An investigation into the composition, management, and economics of silvopastures in the northeastern United States, an emerging regional practice.

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Silvopasture practices are being used to diversify regional farms but a confusion exists regarding what silvopasture is and what it is not. Silvopasture practitioners are experimenting with diverse systems and have a desire for management recommendations.

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• Rationale:

Silvopasture in the Northeastern United States has never been formally documented in the academic literature. A stumbling block in the adoption of silvopasture systems in the Northeastern United States may be that there are few publicly known examples of silvopasture in the region. The path to ensure the sustainable management of regional silvopasture systems starts by providing land managers with documented experiences of others to learn from and consider. Therefore, our objective was to gather baseline data to describe silvopasture practices and perspectives in the Northeastern United States.

• Methods:

We investigated the structure, management of, and reasons for use of silvopastures in New York state and New England through a series of interviews and inventories on farms practicing silvopasture. Twenty-two semi-structured interviews were conducted by phone and on-farm with silvopasture practitioners to document the details of, and reasons for the current use of silvopasture within New York state and New England. In addition to interviews, an inventory was conducted in silvopastures on each farm visited to determine overstory conditions and forage species composition. Twenty-three unique silvopastures at various stages of establishment were inventoried on 15 farms visited.

• Emphasize the major findings/outcomes

Three farmers in this study had been practicing silvopasture on their farms over 30 years; the rest were new to silvopasture in the past ten years. Only three of 20 farmers interviewed in this study had experience practicing silvopasture prior to implementing it on their farms. Forest conversion to silvopasture was the primary starting point for silvopastures observed on regional farms. Orchard, open field edge, outdoor living barn, and plantation silvopastures were also documented on multiple farms. Shade and a desire to maximize use of farm woodlands were primary reasons for silvopasture utilization. A confusion existed by some practitioners as to what silvopasture is and what it is not.

• Implications for the Northern Forest region

This research provides evidence that silvopastures are being used to diversify farms in the northern forest region. Examples exist of decades old, well managed silvopastures in New York state and New England, although the majority of silvopastures identified in this study were in the first few years of establishment. Confusion between silvopasture and degraded wooded livestock paddocks exists in the region and poses a significant threat to the success of silvopasture. Specifically, the use of pigs in wooded areas needs to be addressed as farmers are causing severe damage. For silvopasture to be advanced in the region outreach and further research is needed.

Background and Justification

- Little formal research is available to inform the management of silvopasture systems in the northeastern United States
- A recent report on silvopasturing in New York provides a useful framework for land managers interested in silvopasture but it does not include specific examples of regional silvopastures (Chedzoy and Smallidge, 2011)
- There is a great deal of interest among farmers and foresters related to the use of silvopasture in the region
 - Published work calling for adoption of silvopasture, the Northeastern Silvopasture Conferences hosted by Cornell Cooperative Extension in 2011 and January 2014, and numerous silvopasture workshops held in the last six years in New York and New England.

Chedzoy, Brett J and Peter J Smallidge 2011. Silvopasturing in the Northeast An Introduction to Opportunities and Strategies for Integrating Livestock in Private Woodlands. In Silvopasturing in the Northeast An Introduction to Opportunities and Strategies for Integrating Livestock in Private Woodlands, 28. New York: Cornell Cooperative Extension.

Background and Justification

Although silvopasture in the region has garnered recent interest, the longstanding, and commonly confused, practice of woodland grazing remains widespread, as evidenced by the following table:

Distribution of woodland pasture in New York and New England. Of total pastureland in the region, 1 in 6 acres (17%) is woodland pasture. In the New England states the proportion of woodland pasture to total pasture area is over 1 in 5 (22%). These data were sourced from the Census of Agriculture but the management of these pastures was not addressed (Vilsack and Clark 2014).

			Number of Farms	% of Total Pasture
	Land in	Woodland	Using Woodland	Acreage that is
State	Pasture (acres)	Pasture (acres)	Pasture (*)	Woodland Pasture
СТ	72,018	21,081	1,056 (24)	29%
MA	85,760	17,837	1,093 (59)	21%
ME	118,980	27,105	1,103 (58)	23%
NH	46,446	12,447	706 (54)	27%
NY	985,494	146,995	5,286 (186)	15%
RI	10,098	2,281	198 (7)	23%
VT	195,000	37,100	1,184 (68)	19%
Region	1,513,796	264,846	10,626 (456)	17%

* Number of farms self-identifying as practicing alley cropping or silvopasture

Vilsack, T. and C. Clark. 2014. 2012 Census of Agriculture.in N. A. S. Service and U. S. D. o. Agriculture, editors.



Image 3: Pigs being pastured in woodlands on a Northeastern U.S. farm. The farmer identified this as a form of silvopasture but it was classified as pastured woodlands due to monthly/yearly livestock rotations and no management of trees.

Methods

- Investigated the structure, management of, and reasons for use of silvopastures in New York state and New England through a series of interviews and inventories on farms practicing silvopasture
- Twenty-two semi-structured interviews were conducted by phone and on-farm with silvopasture practitioners
- Documented the details of, and reasons for the current use of silvopasture within New York state and New England.
- An inventory was conducted in silvopastures on each farm visited
- Documented overstory conditions and forage species composition in twenty-three unique silvopastures at various stages of establishment



Image 16: Undergraduate research assistant, Leanne Ketner, inventorying a black walnut silvopasture with an understory of orchardgrass on a Northeast farm.

Results/Project outcomes

Table 1: Reasons for, and challenges of, silvopasture utilization by 20 farmers practicing silvopasture in New York and New England. Farmers were interviewed in 2014 and may have provided more than one reason for or challenge of silvopasture utilization.

Reasons for silvopasture utilization	Number of Farmers
Shade for livestock	16
Expanding pasture acreage and diversity	14
Increased utilization of existing farm woodland	12
Increased forage availability during mid-summer and droughts	12
Diversified livestock diet	8
Overall animal welfare	6
Management of undesired vegetation	5
Winter shelter for livestock	4
Tree health/fertilization	3
Increased farm aesthetics	2
Challenges of silvopasture utilization	
Fencing establishment and maintenance	9
Lack of knowledge toward silvopasture management	6
Lack of time for silvopasture management	5
Unknown forage quality and management techniques	5
Reduced mobility of machinery	3
Lack of support from agricultural extension organizations	3
Undesirable vegetation	2
Fleece contamination in fiber animals	1
Epicormic branching on trees	1
Monitoring livestock	1

Table 2: Type of silvopasture systems found on 20 farms in New York in New England purposefully identified. In some cases, multiple types of silvopasture existed on the same farm. Farms were inventoried in 2014.

Silvopasture type	Number of Farms
Forest conversion to uniform tree spacing	13
Open field edges	7
Orchards	6
Forest conversion to patch tree spacing	5
Outdoor living barns	4
Forest conversion to irregular tree spacing	3
Hardwood plantations	2
Conifer plantations	1
Maple sugarbush	1

Table 4: Undesirable plants stated by more than onesilvopasture practitioner in New York and NewEngland in 2014.

Plant Species	Scientific Name
multiflora rose	Rosa multiflora
Japanese barberry	Berberis thunbergii
Japanese knotweed	Fallopia japonica
oriental bittersweet	Celastrus orbiculatus
buckthorn	Rhamnus spp.
honeysuckle	Lonicera spp.
privet	Ligustrum spp.
thistle	Cirsium spp.
sedges	<i>Carex</i> spp.
mountain laurel	Kalmia latifolia
ferns	spp.

Table 3: Forage and non-woody understory plants occurring in more than 5 silvopasture inventories on 20 farms in New York state and New England in 2014.

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Common forages	Common non-woody plants	Forages actively managed for
red clover (Trifolium pratense)	sedges (Carexspp.)	red clover (Trifolium pratense)
white clover (Trifolium repens)	ferns	white clover (Trifolium repens)
orchardgrass (Dactylis glomerata)	brambles (Rhubus spp.)	timothy (Phleum pratense)
bentgrasses (Agrostis spp.)	wood-sorrel (Oxalis acetosella)	orchardgrass (Dactylis glomerata)
bluegrasses (Poa spp.)	dandelion (Taraxacum officinale)	ryegrasses (Lolium spp.)
fescues (Festuca spp.)		diversified woody browse
timothy (Phleum pratense)		

Dominant tree species/groups (Scientific Name)	Number of Farms
Oaks (Quercus spp.)	11
Maples (Acer spp.)	10
Fruit trees, primarily apples (Malus spp.)	8
Eastern White Pine (Pinus strobus)	4
Hickories (Carya spp.)	4
Eastern Hemlock (Tsuga Canadensis)	3
Commercial nut trees, primarily walnuts (Juglans spp.)	2
Black locust (Robinia pseudoacacia)	2
Goals for trees in silvopastures	
Sawtimber	12
Firewood	12
Fruit or nuts	11
Maple sugar potential	4
Wildlife habitat	3
Fence posts	2
Scion wood	1

Table 5: Tree composition and uses of silvopastures on 20 farms in New York andNew England in 2014.

Photographs of regional silvopastures



Image 14: Open field edge silvopasture converted from a forest with uniform spacing of eastern white pine on a Northeast farm.



Image 9: Low density, uniformly spaced oak and maple silvopasture after 20 years of establishment on a Northeast farm. Note the consistent forage layer and persistence of hay-scented fern in the foreground of this image.

Results/Project outcomes

- Outreach efforts
 - Orefice, Carroll, Conroy, and Ketner (2016) is an open access publication in the journal Agroforestry Systems.
 Leanne Ketner, an undergraduate student at Paul Smith's College, contributed to this work as a research assistant and author. She is included in the publication.
 - This work was presented by Joe Orefice as the keynote speaker at the 2015 Vermont Grazing Conference.
 - This work has been presented at multiple conferences and field walks in the northern forest region and nationally to both foresters and farmers
 - This work has been presented in three webinars, one local and one national, both available online. The third was for a national audience of United States Department of Agriculture employees.

Full citations can be found in the "List of Products" section

Implications and applications in the Northern Forest region

The use of silvopasture is relatively uncommon in the northern forest region. However, the use of poorly managed woodland grazing is rather common. Silvopasture serves as a sustainable alternative to woodland grazing. This project has built the foundation for future research into silvopasture in the region by documenting the characteristics of the practice in use. It has also identified serious livestock management issues that should be addressed in the region, specifically the continuous housing of pigs in wooded areas. This practice is not silvopasture and threatens the health of forests and integrity of soils where it is practiced.

Future directions

Table 6: Areas of silvopasture research requested by two or more farmers during interviews with 20 farmers practicing silvopasture in New York and New England in 2014.

Requested areas of silvopasture research

Forage/browse quality, selection, and management Tree care, regeneration strategies, and management Overall silvopasture management Soil properties and management Best management practices for pasturing pigs Vegetation management using livestock Fencing systems Quantification of animal health and production **Environmental benefits** Management of orchard silvopastures Air temperature dynamics Economics

List of products

- Peer reviewed publications: Orefice, J., Carroll, J., Conroy, D., and L. Ketner. (2016). Silvopasture practices and perspectives in the northeastern United States. Agroforestry Systems. DOI 10.1007/s10457-016-9916-0
- Other publications:

Orefice, J., Carroll, J., and L. Ketner. (in review). Photo guide to northeastern United States silvopasture. Paul Smith's College publication, to be available online as a pdf in the summer of 2016.

- Conference presentations (by Joseph Orefice):
 - World Congress Silvo-Pastoral Systems. To occur September 27-30, 2016. Evora, Portugal. Presentation accepted, and to be given on "Silvopasture practices and perspectives in the northeastern United States."
 - Guest lecture, Sterling College. Craftsbury Common, VT. March 3, 2016. "Silvopasturing the Northeast."
 - Society of American Foresters National Convention. Baton Rouge, LA. November 5, 2015.
 "Silvopasture in the Northeast United States."
 - University of New Hampshire. Durham, NH. April 1, 2015. "Silvopasturing the Northeast United States."
 - Yale University Forest Forum. New Haven, CT. March 5, 2015. "Silvopasturing the Northeast."
 - New York Master Gardeners Meeting. Westport, NY. March 4, 2015. "Silvopasturing the Northeast."
 - Vermont Grazing Conference. Fairlee, VT. January 17, 2015. Keynote Speaker.
 "Silvopasturing in the Northeast."

List of products

- Webinars and workshops:
 - Vermont Grazing Conference. Fairlee, VT. January 16, 2015. "Silvopasture Workshop."
 - Agroforestry in Action Webinar Series. Center for Agroforestry, University of Missouri. October 21, 2015. "Silvopasture in the Northeast United States."
 - Recording available online: http://www.agroforestryinaction.org/#!recorded-webinars-/yzo90
 - Working Webinar. United States Department of Agriculture. September 29, 2015. "Silvopasturing the Northeast."
 - Public Webinar. Paul Smith's College (open to the public). May 5, 2015. "Silvopasturing the Northeast United States." • Recording available online:

https://www.youtube.com/watch?v=3yEKwlBw0IM