Silvopasture: Trees, Livestock, and Forages: Working Together for Profits & More!

John Fike, Virginia Tech

Crop and Soil Environmental Sciences

Agroforestry Practices

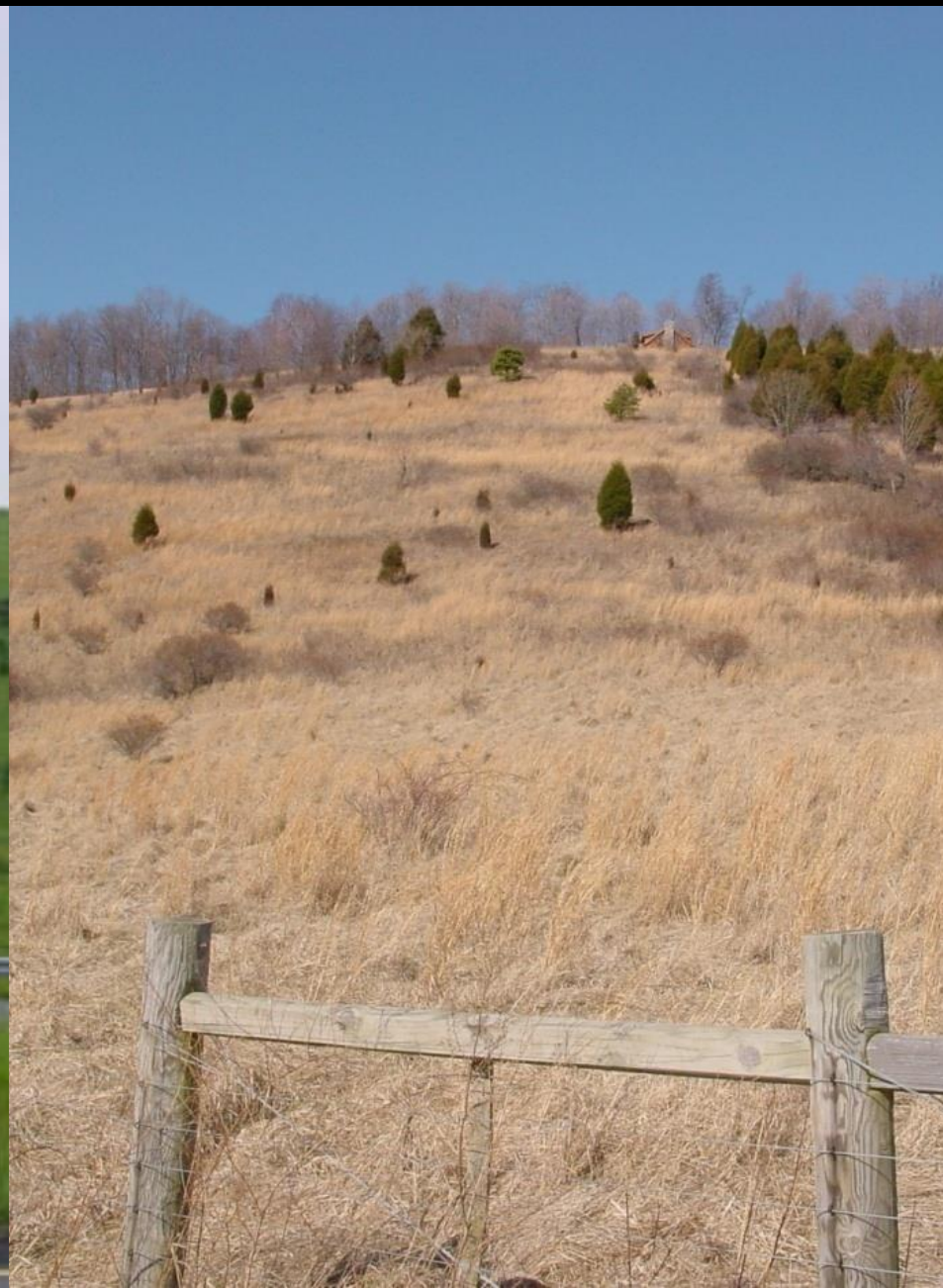
Outline

- Silvopastures: What are we talking about?
  - What silvopasture is – *or isn't*
- Integrating Trees, Livestock, and Forages
  - Planting and thinning
  - Resources and relationships
- SP as a way to increase LEV – and Profits
  - A case study from Missouri
- "And more"
- Advancing SP - Challenges and opportunities
  - Knowledge Gaps
  - Cultural Hurdles
  - What we've seen in Virginia

Silvopasture isn’t new

Silvopasture is NOT
….turning cows loose in the woods

…*nor* is it a solo tree in a pasture



What Are & Why Do Silvopastures?

PRODUCTION FUNCTIONS*

- Increased forage production
- Improved forage nutritive value
- Improved animal performance
- Production of additional products

ECOSYSTEM FUNCTIONS*

- Increased biodiversity
- Greater soil fertility
- Reduced soil erosion
- Improved stream quality

Getting to Silvopasture: Planting

Photo courtesy of NAC
http://www.silvopasture.org/Gallery_photo2.html

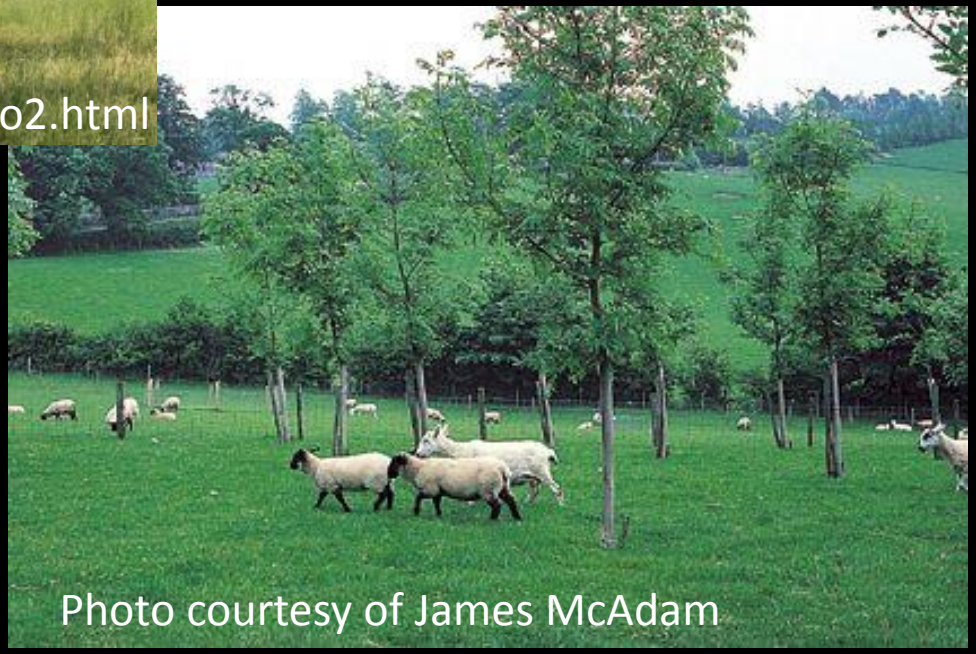
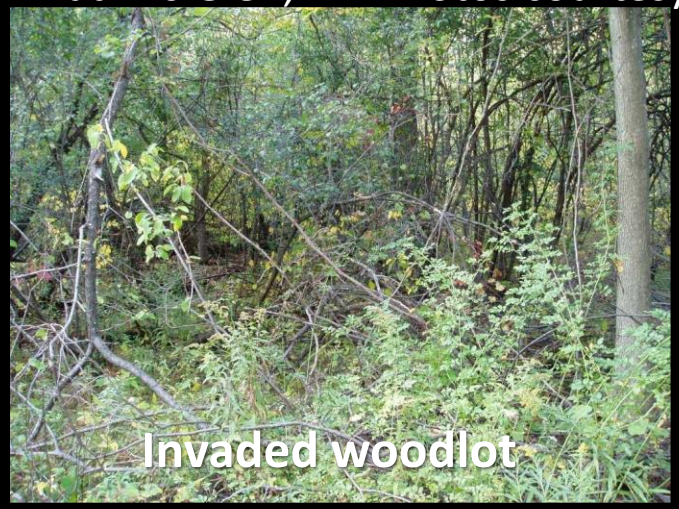


Photo courtesy of James McAdam

Getting to Silvopasture: Thinning

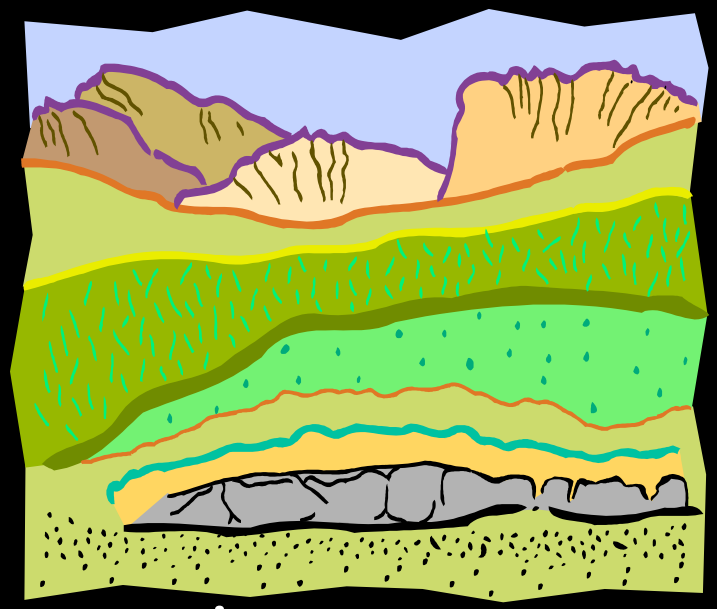
Watkins Glen, NY. Photos courtesy B. Chedzoy



Creating valuable production systems from low quality forest stands – not vice versa.

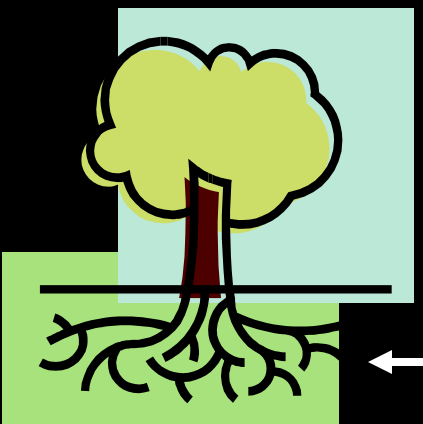
Resources in silvopastures

Light

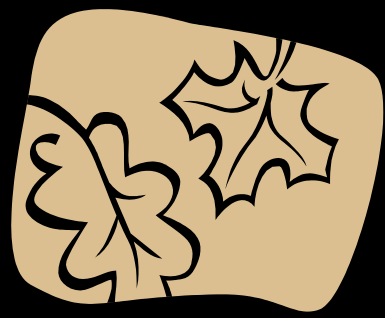


Soil nutrients

Moisture

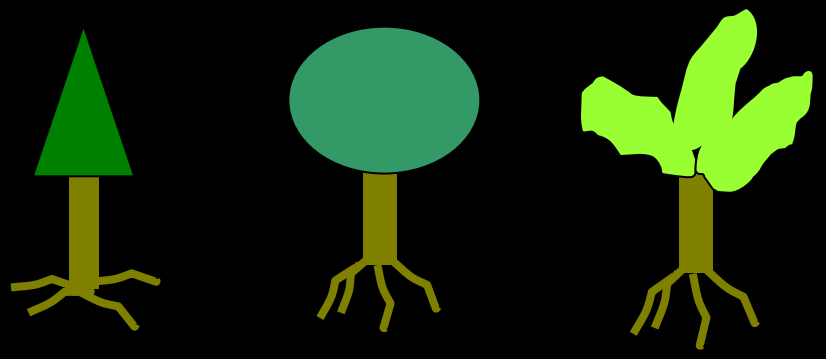


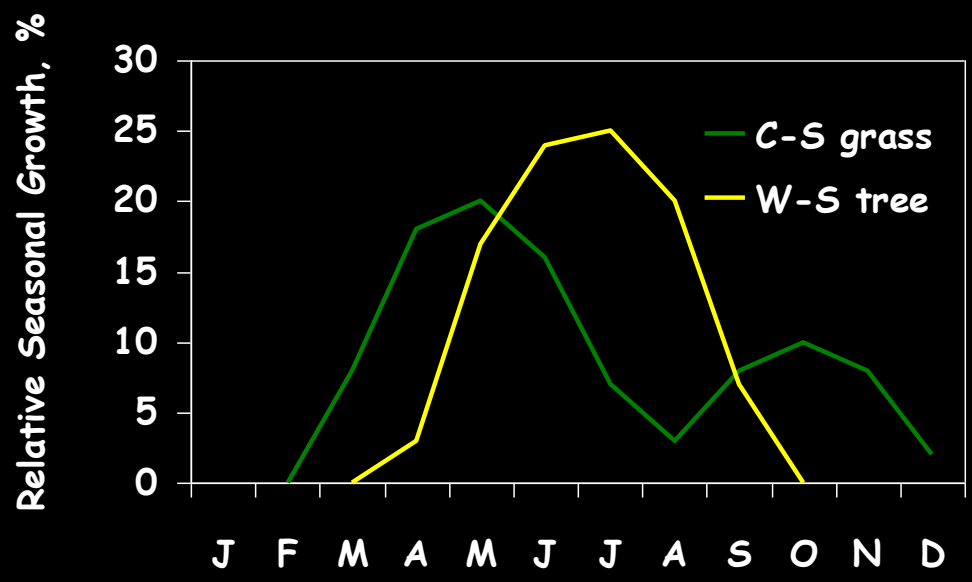
← Nutrient returns →



Light

- Cool season leaves: saturation < than full sun
- Diffuse light: greater use efficiency
- Quality, quantity and timing: differ by tree species



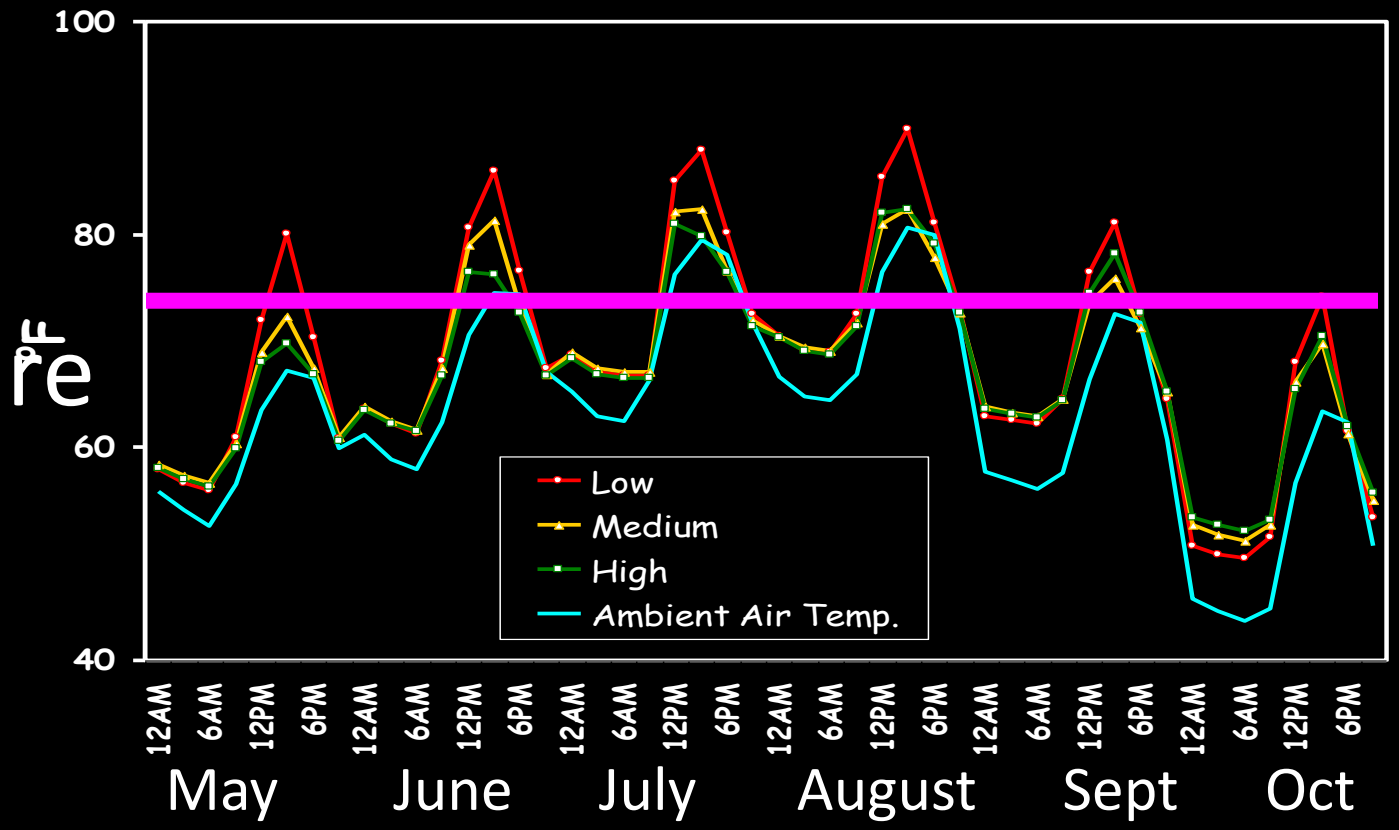


Soil surface temperature averaged within months in response to tree density in 2003

Soil Temperature

&

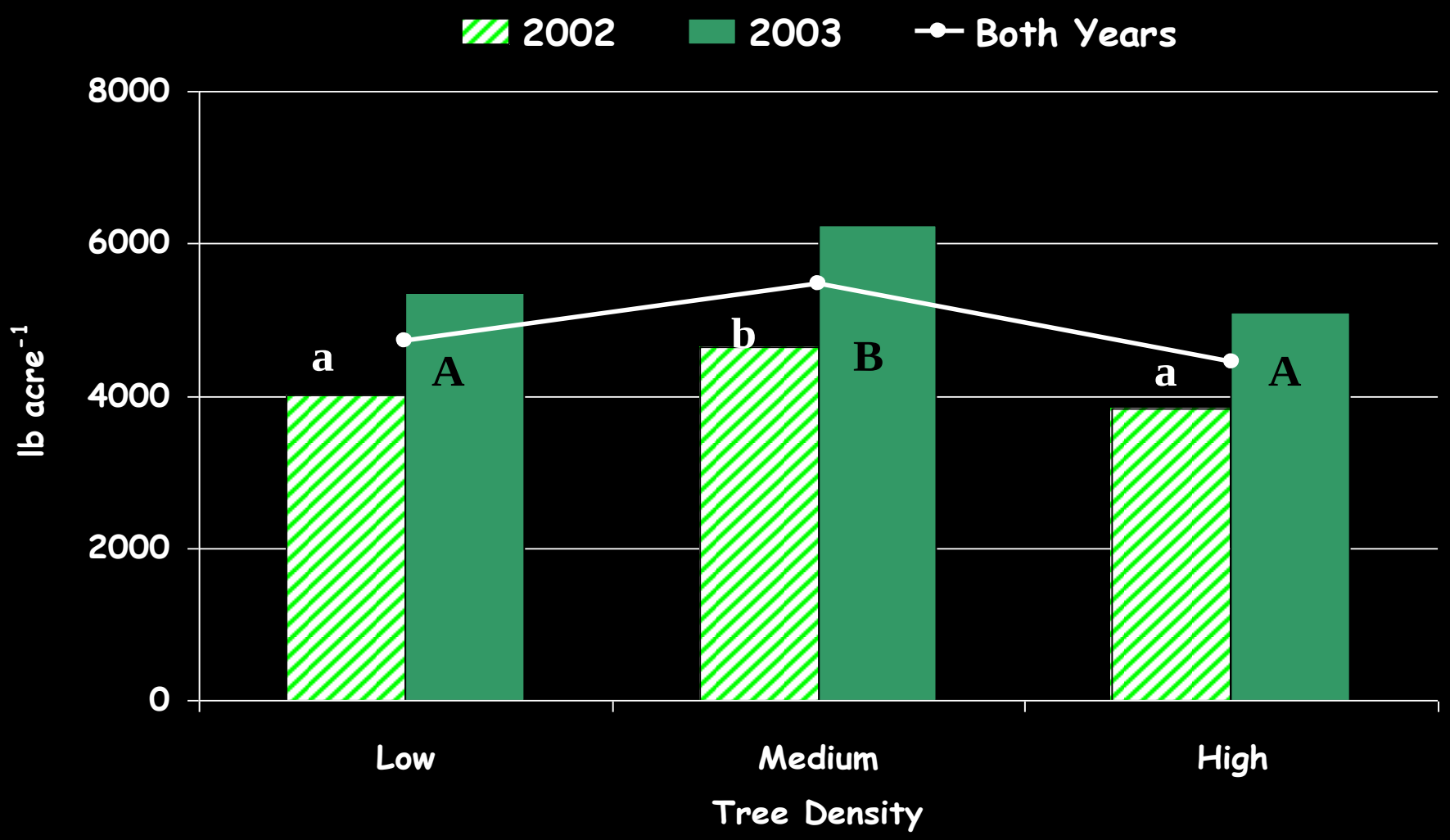
Soil Moisture



- *Variable response across the soil and site conditions and tree species*
  - Deciduous trees: often no differences
  - Lower evapotranspiration

System output implications?

Forage Production



Forage nutritive value

Shaded plants (light or temp effects) can have -

- Greater mineral concentrations
- Greater CP
- Lower fiber (NDF)
- Reduced sugars, but
- Greater fiber digestibility – may offset sugar loss

Livestock production

Livestock production w/ shade and shelter

Shade can

- Reduce heat stress
- Increase daily gain
  - Cows: 1.28 vs. -0.04
  - Calves: 1.85 vs. 1.17
- Trees better than artificial shade

Winter exposure is expensive

– Greater feed demand

– Lower gain

U.Mo. Agroforestry Center

(Kallenbach et al., 2005)

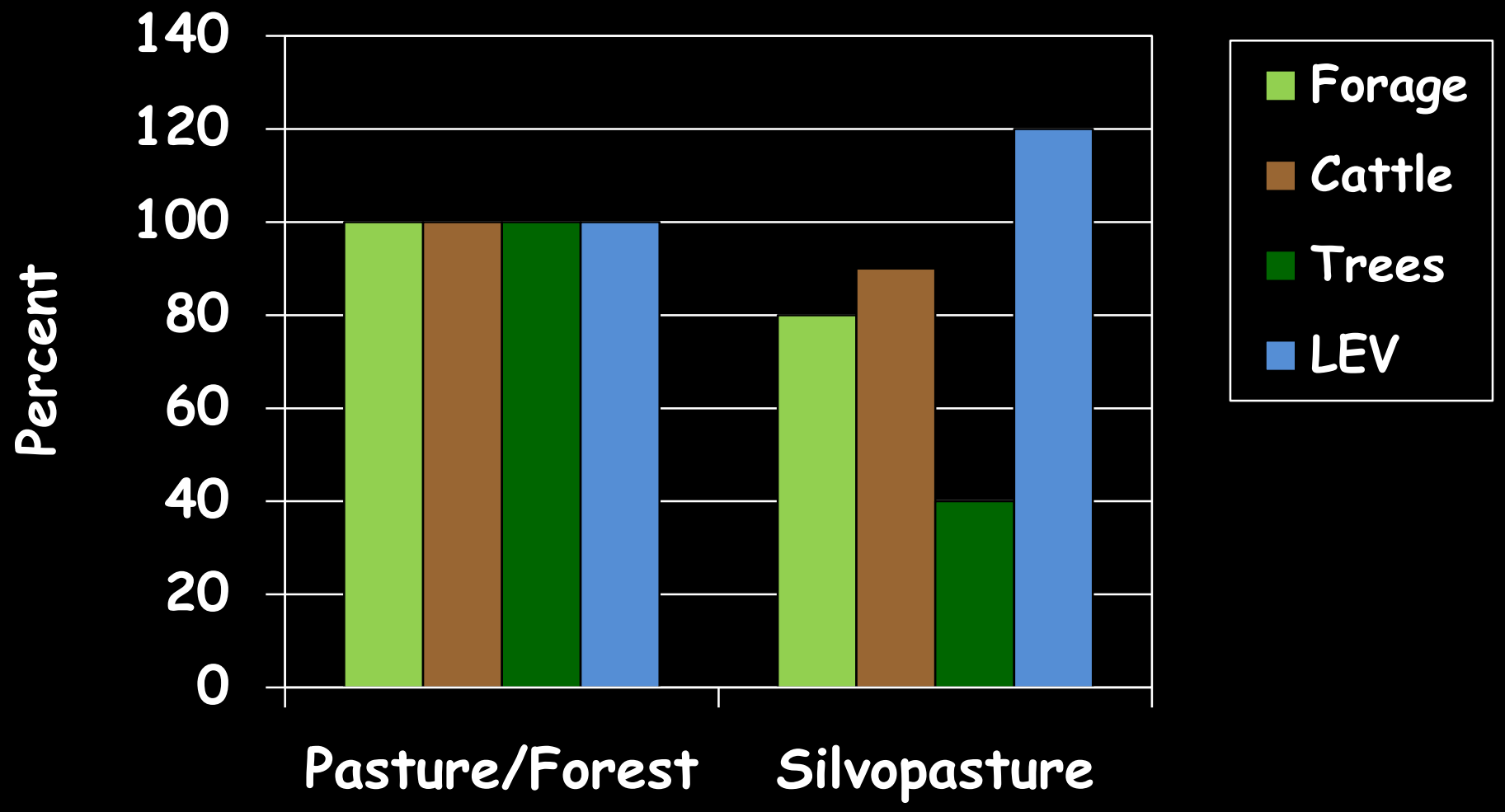
Annual ryegrass in a pine-walnut system

- Reduced seasonal forage yield (20%)
- Forage of greater nutritive value
- No difference in animal gain

Managing relationships

Even if all relationships are “negative competitive”, silvopastures can be more productive than open pasture

Land Equivalency Value (Ratio)



Profit – a case study from Missouri

The Tomazi Farm

- 210 acres divided into 31 paddocks
  - 6 - 9 acres each paddock
  - 84 head cow/calf operation
  - Rotational grazing system
- Reason for adopting silvopasture:
  - Improved weight gain in the heat of the summer,
  - Increased grass acreage without purchasing or renting (put non-productive land into production)

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

L. Godsey, U. Mo.

Profit – a case study from Missouri

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

L. Godsey, U. Mo.

Economic Analysis

- From June 15 – Aug 15, 2010
  - ADG: 1.6 - 2.1 lbs/hd/day
    - (Typical ADG: 0 –(– 1) lb/hd/day)
  - ≅ 96 – 126 lbs/hd
  - $130 - $170/hd
  - $10,920 - $14,280 increase in profit
- The silvopasture edges are estimated to cost about $1200/acre ($3,500 total).
- B/C ratio: 3.12 – 4.08

L. Godsey, U. Mo.

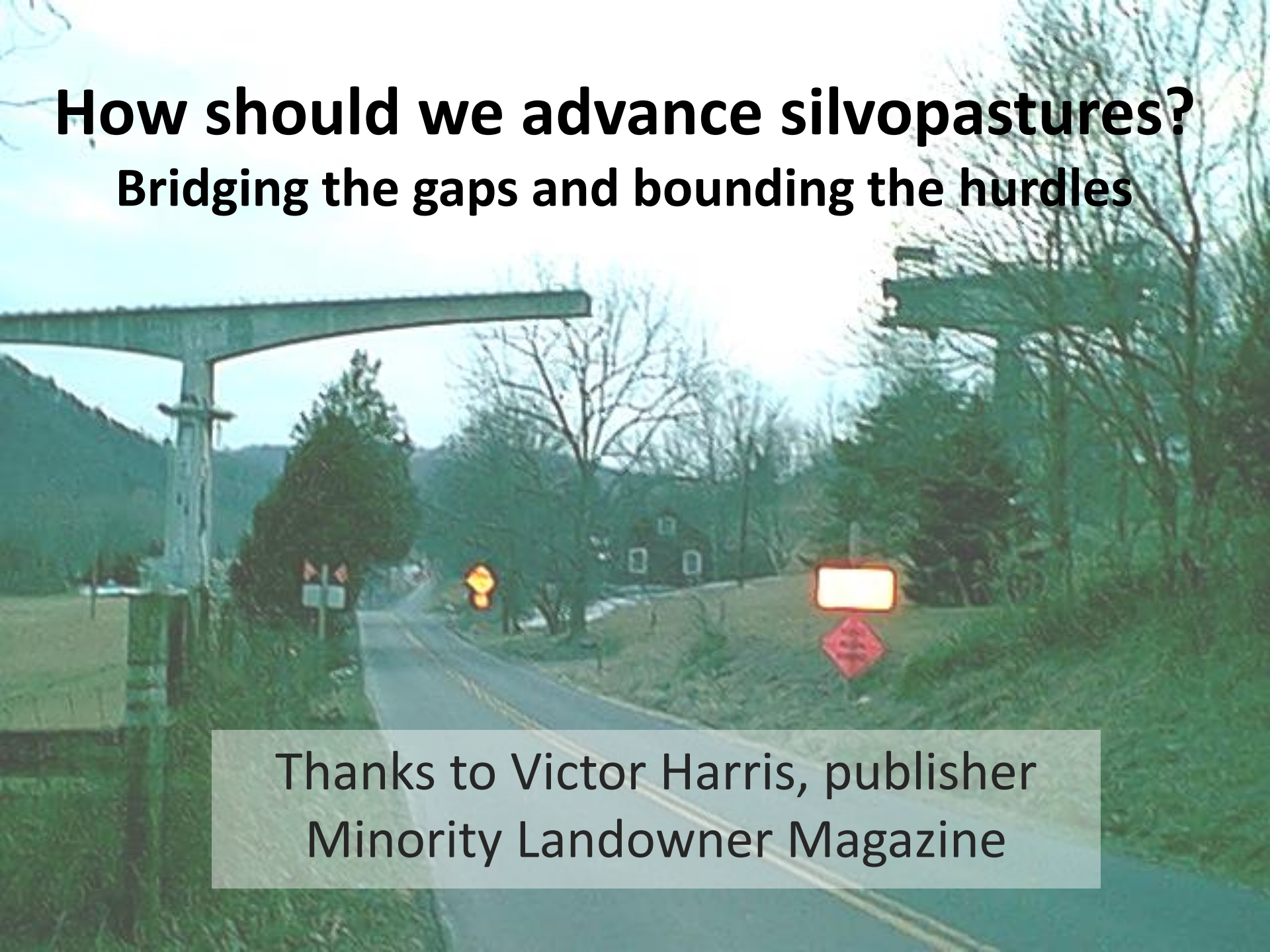
And more!

- Aesthetic appeal
- Conservation benefits
  - Bird and wildlife habitat
  - Reduced stream use by livestock

http://vawatercentralnewsgrouper.wordpress.com/2012/12/05/new-stream-livestock-fencing-funds-and-initiative-announced-by-va-governors-office-on-dec-5-2012/

How should we advance silvopastures?

Bridging the gaps and bounding the hurdles



Thanks to Victor Harris, publisher
Minority Landowner Magazine

Getting to SP: *Knowledge gaps*

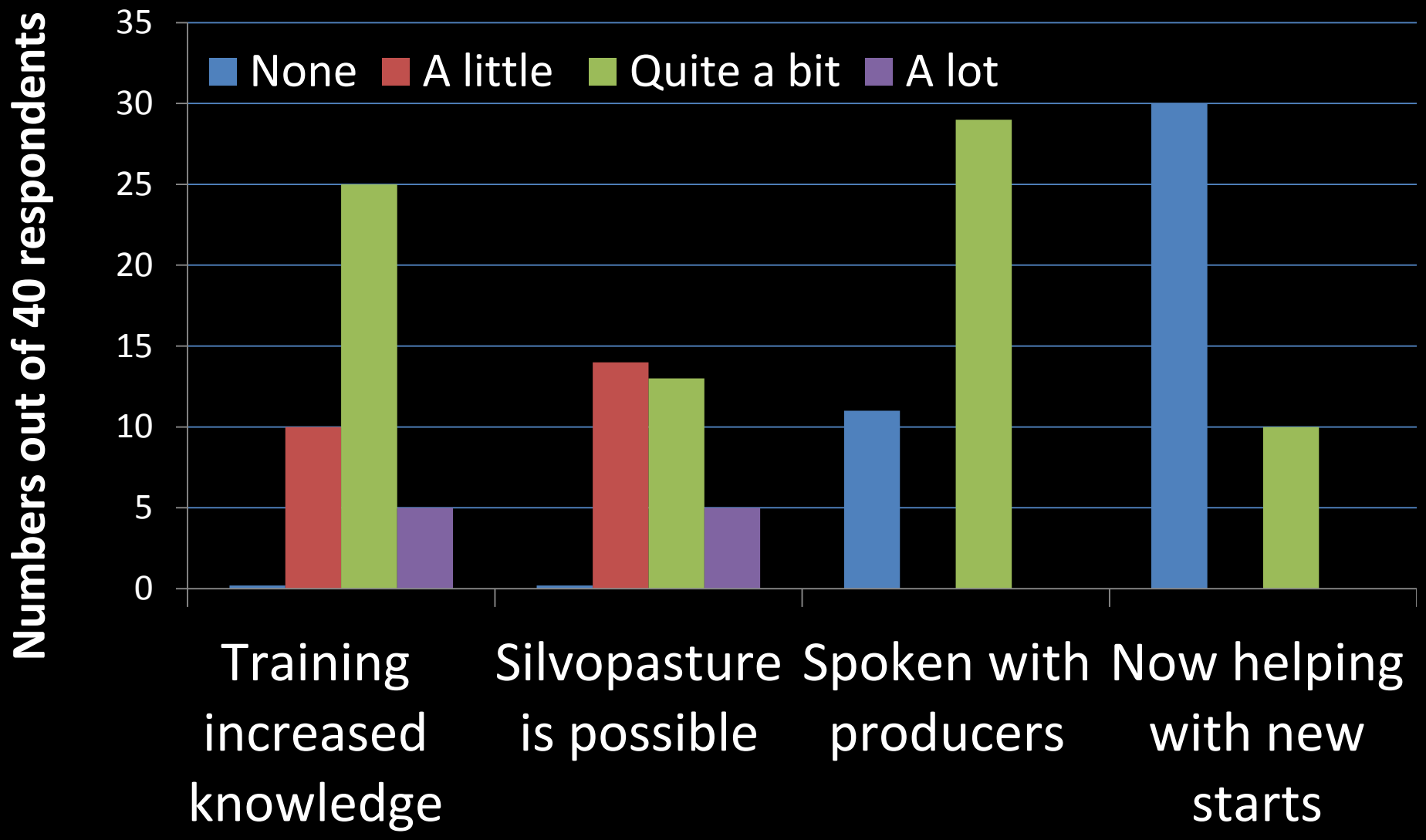
- Trees
  - Species
  - Site suitability
  - Spatial arrangement
  - Protection
  - Thinning/pruning needs
- Forages
  - Establishment
  - Nutrient inputs
  - Shade adaptation
- Livestock
  - Needs/suitability
- Economics
  - Establishment costs
  - Markets for products
  - Future tree value
  - Labor to implement/manage
  - Getting value from small acreages
- Social drivers
  - Aesthetic value
  - Land tenure

Getting to SP: *Cultural hurdles*

- Environmentalist /conservation communities
  - Complexity/diversity preferred
    - Regeneration impossible with large herbivores
    - Forest soil degradation
    - Tree productivity and wood quality impacts
    - Native species loss and wildlife habitat degradation
- Agriculturalist/productivist communities
  - Systems managed by reducing complexity
    - Trees compete with desired crop
    - No interest/ability to harvest trees/tree products
    - Trees impede equipment
    - Ready reliance on cheap non-renewable inputs

Integrated, team approach

Response to training in VA



Silvopasture management

…requires shifting our thinking in both spatial and temporal domains and demands skills in managing [complexity] rather than reducing complexity…

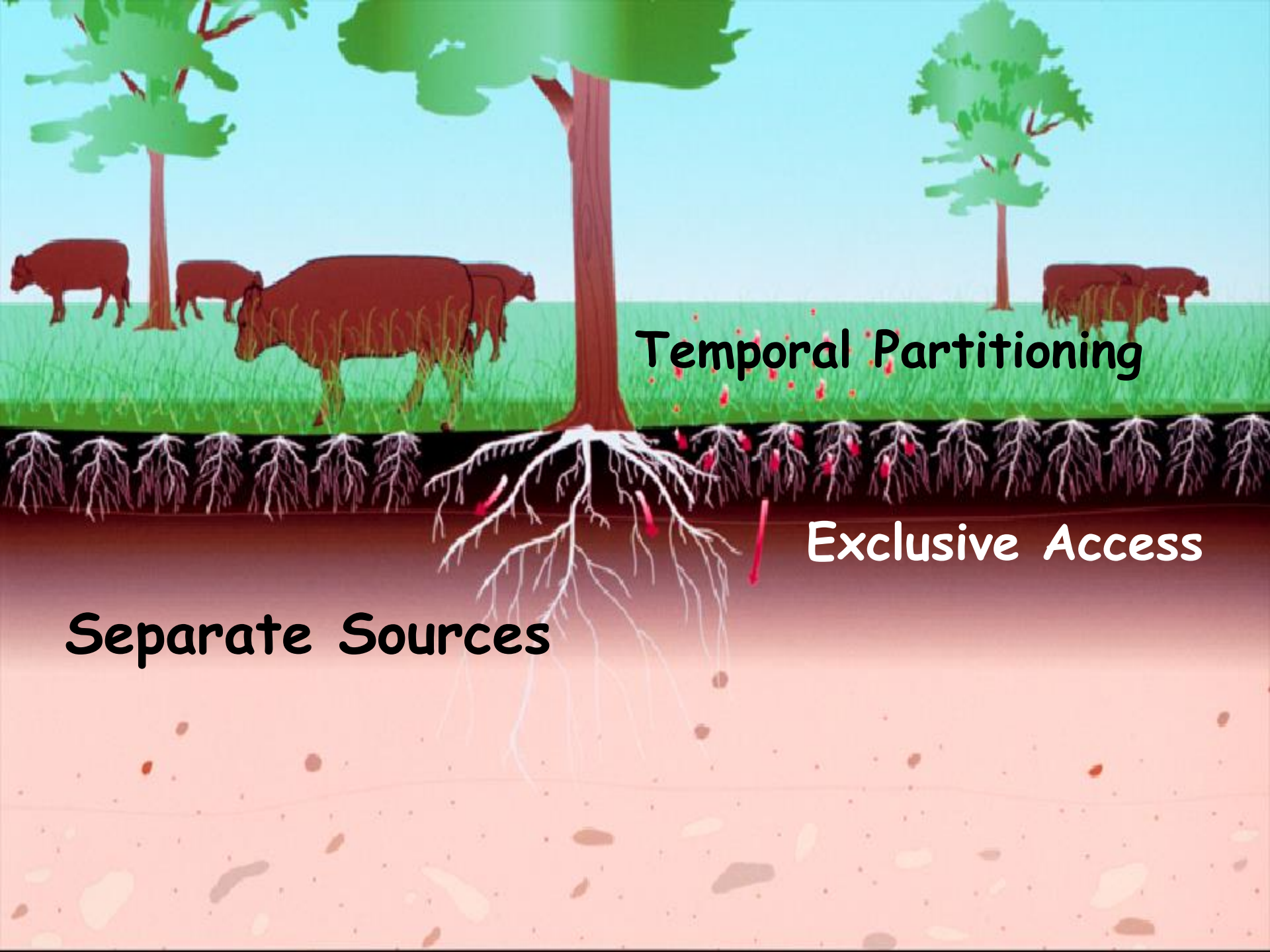
Garrett et al., ’04

Thanks!

jfike@vt.edu

Replacing TF often not an option


High
Yielding
Tree
Low
Yielding
Tree


Temporal Partitioning
Exclusive Access
Separate Sources

Management considerations for establishing silvopastures

What are the existing resources?

- Environment/Climate
- Tree species: thinning or planting
- Forages and Livestock
- Markets
- Producer ability and management goals
- Social / economic constraints

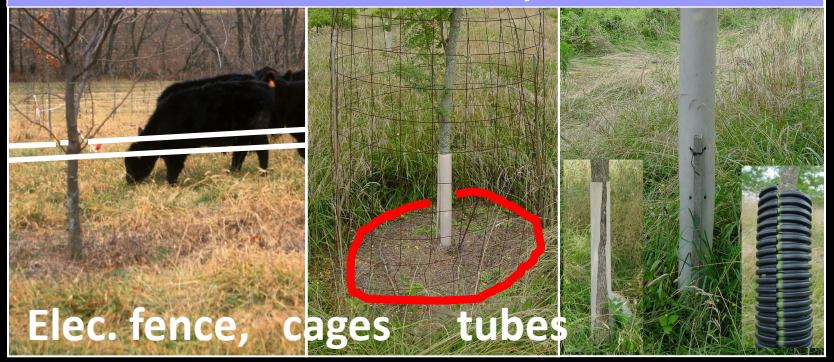
Thinning vs. planting

Larger trees (still require mgmt)
Have to work with what you have

Takes time to reach size
Can choose species, configuration

Renovation opportunity
Tree selection, nutrient input ?s

Protection may be required
Doesn't have to be fancy



Thinning trees - selection criteria

1) market demand (both thinned/“leave” trees)
2) marketable size and timber quality
3) epicormic branching issues
4) invasive? (ailanthus, autumn olive)
5) level of shading (e.g., maples)
6) spatial constraints or infrastructural needs
7) soil compaction
8) labor required

Resource advisors – knowledgeable, collaborative

Companion forages

<u>Grasses</u>

- VA: The usual suspects
  - Arkansas pine data: orchardgrass > fescue
  - Va walnuts: fescue better adapted
- Deep South: W-S grasses okay with pine

<u>Legumes</u>

- Shade tolerance may be an issue
- Clovers, alfalfa sensitive to juglone (walnuts)

Planting trees - selection criteria

1) marketable timber
2) high-quality wood
3) rapid growth
4) deep-rooted morphology
5) drought tolerance
6) additional products (nuts, fodder) and livestock compatibility
7) provision of environmental conservation services
8) labor required
9) rotation length – fxn of:
    1) Producer goals
    2) Land tenure needs/constraints

Planting trees also allows control of spatial arrangement: Rows, spacing, orientation

Planting trees – a few possible species

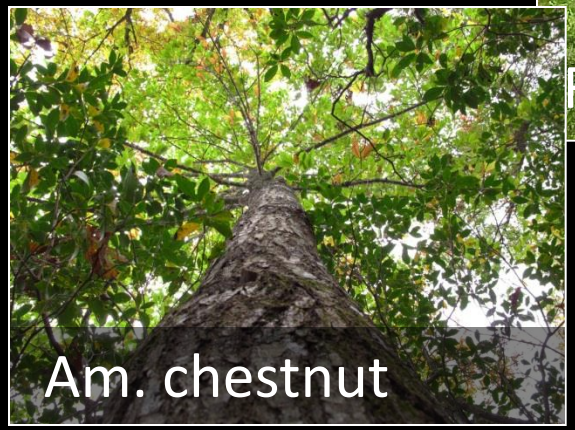
- Fruit trees – apple, cherry, pear, etc.
- Nut trees – walnut*, pecan*, hickory*, American chestnut?
- Locusts*: black†, honey
- Yellow poplar (moderate shade)
- Oaks – white, northern red (high shade)
- Maple (high shade)
- Pines: Loblolly, Long-or Short-leaf, White

*"Warm-season" tree

†Biological N fixers

Match trees to conditions, needs

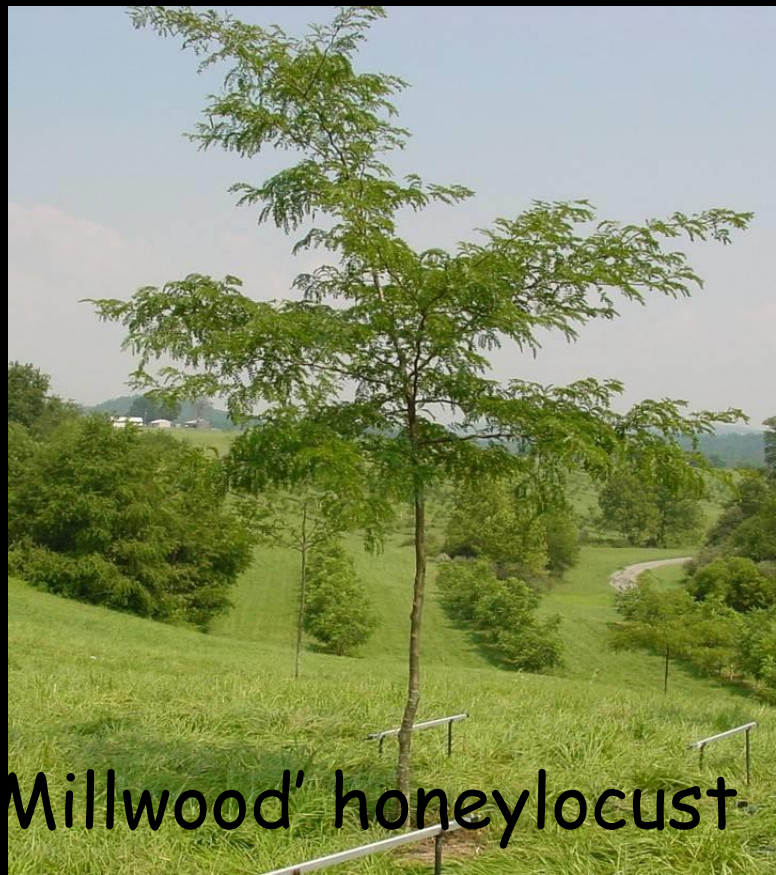
Select for site suitability
Rapid growth?
Market value
Multiple products: fruits, nuts, browse



Livestock-tree compatibility

<u>Tender, palatable trees need protection</u>

- Cows more likely to trample
- Small ruminants
  more likely to nibble
- Are wildlife a problem?
- Can site be hayed
  till trees big enough?



Protection methods

Eastern Red Cedar:

Challenge?

Or Opportunity?


Digital