Carbon Farming

Agroforestry and Soil Data

Carbon farming is a term for a variety of agricultural practices that sequester and store atmospheric carbon into the soil and in the roots, wood and leaves of plants.

Central Traits of Agroforestry Practices

Intentional
combinations of trees with crops and/or livestock—a whole unit, rather than as individual elements

Intensive
management—to maintain their productive and protective functions

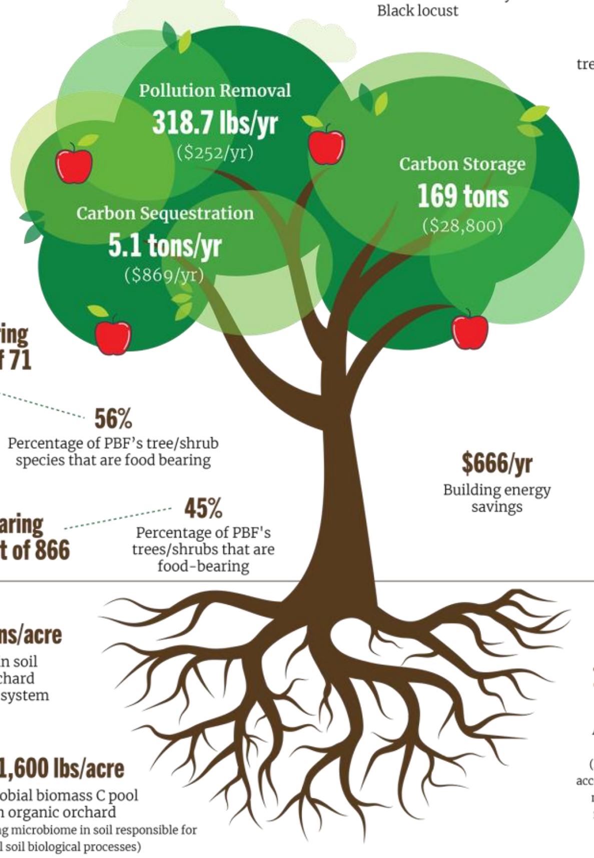
Interactive
between the components—support the biological and physical interactions among tree, crop and animal components

Integrated
agroecosystem—components are structurally and functionally combined into an integrated management system

Interrelational
maintains soil health, promotes soil microbial diversity, cycles nutrients, improves soil structure, assures provision of ecosystem services

Prairie Birthday Farm (PBF) Key Statistics:

West Central Missouri, Clay County
866 trees/shrubs on 14.1 acres



Other information to consider: 1. Biochar amendment in organic orchard enhanced both SOC and AC by about 33%
2. All C pools were higher in the agroforestry system by about 30% and 50% relative to adjacent unmanaged cool-season grass and row crop field sites, respectively
3. Active C (AC) and microbial biomass C (MBC) are pools within the total soil organic C (SOC) content

Photos: Pawpaw (*Asimina triloba*), Spicebush (*Lindera benzoin*), Hazelnut (*Corylus americana*), Warren Pear (*Pyrus communus x*), Pecan (*Carya illinoinensis*)

Linda Hezel Ph.D., R.N., Farm Steward/Artisanal Producer
www.prairiebirthdayfarm.com | 816-560-7878

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www.itreetools.org

For further info on mapping services, i-Tree, or tree inventories, contact:
Molly Gosnell, GISP | Midwest GeoInfo LLC
www.midwestgeoinfo.com | 816.305.0614

Hedgelaying 101

Hedgelaying is a centuries old practice used to build and maintain a living fence that will hold livestock and deter predators.

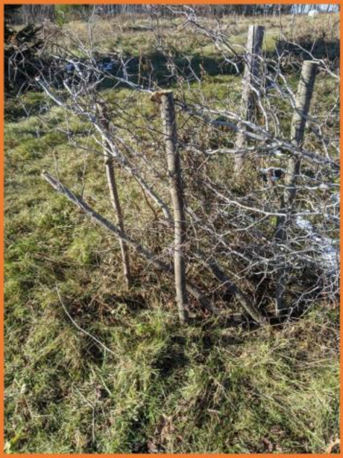
Pruned Hedge

Pleaching

Unpruned hedge

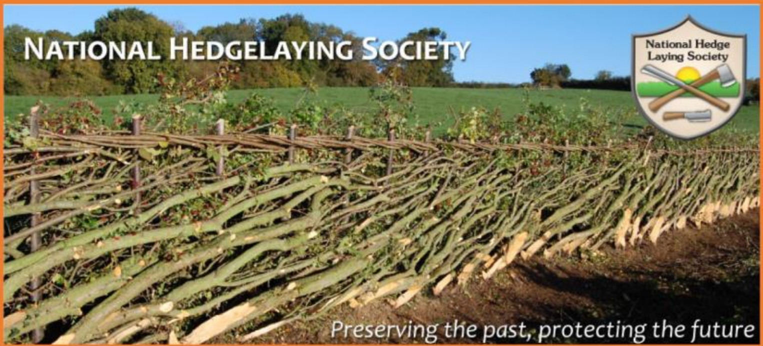
Weaving the Hedge

Finished hedge



Laying the hedge

- Hedge during dormant season
- Trim hedge to maintain
- Cut weavers and stakes first
- National Hedging Competition



A Pilot Suitability Analysis to Identify Implementation Sites in the New York Champlain Valley

Wildlife-Friendly Farming

Project Overview

The unique working landscape of the New York Champlain Valley contains an abundance of diverse wildlife habitat and is a focus area for many conservation groups. The region is also home to numerous farms, and agriculture is a crucial sector of the local rural economy. While most residents are supportive of agricultural activity there remains some concern among conservation groups regarding the potential negative impacts of farming on wildlife populations and their habitat. **Wildlife-friendly farming (WFF)**, a set of farm management practices ranging from non-lethal predator control to the establishment of wildlife habitat on the farm, is one possible solution for mitigating some of the negative impacts associated with traditional farming activities while maintaining a farm's economic viability. A number of local conservation organizations including Wildlife Conservation Society (WCS) and the Eddy Foundation are in the early stages of developing programs and resources to help farmers adopt WFF practices in the Champlain Valley. However, little information currently exists to inform decisions regarding where to focus initial WFF efforts. The aim of this pilot suitability analysis was to utilize publicly available datasets to identify agricultural land that is most suitable for the implementation of WFF practices in the NY Champlain Valley to inform local WFF initiatives.

Methodological Approach

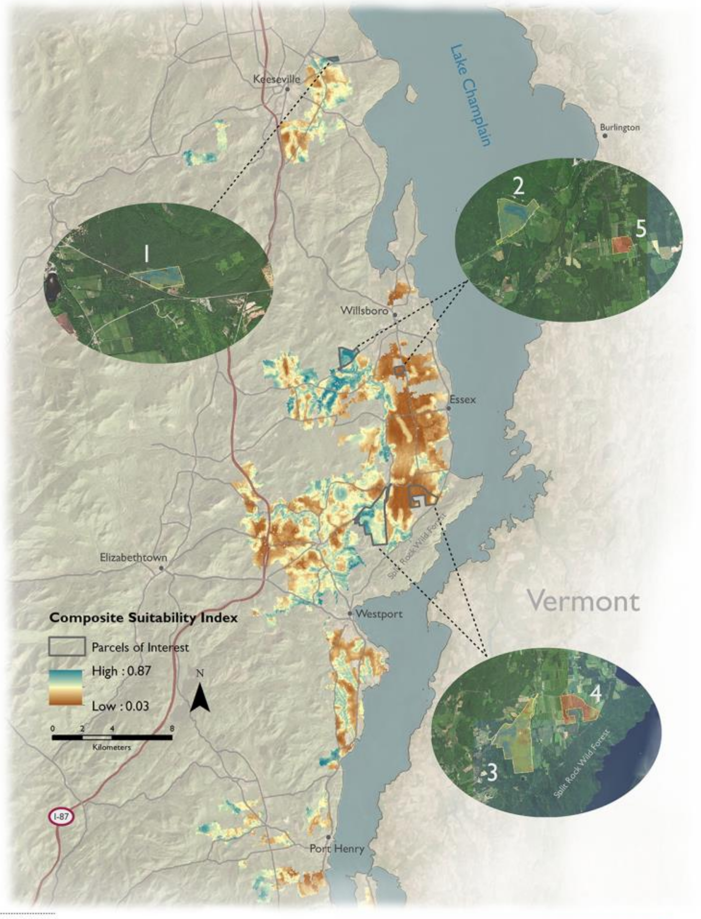
This analysis involved a two-step process. Step 1 consisted of creating individual suitability layers that each represent some spatial or physical phenomena that is relevant to WFF. These individual suitability layers, which are each discussed in further detail below, were combined in Step 2 to create the final composite suitability map to the right. Each time layers were combined they were assigned a weight reflecting their importance to the resulting composite layer.

The analysis used fuzzy membership and reclassify, two geoprocessing tools in ArcMap, to assign a value between 0 and 1 to each pixel in a given layer based on its membership of a specified set. A value of 1 indicates full membership and a value of 0 indicates no membership. Using the riparian habitat input layer as an example, map pixels existing in a zone designated as 'riparian' were assigned a value of 1 (full membership). This value decreased linearly as distance from the nearest riparian area increased. Map pixels that were more than 200 m from a river or stream were assigned a value of 0.
The analysis was restricted to land under protection of New York State Agricultural District Law. Each agricultural district (referred to as parcels) is a collection of individual properties. Zonal statistics were calculated for each parcel. Mean pixel values for each of the individual suitability layers and the composite suitability map are reported for selected parcels of interest in the table below.

Discussion of Results

Five parcels were selected to discuss the fitness of the suitability model. Parcel 1 received the highest mean suitability index value - the average value of a cell in the 36 acre parcel was 0.697. This was largely due to the presence of, or proximity to, existing wildlife habitat (mean habitat value = 0.848). Parcels 2-5 were selected based on their proximity to nearby parcels with disparate suitability values. Parcel 4 highlights a potential shortcoming of the model. Despite abutting Split Rock Wild Forest - a 3,700 acre forest tract with diverse wildlife habitat - it received a low mean suitability score (0.13). Note that the analysis is also affected by the modifiable areal unit problem (MAUP) that results from aggregation of point-based measures into districts. It is important to recognize that the parcel boundaries discussed here are arbitrary to a degree, and this should be taken into account when drawing conclusions from the analysis.

Agricultural Land Suitability for Implementation of WFF Practices



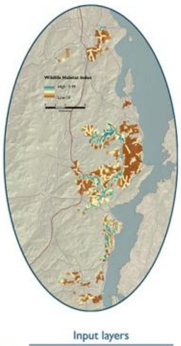
Zonal Statistics for Selected Parcels of Interests	Parcel				
	1	2	3	4	5
Area (acres)	36	266	1075	390	72
Mean Suitability Index Value	0.70	0.65	0.50	0.13	0.09
Mean Habitat Value	0.85	0.60	0.47	0.05	0.02
Mean Connectivity Value	0.61	0.76	0.54	0.10	0.04
Mean Ag Productivity Value	0.52	0.60	0.50	0.36	0.32

Individual Suitability Layers

Important spatial and physical characteristics that determine whether a site is suitable or desirable for WFF practices include existing habitat, regional and local connectivity, and agricultural productivity potential. A suitability layer was created to represent each of these phenomena. These layers were then combined to create the composite suitability map to the right. Individual layers were created using the inputs listed below. The corresponding weight that was assigned to each layer is listed in parentheses.

Wildlife Habitat (50%)

Land that contains or is near existing riparian areas and habitats that are of conservation interest to WCS were given a higher score, as was land with a higher degree of ecological integrity.



Input layers

- Riparian habitat (40%)

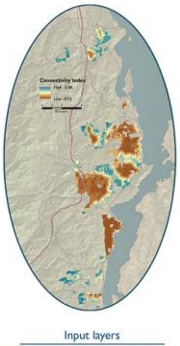
  Habitat that exists at the interface between land and a river or stream.
- Habitats of conservation interest (40%)

  Central Hardwood Swamp, Central Oak Pine, & Northeastern Floodplain Forest
- Ecological Integrity (20%)

  Refers to the ability of an ecosystem to support ecological processes and species diversity.

Connectivity (30%)

Connectivity refers to the degree to which a landscape facilitates wildlife movement. Land with better connectivity received a higher score.



Input layers

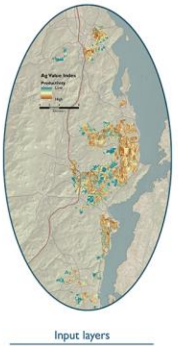
- Core habitat & connectors (50%)

  Patches of wildlife habitat and the corridors that connect them.
- Local connectivity (50%)

  The degree of connectedness of a 90m x 90m cell with its surroundings within a 3km radius.

Agricultural Productivity (20%)

This layer assumes that less productive farmland is more desirable for WFF practices. Land with steep slopes and low soil productivity was prioritized.



Input layers

- Slope (50%)
- Soil productivity potential (25%)

  The inherent capacity of a soil to produce nonirrigated commodity crops.
- Soil wetland potential (25%)

  Soils that appear to have been drained for agriculture and could potentially be converted back to wetland.

Conclusion

Overall, the model created and implemented in this suitability analysis appears to have value for informing decisions regarding WFF initiatives in the NY Champlain Valley. Of course, there are many non-spatial factors that determine where WFF is likely to be successful such as a farmer's willingness and ability to adopt WFF practices. The model could be significantly improved by including protected land (e.g. Split Rock Wild Forest) in the Wildlife Habitat suitability layer. Additionally, using individual parcel boundaries instead of aggregated agricultural districts would allow for identification of specific farms for the implementation of WFF management practices.

Sources

Data sets

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Images

Header image: http://www.publicdomainpictures.net/view-image.php?image=229980&picture=wheat-field

Footer image: https://pixabay.com/en/sheep-goats-flock-quadruped-1563110/

Map Projection: NAD 1983 UTM Zone 18N

UEP 0294, Advanced GIS, Fall 2017

Poster created on: 21 December 2017

Alexander L Caskey

Special thanks to Michale Glennon of WCS for her input and support!

Tufts UNIVERSITY

How do women access land for perennial farming? Stories of innovation and collaboration

Barbara Decré – decre@wisc.edu

ACCESSING LAND

Over the past few decades, accessing land has gotten harder as farmland is being consolidated into larger and larger operations. Land prices keep rising making it difficult for beginning farmers with no connections to find and access land.

GROWING PERENNIALS

Perennials crops represent a long-term investment that cannot be made confidently without tenure of the land. Financial support is most available for annual crops while the establishment of perennial practices can be very costly. Inheriting land in the Midwest often comes with expectations for traditional growing practices.

FARMING AS A WOMAN

Traditional understandings of farming still see men as the primary operators on the farms and women as the main caretakers of children and the household. They are left with less time to farm and learn and left out of the land inheritance path. Systemic wage disparities can also make access to capital harder for women who end up starting their farm later in life.

Methodology:

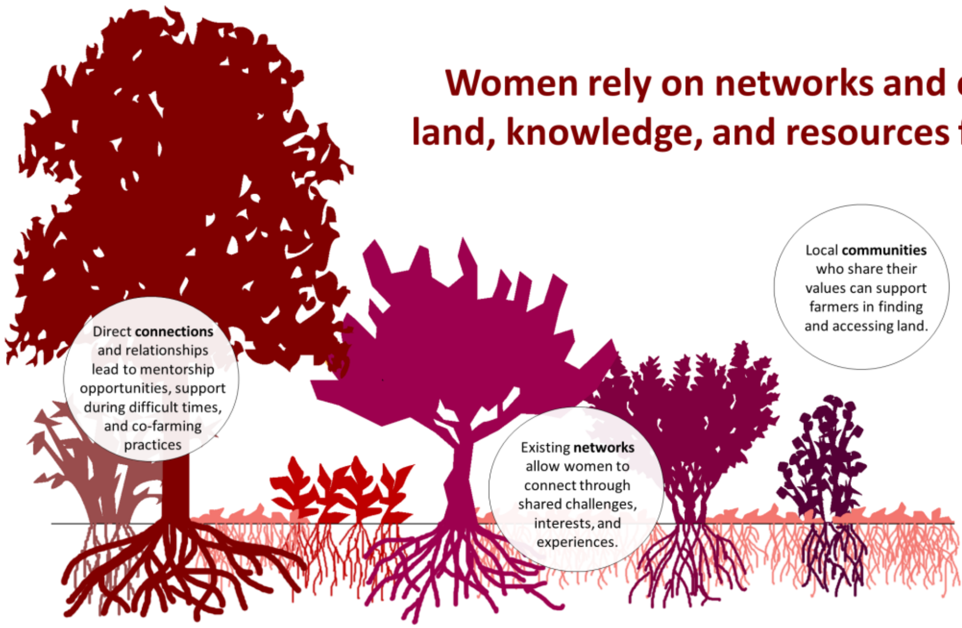
- First contact via email (networks of women in sustainable agriculture)
- Dozen of interviews with women in Wisconsin, Minnesota, and Iowa
- Free-flowing prompts
- Analysis of the content and structure of the conversation according to themes

Women rely on networks and communities to access land, knowledge, and resources for perennial agriculture

"Land prices make it hard if you don't have family to pass it down or no capital. Almost impossible… […] We were holding back on our goals for a long time because of that."

"It was more of a real-estate transaction, complicated by the fact that there is a perennial crop."

"Growing perennial crops just makes sense, but not if you're renting land."



"[My mentor] helped me develop my network and learn that you can really integrate with your community and rely on each other. Farming before that felt like a pretty self-isolated thing."

"Women know how to cooperate."

"You really can't do this by yourself. We couldn't have bought this place without the support of our community."

"You ask yourself 'do I really want to ask people for money for that?' but people want to help. You just can't be afraid to ask. We all need support.

"It felt like I was moving really slowly – at the speed of my own knowledge – until I met [the women from this network]. Now, the possibilities are endless because of this network of people I can rely on.

PAY IT FORWARD

Aware of the importance of these connections and the resources they can provide, women actively participate in developing these opportunities for others. They create the networks they wish had been available to them, share their knowledge through farm tours and podcasts, provide access to their land through mentorships and incubators…

COLLABORATIVE FARMING

After accessing land, many women look for opportunities to farm collaboratively. This increases their sense of security, makes some farm tasks easier to perform and allows them to grow their business at low costs.

Examples of co-farming set ups include incubators, co-operatives, condos… We need to take this into consideration when working to support farm access through match-making activities.

LAND AS A COMMON

Many women's perception of land doesn't exactly fit the "ownership" model that settler colonialism promotes. Working to decolonize their vision of the land can highlight a path towards a better relationship and management.

Some women are aware of the history of land appropriation and working to repair the damage made to the indigenous communities and the land as a result.

CHANGING THE AMERICAN FARMSCAPE?

Collaborative farming opportunities and approaches that consider land as a common resource challenge the system that works to marginalize people and keep them from working the land.

Promoting such land agreements and farming approaches can directly support marginalized community and change the make-up of the American farmland.

Prairie and Tree Planting Tool - PT² (1.0):

A conservation decision support tool for Iowa

John Tyndall, Iowa State University

Introduction With the PT² (1.0) users locate Iowa farms or properties of interest in an online aerial photo and mapping geographic information system (GIS). Users explore areas for tree or prairie plantings by examining different data layers: aerial photos, soil maps, 2-foot contour elevation map, LiDAR hillshade, and a map of current land values (based on estimated land rent). Once an area of interest is delineated, users select from drop down menus tree/shrub species or prairie seed mixes that are suitable for the soils present, and select basic long-term management options. PT²: 1.0 estimates total annualized costs for planned tree or prairie establishment, long-term management, and opportunity costs (based on area weighted expected soil rent), and factors in the potential benefit of utilizing USDA cost-share programming, e.g., Environmental Quality Incentive Program (EQIP) or the Conservation Reserve Program (CRP). **The code is open source and we actively seek partners to expand the data set to other states.**

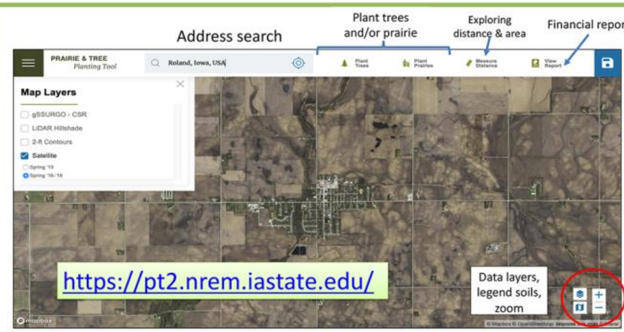
Objectives Diversify farmland by integrating trees & or prairie. There are many conservation & production practices based on trees & prairie cover. Plant trees for windbreaks & shelterbelts to minimize wind erosion & protect fields, buildings, & livestock. Or as forest buffers that mitigate livestock odor, pollen drift or protect riparian areas from field runoff. Plant prairie for pollinator, game & non-game wildlife habitat, as well as other conservation goals.

Three row windbreak in Iowa. Image: J. Randall

Financial Data:

1) **Direct costs** Comprehensive 2020$ enterprise budgets were created for tree and prairie based plantings. For every planting design, PT² 1.0 calculates net present value per unit & total and then annualizes costs across a standardized time period (e.g., 15 years; 2% real discount rate). Our analytical process ensures that financial data is up-to-date, & transparent for users.
2) **Opportunity costs** A land rent proxy estimate for forgone income opportunity on all Ag land removed from production is based on the gSSURGO Corn Suitability Rating (CSR2; an Iowa-specific soil productivity index that factors into IA land rent markets. PT² 1.0 calculates area-weighted average CSR2 for land used by practice. 2020 Iowa Land Rent = $2.77 per CSR2 index point (Plastina et al., 2020).

High diversity prairie planted in a toe slope position, adjacent to crop field and a stream. Creates pollinator habitat and intercepts run-off. Image: Illinois NRCS

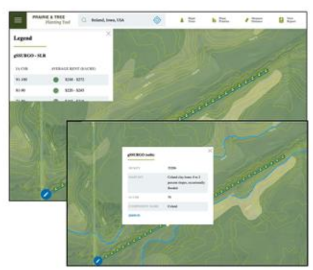


Prairie and Tree Planting Tool PT² (1.0) Online Interface

Users select 1) tree planting, or 2) prairie planting design application. Drop down menus offer data layer options to explore planting opportunities. Tree planting tool selects area of interest for planting trees using a linear selection tool, arrange the desired number of rows of trees, select from a menu of species suitable for the soil conditions (based on *Iowa Woodland Suitability Index*, IA DNR 2014), choose spacing between trees & rows. Likewise, a polygon drawing tool delineates prairie area. Select from menu of seed mixes suitable for the soils present (or enter custom price). Select general long-term management (mowing or burning).

Data exploration:

Explore topography, run-off patterns using Iowa LiDAR Hillshade from the 2007-2010 state-wide collection; with 2-foot elevation contours.



Explore soil conditions & opportunity costs of land using NRCS SSURGO Soils (Corn Suitability Rating CSR2 data layer and land rent estimates)

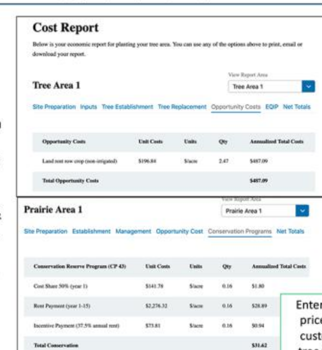
All data can be saved (excel file, shape files, lat-long spatial data), uploaded & reconfigured. All financial data to be updated annually.

Case Study: Creating buffer continuity

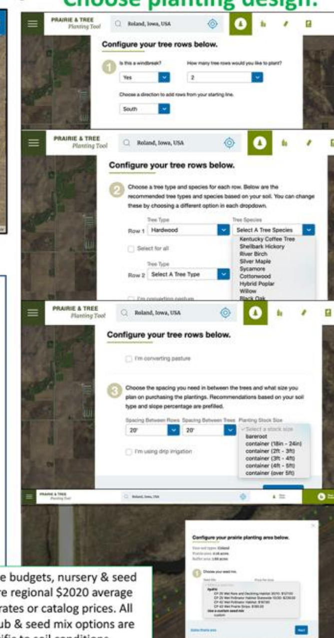
Examine site-level features using Iowa 2016-2018 Spring Orthophotos or 2019 USDA National Agriculture Imagery Program (NAIP) Orthophotos

Financial Assessment

To aid landowners with capital budgeting & design features, PT²: 1.0 estimates total annualized costs for planned tree or prairie establishment, long-term management, & opportunity costs of land, broken down into categories, and summed. Relevant USDA conservation program benefits are estimated.



Choose planting design:



Enterprise budgets, nursery & seed prices are regional $2020 average custom rates or catalog prices. All tree/shrub & seed mix options are specific to soil conditions.

References: Plastina et al. (2020). Cash Rental Rates for Iowa 2019. Ag Decision Maker. ISU, File C2-10.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
SCHOOL OF PLANT AND ENVIRONMENTAL SCIENCES
VIRGINIA TECH.

Soil Nutrient Dynamics in Mid-Stage Hardwood Silvopasture Compared with Open Pasture

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Abstract

Silvopasture management involves deliberate integration of timber, livestock, and forages on a common management unit. Black walnut (*Juglans nigra*) and honeylocust (*Gleditsia triacanthos*) have gained particular interest in silvopastures and other temperate agroforestry systems. Changes in forage species and improved animal performance have been reported in black walnut – (BW) and honeylocust – (HL) based silvopastures. However, soil physiochemical properties and nutrient dynamics in deciduous hardwood silvopastures have received less study. Our objective was to assess soil physiochemical properties and nutrient dynamics in 25-year-old BW and HL silvopastures and compare with open pasture (OP) systems. The study was carried out at the Whitethorne Agroforestry Demonstration Center, Blacksburg, Virginia consisting of three treatments (BW, HL, and OP) replicated three times in a randomized complete block design. Soil samples (topsoil; 0-10 cm) were collected and analyzed for total C and N stocks, inorganic N, organic matter (OM), pH, available P, extractable K^+, Ca^{2+}, Mg^{2+}, and cation exchange capacity (CEC). Soil samples, collected using a core sampler, were oven-dried to determine the soil bulk density (BD). Total C and N did not differ ($p \geq 0.14$) between OP and silvopasture systems, but C:N ratios were greater ($p \leq 0.05$) in silvopastures. Soil OM was 5.6±0.50, 6.4±0.50, and 5.5±0.50 for BW, HL, and OP respectively with trends towards greater OM in HL vs OP ($p=0.06$) and BW ($p=0.08$) systems. Soil pH, P, Mg^{2+}, and CEC did not differ ($p \geq 0.12$) among the treatments. Soil BD was 1.26±0.078, 1.30±0.078, and 1.35±0.078 $g cm^{-3}$ in BW, HL, and OP respectively did not differ among treatments. BW and HL trees in the silvopastures impact soil physiochemical properties and nutrient dynamics. These changes depend upon tree characteristics and age of the system, with important practical applications for agricultural sustainability in the long-run.

Introduction

- Silvopasture – intentional integration of trees, livestock, and forage crops on the same unit of land (Nair, 1993; Garrett et al., 2000)
- Environmental benefits – water quality improvement, soil conservation, carbon storage, wildlife habitat protection, and aesthetics (Garrett et al., 2000; Shrestha et al. 2002)
- Few studies of tree effects on soil properties in mid-stage hardwood silvopastures such as black walnut and honeylocust
- Objective – To compare the soil physiochemical properties and nutrient dynamics in mid-stage black walnut (BW) and honeylocust (HL) silvopastures with open pasture (OP) systems

Fig. 1 Black walnut (BW) and Honeylocust (HL) based Silvopasture

Fig. 2 Sheep grazing Honeylocust Silvopasture (HL)

Material & Methods

- **Study site** – Virginia Tech's Kentland Farm, Blacksburg, VA
  - Temperate climate
  - 636 m above sea level
  - Average annual temperature 11.1 °C
  - Annual rainfall 993 mm
- **Treatments** – BW, HL, and OP replicated three times (0.27 ha each) in RCBD
- Soil samples collected to 10-cm depth with a stainless steel probe
- **Sample analyses**
  - pH
  - OM and Total C
  - Inorganic N (NH_4^+ and NO_3^-) and Total N
  - Bulk density (BD) and Gravimetric water content (GWC)
- **Statistical analysis** – Mixed ANOVA using PROC Mixed in SAS. Difference significant at P<0.05 and as a trend at P<0.10

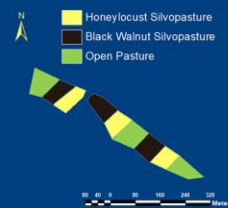

Fig. 3 Experimental Layout

Results

- pH – not different among treatments
- OM – HL tended ($p \leq 0.08$) to have greater levels than OP and BW

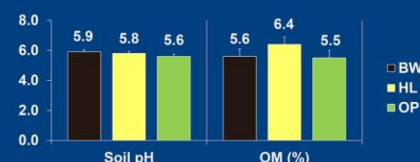

Fig. 4 Soil pH and OM in silvopastures and open pasture systems

- Inorganic N – not different among treatments

Table. 1 Inorganic N content in silvopastures and open pasture systems

	Treatments (LSMeans ± SE)		
	BW	HL	OP
NO_3-N (mg kg^{-1})	4.5±0.05	4.8±0.05	3.5±0.05
NH_4-N (mg kg^{-1})	0.4±0.01	0.4±0.01	0.3±0.01

Results

- TC and TN – not different among treatments
- C:N ratio – greater ($p \leq 0.05$) in silvopastures

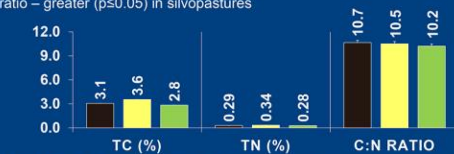

Fig. 5 TC, TN, and C:N ratio in silvopastures and open pasture systems

- Soil BD and GWC – not different among treatments

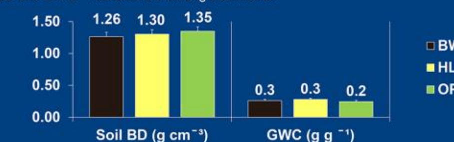

Fig. 6 Soil BD and GWC in silvopastures and open pasture systems

Conclusion

- HL silvopastures tended to have greater soil OM than OP and BW
- BW and HL silvopastures had greater C:N ratios than OP
- Modest changes in soil physiochemical properties observed in these mid-stage (25-yr-old) silvopastures
- Soil changes within hardwood silvopastures depends upon tree characteristics and age of the system
- Trees within the silvopasture may have important practical applications for C accretion and agricultural sustainability in the long-run

References and Acknowledgement

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The authors would like to acknowledge all the staff at Virginia Tech's Kentland Farm, Virginia Tech Soil Testing Laboratory, and Mr. Steve Nagle for providing all the necessary support in carrying out this study

Exploring the potential of woody perennials to integrate conservation and production in Missouri

Raelin Kronenberg & Sarah Lovell

Center for Agroforestry
University of Missouri

Background

Agricultural resource concerns are impacting production and ecosystem function.

Conservation programs designed to manage resources but have been criticized as too inflexible and complex.

Multifunctional landscapes such as agroforestry provide numerous environmental, economic, and social function on the same area of land.

Missouri has agroforestry-specific EQIP funding which offers unique opportunity for conservation.

Do natural resource agents understand the practices of agroforestry and promote their use by landowners?

Objectives

Engage with conservation program administers to:

- Establish common planting plans and species selections in conservation programs.
- Determine how agricultural landowners are supported when enrolling their land in conservation programs.
- Understand to what extent do natural resource professionals understand and promote agroforestry practices in Missouri conservation programs.

Research Design & Findings

1.Methods

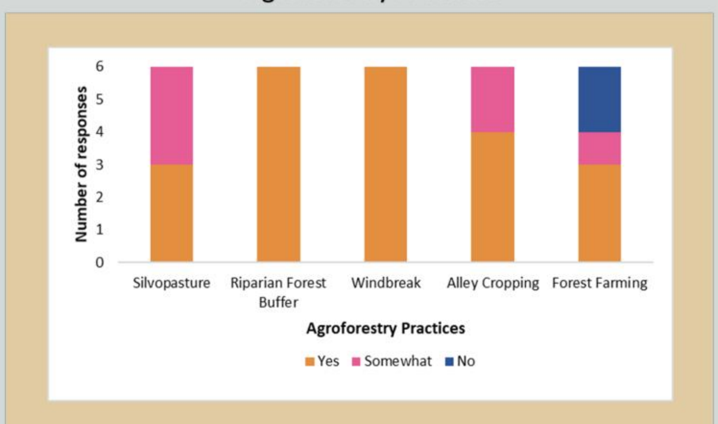
Literature Review → Design Questionnaire → Interview six conservation professionals

2. Analysis

Transcribe recordings → Code themes using Nvivo → Analyze themes and make conclusions

From talking with conservation professionals, both landowners and natural resource agencies express interest in agroforestry as part of the conservation practices that receive funding. The integration of fruit and nut producing trees within the landscape for both human and wildlife consumption showed the greatest promise as a starting point for multifunctional tree and shrub plantings. Currently, agencies wish to promote these practices, but it is clear they need more information on how agroforestry systems function and they ways they can address resource concerns before they feel comfortable implementing these practices with landowners.

Conservation Professional's Familiarity with Agroforestry Practices



Interview Themes

- **Landowner Interest is there, participation is limited by program funding, enrollment requirements and lack of awareness:**

"…there is always more interest than, more applications than we can fill. You know, it's just a matter of dollars."

- **The challenge of building long-term relationships in conservation:**

"It's probably why it's actually a problem, because it's [recruitment] hard. Hard to figure out."

- **Natural resource professionals wish for greater agroforestry knowledge and promotion:**

"I think we do; we have done a good job of promoting agroforestry in Missouri. We can definitely do better. We just need to make sure we are sending out the right message."

Moving Forward

- Educating the educators on agroforestry.
- Bring attention to the potential of agroforestry to support conservation goals.
- For research:
  - Survey Missouri agricultural landowners.
  - Analyze preferences for landscape design and potential for agroforestry to support conservation.

Ramps - A Potential Forest Farming Crop?

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Ramp life cycle and distribution

- Ramps *(Allium tricoccum)* are native "spring ephemeral" wild leeks found in the deciduous forests, and moist and nutrient rich wooded areas of Appalachia.
- Ramps emerge during spring and die back during summer. Mature plants generate a seed stalk in fall. Plants go dormant during winter and take five to seven years to reach maturity.
- Ramps also multiply through bulb development (like garlic) as they reach maturity.

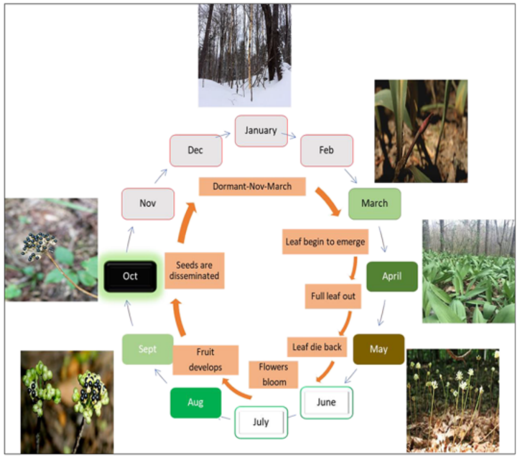

Figure 1: Life cycle of Ramps

Range

The Native range of *Allium tricoccum* is eastern North America, from Georgia to Canada.

Figure 2: Native range of ramps (from USDA's Plant database website)

Traditional collection and use

- Traditionally, ramps have been foraged - gathered from wild – often in large volume
- Appalachian peoples have had strong cultural ties to ramps (Davis and Greenfield 2002), with annual foraging a part of the history and culture.
- Ramps are among the first greens to appear in spring and they provide vitamins and minerals
- Before 1900, ramps were a common food source for Cherokee Indians, slaves and poor people living in the region.
- During the 1920s and 30s, ramps were considered and used more broadly - as a tonic and as a folk remedy (e.g., as a blood and intestinal cleansing agent) - throughout Appalachian region (Cavender, A., 2006) – and the Cherokee ate ramps to treat colds.

Growing interest as food and medicine

- Interest in ramps has grown as many celebrity chefs have promoted the pungent leek as a gourmet food item and "white-table cloth" restaurants have begun serving them (Davis and Greenfield 2002).
- The plants have been promoted both for their novelty as well as for their potential nutraceutical value. E.g., Whanger et al. (2000) found selenium enriched ramps reduced cancer in rats.

Overharvest

- Given their slow growth rates and long lifecycles, ramp populations need many years to recover from a single harvest (Rock 1996).
- Growing awareness of and demand for ramps has spurred a rise in wild harvest, which has resulted in the dwindling of native populations (Davis and Greenfield 2002).
- Ramps are considered a species of special concern in parts of their native range, while a narrow-leafed variety is endangered in New York and threatened in Tennessee.
- Some states have regulation on harvest, but poor regulatory management and strong demand have left ramps at risk across its much of its range.

Figure: Ramps plant: taken from: https://alongthegrapevine.wordpress.com/2014/05/06/ramps-wild-leeks-omelette/

Opportunity or forest farming approach

- Ramps, along with several other non-timber forest products (NTFP) are native to Appalachian region, have a long history of harvest, and could be produced in dedicated forest farming systems.
- Appalachia has significant potential as a hub for sustainable production of culturally important and medicinally valuable specialty crops. Developing such markets would create new opportunities for farmers, forest landowners, and families in rural communities (Mori et.al., 2017).
- Sustainably growing native plants in forest farming systems can create greater product value, reduce pressures on natural populations and meet the demands of global markets (Chamberlain, 2009)

Things we are trying to learn

- Ramp development from seed is limited. Learning how to increase ramp production from seeds would be a big step towards sustainability of ramps.
- Value of inoculating ramps with mycorrhizae is unknown. We are testing whether mycorrhizae ramp survival and growth.
- Can habitat modeling serve as an effective tool for farmers? Such models may help determine site and farmer investment values.

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