Forage Establishment and Management in Silvopastures

The 2nd Northeast Silvopasture Conference
January 30, 2014

Joe Orefice: joseph.orefice@gmail.com
Owner/operator, North Branch Farm, Saranac, NY
www.adkfigs.com
Assistant Professor, Paul Smith's College
NRESS PhD Student, University of New Hampshire

Presentation Outline

- Forage Selection
- Pasture Conversions to Silvopasture
- Forest Conversions to Silvopasture
  - Forage Establishment and Management
- Forage Study, North Branch Farm
  - An argument for silvopasture: Woodland Grazing
- Future Research

Forage Selection – What's Currently Persisting?

Desirable Forage Characteristics in Silvopastures

- Shade/tree tolerant (Cool-Season Forages)
- Nutritious (shade grown tend to me more nutritious and digestible)
  - Heading dates should dovetail with grazing schedules
- Persistent through time
- Respond well to grazing
- Legume component


Fiacchio, Italy

Table 3. Total above ground dry weight of 23 forages under three levels of shade during the 1995 spring-early summer growing season at New Franklin, Missouri (92°46′ W; 39°01′ N).

Species	Full sun (g)	50% Shade (g)	80% shade (g)
Introduced cool-season grasses			
Kentucky bluegrass	22.53a	11.48b	6.81b
Orchardgrass 'Benchmark'	52.61a	37.41a	30.57a
Orchardgrass 'Justus'	25.178a	24.90a	18.52a
Ryegrass 'Manhattan II'	31.52a	14.66b	13.14b
Smooth bromegrass	37.57a	21.76b	17.99b
Tall Fescue 'KY31'	35.63a	24.91a	23.99a
Tall Fescue 'Martin'	31.69a	21.65b	15.83b
Timothy	50.65a	33.32b	23.92c
Native warm-season grasses			
Big bluestem	22.53a	10.95b	5.53b
Indiangrass	15.06a	6.34b	3.41b
Switchgrass	35.53a	18.18b	6.85c
Introduced cool-season legumes			
Alfalfa 'Cody'	30.29a	18.90ab	8.57b
Alfalfa 'Vernal'	24.77a	15.83ab	6.28b
Alsike clover	46.47a	23.68b	5.58b
Berseem clover	49.18a	31.87ab	17.33b
Birdfoot trefoil hybrid Rhizomatous	17.11a	4.63b	1.36b
Birdsfoot trefoil 'Nocern'	24.34a	9.56b	5.65b
White clover	51.73a	24.63b	22.69b
Red clover	60.93a	38.76b	17.84b

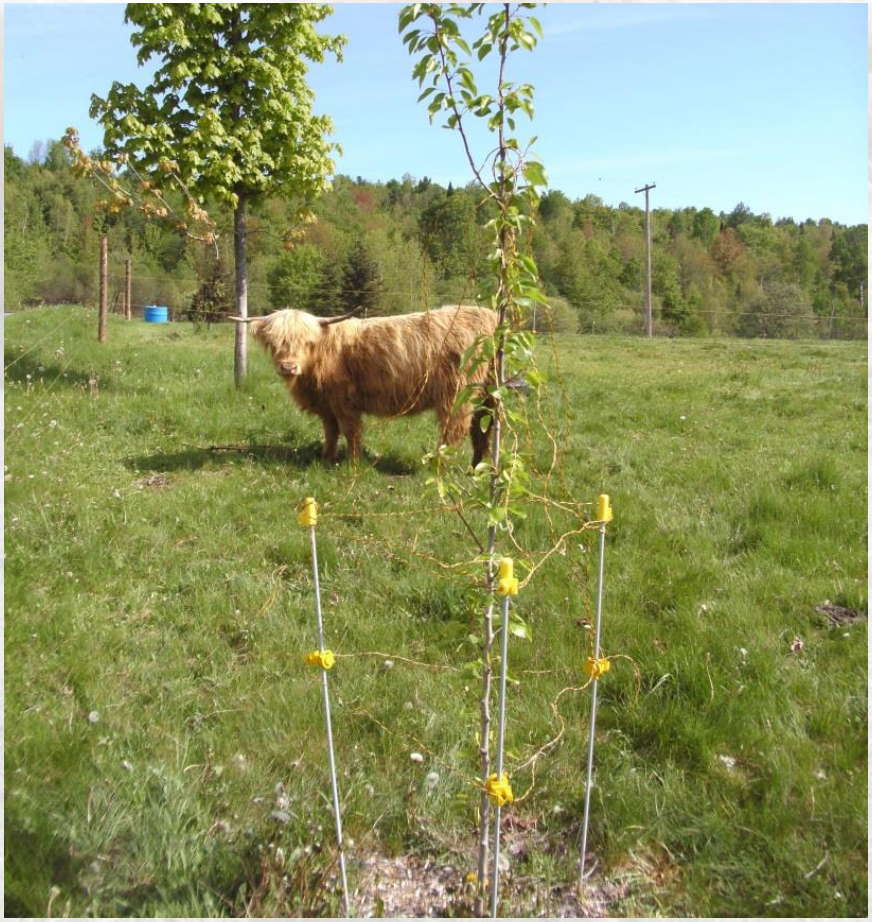
Lin et al 1999, Agroforestry Systems

Table 2. Total above ground dry weight of 27 forages under three levels of shade during the 1994 and 1995 summer-fall growing season at New Franklin, Missouri (92°46′ W; 39°01′ N).

Species	Full sun (g)	50% shade (g)	80% shade (g)
Introduced cool-season grasses			
Kentucky bluegrass	12.45a	12.30a	8.06b
Orchardgrass 'Benchmark'	13.83a	11.73a	6.36b
Orchardgrass 'Justus'	11.71a	11.16a	9.53a
Ryegrass 'Manhattan II'	12.69a	11.10ab	8.59b
Smooth bromegrass	9.61b	11.95a	9.54b
Tall Fescue 'KY31'	13.28a	16.24a	7.96b
Tall Fescue 'Martin'	12.36a	11.79a	6.09b
Timothy	10.23a	8.97a	5.49b
Introduced warm-season grasses			
Bermudagrass	56.05a	37.04b	8.59c
Native warm-season grasses			
Big bluestem	45.27a	33.41b	17.76c
Buffalograss	29.86a	13.67b	6.12b
Indiangrass	42.34a	30.72b	16.86c
Switchgrass	79.46a	57.59b	26.47c
Introduced cool-season legumes			
Alfalfa 'Cody'	6.21a	5.31ab	3.76b
Alfalfa 'Vernal'	9.44a	7.13b	4.23c
Alsike clover	17.02a	9.78b	5.43c
Berseem clover	15.99a	6.95b	2.88c
Birdfoot trefoil hybrid Rhizomatous	15.01a	9.83b	5.28c
Birdsfoot Trefoil 'Nocern'	19.61a	12.65b	5.96c
White clover	15.98a	13.02a	9.45b
Red clover	19.88a	12.08b	3.12c

Lin et al 1999, Agroforestry Systems

Pasture → Silvopasture



North Branch Farm

Pasture Conversions: Is it worth changing forages?

If so, do it before tree roots establish

Tunbridge, VT

Forest → Silvopasture

North Branch Farm

What are you starting with?

Site preparation

Site preparation → to Soil Degradation

Undisclosed NY farm

Slash is competition

Soil Amendments – Get a soil test!

Consider Nitrogen and Lime, Forest Soil pH is often < 5

TABLE 7 - Crop Description, Relative Tolerance of Established Forages to Environmental Hazards, and Ease of Establishment E = Excellent; G = Good; F = Fair; P = Poor

Crop [1]	Cold Frost	Soil Drought	Wet-ness	pH	Estab-lishment	Growth Habit	Minimum Drainage	Minimum Fertility	Anti-Quality
LEGUMES									
Alfalfa	G	G	P	6.6 – 7.2	G-E	T	WD	H	B,S
Alsike clover	F	P	G	6.0 – 6.5	F	M	PD	M	B,S
Birdsfoot trefoil	G	F	G	6.0 – 6.8	P	M-S	SPD	M	T
Hairy vetch	F	F	F	5.8 – 6.5	G	VINY	MWD	M	B
Ladino clover	F	P	G	6.0 – 6.5	G-E	S	PD	M	B,S
Mammoth red clover	P	F	F	6.2 – 6.8	G	M	SPD	M	B,S
Medium red clover	G	F	F	6.2 – 6.8	G-E	M	SPD	M	B,S
Sweet clover	G	G	P	6.8 – 7.2	F	T	MWD	M	C
GRASSES									
Kentucky bluegrass	E	P	G	5.8 – 6.5	P	S	SPD	M	
Orchardgrass	F	G	F	5.5 - 8.2	G	M-T	SPD	M	
Perennial ryegrass [2,3]	P	P	G	5.0 – 8.3	E	M-S	SPD	H	
Red top	E	G	F	4.5 – 6.2	F	S	VPD	M	
Smooth bromegrass	E	G	F	5.5 – 6.5	F	M-T	MWD	H	A
Timothy	E	F	E	5.0 – 6.2	F	M-T	PD	M	

NATURAL RESOURCES CONSERVATION SERVICE Vermont NRCS

SPECIFICATION GUIDE SHEET

for PASTURE AND HAY PLANTING (512)

Seeding

Timing

- Similar to open pastures
  - Early spring or late summer
- Best right after harvesting
  - Prior to competition establishment
- Frost Seeding
- Adjacent Seed Source?

Application

- Broadcast seeding
- Double recommended rate
- Consider annual “nurse/catch” crop – rye
- Inoculate legumes
  - You’re going to need the nitrogen
- Bed seeds
  - Mineral soil
  - Livestock trampling
  - Light rain
  - Mechanical/Drags (issues with slash)
- Fertilize
- Winter hay seeding – Not all hay is created equal!

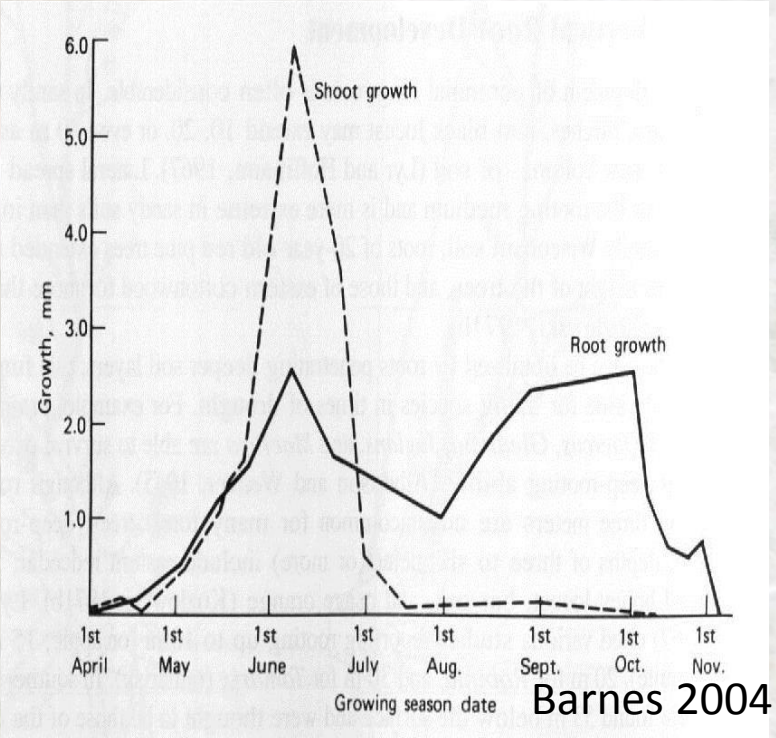
Forest Conversion – Manage Competition!

Prior to forest conversion, ask:

What and how much can my current livestock control?

Grazing Management

- Forest conversions: first few years should focus on defoliation of undesirable woody plants
- Rotational Grazing
  - < 5 day paddock rotations
  - 20+ day rest periods
- Avoid Grazing:
  - 1st year forages
  - Wet soils
  - During periods of heavy tree growth
  - Prior to winter (maintain 3” stubble)
  - Areas with bare soil or forages < 3”



Barnes 2004

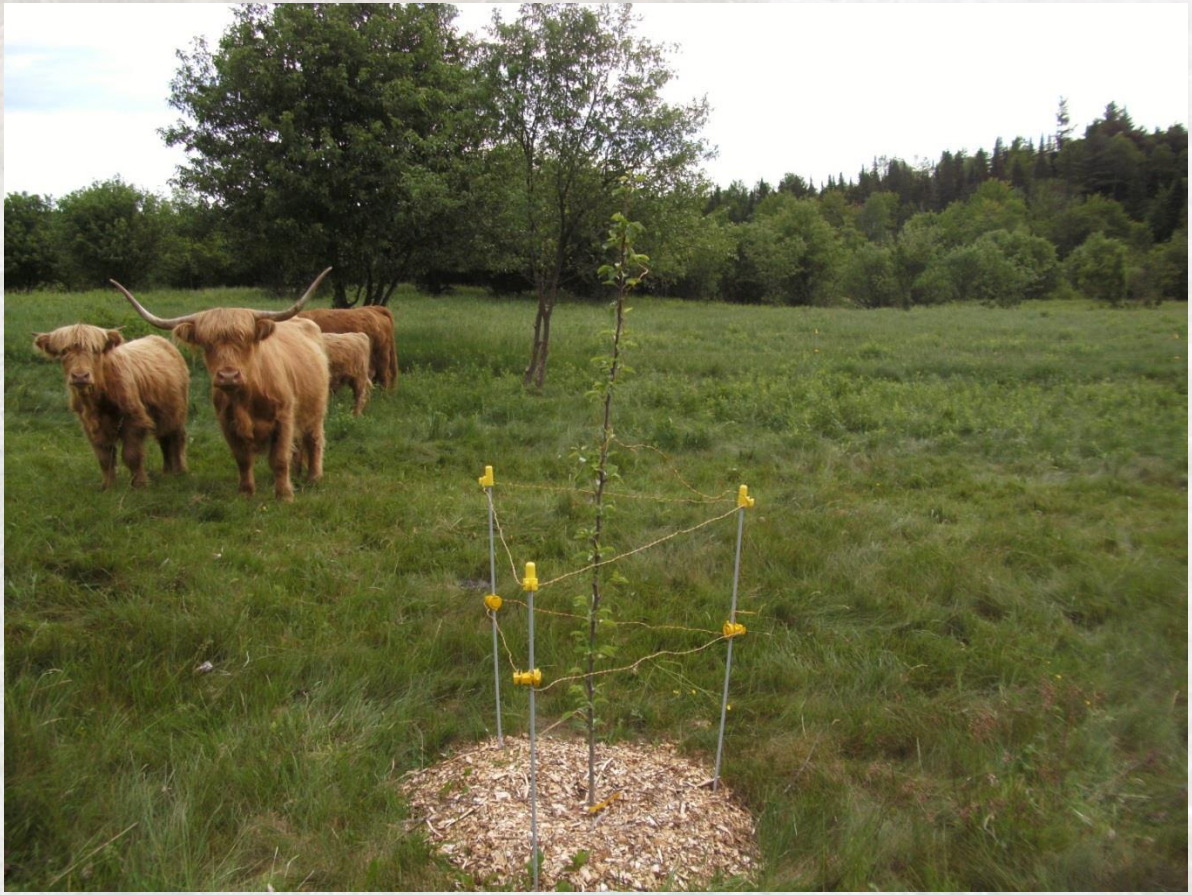

Silvopasture management finds a balance between livestock, forage, and tree prosperity

North Branch Farm Silvopastures

Scrub apples to cider orchard

An apple at every rock

North Branch Farm



Silvopasture in Progress

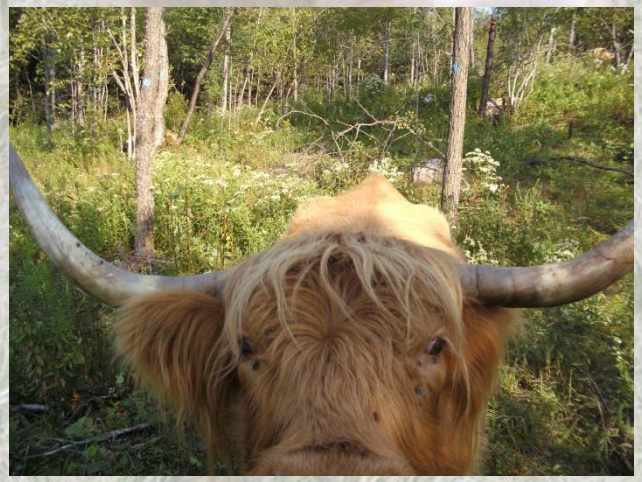
Outdoor Living Barn for winter use

North Branch Farm

Forest Conversion Study

North Branch Farm

Objective: Investigate the system productivity, environmental effects, and economics of forest conversion into silvopasture, open pasture, and managed woodlot.



Rational: Woodland Grazing

Undisclosed NY farm

These problems are inherent to continuous grazing, silvopasture is a sustainable and productive alternative

<u>UNMANGED</u>

Root Compaction

Girdling from Livestock

Bare Soil

Parasite problems

My parent's farm in CT

Regional Pastured Woodlands (Managed?)

State	Pastured Woodland (Acres)	Number of Farms Using Woodland Pasture	% of total pasture acreage that is woodland pasture
CT	16,953	919	27%
MA	21,853	1,160	25%
ME	26,230	1,056	21%
NH	13,703	689	21%
NY	**165,855**	**5,659**	**14%**
RI	2,240	197	21%
VT	40,985	1,145	18%

Data Source: 2007 Census of Agriculture, National Agricultural Statistics Service, USDA

Project Supporters

NORTHEAST SARE
Sustainable Agriculture Research & Education

University of New Hampshire

Paul Smith's College
THE COLLEGE OF THE ADIRONDACKS

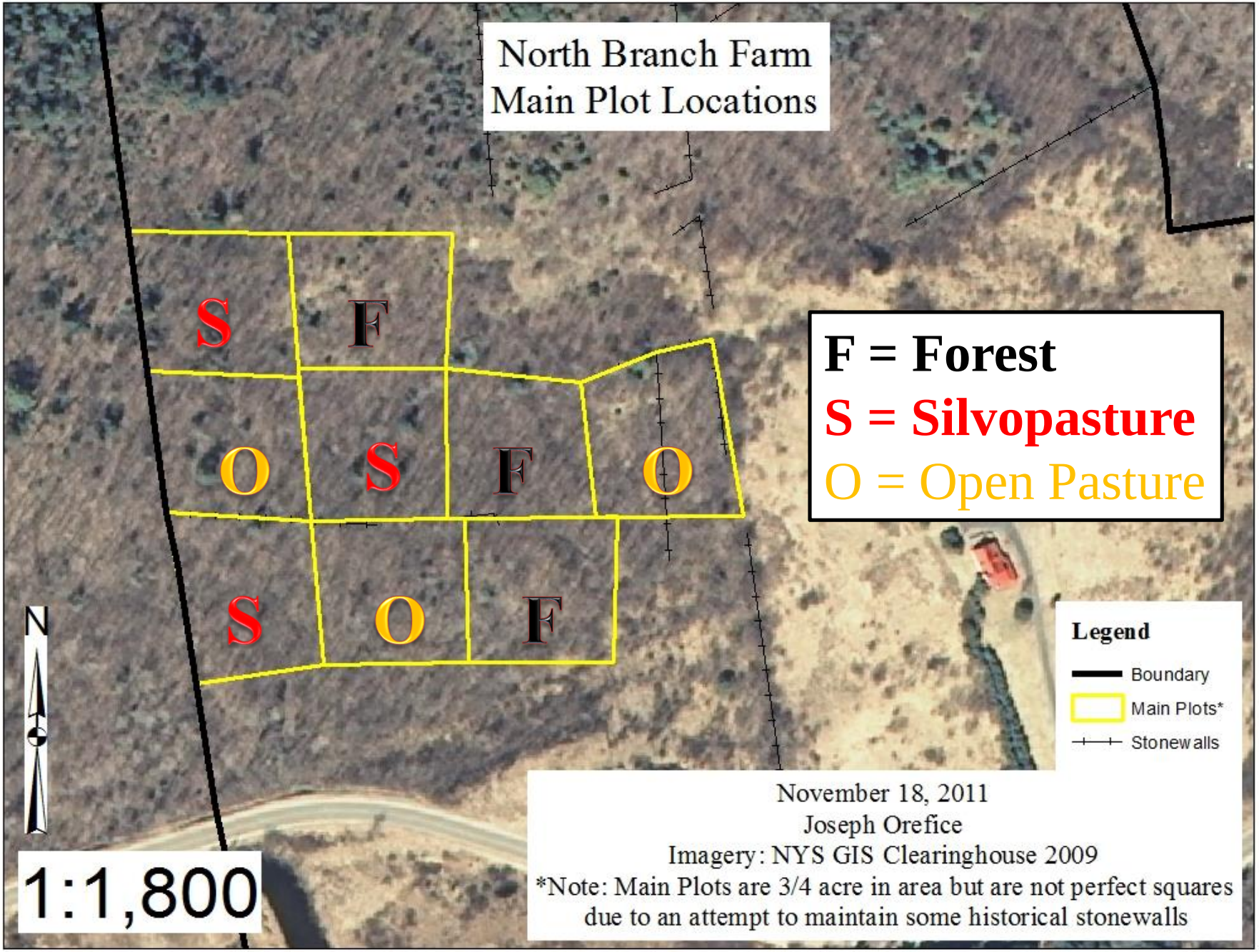
North Branch Farm
208 River Road
Riverview, Town of Saranac, New York 12981

Research Approach: Investigate the system productivity, environmental effects, and economics of forest conversion into silvopasture, open pasture, and managed woodlot.

Northern Hardwood Forest Conversion to Silvopasture, Open Pasture, and Woodlot

Location: North Branch Farm

Northern Adirondack Mountains, Town of Saranac, New York


North Branch Farm
Main Plot Locations
S
F
O
S
F
O
S
O
F
F = Forest
S = Silvopasture
O = Open Pasture
N
1:1,800
Legend
Boundary
Main Plots*
Stonewalls
November 18, 2011
Joseph Orefice
Imagery: NYS GIS Clearinghouse 2009
*Note: Main Plots are 3/4 acre in area but are not perfect squares due to an attempt to maintain some historical stonewalls

Treatment Group	Prescription	Harvest Type	Forages	Cattle
Forest	Crop Tree Release	Whole Tree Removal	No Treatment	Excluded
Silvopasture	Crop Tree Release	Whole Tree Removal	Seeded	Grazed
Open Pasture	Clearcut	Whole Tree Removal	Seeded	Grazed

Silvopasture Prescription

Irregular shelterwood for the benefit of livestock, where the intended regeneration is grass, the leave trees are designated crop trees, and tree regeneration is delayed for years to decades.

- Favor: Cherry, Paper Birch, Maples, and White Ash
- Target basal area of 30% full stocking
- Whole-tree harvesting to minimize slash

July 2012

Pre-Treatment

- Maples, birch, cherry, elm, white ash
- Pole size, un-managed, 50 y/o
- Pastureland 1800's to 1960's

May 2012

Pre-treatment	Mean (Standard Error)
Basal Area/Ac	82 ft^2 (3)
Trees/Ac	985 (50)
DBH_q	4"
Relative Density	78% (3%)
PAR, %full sun	7.8% (1.3)
Soil pH	4.68 (0.02)

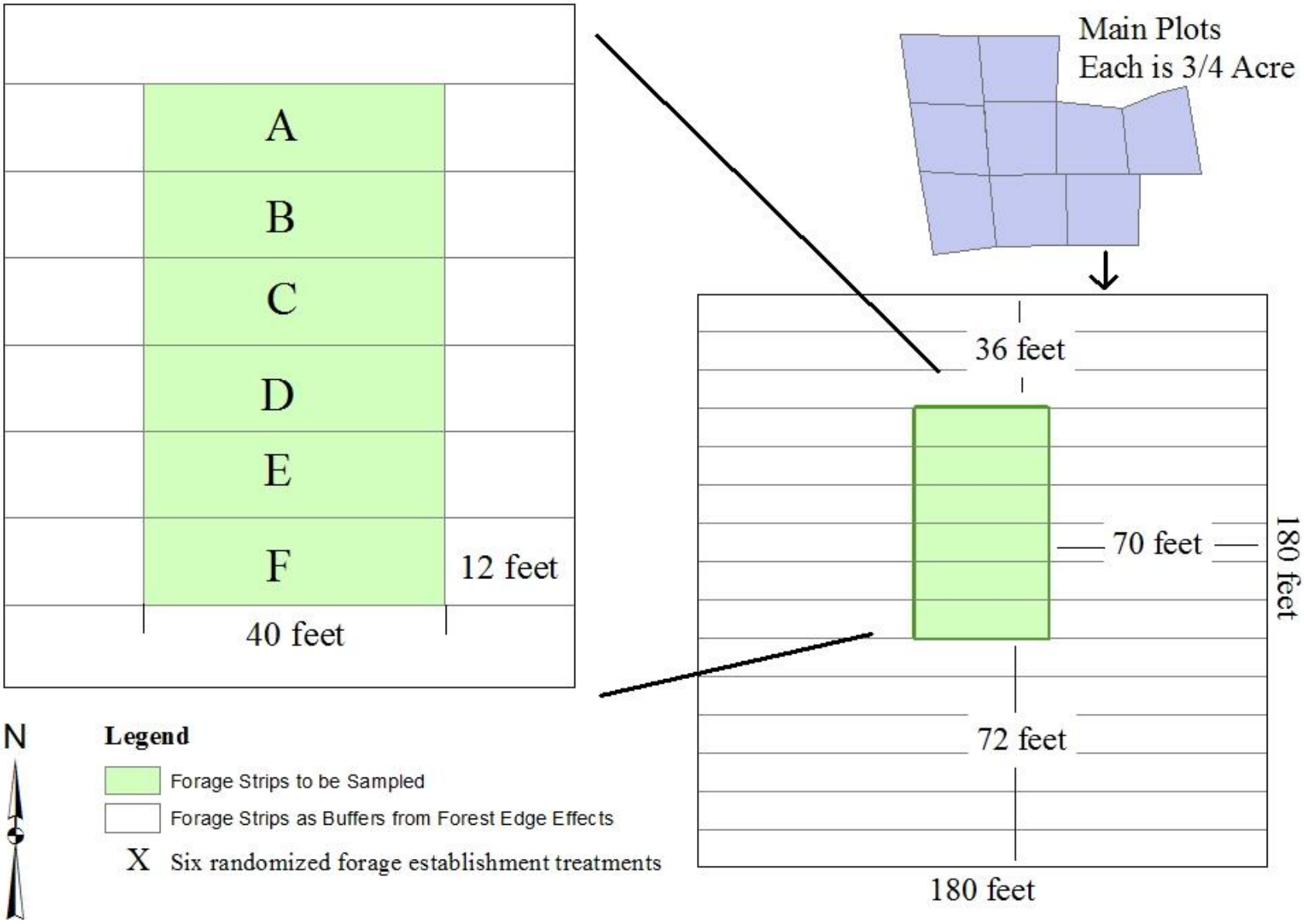
Post-Treatment

- Red maple, black cherry, white ash

August 2012

Post-Treatment	Mean (Standard Error)
Basal Area/Ac	24 ft^2* (2)
Trees/Ac	101 (8)
DBH_q	7"
Relative Density	17% (2)
PAR, %full sun	59.8% (6.7)
**29% of pre-harvest basal area*	

Split Plot Design of Forage Establishment Treatments in Silvopasture and Cleared Forest Plots



Forage Establishment Treatments

- Orchard grass-white clover
- Perennial ryegrass-white clover
- Kentucky bluegrass-white clover
- Smooth bromegrass-white clover
- Loose hay depositing
- None

August 2012

October 2012

October 2012

Cattle Trampling in Seed

August 2012


October 2012

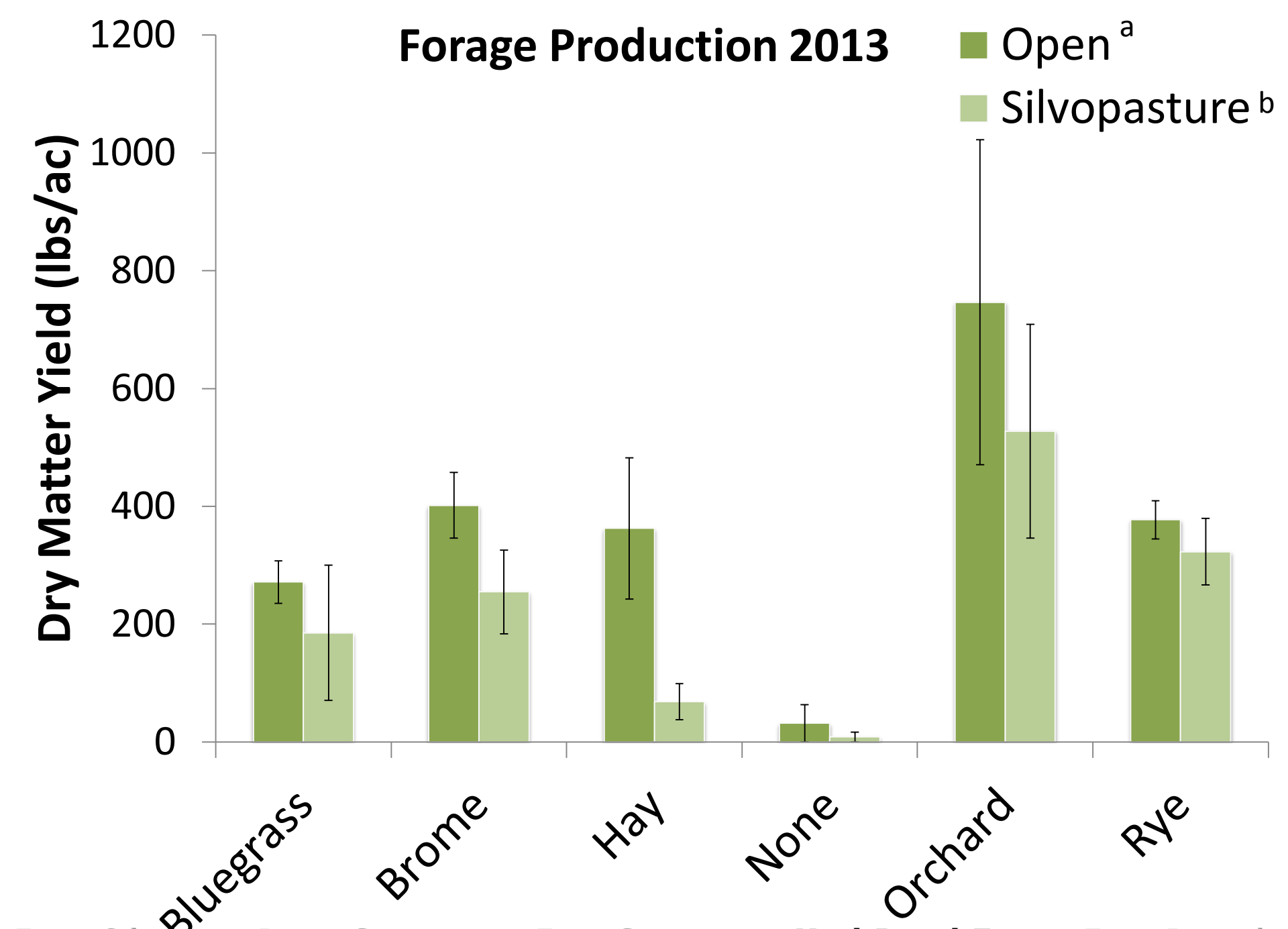
Inventories

- Pre-treatment
  - Forest composition: May 2012
  - Soil properties: July 2012
    - pH, extractable bases, total C and N, available N and P, bulk density
- Post-treatment
  - Forest composition
  - Forage Production
    - Prior to each grazing session – 2013 and 2014
  - Soil properties: July 2014
    - pH, extractable bases, total C and N, available N and P, bulk density

Grazing Management

- August 15-26, 2013 sites were grazed by cattle
  - 2 days per ¾ acre plot
  - Estimated herd weight: 9,400 lbs.

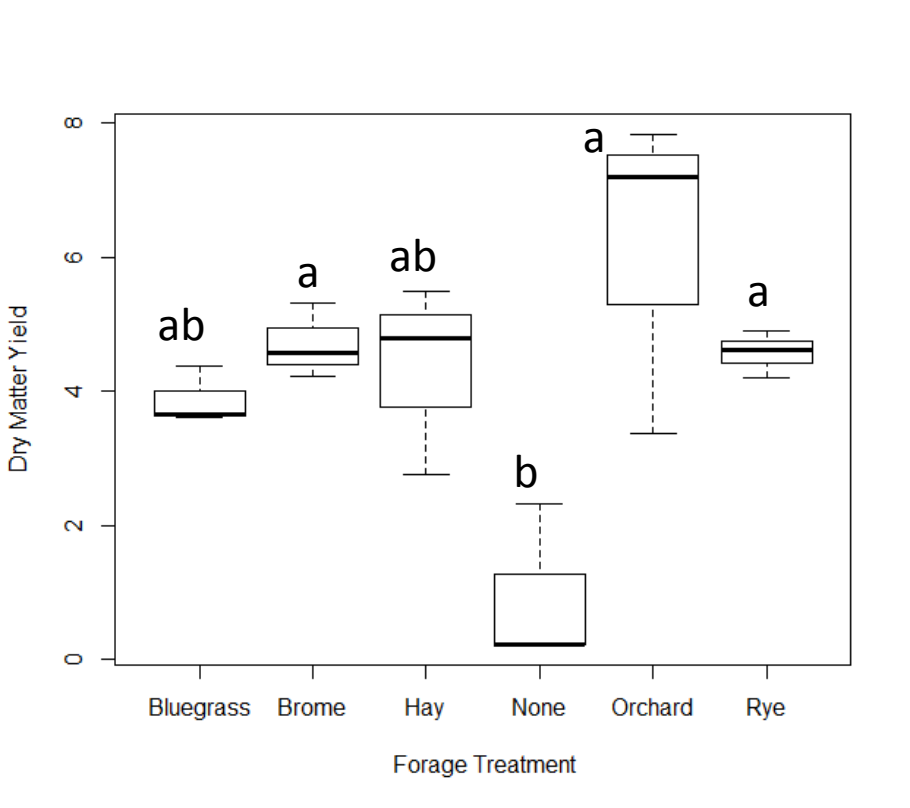
August 2013


Forage Production 2013
Open a
Silvopasture b
Dry Matter Yield (lbs/ac)
1200
1000
800
600
400
200
0
Bluegrass
Brome
Hay
None
Orchard
Rye

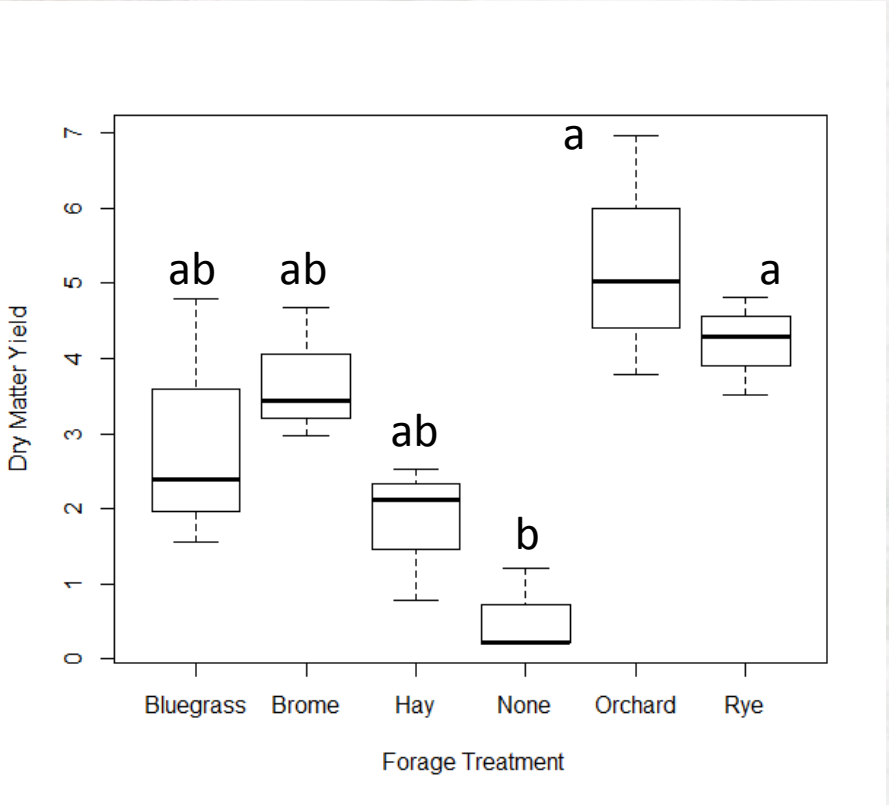

October 2013

Preliminary Results

Forage Pairwise Comparisons

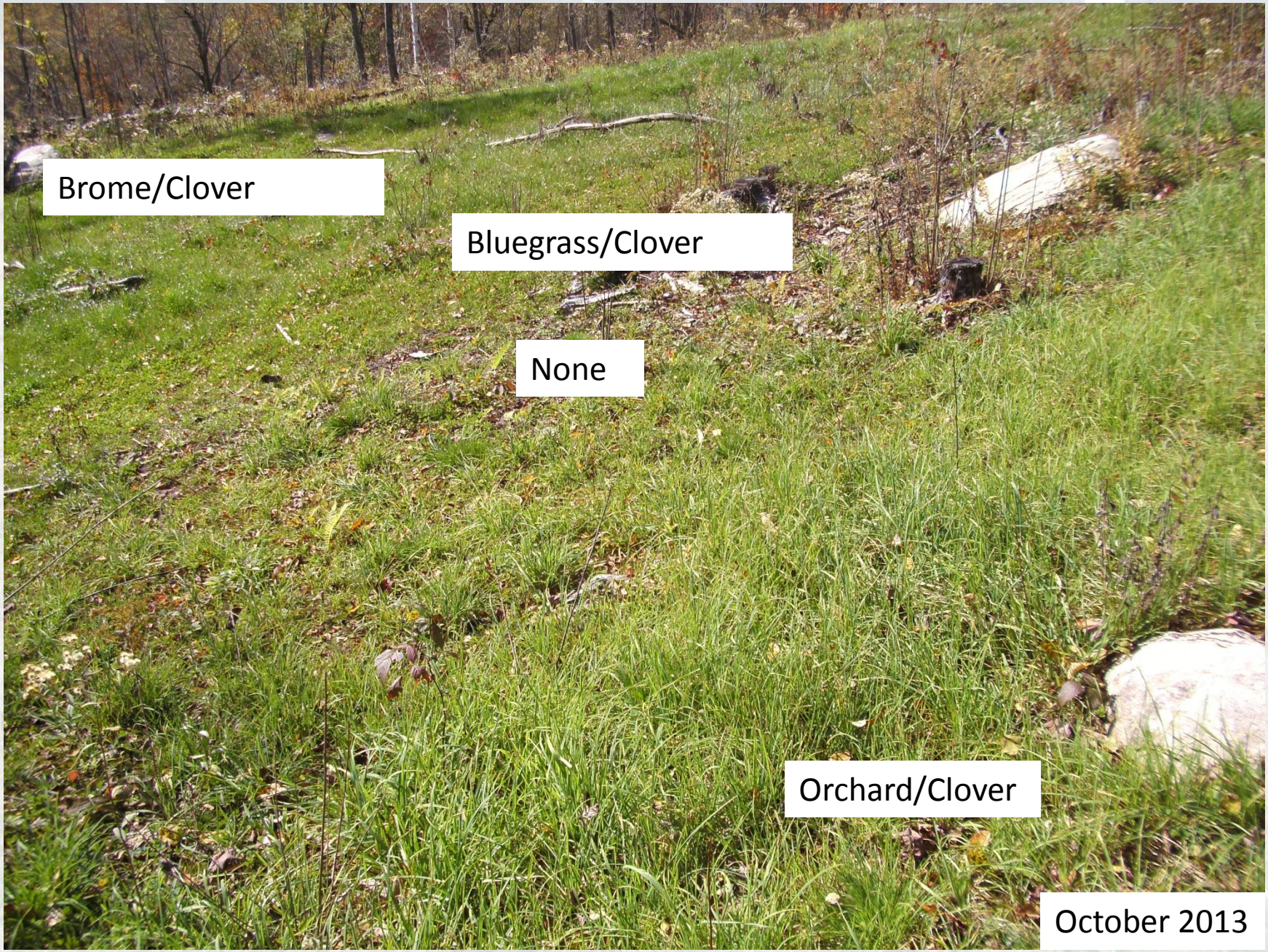


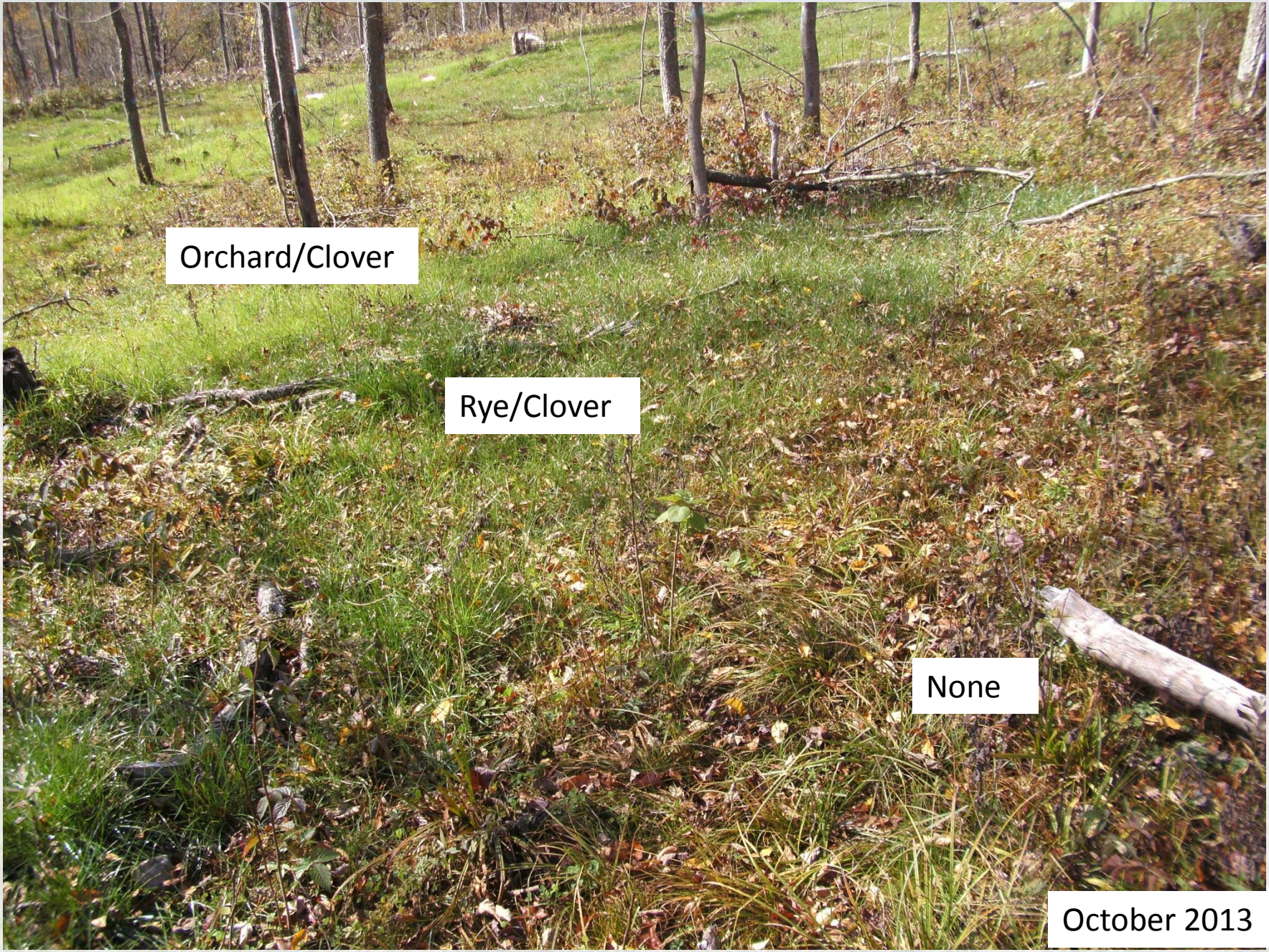
Open



Silvopasture

Tukey's HSD test, 0.05, values of Y-axis are not back-transformed


Brome/Clover
Bluegrass/Clover
None
Orchard/Clover
October 2013


Orchard/Clover
Rye/Clover
None
October 2013

Future Work

- Understory plant, soil, tree vigor dynamics of the site
- Forage production and quality assessment

- Document and describe silvopasture characteristics, management, and reasons for utilization on farms in New York and New England. Looking for Participants!

www.ADKfigs.com