

2018 NE SARE Farmer Grant
COVER SHEET

Project Title	Tree Leaf Fodder for Goats, Hogs, Sheep and Cows; Transitioning Farm Woodlots to 'Air Meadow' for Climate Resilience
Proposal Number	FG18-037
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SARE Request	\$15,000
Project Duration	Mar 1, 2018 - Feb 28, 2020
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PROJECT SUMMARY

“Multistrata agroforestry systems represent the highest level of carbon sequestration in food production... There is a need for development of multistrata production systems for non-tropical climates... Fodder tree silvopasture in particular is worthy of broad-scale expansion” (Toensmeier, 2016, pp.323-4).

Recent droughts emphasize need for climate-resilient livestock fodder alternatives. Multi-strata ‘air meadow’ canopy harvests of existing woodland are less vulnerable to weather extremes than grasslands, and have immediate feed results.

Historically Europeans relied on established ‘air meadows’ of pollards heavily pruned in 3 to 5 year cycles, to overwinter cows, sheep, goats and hogs. Transition from a woodlot of standard trees is more labor intensive than subsequent harvests, methods are less known, and fodders produced are untried in our region.

We will document guidance from pollards (already established during 7 years multi-lingual research), and transition 1 acre of woodland to pollards sprouting above browse height. We will describe for comparability to other farmers’ woodlots. We will track person-hours, and calculate total edible dry matter used by goats in plot. We will solicit responses of cows, hogs, goats, and sheep to 8 broadleaf species fresh, dried and (excepting maple) ensiled, intact and shredded, plus cooked (cows and hogs only), for broader farm applicability.

Our reports, shared at regional events, will provide farmers with how-to information, ideas of labor output and fodder weight produced, and livestock species’ feed choice ratings. Final photos will include growth in 2019. Farmers will be equipped to design ‘air meadow’ canopies to back up conventional rations.

WHAT IS THE PROBLEM AND WHY IS IT IMPORTANT?

Droughts in 2015 , ’16, and ’17 caused grass shortages. Summer hay need rose with dried out pastures; prices for scarce winter feed sky-rocketed. Maine slaughter houses in 2016 were fully booked causing low auction prices of dairy cows, as farmers downsized to match low storage of hay and baleage. Many farmers here own woodlands, yet have no tradition, nor knowledge, of use to feed livestock.

Increased ice, wind and flooding threaten trees, which threaten buildings. NRCS just announced emergency loans to repair farm damages by trees breaking or uprooting during our October storm. Compact rejuvenated canopies of a cyclically pruned (pollarded) woodlot, well-balanced on broadening trunks, are designed to be storm-proof fodder sources. The same skills can be applied to trees in the open near buildings. Since Northeastern farmers are not harvesting tree tops, this preventative benefit is unknown.

Hundreds network on Carolyn Sloane’s Tree Hay Facebook page, yet lack of knowledge makes most efforts tentative. Dave Jacke and Mark Krawszek offer blog-posts but still seek pollarding information for their Coppice Agroforestry book (pollarding, unlike low coppice, allows grazing or browsing beneath versus fencing wild and domestic animals out to protect sprouts). Publications respond to interest with articles (Hanson, Acres USA, May ’17; Walder in same; and Hanson,

MOF&G Summer '17). Yet no woodland plot has been transitioned to 'air meadow' in our region.

In 4 years of leaf fodder presentations at Common Ground Fair (see YouTube, Shana Hanson), attendees consistently ask about correct pruning cuts toward pollard development, productivity/acre, storage methods, and species edibility per livestock type, and receive anecdotal or historic answers.

Uncomfortable summer heat for farmers and livestock, livestock intestinal parasites, and the broad global issue of carbon releases to the atmosphere, are all problems that may be positively affected by our woodland fodder approach, yet are beyond the scope of this initial project.

WHAT IS YOUR PROJECT'S OBJECTIVE(S)?

We will: Examine our previously established pollards and document findings, to guide development of durable and fodder-productive tree structures; Restructure 1 acre of woodland to create pollarded 'air meadow' fodder canopies, prioritizing species with long seasonal windows of usage by our goats, and prioritizing mid-sized trees over large and small trees for immediately productive but reachable canopies; Record descriptive data for farmer woodlot comparison including end height projection, and tracking labor time; Record weights of fresh and dried fodder eaten on the 1 acre site year-round by goats, trialing modern adaption of traditional stacking, and compute lbs. DM/acre; Document goat, sheep, cow and hog responses to 8 species of intact and shredded 'twig-leaf' fodders fresh, dried, ensiled (excepting maple), and (hogs and cows only) dried then cooked, so that farmers can offer feeds likely to be useful to their livestock; and present our user-friendly and instructive reports to regional farmers at face-to-face events.

Northeastern farmers will thus be better informed to establish tree leaf fodder production as supplement to grassland feeds, reducing their environmental risks. Our Final Report and demo site plus subsequent efforts of other farmers can found an up-to-date knowledge base adapting this well-tried methodology to the Northeast.

WHAT EFFORTS HAVE BEEN MADE BY OTHERS TO SOLVE THE PROBLEM OR TAKE ADVANTAGE OF THIS OPPORTUNITY?

Ingvild Austad with others (Austad, Braanaas and Haltvik, 2003) fed shredded and dried or barrel-ensiled twig-leaf fodder from ancient pollards to sheep in Norway, EU, took blood samples and body weights, timed labor, tested fodder chemical and mineral content, and determined this feed to be economically and nutritionally useful to Norwegian sheep farmers. The waste litter tested comparable to straw for absorbency and carbon-nitrogen balancing as animal bedding. (Ingvild just sent a bound copy of the report, and Maija Lindaas translated to answer my questions. Previously I was limited to two pages of English summary.)

Tree canopy harvests were integral to over-wintering European livestock for many millennia. Brauner (1756, Sweden) recommends dividing all woodlots into three parts, to establish a cutting cycle wherein nearly all greenery is removed every third year. Nutrition and yields per area were historically considered comparable to those of a good hay meadow (Brauner, 1756; Maschatchek, 2002). Nutrition has been confirmed by modern European researchers (Austad, 1993; Garmo, 1999).

In many warm countries, leaf harvest remains prevalent for cows, goats, sheep and hogs. See

Poudyal, 2017:

<https://www.youtube.com/watch?v=VjxqpgAcLWA&feature=youtu.be>

Out-of-print books by Hakan Slotte (2000) (Sweden) and Michael Maschatchek (2002) (Austria) describe traditional northern methods, though only sparsely address start-up pruning. In 2016, Tree Fodder Seminar participants successfully raked twig-leaf sheaves following Slotte's information, and a Unity College Sustainable Ag class and I packed 5 gallon buckets of maple leaf silage (one bucket met caprine approval, due to sufficient moisture), inspired by Maschatchek's mention of leaf silage for cows and pigs. In summer 2017 my hogs eagerly consumed 1/2 bucket of ensiled American Elm leaves. Cooked or hot-soaked leaves for cattle and hogs are mentioned by multiple historic sources.

Helen Read (2003) compiled "Arboricultural Notes" from comments of pollarders in 8 European countries, as part of her unpublished report (sent to me on disc in 2011 or '12). These instructions are focused on pollards in fields or hedge rows, as these trees have persisted to old ages, unlike pollarded woodlands which grow over more quickly. Only Slotte (2000) and Brauner (1756) address woodland situations, both without much detail, and in Swedish. Watkins (2015) describes English history related to fodder use of woodlands.

Dave Jacke, author of Forest Gardening Vols. 1 and 2 travelled across states to spend two days in fall of 2015 with me, took notes and shared tree bud terminology. His 4/28/17 post, "Pollarding Physiology and Practice Update," includes tentative recommendations of cut locations for boll development, from his conversation with arborist Andrew Lyman who manages established pollards in Pennsylvania.

In Europe and the UK people are restoring ancient pollards, some of which I saw last winter. I visited Paul Hand who has established young traditional pollards of three species, and restores 500-600 year old black poplar and holly pollards, Ted Green who is experimenting with new young pollards, Professor Charles Watkins, author of Trees, Woods, and Forest, and Helen Read of Burnham Beeches. Hakan Slotte commented in recent email that Helen knows more about old pollards than anyone else in Europe. He has provided a personal copy of his beautiful doctoral book (mentioned above) on leaf-harvest in Sweden and Aland.

Michael Walder, Mahna Farm, Ontario, Canada, began establishing 'air meadow' production as the primary food source for his GMO-free Boer-cross meat goats three years ago, with distant mentorship from myself. He prunes 320 lbs. av./day edible portion in two hours with hand tools. He emailed (8/3/16): "After slaving away for three months (cutting and carrying 75% tree/shrub fodder, 25% grasses) to see this crop of kids through to weaning, I got my GHIP data (<http://www.trufflemedia.com/agmedia/video/14703/what-goat-herd-improvement-program-ksu>) back... and from it was able to see a 17% increase in average daily gains from 2015 to 2016. " Now (10/24/17) he plans to begin using a new shredder.

CJ Sloane, Forage Farm, Vermont, and Becky Bemus, Roving Winds Farm, Ontario, Canada both attended our 2016 Tree Fodder Seminar, then stored and fed dried twig-leaf sheaves of many species to cattle, sheep and goats in winter.

I visited Hank Ainsley and Marina Garland, Weathersfield, Vt. (10/8/17) to see their pollard

development and long leafy branch storage for Katadin sheep, which inspired the semi-traditional low-effort stacking method in this proposal.

WHAT WILL BE YOUR PROJECT'S METHODS, MEASUREMENTS AND TIMELINE?

SH = Shana Hanson, TA = Tech Advisor, I = Intern, E = Elliot Richter, B = Brittany Turner

SH, I and E: 2 x 6 hr. days/wk. May – Oct. 2018 (SH paid only in leaf fodder these 2 days/wk.).

B joins above 2 x 6 hr. days alternate weeks May – Oct. 2018.

SH and B: 2 additional 6 hr. days alternate weeks May – Oct. 2018.

SH and I: 1 additional 6 hr. day/week mid-March 2018 – mid-March 2019.

SH 10 x 6 hr. days April 2019 – Jan. 2020.

SH, I, E, and B each 4 days off (unpaid by grant).

SH data and typing unpaid on goat walks.

TA 3-5 visits av. 2 hrs./visit

* = Outreach

*Feb. 26 - March 6, 2018, SH: March 1-3 Pollarding Symposium , Sare, France.

A. Study pollards established 2011-'17 (big toothed aspen, quaking aspen, basswood, beech, black locust, American elm, red maples, red oak, white birch, yellow birch).

1. Observe productive forms:

a. March 2018, SH: Contract Intern.

b. March - April 2018, SH, I: Tag with species initial, number (surveyor tape, marker) 1 - 4 successful sprouting locations/tree species. Note prior pruning dates (pollard notebook, observe annual growth segments).

c. May – Sept. 2018, SH, I: In correct harvest season/species, photograph whole tree and close-up of marked location; prune whole tree; re-photograph (digital camera).

d. Aug. – Sept. 2019, SH: Re-photograph, 1 yr. growth.

2. Document healing and structural concerns: March - April 2018, SH, I: Identify cut diameters/locations with sound closure/species to inform development of durable structures. Photo-illustrate observations.

3. Summarize and apply: April or Dec, 2018, SH, I: Draft observation narrative/species with photos; May – Sept. 2018, SH, I: Apply observations to:

B. Demonstration plot: Because person-hrs. are a measured outcome, days needed are unknown. Demo will be priority for each species harvest in season. Shana can complete if unfinished in same

months 2019.

1. Create:

- a. March 2018, SH, TA: Mark and April – May 2018, SH, I: fence (6 strands electric wire) 1 acre square (208' 8.5" sides) plot of 55 yr. multi-aged species diverse tree growth selectively cut for firewood since 1963; move scale and chipper/shredder, string tarp over.
- b. March – April, SH, with E or I: Fell or prune softwoods (retain white cedar, hemlock).
- c. April – May 2018, SH: Draft our "pruning rules" using A.3. (Ongoing - can add and edit – working doc).
- d. Growing season 2018, SH, E, B, I, G: Prune or fell (hand and power saws, ladders, ropes, harnesses), prioritizing oak, ash, yellow birch and poplars (longer nutritional seasons) over beech, maple, and white birch, and mid-sized trees over large and small trees (productive reachable canopies); process fodder: March – April 2018: softwoods (keep white cedar, hemlock; fell most others); May – June and Oct. 2018: beech; June – July: white birch; July – Sept.: yellow birch, ash; August – Color change: red maple, poplars, red oak.
Spacing >6' between retained branch structures of separate trees.
Light >1/3 day = 60 degrees of sky (Slotte, 2000), eyed from pruning cut locations along equilateral 3" triangle (translucent red plastic).

*June 2018, SH, G: Willow harvest at MOFGA Farm & Homestead Day.

*July 8-14, 2018: Tree Fodder Seminar, SH schedules presenters; MOFGA Day trip.

*Aug. 2018: MOFGA Apprentice Supper, SH schedules with Daniel McPhee

*Sept. 2018: Grass Farmers' Network walk, SH Common Ground Fair presentations.

2. Describe:

- a. March or April 2018, SH, TA: Set up Excel spreadsheets for: site description; livestock weights, hours and person-hrs.; livestock responses to offerings.
- b. May – October 2018, SH, I: Record retained tree species, diameters at 4' (diameter tape), initial and pruned heights (surveying tape down from top of pruned tree plus length cut central leader), diameter and # growth rings of cut on central leader. Tag and Photograph representative pruned trees.
- c. Nov. – Dec. 2018, SH, I: Summarize: Group data into 3 diameter classes/site, count members/class/species, and compute mean measures/class/species (Excel spreadsheet, then chart summary data for Annual Report). TA visit.
- d. Sept. 2019, SH: Re-photograph tagged trees for Final Report.

3. Quantify initial plot productivity: Weigh tree matter consumed in goats on demo plot.

- a. May 2018, SH, E: Put hogs on poison ivy in demo plot for 1 week, and as needed.
- b. May – Oct. 2018, SH, E, I: Bring goats each site work day. Record goat weights and time at our entry and exit (platform scales, notebook then Excel on Microsoft Surface Pro 2).
- c. May 2018, SH, E, and I (1 hr. turns): During 3 hrs. of 1 day in enclosure, count goat defecations and urinations/hrs. Collect and weigh fresh defecation total (bucket, plastic glove). Capture and weigh 3 urinations. Compute rough "weight excretions/hour".
- d. (May 2018 trial), Oct. – Nov. 2018, SH, I, TA if needed: Compute total weight fresh fodder consumed = (total goat exit weights + weight excretions/hr. x hrs. spent) – total goat entry weights. Compute mean weight fresh tree matter consumed per visit (Excel).
- e. Dec. 2018 – March 2019, SH: Put goats in demo 2 - 4 hrs./day, 3-4 days/wk. until stacks (4.a. below) run out. Provide calf hutch. (Water provided in home quarters.) Feed dried branches by

standing/tying against stack , butt ends down. Chip refuse periodically and spread where manure is landing. Weigh goats and compute as b. and d. above, for total weight and mean weight/visit dried fodder consumed.

f. SH, I: Add .50xlbs. fresh fodder consumed to lbs. Dry Matter (DM), (USDA NRCS, 1997, National Range and Pasture Handbook) , to offer total lbs. DM edible portion/acre to farmers.

4.Store

a. Dry, intact:

May – Oct. 2018, SH, E, B, I: Set 10' D junk wood bases for branch stacks, around standing trimmed center poles cut at 8 ft. (can be rooted).

May – Oct. 2018, SH, E, B, I: Piece unbrowsed branches to < 2 " butts, length < 8 ft. (wheeler saws, billhooks, loppers) when surplus is evident. Stack, leaf ends inward with 1 –3 ft. overlaps past center pole, such that subsequent layers slope downward toward butts at circumference. Cover (bucket over pole top, 12'x12' tarp, 4 bungies)

b. Dry, shredded: May – Oct. 2018, SH, E, B, I:

Shred (Troybilt Super Tomahawk or comparable) twig ends of fresh branches down to 1" from 1. b., of each species as sufficient quantities are harvested, into 30 gal. barrel to make 20 – 30 loose gal./species.

Spread 7 - 10 gallons shredded leafy branches/species 3" deep in stacked wooden flats, in open barn.

c. Ensiled:

May – Oct. 2018, SH, E, B, I: Snap off green leaf bunches; fill firmly to 5 gallons (less per species availability) in contractor bag inside 5 gal. bucket, for each broadleaf species in quantity at demo sites excepting maple unless gallic acid can be tested (will explore), so using beech, white and yellow birch, white ash, red oak, big tooth, quaking aspen; compress with hands; tie tightly. Store in barn (carefully without bucket if bags appear airtight – use buckets if not) for 5.

May – Oct. 2018, SH, E, B, I: Pack shredded branches (from 4.b.) as in 4. c.

d. Cooked: Jan. 2019, SH: Add water to cover dried leaves, each species in B.1.d.. Bring to a simmer. Take off heat and cool slowly. Useful to farms having many sheep and/or goats with small number cows and/or hogs.

5. Rank livestock fodder responses: May 2018 – March 2019, SH, E, or I: Trip to all farms for each or multiple feed item/s. (Excel spreadsheet:) Enter date, tree species and description (detailed in 4. plus fresh intact and fresh shredded) ; rank as 3="immediately consumed", 2="eventually consumed", 1="nibbled", or 0="refused," by

a. Freisan-Dorset cross dairy sheep, Y Knot Farm

b. Saanen goats, 3 Streams Farm

c. American Guinea hogs, 3 Streams Farm

d. Holstein cows, Faithful Venture Farm

e. Dexter cow and Dexter-Jersey heifer, Jackson Regenerational Farm

Order rankings per livestock species.

6. Time labor output: May – Oct. 2018, SH, E, I: Manual labor time on demo site recorded

daily/person in hrs. Time collecting data (1 person assigned/day) and packing silages, hrs. not counted. Report total person-hrs. logged.

C. Annual Report: Jan. – March 2019, SH, I.

1. Livestock fodder rankings (B.5.).
2. Our “Priorities for tree retention” and “Pruning Rules” (B.1.C.), with discussion.
3. Species specific pruning cut recommendations and structuring (A.3).
4. Plot description (B.2.c.).
5. Person-hrs. (B.6.).
6. DM consumed by goats/this 1 acre (B.3.d.-f.).

*Jan. 2019 or ‘20, SH: NOFA NH Winter Conference.

*March 2019 or ‘20, SH, I: Grazing Conference.

* June 2019, SH: MOFGA Farm and Homestead Day.

*July 7-13, 2019, SH, Presenters: Tree Fodder Seminar.

*Sept. 2019, SH: Common Ground Fair.

* Sept. 2019 or ’20, SH: Grassfed Exchange Conference.

*Oct. 2019 or ‘20, SH: Farmer to Farmer.

D. Final Report: Dec. 2019 – Jan. 2020, SH (TA edits):

- a. Contents of Annual Report (C.1.-6.), adding any new data and editing.
- b. Final photographs(A.1.d. and B.2.d.).
- c. Discussion.

WHAT IS THE OUTREACH PLAN?

Shana will email a press release describing project and SARE Farmer Grant award to Bangor Daily, Free Press, Village Soup, MOF&G newspaper, and Acres USA magazine.

Shana will maintain overseas contacts, in person March 1-3 and by email.

CJ Sloane and Maria Gail will copy press release and short bi-monthly updates that Shana and Intern provide on www.3streamsfarmbelfastme.blogspot.com, inc. links to Annual and Final Reports, onto Tree Hay (over 350 members) and 3 Streams Farm Facebook pages respectively. (CJ and Maria already copy postings from the blogspot.) Intern will post on www.silvopasture.ning.com.

We will host the 3rd annual Tree Fodder Seminar July 8-14, 2018, with guest presenters and likely MOFGA sponsorship and collaboration on one day there, plus usual MOFGA Day Trip farm tour, and additionally publicize through NOFA, University of Maine Cooperative Extension, Maine Grass Farmers’ Network, Belfast Transition and Permaculture, and local NRCS/USDA FSA. The 4th Seminar will be July 7-13, 2019. These week-long events, with partial attendance options, will give farmers hands-on experience and a close look at demo plot progress.

Shana’s usual participation in MOFGA Farm and Homestead Days Junes 2018 and ’19, and Common Ground Fair Sept. 2018 will highlight discoveries from our project.

We will seek to present our instructive and farmer-user friendly Annual Report in 2019, or Final Report in 2020, at January NOFA NH Winter Conference, March Maine Grass Farmers’ Network’s Grazing Conference, September MOFGA Common Ground Fair, September Grassfed Exchange Conference (Albany, NY), and November MOFGA Farmer to Farmer Conference.

WHAT IS YOUR FARM BUSINESS AND WHAT EXPERIENCE AND SKILLS DO YOU AND

YOUR TECHNICAL ADVISOR BRING TO THIS PROJECT?

Our pair of registered American Guinea Hogs produce 1-2 Certified Organic litters of piglets/yr. Mixed Organic poultry procreate. Our 5 Saanen goats provide organic whey to pigs, and seasonal milk contracts to 11 families, from fresh greenery. Tree canopy harvest and browse walks provide 50% of the goats' fresh season diet (significant but smaller % for hogs) - in droughts 2015 - '17, much more.

2017 intern Elliot has worked on Maine farms for 3 seasons. Brittany first came to this farm in 2015. She has an instrumental role in a Unity community garden.

Our project Intern may be Joshua Kauppila, 2014-'15 apprentice, who will help edit reports, regardless.

I have farmed and provided farm labor (pruning, grafting, blueberry harvest, cow milking) since 1983, and here since fall 2000. Milk contracts plus fruit related employments provide the steadier half of my income. Demo pruning will replace my usual work for goats.

Faithful Venture Farm in North Searsmont produces Certified Organic Holstein milk for Horizon. These cows are unfamiliar with tree leaf fodder. Y Knot Farm in Belfast sells cheese and meat from their East Freisian x Dorset sheep, plus chicken eggs, at their farm store; the sheep were taught by goats to love tree matter. Jackson Regenerational Farm in Belmont is opening woodland for a tree leaf fodder/acorn savannah raising American Guinea pork, broiler chickens, eggs, and a Dexter milk cow and Dexter x Jersey calf, who already choose leaves significantly.

Technical Advisor Eric Evans breeds chestnuts for the American Chestnut Society, Maine Chapter, and tends a home fruit and nut orchard in nearby Camden.

Farm funds are set aside for shredder, tarps, bungees, contractor bags, fence posts and clips. We just bought a platform scale, and have sufficient fence wire, buckets, ropes, harnesses, two chain saws and pruning tools.

Budget

Category	Line Item Description	Amount
Personnel	Project Leader	\$4,000
	Support staff	\$10,000
Materials and Supplies	None	\$0
Travel	travel	\$300
Printing and Publications	None	\$0
Other Direct Costs	Arborist	\$400
	Services from Farms	\$300
Indirect Costs	None	\$0
Total Request		\$15,000