Our Tree Fodder*(& other) Research (p.1)

* I am using the alternate terminology of "Tree Forage" often lately, especially for stored tree matter, to be included & understood by labs and forage educators. Also "Fodder" to me implies something fed. My animals forage for much of what I cut, traveling to harvest sites on free browse wanders.

Click on this PDF &
Page Down or Scroll for:

My steer Angelo above,
& sheep at Meadowsweet Farm below,
both enjoy Yellow Birch leaves.

p.2 SARE FNE24-083 "A Closer Look to Guide Farm use of Tree/Shrub Silages: Per-Species & Ensilement Analyses for Safe, Nutritious Rationing, plus Replicable Trial Results"

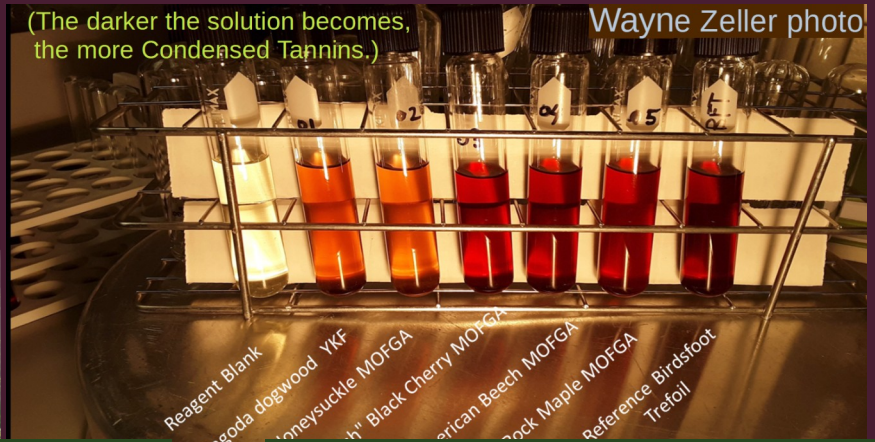
Annual Report (I'm working on Final), posted by Northeast SARE:
https://projects.sare.org/sare_project/fne24-083/

I made the mistake* of following academic advice to nutritionally test every leaf-silage barrel used in my FNE22-013 animal trial (in case anyone wanted to publish a scholarly article, but that real-life on-farm trial was unlikely to meet academic publishing guidelines).

(*Example: Silage from the MOFGA Quaking Aspen stand did not need to be tested 11 times.)

Yet toxin tests on both Cherry & Maple species, though fallible & confusing, did yield eye-openers, & my collaboration re: C Tannins was supported, plus I acquired more data on positive value of blacklisted plants, inc. Autumn Olive, M Rose, Bittersweet & Buckthorn.

Moe Martin helped me add species..



Wayne Zeller continues to explore tannins.

Our Cherry HCN results were confusing..

 My SARE FNE24-083 take-away from expensive nutritional & toxin testing at 3 laboratories:
Lab processes are complex, fallible, & inconsistently predict utilization by my animals, but occasional gems of tentative further understanding occur.

Dairy One Forage Laboratory had trouble measuring Soluble Protein (SP) & Rumen-Degradable Protein (RDP) in so many of my tree & shrub leaves that they asked for me to stop ordering those tests. Wayne Zeller thinks that tannins may be binding proteins, to clog their filter; we don't have enough tannin screens done yet to test this hypothesis.

Some of these spreadsheets started out in FNE22-013, but the additional funding of FNE214-083 added more data.

Dairy One NUTRITIONAL DATA from ALL 2022-'24 LEAF-SAMPLES analysed

Dairy One FERMENTATION & Nutrition, comparing 2018 short fermentations with 2023-'24 1 yr+ fermentations

Dairy One data comparing PAIRED FRESH & ENSILED leaf-samples

HARVEST-DATE categories COMPARED, Dairy One PAIRED FRESH & ENSILED samples *

3 HARVEST-DATE categories COMPARED, Dairy One data on SELECTED leaf-samples *

* My 2 attempts above to compare nutritional data from differing harvest dates were limited by use of existing samples from FNE22-013, which were not collected for that purpose.

Nutritional highlights: Tree & shrub leaves offer much higher energy & lower fiber than do grass forages, & lots more minerals, especially Calcium. Autumn Olive offers consistently high protein content. Ensiled leaves strangely have higher Crude Fat content than fresh; we don't know if purportedly indigestible cutin & wax benefit the animals.

ISU Veterinary Diagnostic Laboratory (ISUVSDL) toxicologist Scott Radke had told me that Hydrogen Cyanide (HCN) in other forages was generally considered to decrease to safe level after 60 days ensilement.

Other contacts & sources said same about drying (one source specifically said this about cherry leaves).

The literature says that young & wilted cherry leaves are most toxic.

Results on these 2022-'23 samples seemed to confirm ensiled safety,

but then….

Iowa State U Veterinary Diagnostic Labortory Cyanide (HCN) Analyses on Cherry Leaves

*Ensiled samples were drawn and frozen in winter or early spring.
June-harvested samples had more warm weather for fermentation than did October-harvested.

Harvested	Site, Sample Description	CN ppm as fed	% Moisture	HCN ppm DM
09/29/22	YKF Black Cherry, Fresh	123.8	60	309.50
09/29/22	YKF Black Cherry, Ensiled	22.3		
06/27/23	MOFGA Black Cherry, Fresh	201.9	62	531.32
06/27/23	MOFGA Black Cherry, Ensiled	<50	66	<147.06
06/29/23	MOFGA Pin Cherry, Fresh	115.3	58	274.52
06/29/23	MOFGA Pin Cherry, Ensiled	<50	67	<151.52
10/11-12/23	YK WW Black Cherry, Fresh	113.4	58	270
10/11-12/23	YK WW Black Cherry, Ensiled	<50	64	<138.89
	(left out 24 hrs on a gray day)			

ISUDVL Guidelines:

ppm HCN DM	
0-500	Generally safe, should not cause toxicity
600-1,000	Potentially toxic, should not be the only source of feed.
1,000 & above	Dangerous to cattle & usually will cause death.

 Lab processes & CYANIDE PROCESSES are complex…(continued...)

ISUVSDL Hydrogen Cyanide (HCN) in cherry leaves 2025 results had no expected patterns. The 7/3/25 "wilted 4 hrs" batch became very toxic at 90 days ensiled, the 6/3/25 batch became very toxic dried vs fresh (but the dried sample somehow had gotten just as wet as the fresh), & wilting generally seemed to decrease vs increase toxicity.

All 2025 samples were frozen (some previous 2022-'23 ensiled samples were not frozen); 2025 samples were ensiled in containers that were not opened prior to testing (2022-'23 samples were drawn from larger containers into double bags); the 2025 dried sample was double-bagged & frozen. 2025 samples were sent by FEDEX overnight service all at once (2022-'23 samples went piecemeal by UPS 2-day or slower ground service).

Further understanding may still occur? Scott Radke sent me an article (link is below) indicating that if leaves are intact versus damaged, they can re-activate & make more HCN, even when dried. I machine-stripped the 6/3/25 ensiled sample, & then hand-stripped to remove twigs; 2022-'23 samples were all machine-stripped then sorted similarly. But I used no machine & only hand-stripped the 7/3/25 samples, by running my hand down new growth only (hoping to get the highest Cyanide level in this young growth). I may have also hand-stripped the 6/3/25 dried sample. Perhaps doing that was less damaging? I would have thought that drying for many days in a sunny room & then freezing would cause sufficient damage to release all Cyanide potential, in that toxic dried sample.
https://enewsletters.k-state.edu/beeftips/2025/09/01/good-news-and-bad-news-on-prussic-acid/
I opened an extra 6/3/25 ensiled then frozen sample, & it seemed properly fermented, despite the small quart container. Is there some way that Cyanide released by leaves gets trapped in a non-gaseous form in my sealed containers, & so doesn't dissipate when opened? My containers also varied in air-space left; I put in a bit of bubble-wrap sometimes to take up space at top. I should have weighed each to make identical amounts. Scott will get back to me with what chemical form/s of cyanide their HP Liquid Chromatography measures. ISUVDL re-measured moisture levels, & found the dried sample to now have 39% versus their first measurement of 60% moisture. Are they opening the bag when very cold, in a warm room? That might get crisp dried leaves to be so wet. My 2018 samples that were dried outdoors had about 11% moisture; these 2025 samples were dried in a sunny room.
Please if you know more about chemistry which may have happened to cause results on next page, CALL me! & leave Voicemail: (207) 338-3301

2025 ISUDVL data on Cyanide in Cherry Leaves

I was surprised that my crispy screen-dried Black Cherry leaves harvested 6/3/25 yielded 60% moisture (a level similar to that in ensiled samples), & had a higher level of cyanide than that found in any other sample - almost 8x as much as found in the matched 6/3/25 fresh sample. (That fresh sample was considered safe).

I also cic not understand how the 90-day ensiled sample in the 7/3/25 “wilted 4 hrs” batch produced or retained slightly more cyanide than the initial non-ensiled sample in same batch, while the same-batch samples ensiled for shorter periods seemed to successfully lose cyanide, with the 60-day sample becoming safe.

Another eye-opener was that my “wilting” decreased cyanide. They did become drier. Acc to literature, wilting is supposed to be dangerous, & drying should bestow safety.

2025 Iowa State U Veterinary Diagnostic Labortory Cyanide (HCN) Analyses on Cherry Leaves

*Fresh samples were packed into 1 qt plastic wide-mouth lab jars with foam cap liners & frozen.

*Ensiled samples were packed likewise & kept in a cabinet in a sunny room, then frozen.

*6/3/25 fresh sample was machine separated, then further hand-sorted to remove twigs. I may have hand-stripped the 6/3/25 dried sample. All other samples were hand-stripped.

*The dried sample was double-bagged & frozen (all others were in containers as above).

Harvested	Site, Sample Description	ICN ppm as fed	% Moisture	HCN ppm DM
07/03/25	3SF Black Cherry, Fresh	613.90	67	1860.30
07/03/25	3SF Black Cherry, Ensiled 30 days	297.60	71	1026.21
07/03/25	3SF Black Cherry, Ensiled 60 days	381.50	71	1315.52
07/03/25	3SF Black Cherry, Ensiled 90 days	<50	53	*n.d.
				*n.d.= none detected
07/03/25	3SF Black Cherry, wilted 4 hrs, Fresh	374.30	59	912.93
07/03/25	3SF Black Cherry, wilted 4 hrs, Ensiled 30 days	284.40	55	632.00
07/03/25	3SF Black Cherry, wilted 4 hrs, Ensiled 60 days	<50	58	n.d.
07/03/25	3SF Black Cherry, wilted 4 hrs, Ensiled 90 days	380.30	63	1027.84
07/03/25	3SF Black Cherry, wilted 24 hrs, Fresh	118.00	43	207.02
07/03/25	3SF Black Cherry, wilted 24 hrs, Ensiled 30 days	<50	44	n.d.
07/03/25	3SF Black Cherry, wilted 24 hrs, Ensiled 60 days	<50	46	n.d.
07/03/25	3SF Black Cherry, wilted 24 hrs, Ensiled 90 days	<50	57	n.d.

For above 7/3 samples, this season’s new growth was snapped off, then leaves were hand-stripped & packed into air-tight containers, or the new growth was set upright in baskets to wilt for designated time-period before said hand-stripping/packing.

05/21/25	YKF Black Cherry, Fresh (container)	300.20	69	968.39
06/03/25	YKF Black Cherry, Fresh (container)	126.30	66	371.47
06/03/25	YKF Black Cherry, Dried (double-bagged)	945.60	60	2364.00
07/13/25	Choke Cherry, Fresh, Harriman Rd Swanville (container)	246.90	65	705.43

ISUDVL Guidelines:

ppm HCN DM

0-500 Generally safe, should not cause toxicity

600-1,000 Potentially toxic, should not be the only source of feed.

1,000 & above Dangerous to cattle & usually will cause death.

Toxins in MAPLE SPECIES inc. BOX ELDER, plus STAGHORN SUMAC

My MU Metabolomic Center contact Gentian Lei had told me that hydrolyzation of Gallic & Ellagic acids would show total content including free acid, but both acids ended up having data-points where hydrolyzed level is lower than free level. Gentian Lei said this was probably due to evaporation when heated.

Gentian convinced me to include Ellagic acid though not known to be problematic in the literature, because they had what was needed to measure that. I was gullible to agreeing to anything, as I was having trouble with my relationship to the U Missouri Center for Agroforestry (my payment go-between for accessing services, as I'm a farmer vs academic researcher).

Occasional gems of tentative further understanding occur. The proteiogenic compounds Hypoglycin A & B & their homologues were said by other researchers to be problematic in Box Elder. These MU results more strongly implicate Hypoglycin A in my animals' Sugar Maple leaf intake limitations, & MCPrG in Red Maple leaf intake limitations (said mostly be due to Gallic Acid).

Link to MU Metabolomics Center Charts & Graphs

(Charts linked above illustrate high variability between same-species samples, & compare amounts per species.)

Date Cut	Species	Site	Free Gallic acid (ug/mg)	Hydrolyzed Gallic acid (ug/mg)	Free Ellagic acid (ug/mg)	Hydrolyzed Ellagic acid (ug/mg)	Hypoglycin A (HGA) peak area	Hypoglycin B (HGB) peak area	Methylenecyclpro-pylglycine (MCPrG) peak area	Γ-glutamyl-MCPrG peak area
06/24/2024	Staghorn Sumac	Belfast Rail Trail, Belfast	20.34	5.45	n.d.	n.d.	11904	n.d.	6413	1621
06/24/2024	Staghorn Sumac	Old Belmont Rd., Lincolnville	20.28	52.13	n.d.	n.d.	6043	n.d.	8600	1664
06/25/2024	Staghorn Sumac	Y Knot Farm, Belmont	24.01	24.98	n.d.	n.d.	7562	n.d.	7955	1332
					Note: n.d. Not detected					
06/24/2024	Box Elder	Belfast Rail Trail, Belfast	12.61	5.46	n.d.	n.d.	14908	29957	3117	5015
06/28/2024	Box Elder	Hunt Rd., Unity	12.89	5.01	n.d.	n.d.	11351	25632	7507	10652
06/28/2024	Box Elder	MOFG Kitchen, Unity	12.59	33.76	n.d.	n.d.	17159	161409	7623	52148
06/24/2024	Red Maple	Belfast Rail Trail, Belfast	52.48	26.21	n.d.	0.17	2655	n.d.	42351	629
06/25/2024	Red Maple	3 Streams Farm, Belfast	35.18	21.4	0.16	n.d.	1429	n.d.	36843	n.d.
06/25/2024	Red Maple	Y Knot Farm, Belmont	73.04	6.07	1.20	0.70	1712	561	28661	n.d.
06/24/2024	Sugar maple	Belfast Rail Trail, Belfast	15.25	0.32		21.18	5153	n.d.	8692	1020
06/25/2024	Sugar maple	3 Streams Farm, Belfast	16.16	4.26	6.05	21.25	74983	934	11062	609
06/25/2024	Sugar maple	Y Knot Farm, Belmont	13.91	7.1	0.17	14.65	70984	n.d.	10416	1286
								n.d.		
06/24/2024	Norway Maple	Belfast Rail Trail, Belfast	17.83	26.88	n.d.	0.18	755	n.d.	2598	1733
06/25/2024	Norway Maple	3 Streams Farm, Belfast	13.48	0.52	n.d.	n.d.	4174	n.d.	8921	1353
06/25/2024	Norway Maple	Y Knot Farm, Belmont	13.36	0.56	n.d.	n.d.	5426	n.d.	14890	1899

Link: Wayne Zeller's Condensed Tannin (CT) Screens, my slides & 3 of Wayne's

See "Current Collaborations" on p. 22,
for more about Wayne Zeller's continuing work with leaf-samples I collected.

Apparently most funding for provision of CT to cattle or other ruminants has focused on bio-engineering of leguminous field crops (Alfalfa, White Clover) to cause those plants to produce tannins. No one has examined the nature of tannins in most tree & shrub leaves, which cattle have eaten for 8,000 years.

CT aids digestion of proteins, increasing utilization by as much as 25%. These tannins bind & protect the proteins, to pass through the rumen intact, for less destructive digestion in the small intestine. CT also reducses methane production/emission & intestinal parasites.

Thank you to Andrea Clemensen, Environmental Biologist,
USDA ARS Northern Great Plains Agricultural Research Center
(who co-authored an excellent article on Tanniferous Forages), for connecting me to Wayne.

p.9 SARE FNE 22-013

"Tree/Shrub Silage Production from Field Edges: Climate-Resilient Forage Supplement for Cattle, Sheep, and Goats"

With many helpers, I made 1¾ tons of machine-stripped leaf-silage. Animals at 4 farms wanted much more!

Final Report, posted by Northeast SARE:
https://projects.sare.org/project-reports/fne22-013/

Colin Yarnell's short video of Shana feeding a "braided" tangly gray birch trunk to the Chain-Flail Leaf-Separator:
Video of the Leaf Separator

Harvests of leafy field edge growth at 3 sites:
Harvest Photos

Animal trials measuring intake of leaf-silage & milk yield
Animal Trial Photos

Ethan Andrews' article (The Free Press, July 11, 2023, p.3)
For the Munching of Aromatic Leaves

We made 30 gal (50 lbs, 22 lbs DM) leaf-silage per 10½ LFT field edge at 2 farm sites, & every 15 ft at MOFGA.

Saanen goats gave the same butterfat lbs/day with 55%DM leaf-silage vs 2nd-cut hay.

Angelo chose leaf-silage as 1/3 of his DM in just a 2 hrs/day offering period..

Karl Hallen made the machine.

SARE FNE 18-897

"Tree Leaf Fodder for Livestock: Transitioning Farm Woodlots to "Air Meadow" for Climate Resilience"

Final Report, posted by Northeast SARE:
https://projects.sare.org/project-reports/fne18-897/

Photos of ttrees before & after, harvest activities, dried storage piles & silage, & animal trials for palatability:
Photo Folders

Josh Kauppila & I weighed goats in & out, to measure their tree fodder intake while we climbed & cut. Without Josh, this project wouldn't have happened. Thanks, Josh!

Emily MacGibeny had her hands in this project plus made this website with Shana. Thanks, Emily!

Our on-site harvest yield of eaten* tree matter, including summer leaves, & in winter dried leaves & fresh maple bark, from this mixed-age tall woodlot (previously lightly & selectively cut for firewood) was about 1.200 lbs/acre. A bit of conifer greenery was included, but a lot more was left uneaten, & we didn't measure chipped or stripped silage and dried intake off-site.

*Yes, we weighed the goats & added defecation rate x hrs eating. :)

VT Grass Farmers' Network (VTGFN) Mini-grant

"Lab Nutritional Analysis of Ensiled Tree Leaves and Ensiled Chipped Leafy Branches, with Dried (non-ensiled) Comparisons, plus Average Grass Fodder Comparison, and Relation to Animal Responses"

My posting of Final Report:
VTGFN Lab testing of Stored Winter Tree Leaf Fodders, Final Report 2020

VTGFN awarded me this $1,000 "mini-grant" to have Dairy One run nutritional analyses on frozen samples of the tree fodders we'd produced within SARE FNE18-897 (p.4). These included ensiled hand-stripped tree leaves, ensiled or dried chipped leafy branches up to 1" diameter butts, & dried leaves from whole branches up to 8 ft long piled & dried under tarps. My report above includes thorough comparisons of nutrition from these various storage methods.

Our chipping to 1" butts mirrored shredding that researchers did in Norway EU, in this study that Ingvild Austad had sent me: (Their report is much more thorough than mine.)
Link:: Shredded Leaf Fodders for Sheep, English Summary, (Austad et al., 2003)
I have the full bound copy in Norwegian, with notes from some parts translated by friends. Call me if you'd like to look through it, or fully translate it!

See FNE24-083 (p.2) for abundant Northeastern US nutritional data on ensiled machine-stripped leaves from trees & shrubs, plus some fresh leaf data.

Shana Hanson, 3 Streams Farm, Belfast, Maine
(207)338-3301 shanahanson@gmail.com
www.3streamsfarmbelfastme.blogspot.com

Nutritional Analysis of Ensiled Tree Leaves & Ensiled Chipped Leafy Branches..., and relation to Animal Responses

Samples were produced as part of SARE FNE18-897 2 year Leaf Fodder project.

> Historically, ruminants were wintered on only tree leaf fodders, & seasonally milked.

LABORATORY FINDINGS

Higher than Grass Silage

Non-fiber Carbs
ave. 36 (20 chipped);
Digestible Energy
ave. 3 (2.25 chipped);
Relative Feed Value (RFV)
ave. 156 (82 chipped).

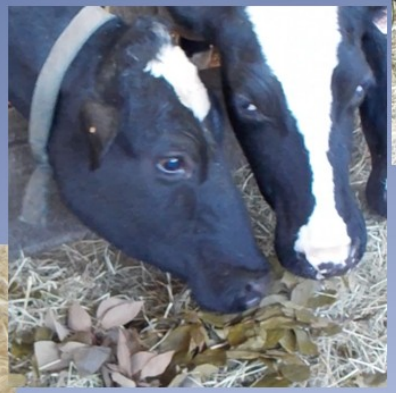
High Mineral Contents

Calcium: W. Ash, Q. Aspen, Hyb. Willow
Manganese: W. Birch, Y. Birch, R. Maple
Zinc: Y. Birch, Q. Aspen

Top Tree Species

By RFV? Q. Aspen, R. Maple, Beech*- No! ... All good differently!

Protein: Lower than Grass Silage. Beech* and R. Oak highest.**



•Beech cut in early spring (only hogs like later).

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** Both were 3rd vs. initial cuttings of pollards.

ANIMAL OPINIONS

Rating Totals across Animal Groups,

Highest to Lowest: (3 = immediately consumed)

Hyb. Willow$^{2.88}$> Beech$^{2.84*}$> Y. Birch$^{2.81}$> W. Ash$^{2.75}$> R. Maple$^{2.47}$> W. Birch$^{2.41}$> Q. Aspen$^{2.38}$> R. Oak$^{2.27}$> B. T. Aspen$^{2.25}$. (0 = refused).

Yet W. Birch was Sheep Top Favorite!, and B.T. Aspen was Cattle Top Favorite (tied w. Willow).

Each group ate differently.

Individuals ate differently, too.

I was iinvited to present this poster at the 2020 VT Grazing & Livestock Conference, where I tabled to talk one-on-one with farmers. There I met Dr. Juan Alvez, UVM, who enjoyed aromas of my leaf-silages & became my livestock research design consultant for the next SARE grant.

I drove though a snow storm to get there, went off the road, & had to pay a tow truck. I slept in my Suzuki Samurai in the parking lot (quite cosy).

Originally UVM was going to pay my travel expenses for a full presentation vs poster. I had already told folks I was coming, so came low-budget.

Applying & following through on grants takes extra time. So often I (Shana) risk financial insecurity and farm production insecurity to try unknown farming practices, in my pursuit of information for myself & other farmers. My herd feeds and comforts me; my ideas and collaborations keep me alive.

The pay for my own time in 3 SARE grants has actually been minimal to totally absent. The biggest differences in funded versus unfunded farm research are the amount of intern help, & full publicizing (versus lack thereof) of experiments & results. So I'm taking time here to share some of my unreported studies.

Gray Birch as Forage, from Blueberry fields

The goats, steer & I continue to explore shifting palatability of Gray Birch leaves, from unwanted coppice in the blueberry field. Gray Birch has seeded itself in from wooded edges, responding reparatively to chronically bare soil patches created by previous farmer Gary Masalin's use of herbicides.

My animals usually will eat Gray Birch fresh any time if fed in a paddock, but they freely browse it voraciously only in spring & fall. They did not wanted dried sheaves we made in 2022, even though harvested 1st days of October (did I not cover them when left piled on the sunny stone wall?). They devour well-timed fall silage, but barely pick through summer-harvested silage.

This year (2025) we made 2 barrels of silage June 16th from 2 ½ yr growth, then on September 26th 4 barrels of 4-month growth. The animals prefer older growth, but young growth is easier to pack. On September 29th I dried baled armloads of the preferred 6 yr growth, trimmed of less leafy lower portions, just piled under a tarp. On December 4th certain goats ate enthusiastically; nothing was finished.

Gray Birch is ironically one of the few species that tangles in my Chain-Flail Leaf-Separator. I'm thinking to replace current square chain-flail rotors with new cylindrical rotors. There's a chance that Gray Birch might pull off of round rotors when it wraps, versus bending & catching around the square ones. Leaf-separation from 8 foot growth might become ideal; our current attempts to gather & pack small intact cuttings are laborious, plus poorly utilize space in the barrels.

Burnable Agroforestry for Blueberry Fields

Forests of Burr Oak & Chestnut used to be cleared of undergrowth by burning. Once mature, these trees have thick, fire-resilient bark. Over half the blueberry land in Maine has been abandoned in the last 10 years, which means more dead twigs, less climate-cooling leaf surfaces, & less food. 90% of our food now is now coming from far places. In fields still maintained, high winds increasingly challenge blueberry pollinators, & warming air temperature is a long-term threat. It makes sense to explore adding food-bearing trees to abandoned fields for productive forest succession, & possibly adding the same to maintained fields as cool pollarded wind-breaks.

In Spain, Chestnuts are pollarded to increase nut production, & keep it in reach. I need to find out more about their pollarding cycle & canopy size. My animals will certainly use the leaf-forage from pollard cuttings of both Chestnut & Burr Oak, whether or not a (possibly longer cycle) nut-bearing canopy is too shady for blueberries.

Walnuts & Hickories want rich bottom land or large compost piles; Chestnuts thrive in more acidic soil, & at 3 Streams Farm have grown well among roots of White Pine. A long well-spaced row of American Chestnuts we obtained from Eric Evans in Camden & planted in 2020, in a bare area downhill from blueberries, are growing very well; we gave each a handful of nearby woodland duff, at planting.

In spring 2025 I planted 10 American & 10 Chinese Chestnuts. The Chinese are in their own area just north of the Americans, & all are uphill from previously planted Chestnuts. I planted them altrernately into blueberry sod or bare ground, lightly rotating an iron bar, then dropping them in and patting it shut (no duff was added, this time). All 20 germinated & look fine; I see no difference between those on bare ground versus blueberry sod.

I’ve purchased rather expensive Rockwool pipe insulation, 4”D x 1” thick, to test as burn protection in spring.

Burnable Agroforestry for Blueberry Fields, continued

These are 5 year old American Chestnuts, in the non-blueberry lower edge of the field.

The new Chinese & American Chestnuts are planted in blueberries & bare patches above these.

Soda bottle protectors are NOT fire-proof; they shrink! Rockwool pipe insulation will replace the lower 2-3 ft of bottles.

Goat/Steer Fertilization & Weeding of Low-Bush Blueberries

Current organic blueberry practices do not include fertilization, whereas “conventional” growers use chemical fertilizers compensated by species-specific herbicides. Past traditions included sheep, but the only recent study I’ve seen (SARE FNE02-431, Stoneset Farm, Brooklyn ME) threw out the idea because the sheep ate new growth right after burning.

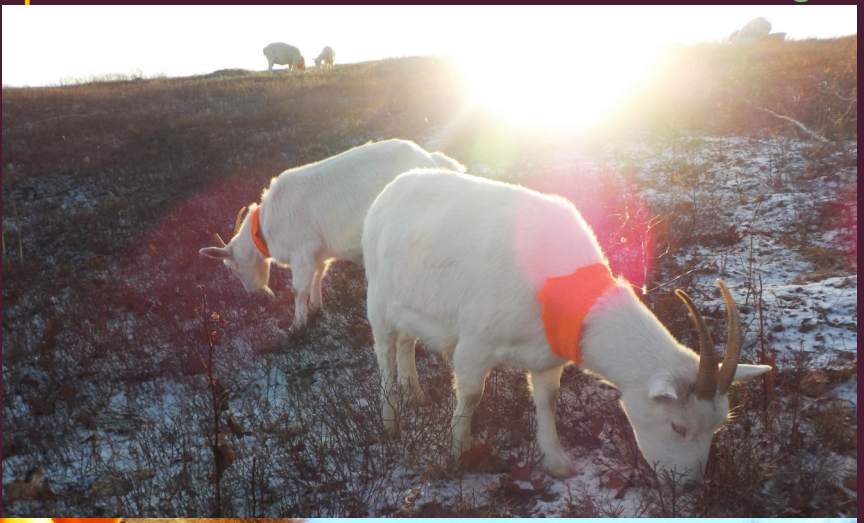
From June 16th to July 1st 2025, my 8 goats & 3-yr old steer chose weeds versus young blueberry growth on the burned side of our field, wandering freely with me for a portion of each day while I weeded. Our footsteps may or may not have impacted later production of fruit buds for the next year’s crop. We left when they started noticing some ripening fruit at the edge of the OTHER side.

The animals’ feces in past yarding on blueberries have not been of sufficient quantity to noticably support an increase in weeds. This time, their small nighttime yard became VERY manured & trampled; I will watch the 2 small blueberry patches there either recover or transition. The rest of that sloped yard was 8 ft tall Gray Birch coppice, some of which I bent down for them to eat each day. I will watch for increased erosion versus new plant cover, as the animals’ feet & manure left no leaf duff.

The trampled Goldenrod in that trampled night-yard came back up late, & made very late large dense nitrogen-fertilized flower heads, which were covered in bumblebees after other Goldenrod was long gone. The bent-over Gray Birches made young basal sprouts with leaves very dark green, due also to nitrogen from the manure. Perhaps this site will support planting of pasture grasses among the coppice next spring.

(Ciontinued on next page...)

 Goat/Steer Fertilization & Weeding of Low-Bush Blueberries, continued…



September 6 to December 2nd, my herd lightly spread wasted feed hay & manure on the harvested blueberry top half, to be burned in spring 2026. I moved them when there was no longer poop-free spots of blueberry sod on which to place their feed hay. I set 9 consecutive temporary fences, but we also wandered. Leaves of our numerous Gray Birch coppices become most palatable in late fall.

In 2023, we occupied one area only; the crop there in summer 2025 was plentiful, & no weed difference was noticed. So we did one area on the bottom half in 2024.

The animals ate tops of certain newly leafing or mistakenly flowering blueberries even in September, but that is good utilization, as this side will be burned. On daily browse wanders to the abandoned south side of this mountain, both steer & goats suddenly in mid November found significant forage value in good-sized areas of new blueberry leaf-growth; perhaps the deer prepared these by browsing fruit buds in spring? After good freezes in late November, ALL clean blueberry plant-tips became browsable. They also began to utilize bare twigs of Gray Birch (but they much prefer the Red Maple I pollarded for them from wooded edges).

Pollarding Red Maple in Winter for Understory Browse Development

Since winter 2020-’21 I’ve set a new welded wire cattle panel winter yard full of Red Maples to pollard, for the goats & now steer (he was born in July 2022). They have eaten significant amounts of Red Maple for winter sustenance since long before, but now with a large bovine (first Tulip, now Angelo) they are safe to stay there day & night. Twig & bark-stripped brush piles up all winter; in the paths, hay feeding areas, & houses (3 calf hutches & a 2 cattle-panel arched run-in), the manure & discarded hay pile up. Angelo strips large pieces of maple, eats twigs down to ½”, & helps to bring woodchips or sawdust to add to paths during thaws. In future years rotted branches will balance dung, if I re-route paths.

In spring, I leave the fence there to protect germination of trees, & shrubs (responding to sunlight entry from pollarding) & pasture plants (in the manured hay), plus I sometimes seed in additional growth. My hope is that at next 6 to 8 yr rotation, these plants will be mature enough to withstand a winter trampling. We have been rotationally grazing orchard grass seeded into the 2022-’23 winter yard, in short visits to minimize damage to woody plants (some of which now have soda bottles or wire for fallible protection).

In 2021-’22 I used a pole chainsaw on young coppice.
Here those are in their second year of growth.
In 2024-’25 (below) I climbed high & cut huge tops with a handsaw.
You can just see some of them, behind Angelo.

Red maple bark is a staple for us (even for Angelo).

That grassy 2022-’23 winter yard still does have a few surviving seedling trees & shrubs, despite our visits. The grass held for this November 2024 visit.

In winter 2023-’24, I only pollarded maple at end of winter, since our SARE FNE22-013 trial used barrels of leaf-silage, alternated with no tree matter & 2nd-cut hay, instead.

That trial ran from around Winter Solstice in December through January & into February.

When I finally cut Red Maple for them, Tilia suddenly freshened in milk (with no baby ever).

p.22 Ongoing Collaborations

Wayne Zeller, USDA Agricultural Research Service Dairy Forage Research Center in Madison, WI has renewed his Condensed Tannin (CT) work on tree & shrub leaves that I collected, froze & sent; this work was delayed by the federal 1½ month furlow break October 1st to mid-November 2025. He and a student are isolating, purifying, & describing CT in fresh & 60-day ensiled tree & shrub leaves which rate "5" or greater (scaled 1 to 10; Birdsfoot Trefoil rates "6") in relative CT level screenings. See this SARE FNE24-083 Report link for my summary of his results so far.

Jo (?), USDA ARS in Minneapolis MN, is receiving portions of my tree/shrub samples from Wayne. She is measuring digestibility & methane emmisions using a continuous-feed rumen simulator. Unfortunately they are not feeding woody forages to the cow from whom rumen fluid is drawn, so microbe populations are likely to be different (& less effective) than those within my browsey steer Angelo. I assume they give the machine a rumen adjustment period, so that the results will at least accurately reflect tree/shrub leaf-forage usefulness to a conventional cow who has no access to a treeline.

Elizabeth Tarantino, Wolfe's Neck Center in Freeport ME, submitted a SARE Farmer proposal this fall 2025, to measure milk effects of feeding leafy brush along field edges to 30+ cows at 12% of their Dry Matter (that means cutting 1,000 lbs of brush/day!) Their long-time vegetable operation manager happens to be an arborist, & may jump on board. If awarded, I will be committed to regular 1½ day stays down there to help. :)

Glendon Mehuren, Faithful Venture Farm in Searsmont ME, & I plan to arm ouirselves with chainsaw, brushsaw and double chopper mitts in summer 2026, to make cattle & goat feed from Multiflora Rose. Calves at Wolfe's Neck Center have dwarved all such tasty roses in their pasture, but Glendon & Jody's heifers have apparently not learned to navigate the thorns (perhaps they need to start younger, & with younger plants?). This will be unfunded bloody work, but my steer & goats will get some Multiflora Rose from it – which THEY love!

If we develop a doable Multiflora Rose harvest protocol, fill barrels (the Chain-Flail Leaf-Separator works on Multiflora Rose) & teach calves in the barn how tasty it is, or put them out on the new growth directly, perhaps I will apply for a grant at some point, to track the calves' subsequent rose browsing as heifers.

p.23 Wishes for Collaboration

I am open to YOUR wishes for collaboration, whether you are a farmer, or researcher, or machine creator. I try to support efforts to increase ruminant access to tree & shrub forages. Call me! (207) 338-3301, & Leave Voicemail.

If you have expertise on human health effects of numerous lipids we've identified in our goats' milk, with & without them being fed tree/shrub leaf-silage, or can explore as-yet unmeasured lipids in the ensiled tree/shrub leaves which the goats ate (to relate to our lipidomic data on the goats' milk), then Yulica Santos Ortega & I would love to hear from you. Yulica was inspired to do pro-bono laboratory work on her weekends, then moved to an all-consuming job at University of Virginia, passing samples & data back to me.

We sampled milk when my goats were fed/not fed leaf-silage during my SARE FNE22-013 winter 2023-'24 milking trial. Yulica identified all lipids present in the milk, & charted differences of HPLC spikes in 10 lipids with greatest difference when ensiled tree & shrub leaves were fed/not fed. She also compared our Saanen goat's milk to differently-fed Saanen goat's milk collected by Kali Wardwell, Abraham's Creamery in Newport ME, & to milk from a cow at John & Wndy Morse's Tilden Pond Farm. Yulica's lipidomic data and those plus additional frozen milk samples, as well as frozen dated samples from batches of leaves the goats ate, are all available.

Andrea Clemensen, USDA ARS Northern Great Plains Agricultural Research Center, ND,had found a colleague to identify lipids in the ensiled leaves eaten, & examine in relation to those in the same-day's milk, but that person's position was cut.

Gray Birch separated July 10th

Green Ash separated July 26th

Hawthorn, tattered small % leaves separated (tangles)

Honeysuckle separated (plus red maple leaves), June 23rd

Hybrid Willow, MOFGA S Or, cut Sept 24th, sep Sept 26th

Multflora Rose, FVF, separ Sept 18, 2024 at John & Na