

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

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Crop and Soil Environmental Sciences



Riparian buffers



Forest farming



Wind breaks

Agroforestry Practices



Silvopastures



Alley cropping

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

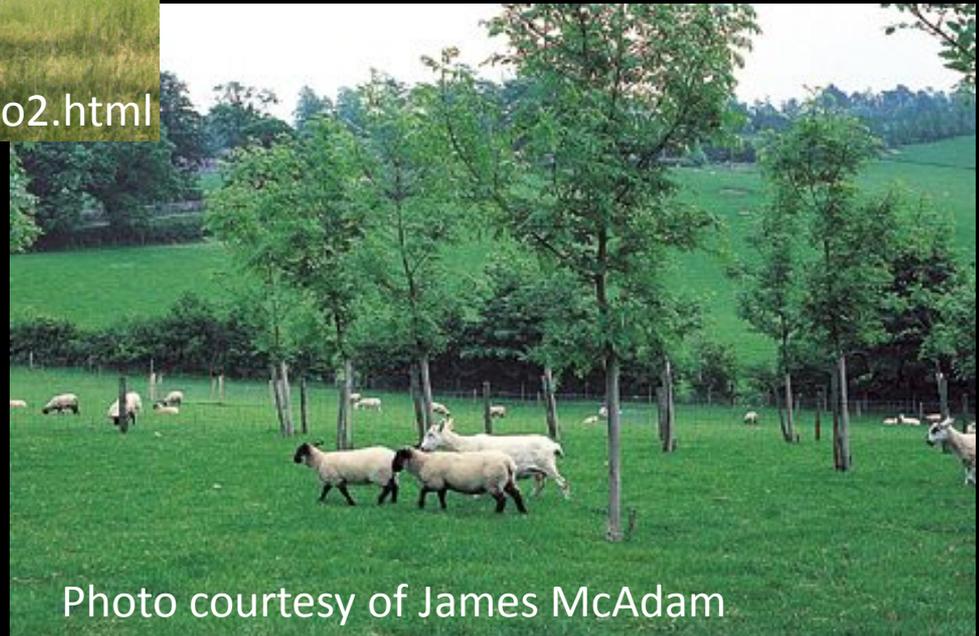
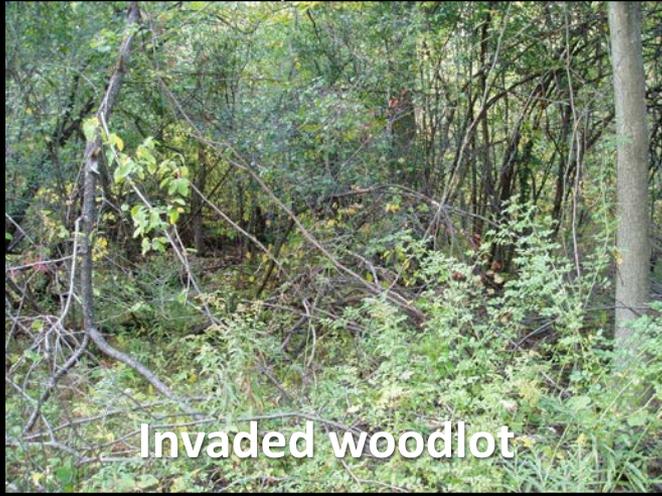


Photo courtesy of James McAdam

Getting to Silvopasture: Thinning

Watkins Glen, NY. Photos courtesy B. Chedzoy

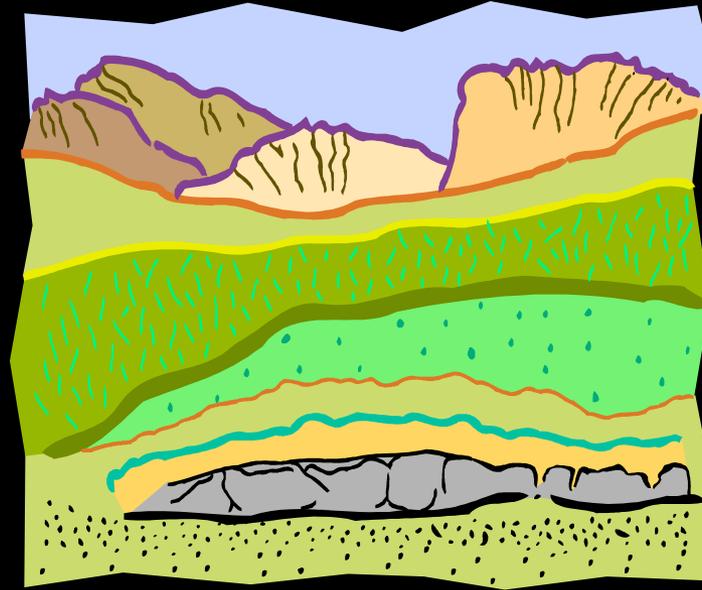


Creating valuable production systems from low quality forest stands – not vice versa.

Resources in silvopastures



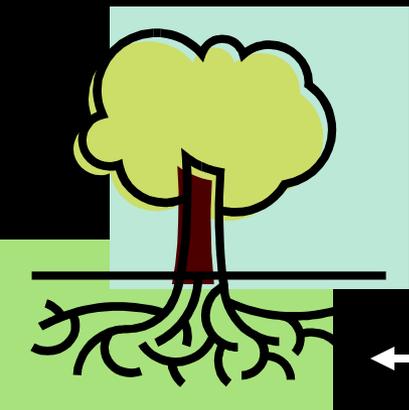
Light



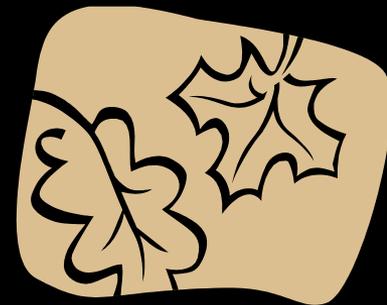
Soil nutrients



Moisture

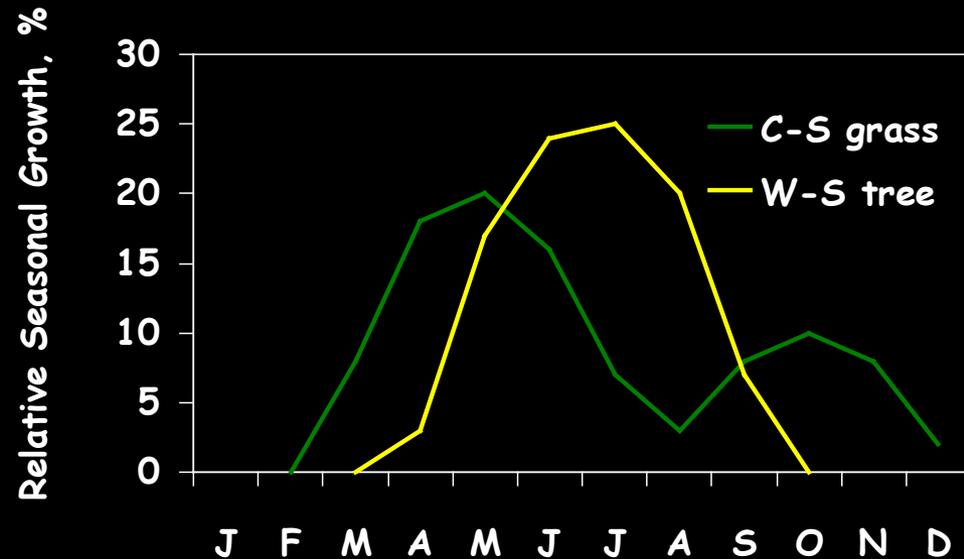
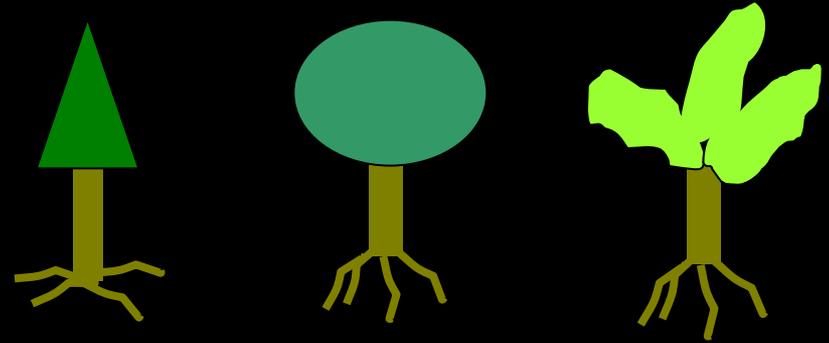


Nutrient returns



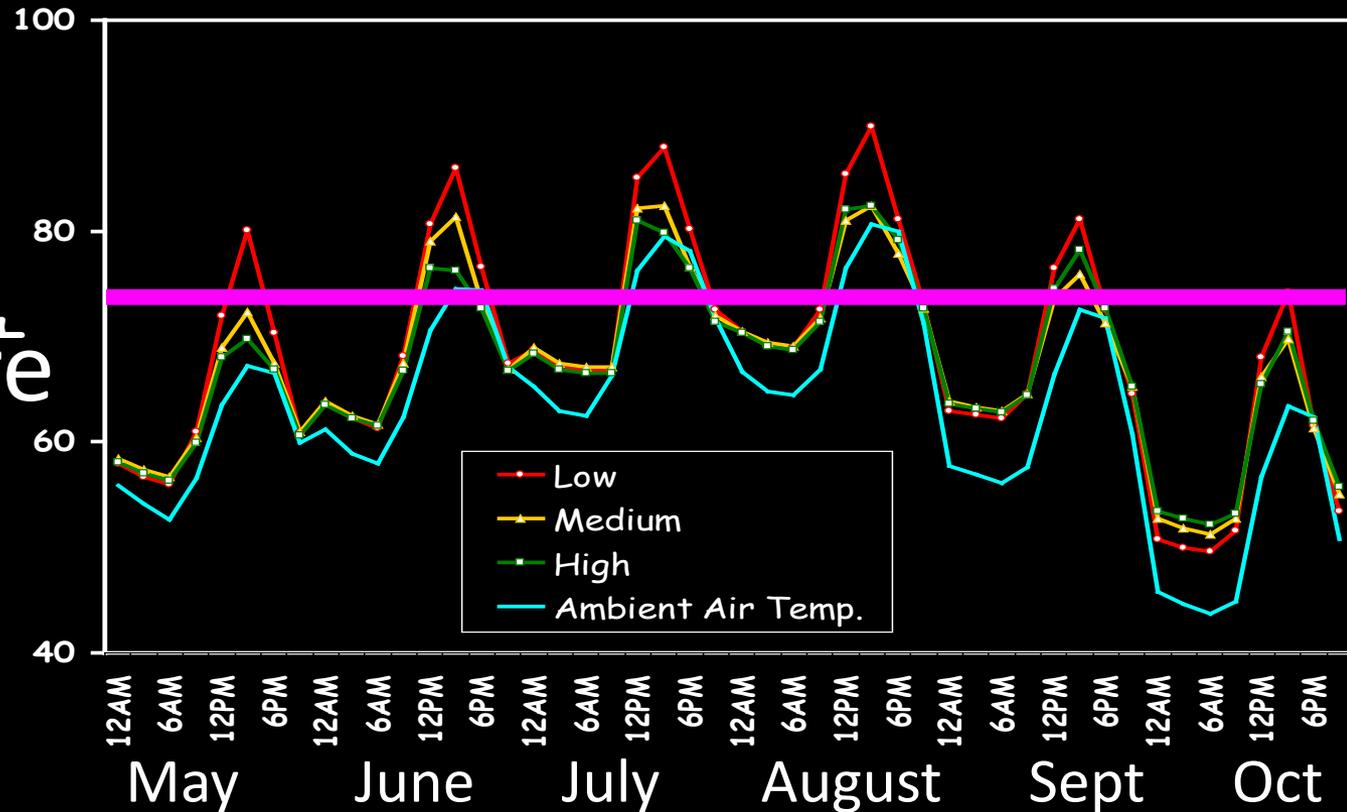
Light

- 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



&

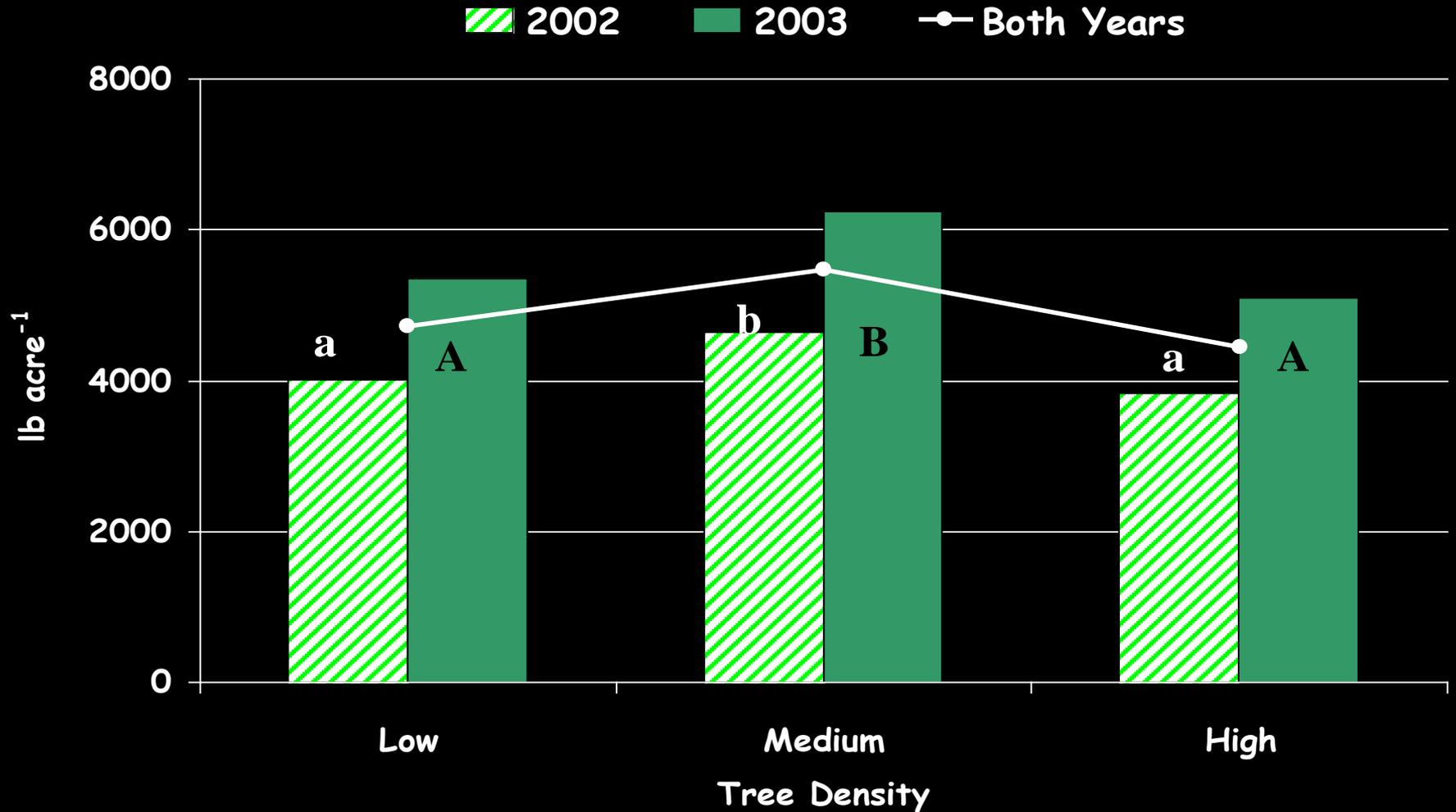
Soil
Moisture

- *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

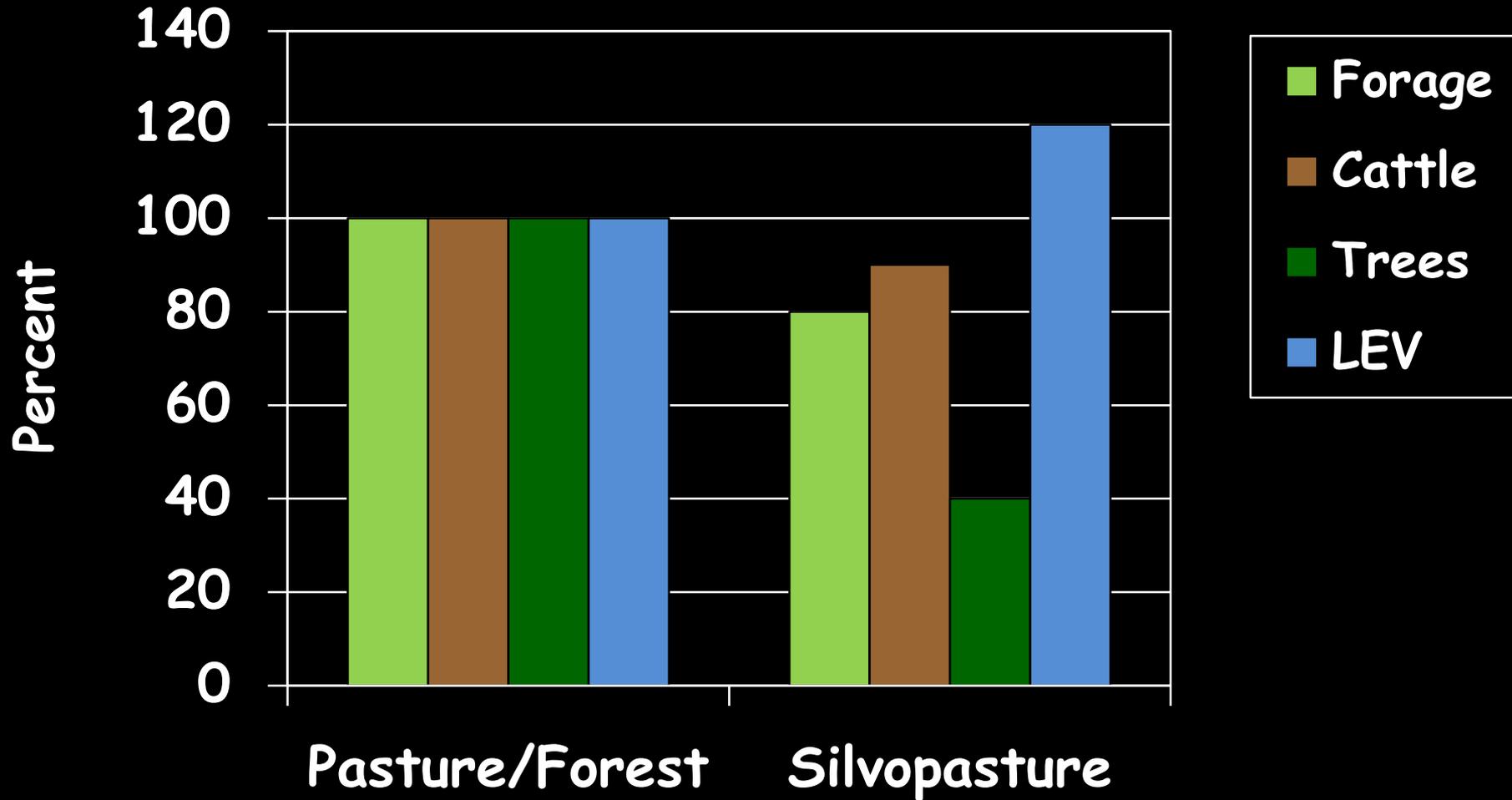
- Reduced seasonal forage yield (20%)
- Forage of greater nutritive value
- No difference in animal gain



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)



Profit – a case study from Missouri



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

Economic Analysis

- From June 15 – Aug 15, 2010
 - ADG: 1.6 - 2.1 lbs/hd/day
 - (Typical ADG: 0 –(- 1) lb/hd/day)
 - \cong 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

And more!

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

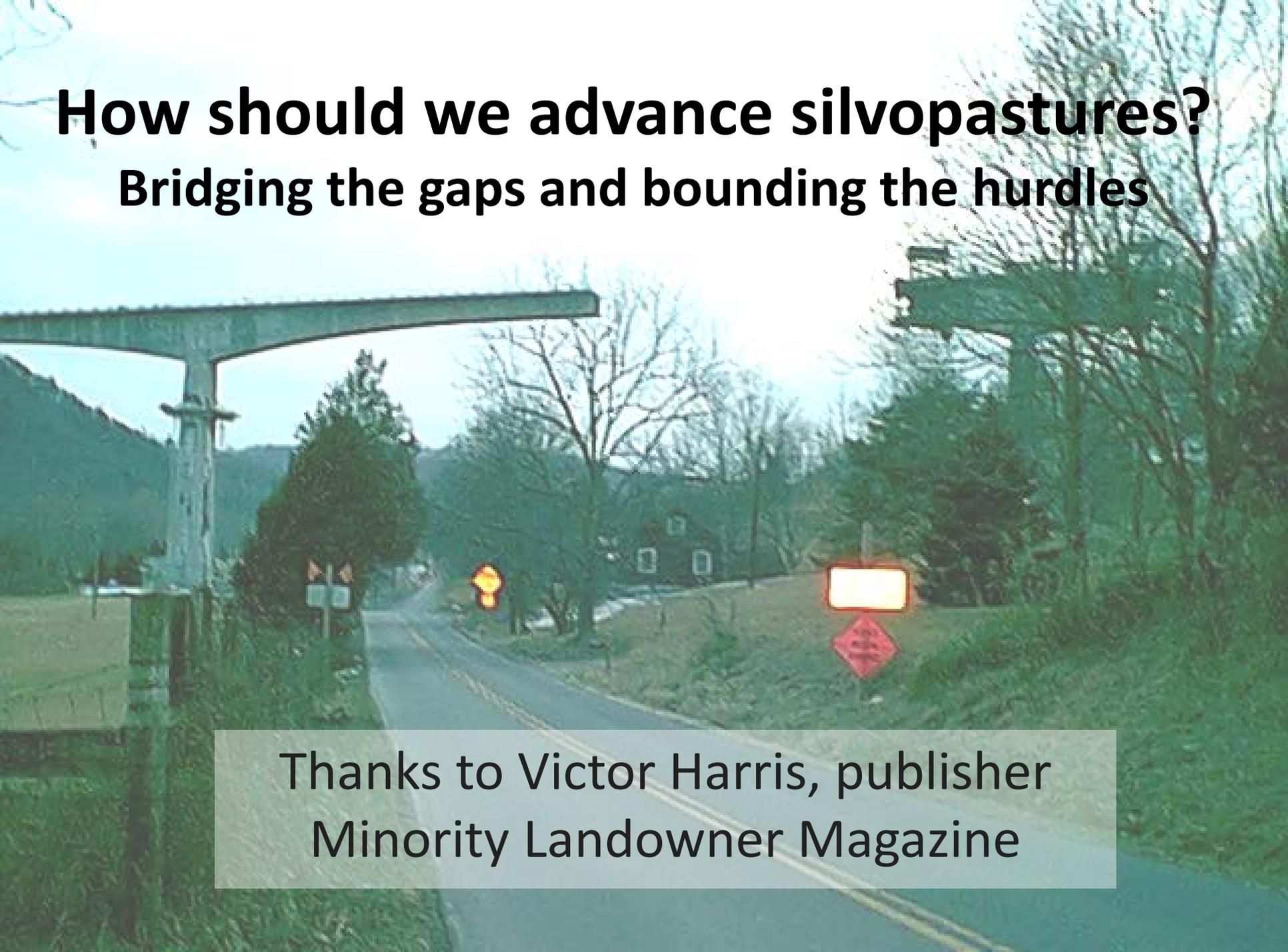


Shade in
pastures can
keep cows out
of streams



<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

A photograph of a rural road with silvopasture structures and signs. The road is paved and has a yellow double line down the center. On the left, there is a wooden structure with a curved top, possibly a gate or a shelter. On the right, there is a wooden structure with a flat top. In the background, there are trees and a house. The sky is overcast.

Thanks to Victor Harris, publisher
Minority Landowner Magazine

Getting to SP: Knowledge gaps

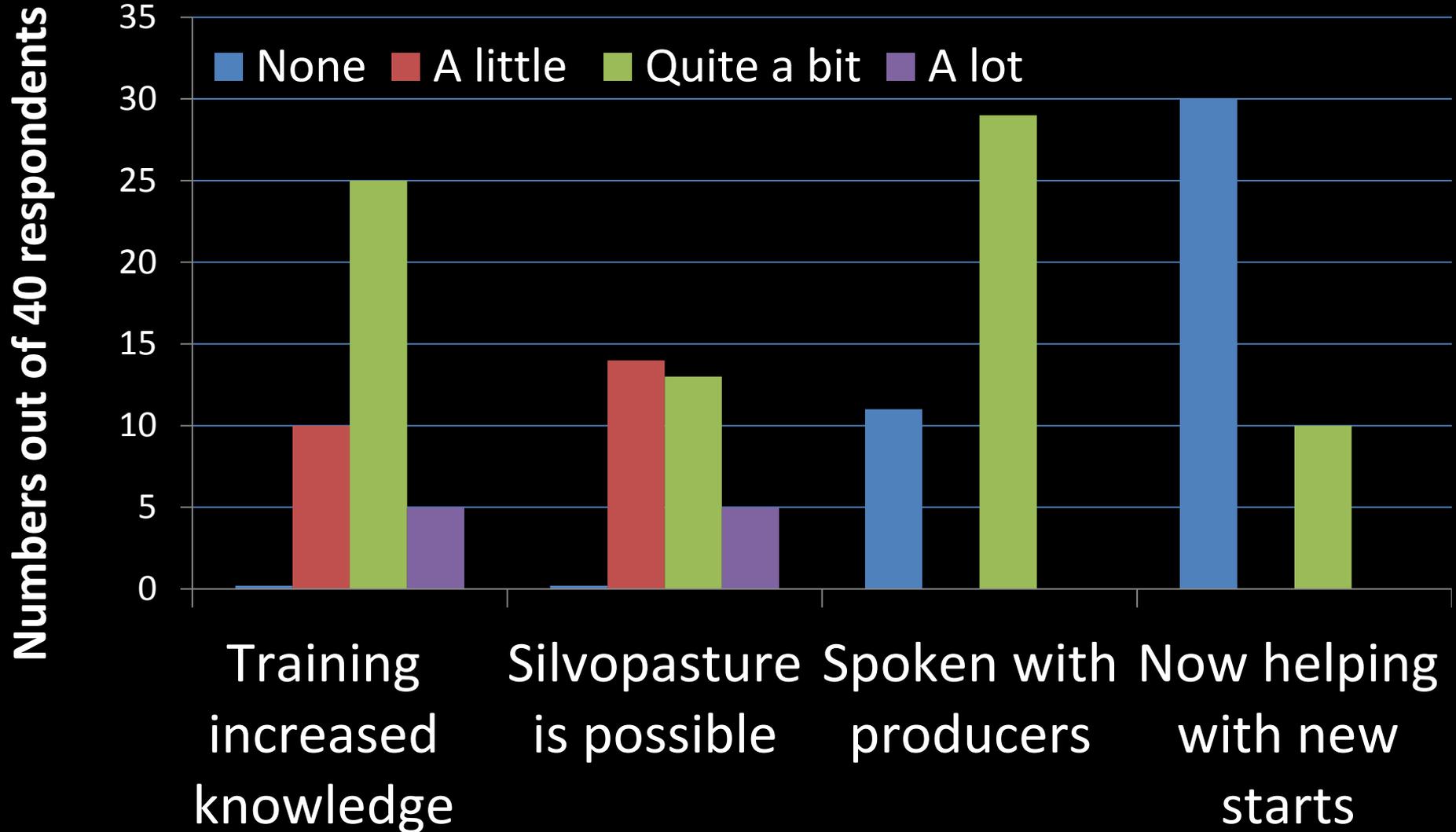
- Trees
 - Species
 - Site suitability
 - Spatial arrangement
 - Protection
 - Thinning/pruning needs
- Forages
 - Establishment
 - Nutrient inputs
 - Shade adaptation
- Livestock
 - Needs/suitability
- Economics
 - Establishment costs
 - Markets for products
 - Future tree value
 - Labor to implement/manage
 - 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



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!

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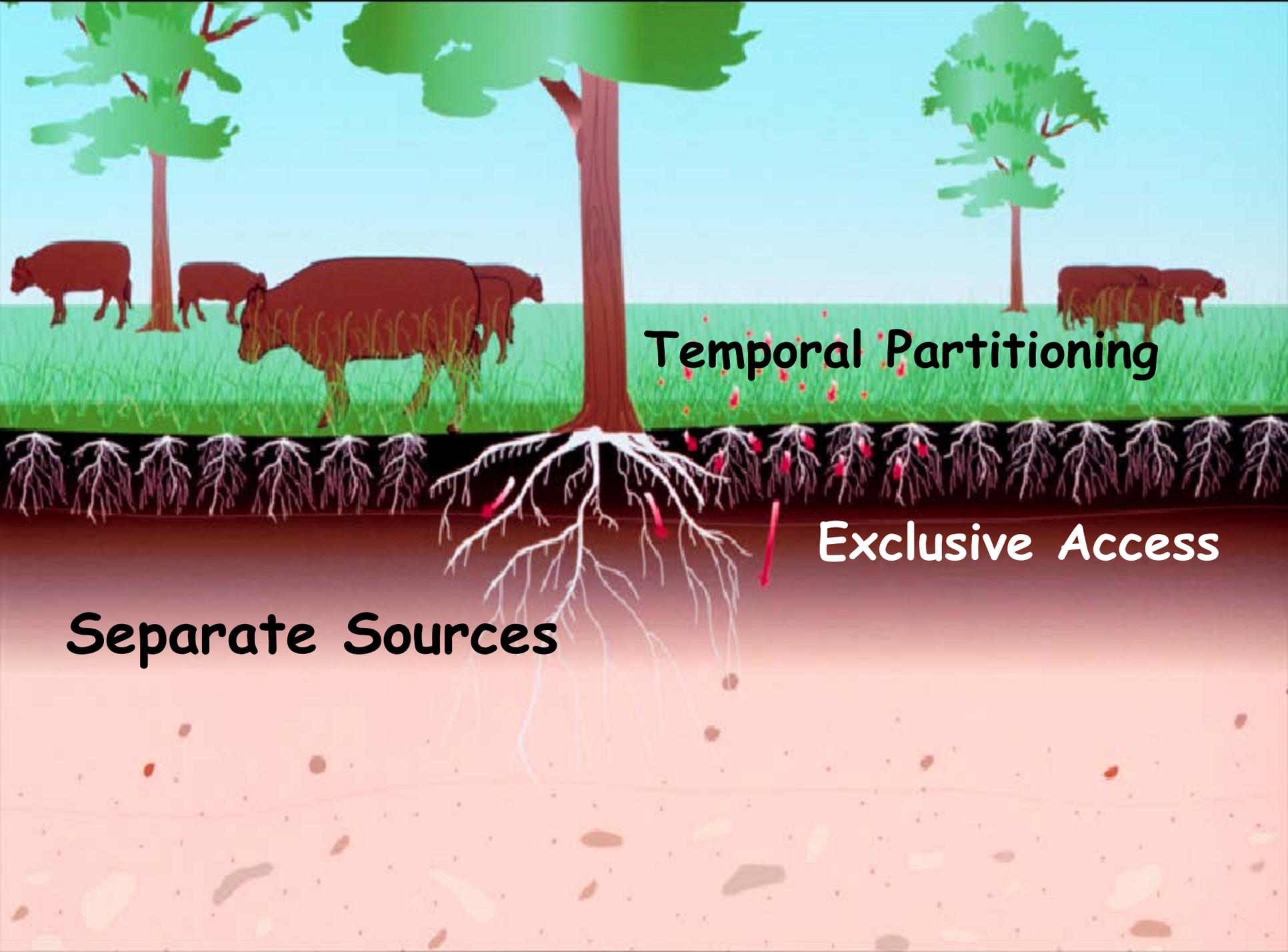
Replacing TF often not an option



High
Yielding
Tree

Low
Yielding
Tree





Temporal Partitioning

Exclusive Access

Separate Sources

Management considerations for establishing silvopastures

What are the existing resources?

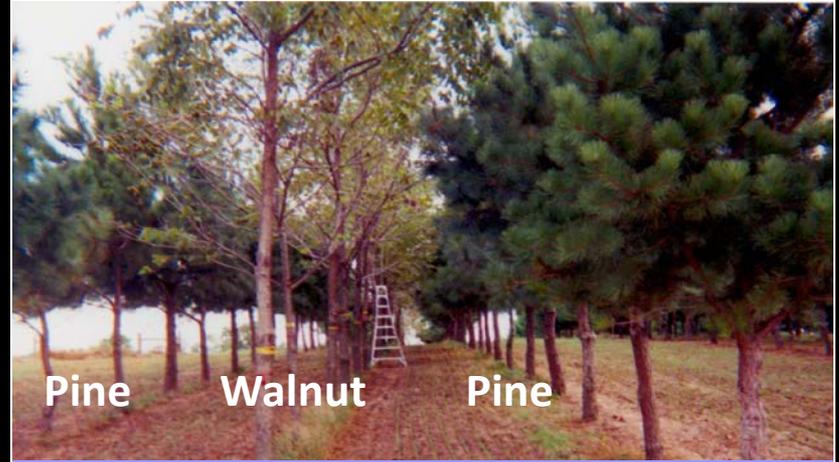
- Environment/Climate
- Tree species: thinning or planting
- Forages and Livestock
- Markets
- Producer ability and management goals
- Social / economic constraints

Thinning vs. planting

Eastern Red Cedar:
Challenge or Opportunity?



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



Elec. fence, cages tubes

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

Grasses

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

Legumes

- 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

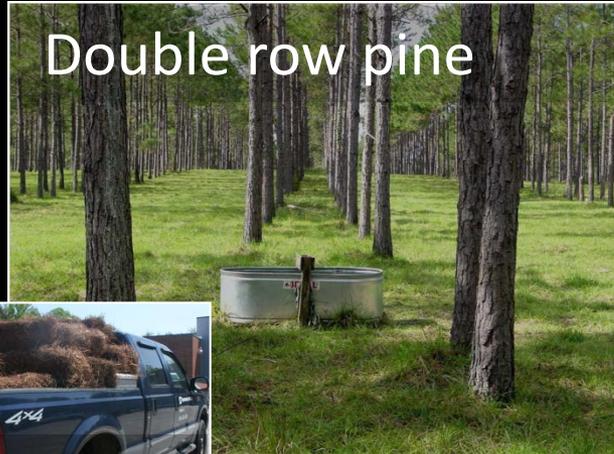
Match trees to conditions, needs

Select for site suitability

Rapid growth?

Market value

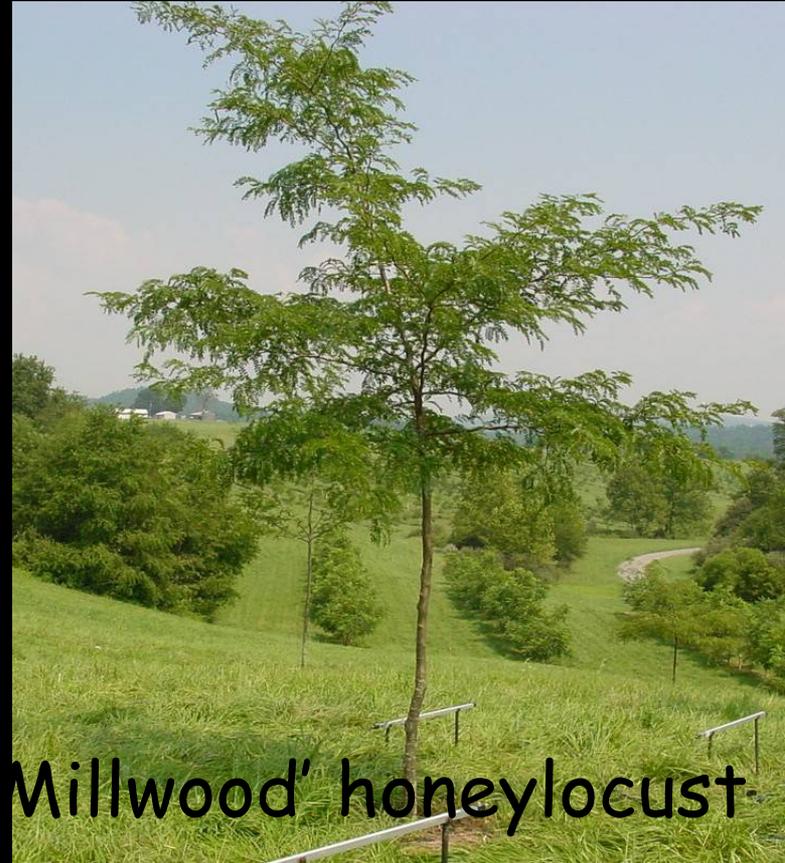
Multiple products: fruits, nuts, browse



Livestock-tree compatibility

Tender, palatable trees need protection

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

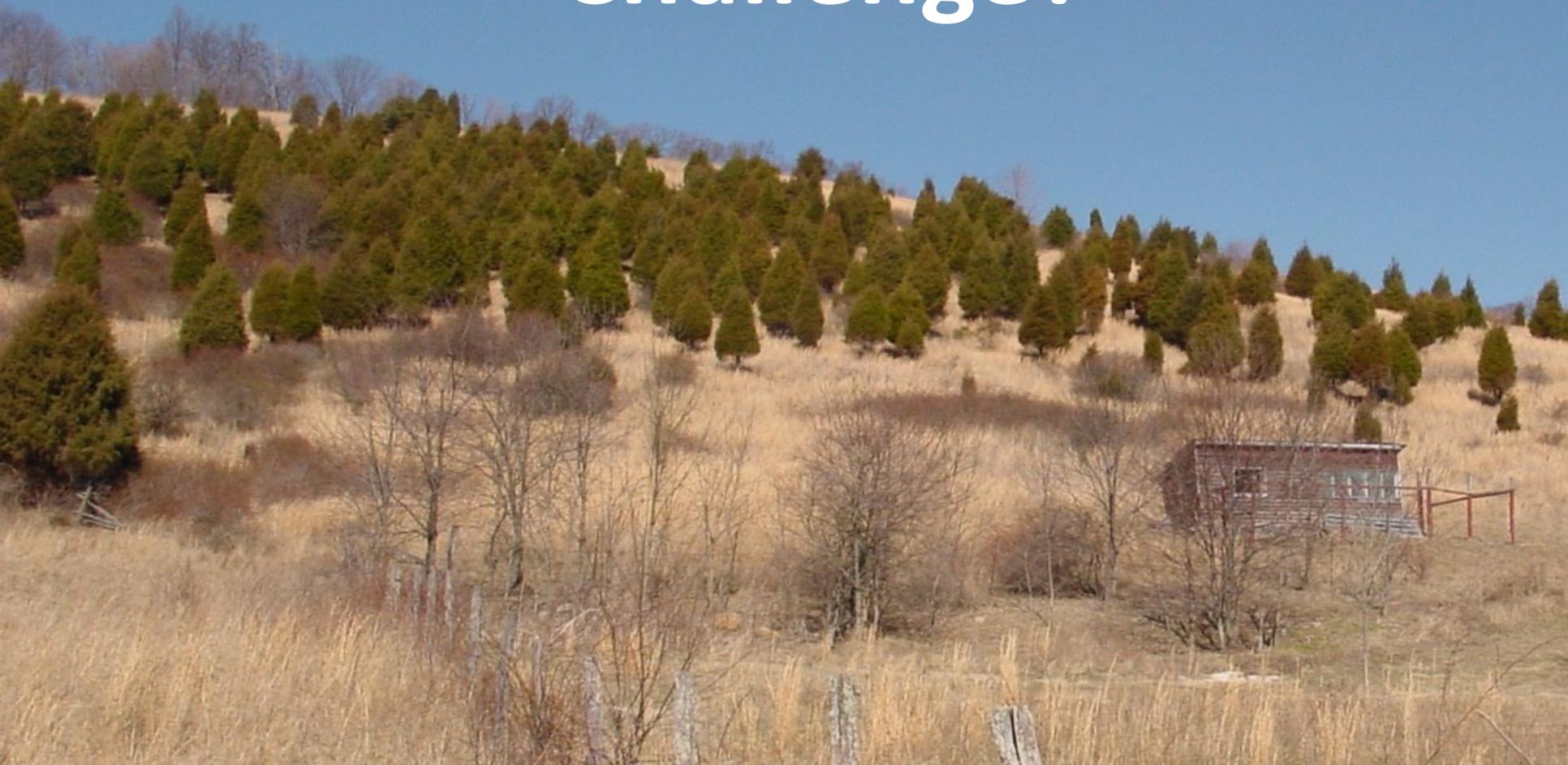


Millwood' honeylocust

Protection methods



Eastern Red Cedar: Challenge?



Or Opportunity?





