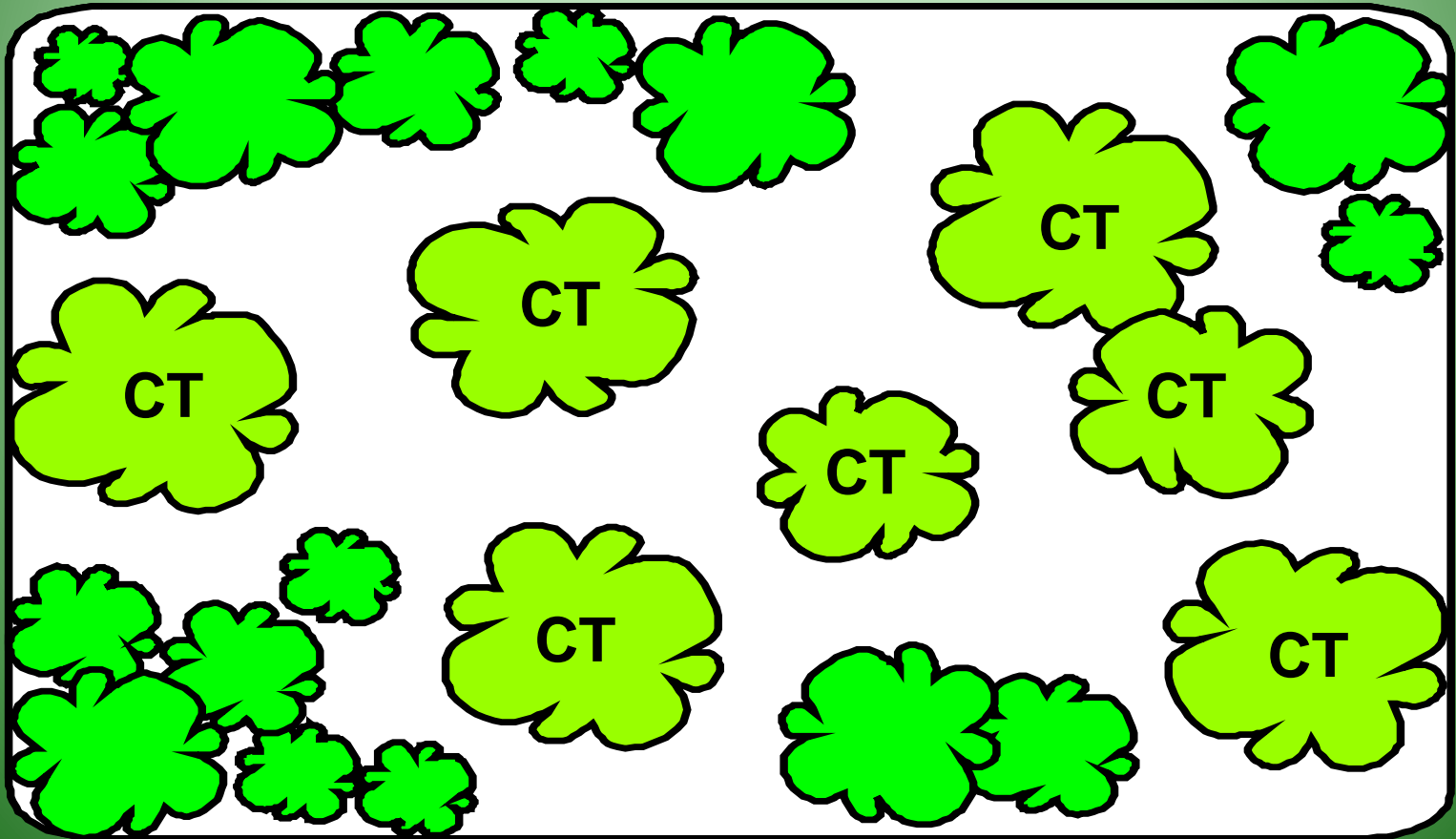
# Use Tree Selection methods *similar* to Crop Tree Release

1. Identify “best” trees
    - i. Site appropriate
    - ii. Quality related to objectives
  
  2. Thin around “best” trees to open the crown
    - i. 50–60% open across the site
  
  3. Identify next “best” tree
- 

# Crop Tree Release



# Crop Tree Release





**Thin for light**

**Thin for quality**



# MU Wurdack Farm Silvopasture Demo

## Soil Fertility Adjusted

1. 5 tons ENM pelletized lime/ac (initial pH 4.3)
2. 450 lbs 0-150-75 NPK / ac

## Forages Established in the Spring 2003

1. Kentucky 31 tall fescue (34 lb/ac)
2. Red clover (2 lb/ac)
3. Marion lespedeza (7 lb/ac)

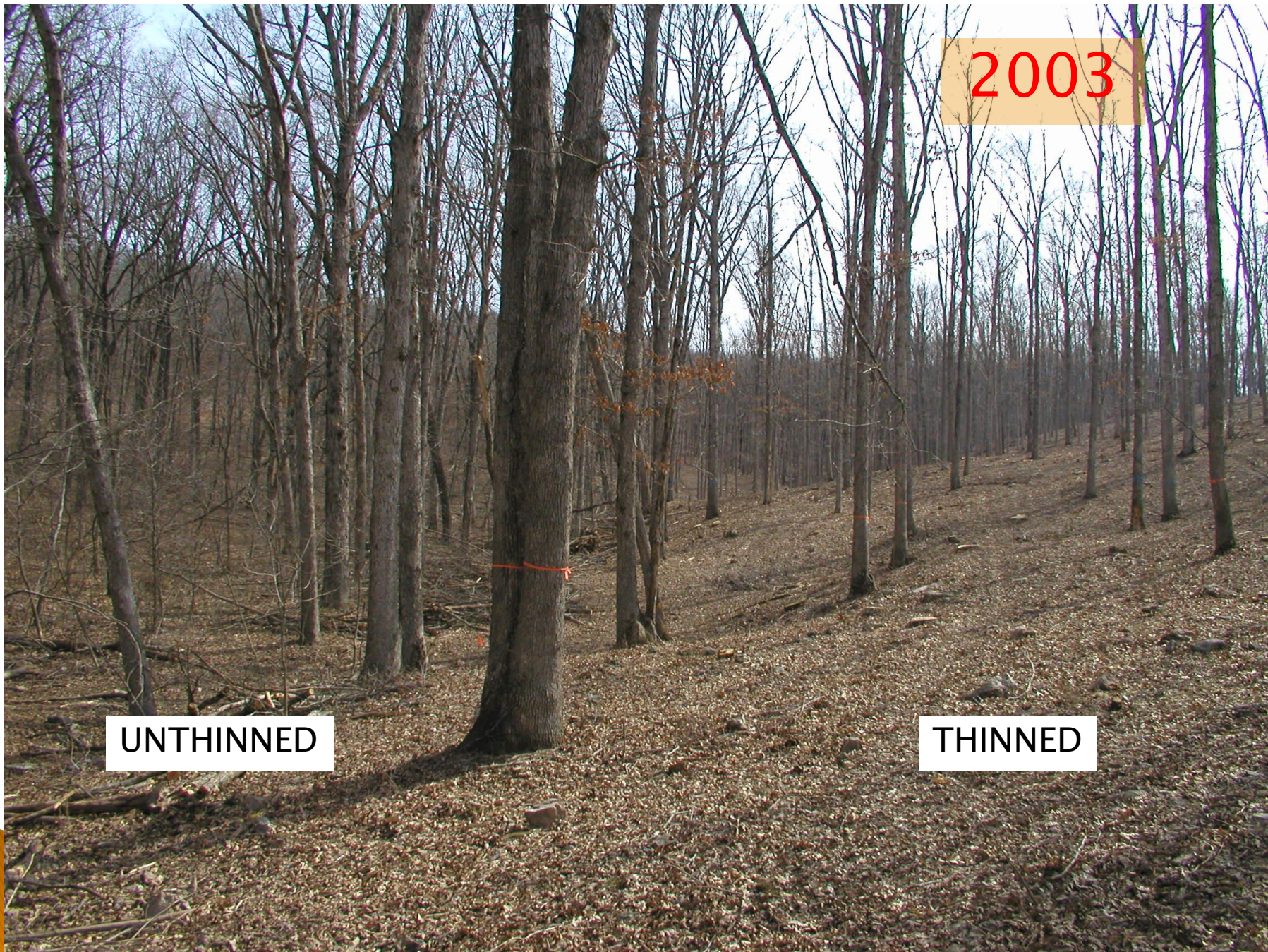




2003

UNTHINNED

THINNED



2005



2005



# Pasture in the Woods

## Possible Concerns

Log quality impacts – –

epicormic branch development?

Site impact/degradation – –

growth rates of residual trees

Regeneration – –

what about the next generation tree

# Regeneration

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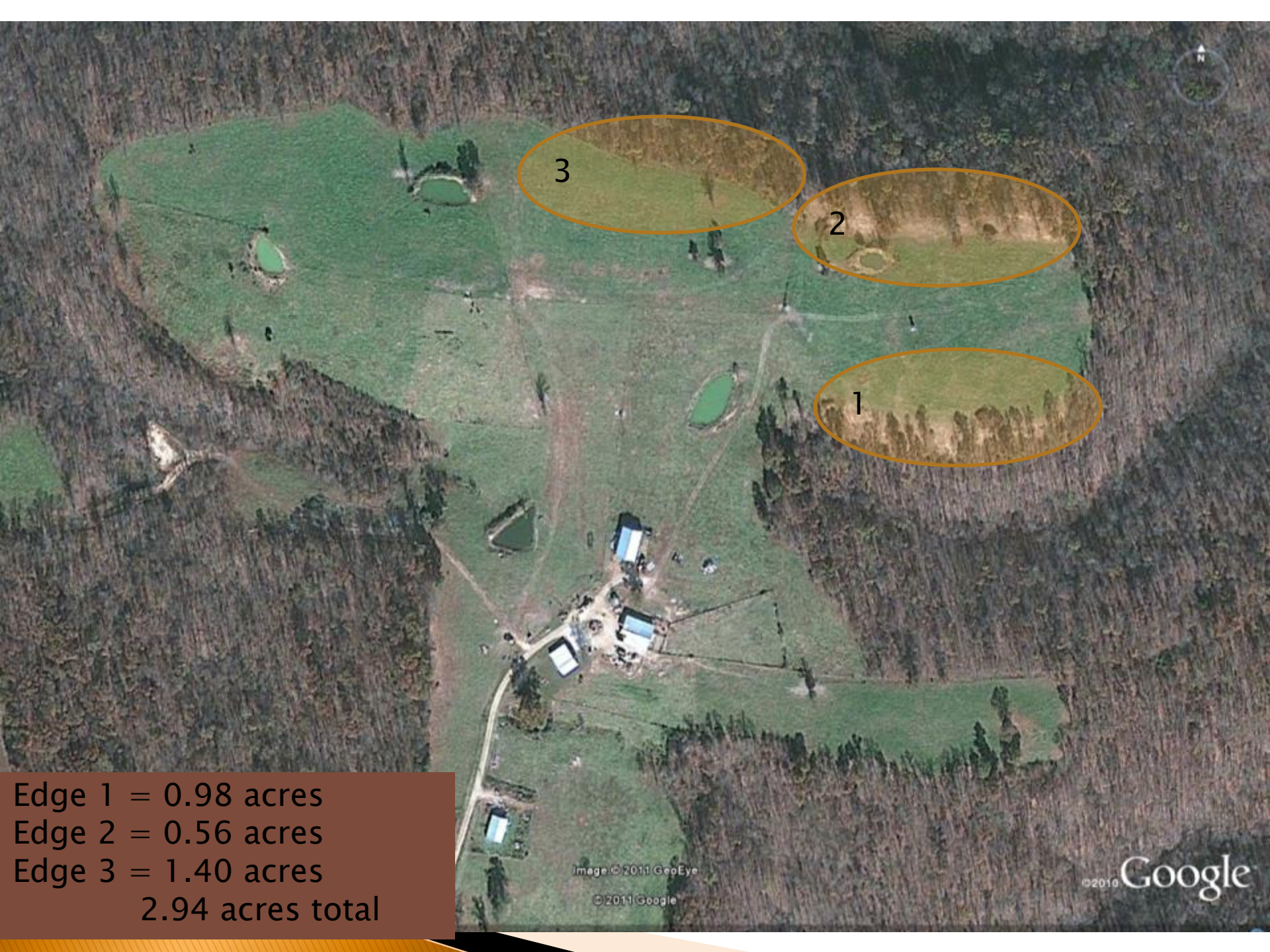
1. Seed

2. Seedlings (existing or planted)

3. Stump Sprouts

The key will be protection & weed control !!!





Edge 1 = 0.98 acres  
Edge 2 = 0.56 acres  
Edge 3 = 1.40 acres  
2.94 acres total



Edge 3: Established in 2011, area cleared was approximately 84 ft x 723 ft

# *Silvopasture Pitfalls*

## 3 Potential Problem Areas

### Forage:

- i. Wrong forage for the light and/or site
- ii. Too much shade

### Livestock


- i. Lack of a rotational grazing plan – Overgrazing
- ii. Distance to water (paddock size – water system)

### Trees

- i. Wrong tree for the site
  - ii. No plan for regeneration
- 



# Process to a successful Silvopasture Practice

1. Is the landowner practicing rotational grazing?
  2. Does each paddock have water?
  3. Overseed forages as necessary to develop appropriate shade tolerant pasture.
  4. Manage/maintain tree spacing to create desired light levels (i.e. plant spacing or crop tree thinning intensity)
  5. Plan to integrate paddocks with trees to the grazing system so that livestock stress is minimized.
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# Silvopasture = Increased Diversity

- ▶ Plant Species
- ▶ Vertical structure
- ▶ Wildlife species
- ▶ Rooting depth
- ▶ Nutrient uptake/cycling
- ▶ Soil biota



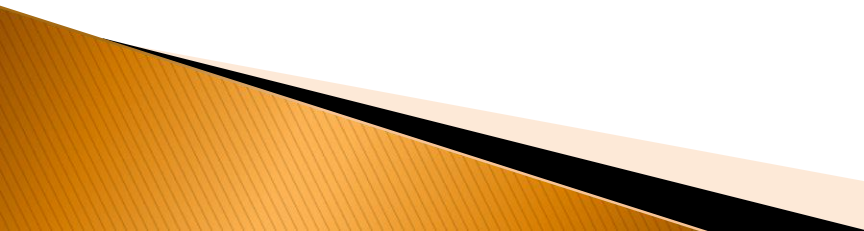
# Final Comments

Long-term viability of all of our agricultural practices (including forestry) hinges on productivity and the enhanced utilization of resources without their degradation.

Through appropriate combinations of trees, forages, and grazing principles, productivity and resource utilization can be enhanced.

This is Silvopasture.

# Addressing Opposition to Hardwood Silvopasture

- ▶ Intensive rotational grazing, already in place
  - ▶ Crop tree management, favor the best trees
  - ▶ Forest health, increase vigor of released trees
  - ▶ Diversity: species, structure, soil biota
  - ▶ Water quality, due to diversity of understory spp. & structure
  - ▶ Opportunity to reverse past mis-management (high-grading)
  - ▶ Last resort: Limit to adding trees to pasture.
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# Bare Ground = Soil Erosion = Sedimentation



# Pre-Settlement Hill Prairies



# Questions?

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