

# Silvopasture Experiences

A large flock of sheep of various colors (white, black, brown) grazing in a lush green field with a dirt path leading through a wooded area. The sheep are scattered across the field, some standing and some grazing. The path is a narrow dirt trail that winds through the field and into the woods. The trees are tall and green, creating a canopy over the field. The sky is blue and clear.

**By Cherrie Nolden**

1dr Acres Farm, <https://www.wonderacresfarm.com/>

**2025 Wisconsin Sheep and Wool Festival**

Sept 5-7, Jefferson, WI



Lawn-fed lambs, orchard mowing



Topography

# Our Farm System



Photos by Cherrie Nolden



## Current herds:

~150 goats

~150 sheep

53 small draft horses

2 donkeys

7 adult LGDs

2 herding dogs

10 laying hens

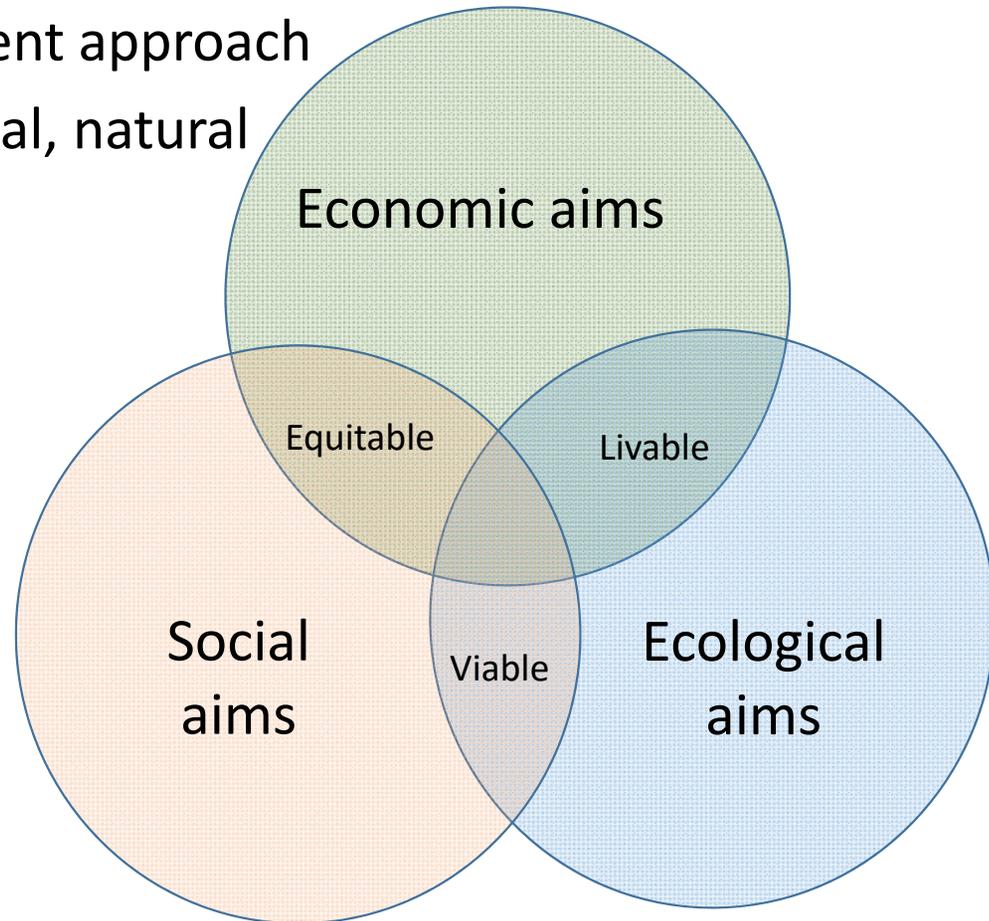




Body Condition Maintenance  
– selection for  
landscape-adapted sheep

# Problem Solving - Holistic Management

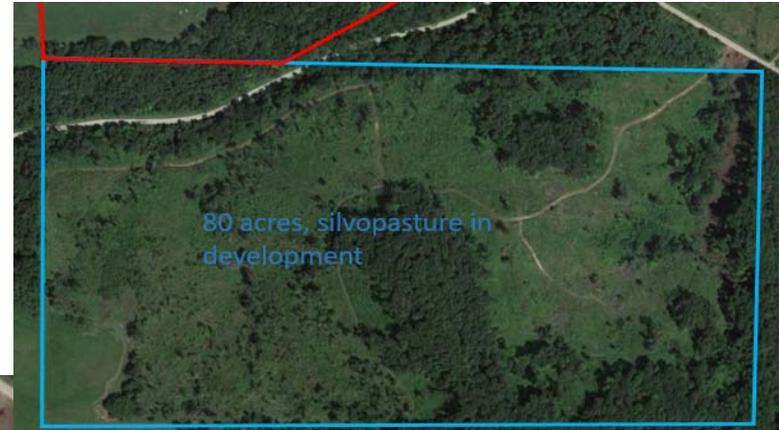
- Holistic, systems management approach
- Mostly organic, non-chemical, natural
- Low input/management
- Low stress
- Optimal nutrition
- Clean water and air
- Individual choices
- Diversity
- Adapted genetics
- Not product substitution



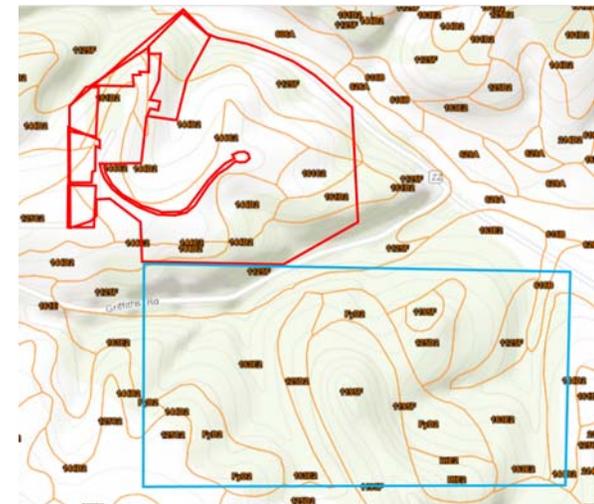
# Farm Layout



# Farm Layout - Silvopasture



- Permanent fences
- Temporary electronet
- Planned permanent fences





























## Topics

- Fencing
- Pasture/Forage/Nutrition
- Phytonutrients
- Parasites
- Selection Criteria
- Income
- Predators
- Stocking Rate
- Events by Season
- Resources



# Collars for Goat, Sheep, Cattle Virtual Fence



## Testing Virtual Fence Technology in an Upper Midwestern Goat Grazing Operation

### Final report for FNC21-1306

[FNC21-1306 \(project overview\)](#)

**Project Type:** Farmer/Rancher

**Funds awarded in 2021:** \$8,910.00

**Projected End Date:** 01/31/2023

**Grant Recipient:** The Munch Bunch LLC

**Region:** North Central

**State:** Wisconsin

**Project Coordinator:**

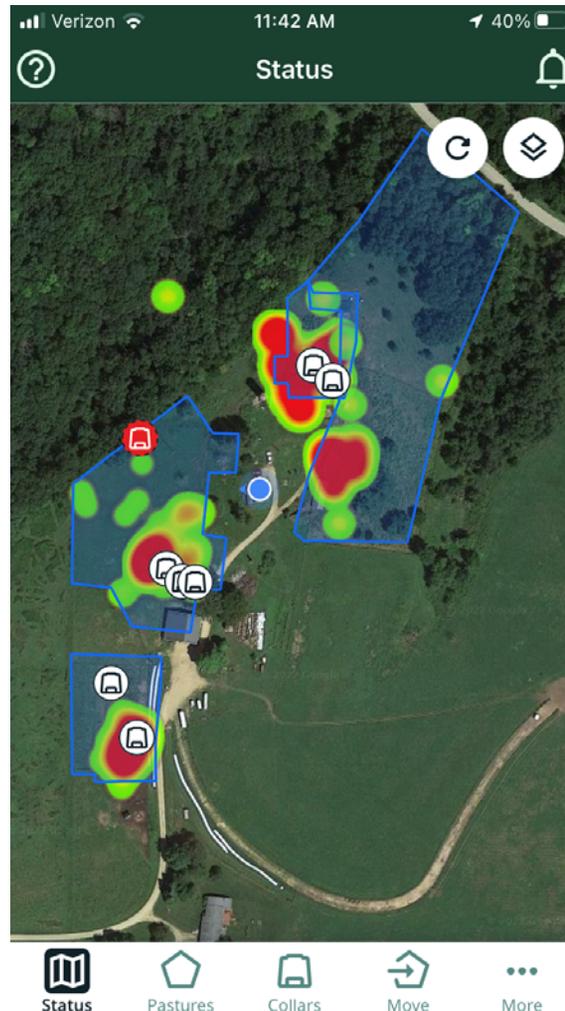
[Allysse Sorensen](#)

[Email](#)

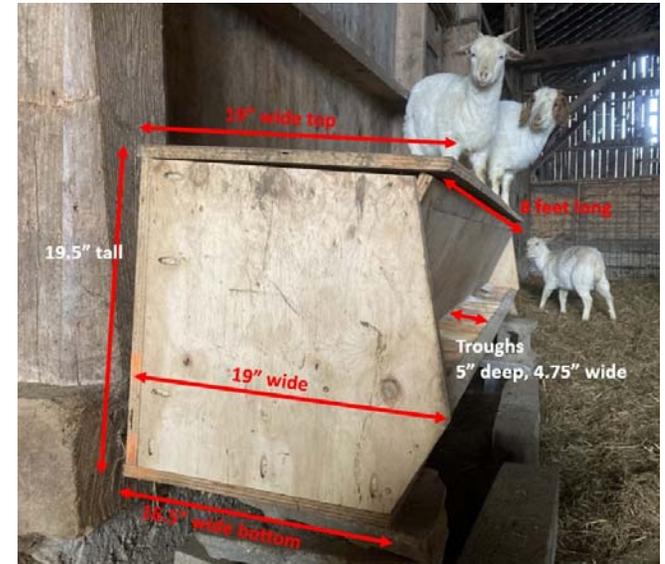
The Munch Bunch LLC

Expand All  Collapse All

**Project Information**



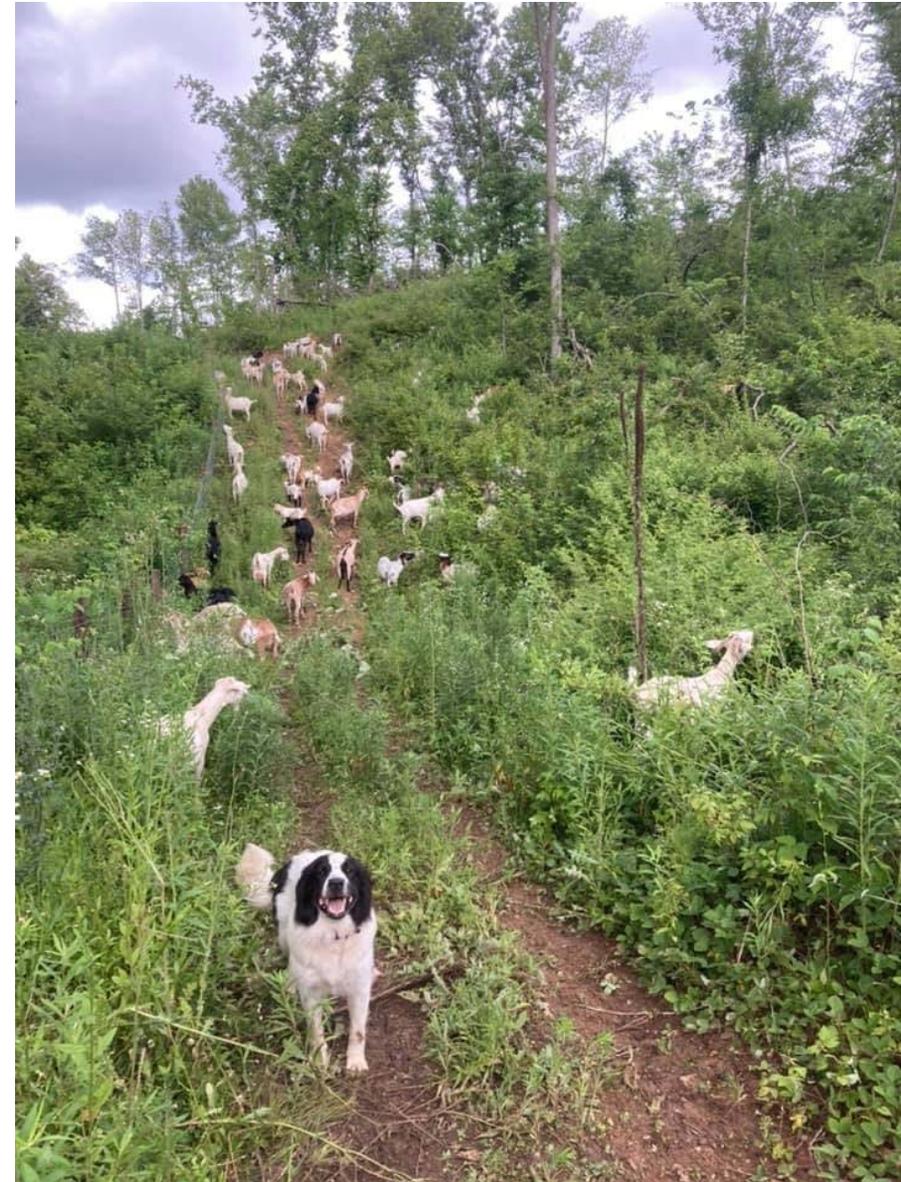
# Minerals





# Comparative Nutrition

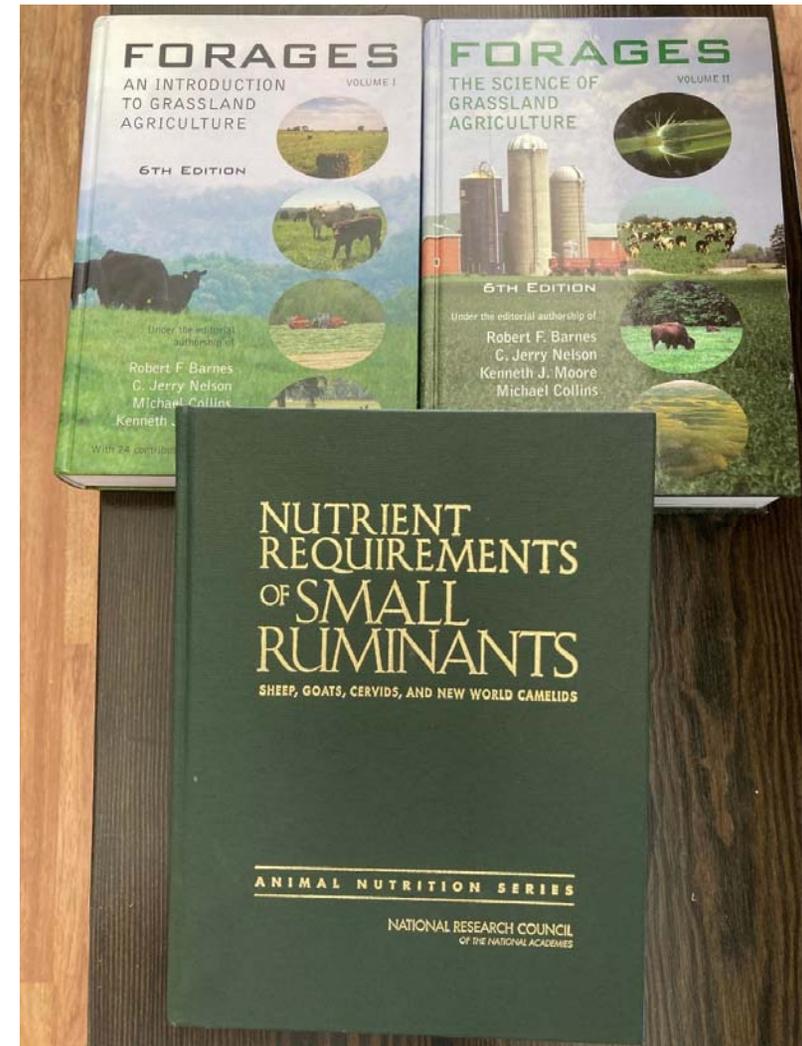
<u>Item</u>	<u>Cattle</u>	<u>Sheep</u>	<u>Goats</u>
Crude protein, % DM	4.5c	9.3b	10.2b
NDF, % DM	74.3a	64.6b	61.6b
ADF, % DM	49.2a	39.5b	37.1b
Lignin, % DM	7.6a	6.2ab	5.8bc
IVDMD, %	43.6c	55.8b	51.0b



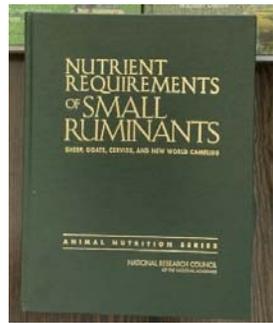
# Pasture Meeting

## Nutritional Requirements

<b>154 lb ewe</b>	<b>Days</b>	<b>Intake %</b>	<b>Intake (lbs)</b>	<b>TDN (lbs)</b>	<b>CP (lbs)</b>
Maintenance (dry)	95	1.7	2.6	1.5	.25
Flushing	30	2.6	4	2.3	.36
Mid Gestation	75	2.0	3.1	1.7	.29
Late Gestation	75	2.6	4	2.3	.42
Lactation (1- 1.5 lambs)	90	3.6	5.5	3.6	.73



# Comparative Nutrition



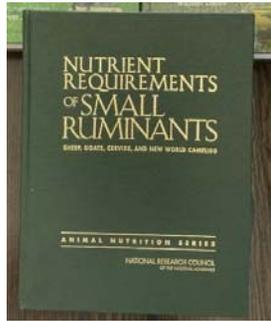
<u>Species</u>	<u>Class</u>	<u>TDN, %</u>	<u>CP, %</u>	<u>Feed</u>	<u>TDN, %</u>	<u>CP, %</u>
Sheep	Maintenance	55	10	Pasture, vegetative	60-76	12-24
	Late Gestation	60	11	Pasture, mature	50-60	8-10
	Lactation	65	14	Pasture, dead leaves	35-45	5-7
	Weaned Lambs	63-65	11	Fescue hay, 6 weeks growth	58-62	8-11
	Finishing Lambs	72-77	12	Fescue hay, 9 weeks growth	48-53	7-9
	Yearlings	59	10	Bermuda hay, 7 weeks growth	54-58	9-11
Goats	Maintenance	55	10	Bermuda hay, 12 weeks growth	47-50	7-9
	Late Gestation	60	10	Alfalfa hay	50-63	13-20
	Lactation	60-65	16			
	Weaned Kids	68	14			
	Finishing Kids		12			
	Yearlings	65	12			

<https://content.ces.ncsu.edu/nutritional-feeding-management-of-meat-goats>

<https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/6685/files/2015/09/NRC-Sheep-1985-1m52js8.pdf>

<https://content.ces.ncsu.edu/nutritional-feeding-management-of-meat-goats>

# Comparative Nutrition



<u>Species</u>	<u>Class</u>	<u>TDN, %</u>	<u>CP, %</u>
Sheep	Maintenance	55	10
	Late Gestation	60	11
	Lactation	65	14
	Weaned Lambs	63-65	11
	Finishing Lambs	72-77	12
	Yearlings	59	10
Goats	Maintenance	55	10
	Late Gestation	60	10
	Lactation	60-65	16
	Weaned Kids	68	14
	Finishing Kids		12
	Yearlings	65	12

<u>Feed</u>	<u>TDN, %</u>	<u>CP, %</u>
Honeysuckle, leaves + buds	70+	16+
Honeysuckle, mature	68+	10+
Sumac, early vegetative	77	14
Oak, buds and young leaves	64	18
Persimmon leaves	54	12
Hackberry, mature	40	14
Juniper (leaves)	64	6
Acorns, fresh	47	5
Curly dock	74	13
Chicory	65	15
Mimosa (leaves)	72	21
Mulberry (leaves)	72	17

<https://content.ces.ncsu.edu/nutritional-feeding-management-of-meat-goats>

<https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/f/6685/files/2015/09/NRC-Sheep-1985-1m52js8.pdf>

<https://content.ces.ncsu.edu/nutritional-feeding-management-of-meat-goats>

# Forage Quality of Woody Spp Leaves, Stems by Season

- *Colutea arborescens*, bladder-senna
- *Arbutus unedo*, strawberry tree
- *Morus alba*, white mulberry
- *Amorpha fruticosa*, false indigo-bush
- *Robinia pseudoacacia*, black locust

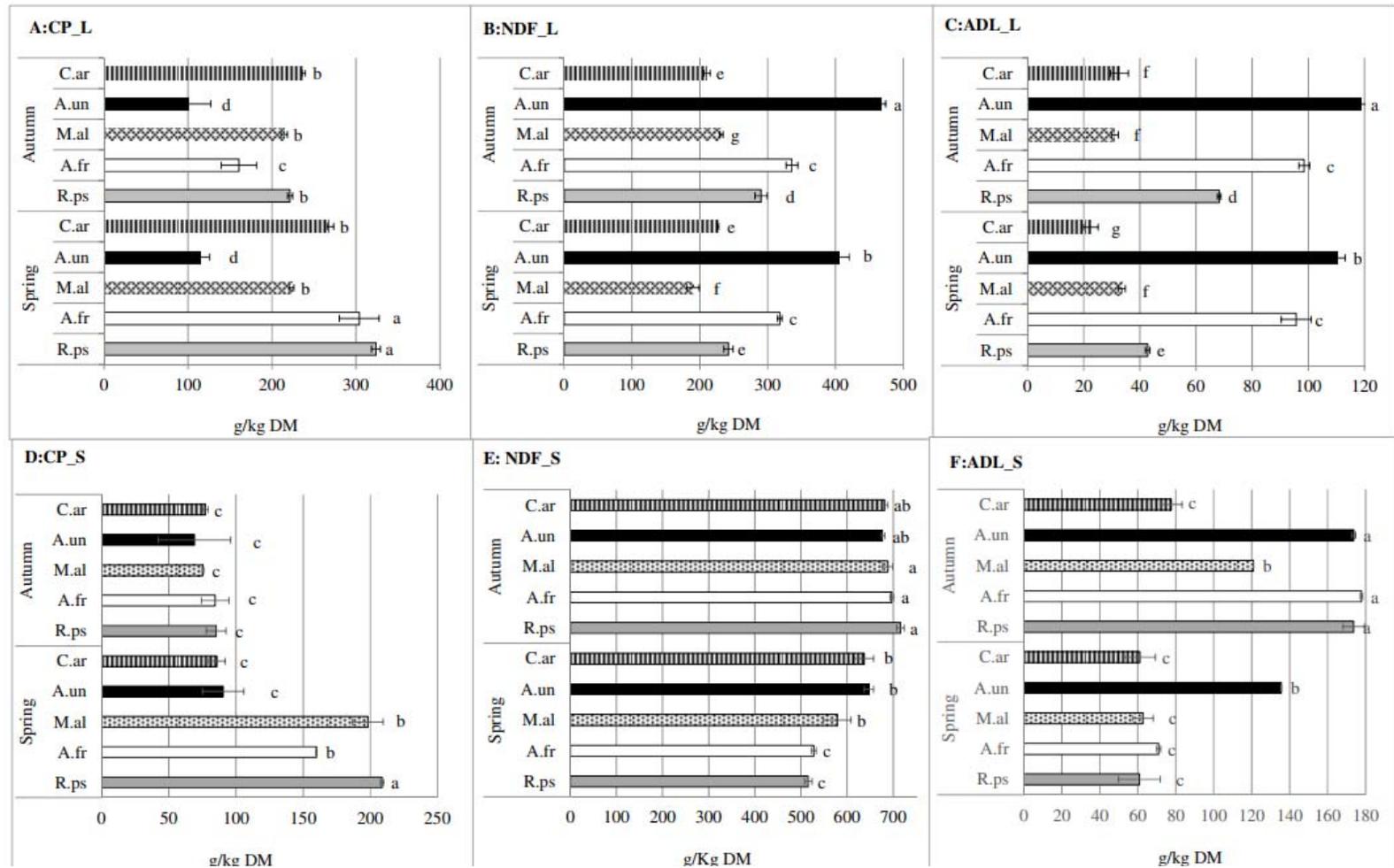


Fig. 1. Interactions between season × browse species for CP (g kg<sup>-1</sup>DM), NDF (g kg<sup>-1</sup>DM) and ADL (g kg<sup>-1</sup>DM) content, for leaves (L) and stems (S). R.ps.: *Robinia pseudoacacia*, A.fr.: *Amorpha fruticosa*, C.ar., *Colutea arborescens*, M.al.: *Morus alba*, A.un.: *Arbutus unedo*. \*Means followed by the same letter for the same content did not significantly differ (P>0.05).

# Invasives Eagerly Consumed:

## Goats:

- Poison ivy
- Wild parsnip
- Virginia creeper
- Autumn olive
- Russian olive
- Eastern red cedar
- Honeysuckle
- Boxelder
- Sumac
- Buckthorn
- Black locust
- Siberian elm
- Winged burning bush

- Garlic mustard
- Thistles
- Prickly ash
- Multiflora rose
- Brambles
- Red osier dogwood
- Willows
- Japanese knotweed
- Reed canarygrass
- Brome
- Crown vetch
- Mulberry
- Wild grape
- Elderberry

## Sheep are better:

- Garlic mustard
- Crown vetch
- Brome
- Wild parsnip
- Undesirable forbs
- Grasses

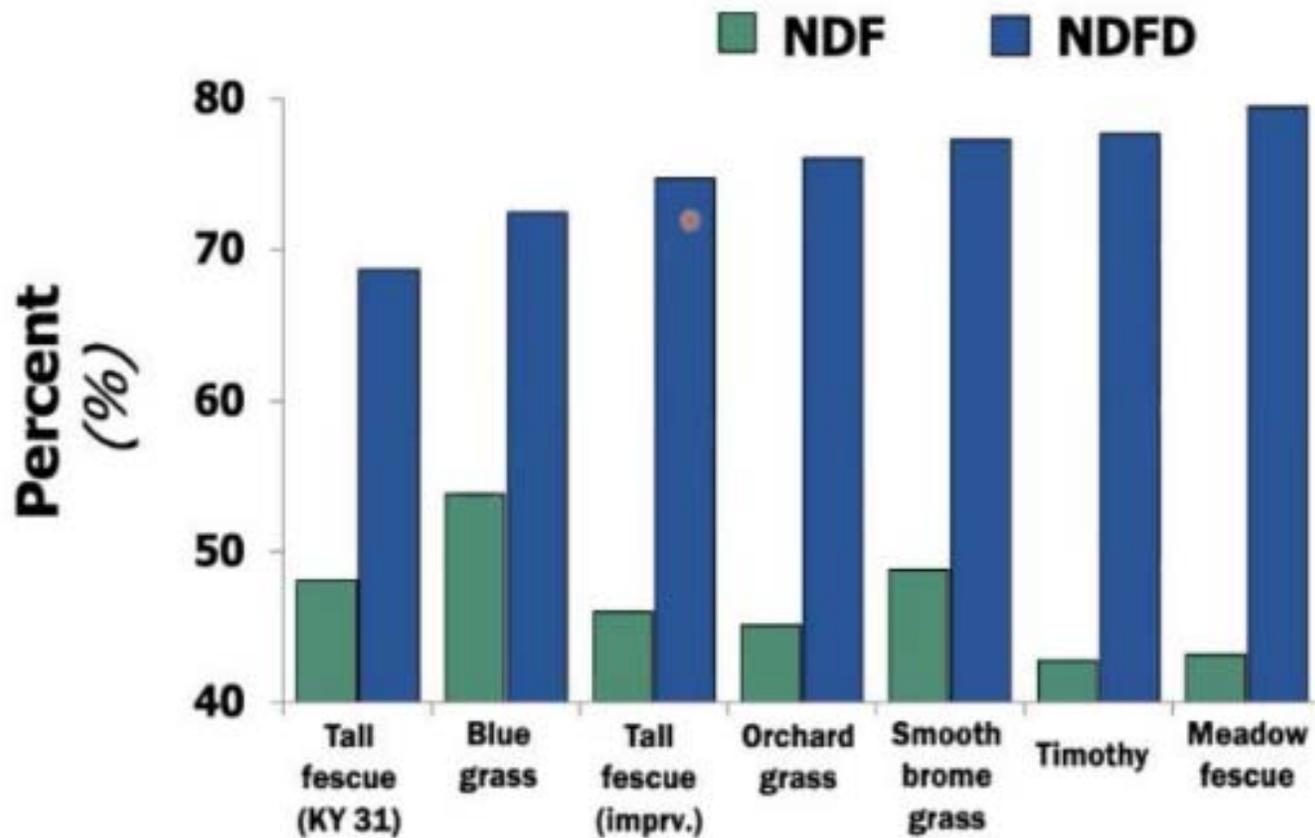
## Species not liked:

- Common mullein
- Mint family
- Novel species
- Overabundant spp

# Our Pastures

- Planted:
    - Narrowleaf Plantain
    - Chicory
    - Birdsfoot trefoil
    - Alfalfa
    - Dutch clover
    - Orchardgrass
    - Tall fescue-SE
    - Timothy
    - Perennial Rye
    - Annual Rye
    - KY Bluegrass
  - Reed canarygrass
  - Smooth Brome
  - W. Wheatgrass
  - Barnyard grass
  - Quackgrass
  - Foxtail
  - Garlic mustard
  - Bindweed
  - Ground cherry
  - Horsenettle
  - Ragweed
  - Lambsquarters
  - Burdock
  - Canada thistle
  - Bull thistle
  - Wild lettuce
  - Bergamot
  - Milkweed
  - St John's wort
  - Cleavers
  - Asters
- Wild parsnip
  - Chickweed
  - Yarrow
  - Pigweed
  - Wild carrot
  - Curly dock
  - Purslane
  - Ladysthumb
  - Mullein
  - Marestail
  - Velvetleaf
  - Bladder campion
  - Broadleaf plantain
  - Dandelion
  - Yellow rocket
  - Heal all
  - Violet
  - Shepherds purse
  - Pennycress
  - Wild mustard
  - Hoary alyssum
- Pineapple weed
  - Sedges
  - Shooting stars
  - Bloodroot
  - Mayapple
  - Jacobs ladder
  - Ostrich fern
  - Goldenrod
  - Many more
- Trees/Shrubs
    - Oaks
    - Hickories
    - Walnut
    - Black locust
    - Hazelnut
    - Wild Cherry
    - Prickly ash
    - Honeysuckle
    - Mulberry
    - Elms
    - Cedar
- Pines
  - Boxelder
  - Multiflora rose
  - Autumn olive
  - Quaking aspen
  - Birch
  - Willows
  - Apple
  - Pear
  - Wild plum
  - Chokecherry
  - Dogwood
  - Viburnum
  - Hackberry
  - Raspberries
  - Blackberry
  - Elderberry
  - Hawthorn
  - Buckthorn
  - Maples
  - Many more

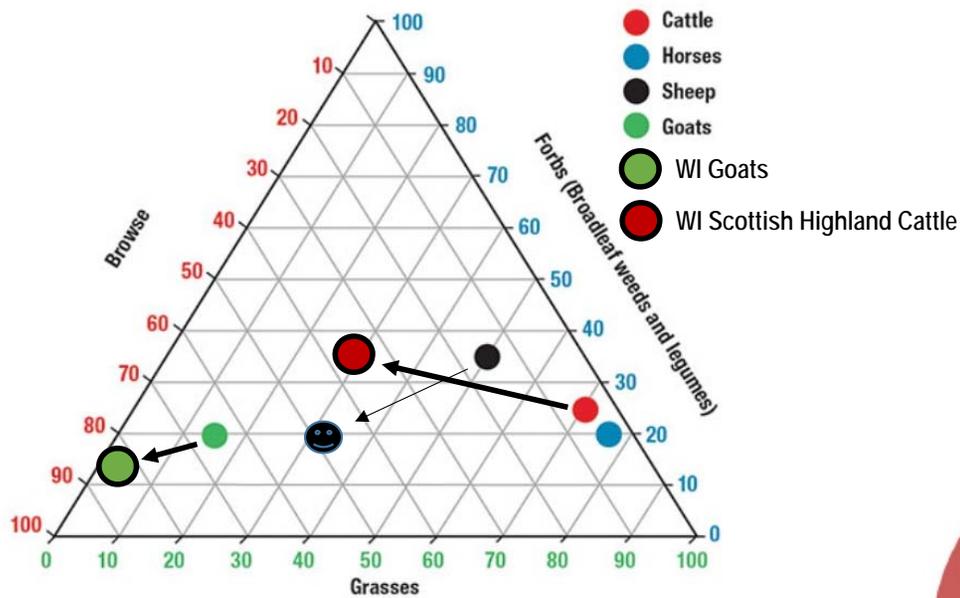
# NDF alone is insufficient to assess quality



- Need to test Digestibility of forages to really assess what the animal could extract as energy



# Forage Preferences



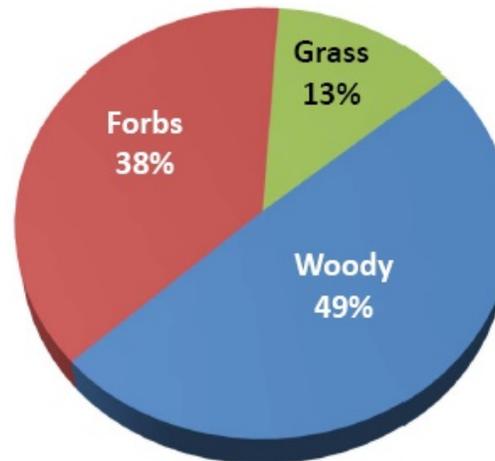
Cattle	Sheep	Goats
<ul style="list-style-type: none"> <li>Grass → Forbs → Browse</li> <li>Primary grazers of grasses and legumes</li> <li>Tend to graze taller grasses that sheep will refuse</li> <li>Prefer lower flatter areas</li> <li>Sensitive to plant toxic compounds and tannins</li> </ul>	<ul style="list-style-type: none"> <li>Forbs → Grass → Browse</li> <li>Prefer clovers</li> <li>Graze close to the ground</li> <li>Inclined to graze higher and drier areas</li> <li>Can tolerate salty compounds</li> </ul>	<ul style="list-style-type: none"> <li>Browse → Forbs → Grass</li> <li>Opportunistic grazers</li> <li>Do not like clover but will eat it</li> <li>Do not like to graze close to the soil surface</li> <li>Inclined to graze higher and drier areas</li> <li>Tolerance for tannins and bitter plant compounds and fewer problems with plant toxicities</li> </ul>

In Brushy Oak Savanna:

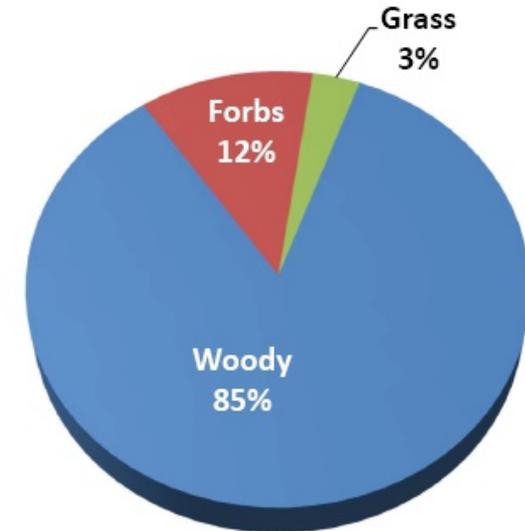
WI goat diet preferences:

- More Browse
- Less Grass
- Less Forbs

2011-2014 Ave Forage Availability



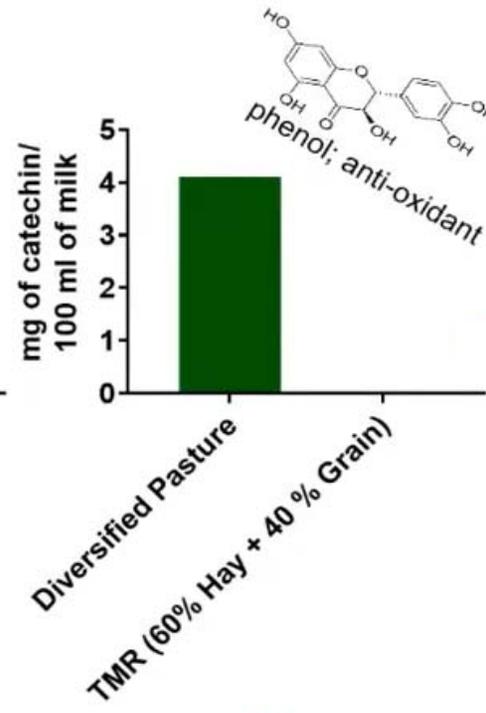
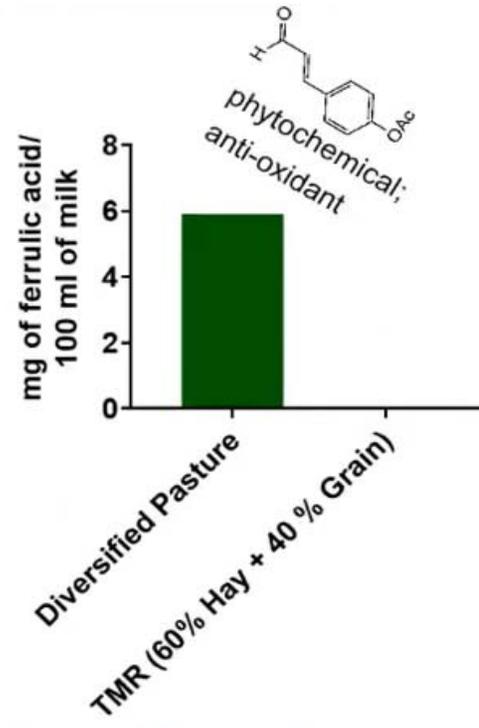
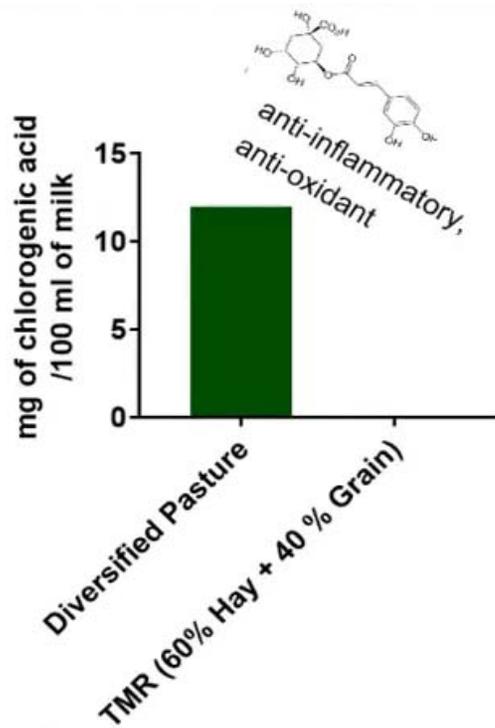
2011-2013 Ave Goat Forage Selections



(Nolden et al., 2020; R. Lemus, 2012; Harrington and Kathol, 2009)



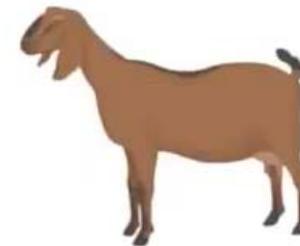
# Pasture concentrates phenolic compounds in milk



Diversified pasture  
 ➤ 10 major species  
 Forbs, shrubs,  
 woody plants



Common anti-oxidant phenolics are found **exclusively** or in **↑ concentrations** milk from grass-fed animals



data adapted from Delgadillo-Puga et al. 2019. doi:10.3390/ani9080515

# Alternative forages

- Chosen by animals for health reasons
- Forages containing plant secondary metabolites PSMs

- Sericea lespedeza
- Chicory
- Birdsfoot trefoil
- Plantain
- Wormwood
- Thyme
- Rosemary

How do they work (?) – reduce egg hatch and development of larvae.

P.E. Kearney et al. / Veterinary Parasitology 220 (2016) 93–107



# Alternative Dewormers

- COWP
- COWP plus herbal products
- Tannin drenches, herbal supplements
- Anthelmintic plants
- Immune-primed eggs



American Consortium of Small Ruminant Parasite Control



## Discussion

- Fecal egg counts were lower ( $P = 0.05$ ) and packed cell volumes were greater ( $P = 0.05$ ) for D7 and D14 lambs compared to the control group.
- Average daily gain and total weight gain were greater ( $P = 0.02$ ) for D7 and D14 lambs compared to control lambs.
- Body condition scores and FAMACHA® scores did not differ ( $P \geq 0.50$ ) across treatments.

Cash et al., 2014. UNL

# Organic Anthelmintics

Activity against Helminths	Plant Secondary Metabolite	Reference
Inhibit energy metabolism	Tannins	(de Macedo et al., 2015)
Cause epidermal lesions	Adenine, ascorbic acid, chymopapain, caricain, genistein, glycyI endopeptidase, lutein, malic acid, papain	(Duke 1992; Piluzza et al. 2014; Vieriera et al. 2001)
Decrease motor activity	Tannins, saponins	(Athanasiadou and Kyriazakis 2004; Hoste et al. 2006; Williams et al. 2014)
	Terpenoids	(Athanasiadou and Kyriazakis 2004)
	Caffeic acid	(Cowan 1999)
Inhibit transformation of eggs to larvae	Tannins	(Athanasiadou and Kyriazakis 2004)

French, K., J. Harvey, J. McCullagh. 2018. Targeted and Untargeted Metabolic Profiling of Wild Grassland Plants identifies Antibiotic and Anthelmintic Compounds Targeting Pathogen Physiology, Metabolism and Reproduction. *Nature Scientific Reports*. 8:1695.

French, K. 2018. Plant-Based Solutions to Global Livestock Anthelmintic Resistance. *Ethnobotany Letters*. 9(2):110-123.

# Midwestern plants containing anthelmintic PSMs

## • Tannins

- Chicory
- Plantain
- Birdsfoot trefoil
- Walnut
- Black locust
- Oak
- Raspberry
- Poison ivy
- Wormwood
- Aronia

## • Terpenoids

- Pine
  - Bedstraw
  - Cedar
  - Ginkgo
  - Hemp
- ## • Caffeic acid
- Tobacco
  - Artichoke
  - Wintergreen
  - Heal All

## • Saponins

- Alfalfa
- Plantain
- Sunflower
- Wild yam
- Asparagus
- Garlic
- Horsenettle
- Tomatoes
- Potatoes
- Bindweed

## Native American Dewormers:

- Butternut oil expels tapeworms
- Gooseberry root and barn infusion
- Horsenettle leaf infusion
- Indian hemp root decoction
- Milkweed latex
- Pine gum decoction
- Artemesia leaf tea
- Staghorn sumac decoction for pinworms
- Thistle root decoction
- Source: Iwigara: American Indian Ethnobotanical Traditions and Science, Enrique Salmon.

French, K., J. Harvey, J. McCullagh. 2018. Targeted and Untargeted Metabolic Profiling of Wild Grassland Plants identifies Antibiotic and Anthelmintic Compounds Targeting Pathogen Physiology, Metabolism and Reproduction. *Nature Scientific Reports*. 8:1695.

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# Mixed or multi-species grazing

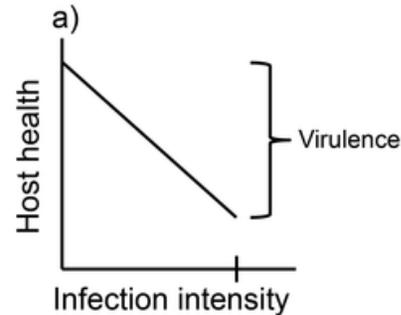
- Parasites are mostly host-specific
  - Worms rarely transmit from one species to another
  - Cattle and horses have different parasites than sheep and goats
- Complementary grazing habits
  - Goats → browse
  - Sheep → forbs
  - Cattle → grass
  - Horses → grass



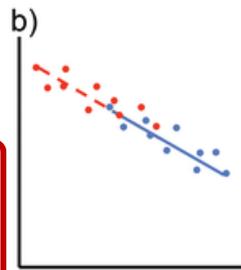
Stallions, Corsican hair rams, commercial buck goats

# Host and Parasite Sources of Genetic Variation

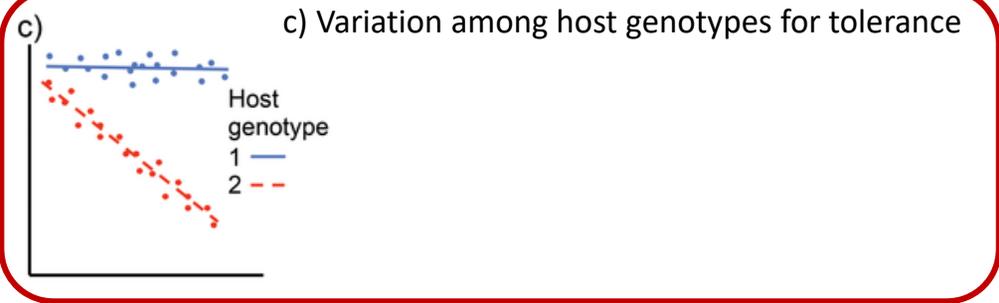
Dots are individual hosts. Lines represent reaction norms for different host or parasite genotypes



b) Variation among host genotypes for resistance

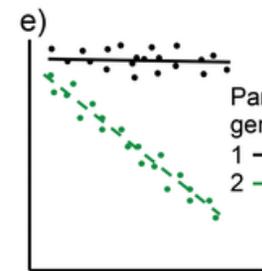
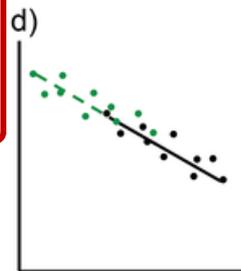


c) Variation among host genotypes for tolerance



d) Variation among parasite genotypes for "exploitation."

Host health



e) Variation among parasite genotypes for "per parasite pathogenicity."

Infection intensity

# Breed Differences in Parasite Management

- Texel, Suffolk, St. Croix, Katahdin
- Low FEC mechanism
  - Prevent L3 larvae attachment, St. Croix
  - Prevent adult larvae egg production, Texel
  - Suffolk rarely have either strategy; high FEC
  - Katahdins can have low or high FEC
- Low FEC sheep resist other diseases better
  - Hoof rot, mastitis, vaccine IgG, LPS recovery
- Serum IgA important for resistance
  - High protein diet and minerals needed



# Parasite Egg Identification

**Intervet**  
EXPECT MORE™

## Guide to Internal Parasites of Ruminants

Sponsored by Intervet—providers of Panacur®/Safe-Guard® to the livestock industry.

**Ostertagia**  
(brown stomach worm)

**Cooperia**  
(small intestinal worm)

**Moniezia**  
(tapeworm - sheep)

**Moniezia**  
(tapeworm - cattle)

**Bunostomum**  
(hookworm)

**Haemonchus**  
(barberpole worm)

**Nematodirus**  
(threadneck worm)

**Trichostrongylus**  
(bankrupt worm)

**Oesophagostomum**  
(nodular worm)

**Trichuris**  
(whipworm)

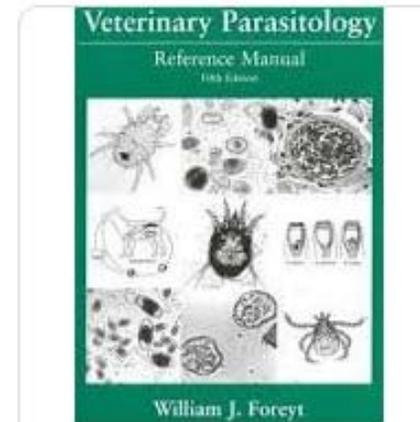
**Strongyloides**  
(threadworm)

**Coccidia**  
(a protozoan that causes coccidiosis)

**Dictyocaulus**  
(lungworm)

**Mite Egg** - 1/4 actual size  
(contaminant - often mistaken for worm eggs)

D.H. Ellis and W.G. Kvanenick; the compendium, April 1997

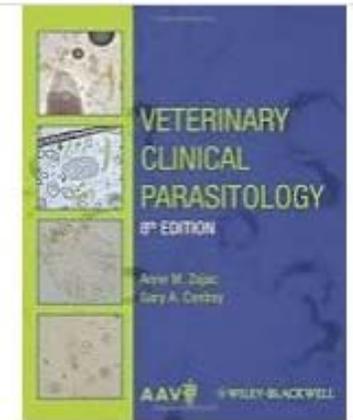


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Map Unit Symbol	Map Unit Name	Ac in AOI	Forage suitability group	Forage Yield (T/ac)	Total Yield in AOI (T)
125C2	Pepin silt loam, 6 to 12 percent slopes, moderately eroded	3.1	High AWC, adequately drained (G105XY008WI)	2.54 (set) 3.72 (3d)	7.874 11.532
125D2	Pepin silt loam, 12 to 20 percent slopes, moderately eroded	4.6	High AWC, adequately drained (G105XY008WI)	2.46 (set) 3.59 (3d)	11.316 16.514
144D2	Newglarus silt loam, deep, 12 to 20 percent slopes, moderately eroded	0.5	Mod AWC, adequately drained with limitations (G105XY006WI)	2.66 (set) 3.89 (3d)	1.33 1.945
163E2	Elbaville silt loam, 20 to 30 percent slopes, moderately eroded	15.9	Mod AWC, adequately drained with limitations (G105XY006WI)	1.33 (set) 1.95 (3d)	21.147 31.005
1195F	Elkmound-Northfield complex, 30 to 60 percent slopes, very rocky	0.5	Not suited, slopes > 30% (G000XY011WI)	1.1 (set) 1.61 (3d)	0.55 0.805
FyD2	Fayette stony silt loam, valleys, 12 to 20 percent slopes, moderately eroded	6.0	High AWC, adequately drained with limitations (G105XY009WI)	2.74 (set) 4.01 (3d)	16.44 24.06
<b>Totals for Area of Interest</b>		<b>30.5</b>	<b>Pred. Yields:</b>		<b>58.657</b>
				<b>1.9 T/a Set</b>	<b>T (set)</b>
				<b>2.8 T/a 3d</b>	<b>85.861</b>
					<b>T (3d)</b>

30.5 acres, 150-200 goats cleared the brush in 180 days time  
150 goats / 30.5 ac = **4.9 goats/ac** stocking rate (whole season)  
200 goats / 30.5 ac = **6.6 goats/ac** stocking rate (whole season)

NRCS TSP Graziers Math: 267.7 goats, if this was set-stocked grass/legume

Pred. Yields:  
1.9 T/a Set  
2.8 T/a 3d

Brush Supports:  
56%-74% of  
grass/legume  
carrying capacity



# How to be Profitable

## • Reduce Costs

- High fecundity – twins raised, low base herd:sales herd ratio
- Thrive on local forages – don't need supplemental energy
- Healthy – free from diseases, don't need deworming, treatments for lice, mastitis, hoof rot, respiratory
- Low labor – hooves, birthing assistance, shearing, stay in fences, maternal, doctoring
- Hardy to local weather – outwintering
- Easy to market
- Low cost infrastructure – handling facility, shelter, fences, feeders, waterers, mineral feeders, straw

## • Increase Income

- Services
  - Brush management
  - Lawn mowing
  - Solar grazing
  - Dog trials/training
  - Agritourism – yoga, photo booth, petting
- Direct sales
  - Meat, hides, horns, bones
  - Fiber – wool, cashmere, mohair
  - Milk
  - Breeding stock
- Auction

# Predators

- Protect your genetics!
- **Fencing**
  - Woven wire
  - Electronet
  - Fladry
  - Paddock size
  - Brush density
  - Topography
  - Movement interval
- LGDs
- Donkeys/Llamas
- Hunting/Trapping



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# Predators

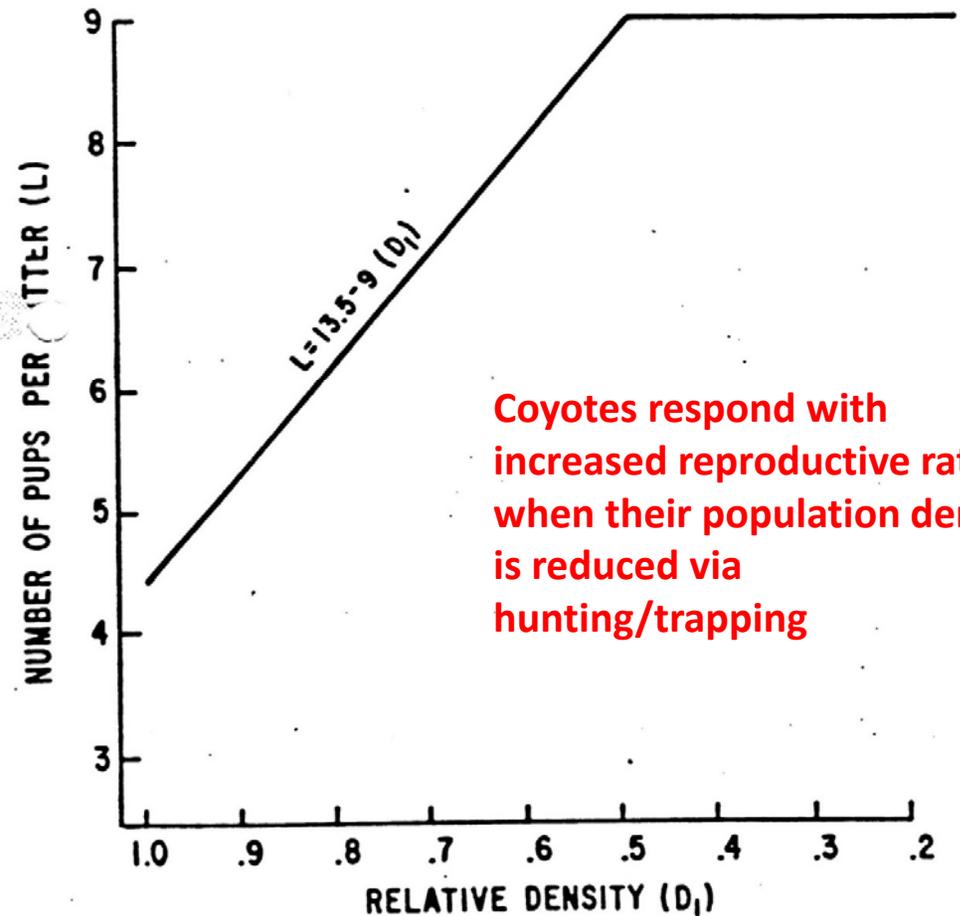
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# Predators

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- **Hunting/Trapping**

COYOTE LITTER SIZE RELATED TO COYOTE DENSITY



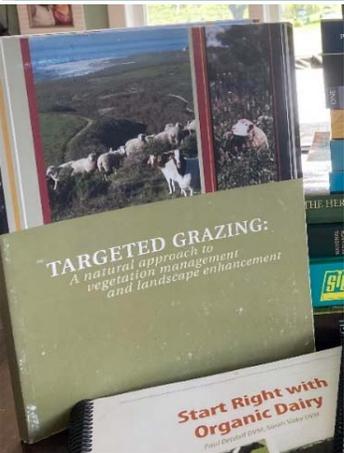
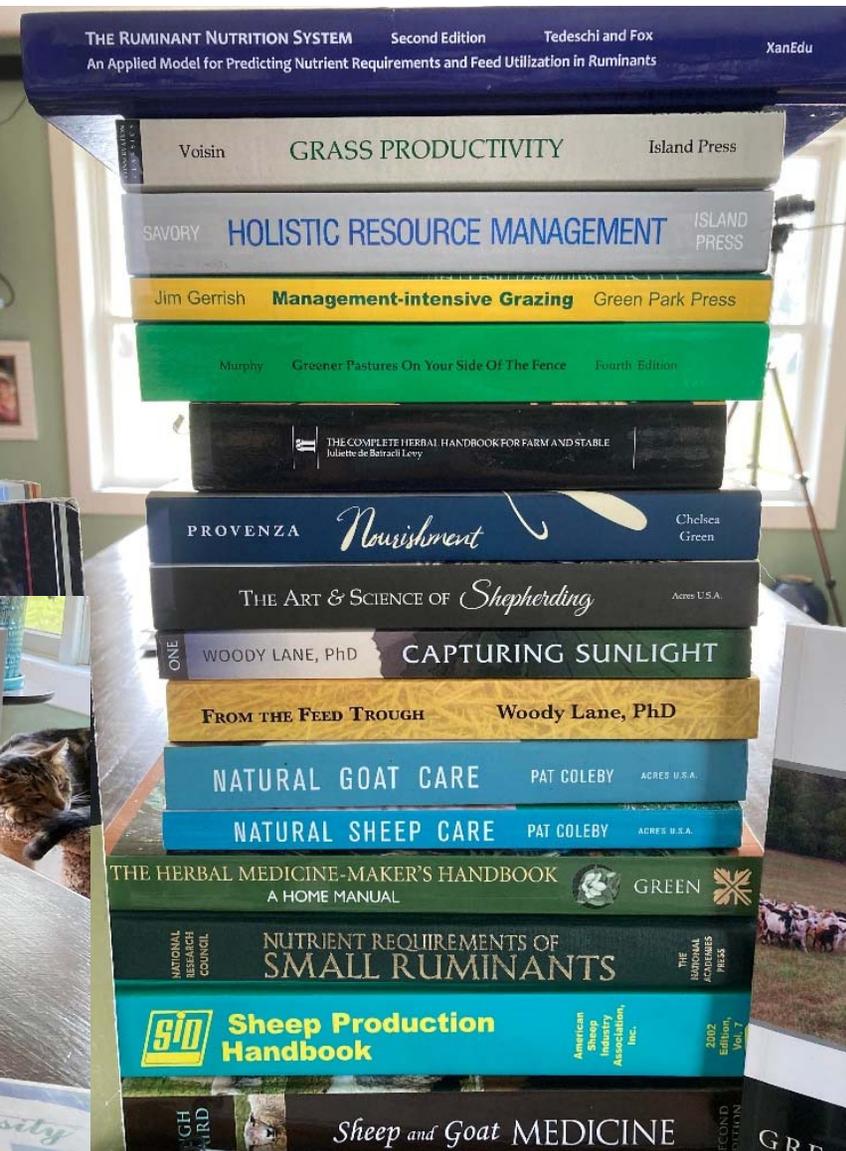
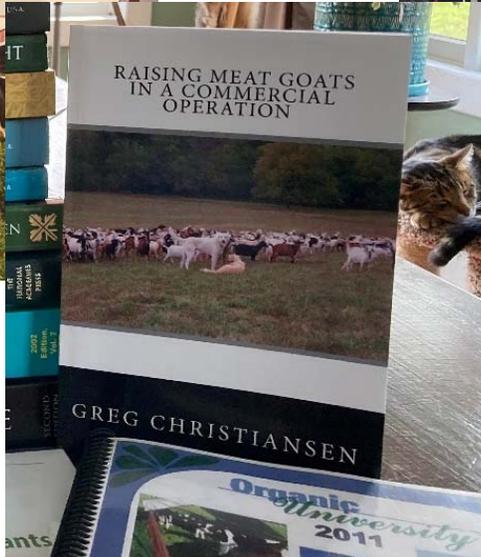
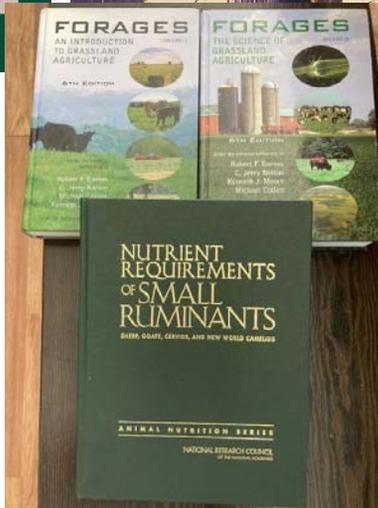
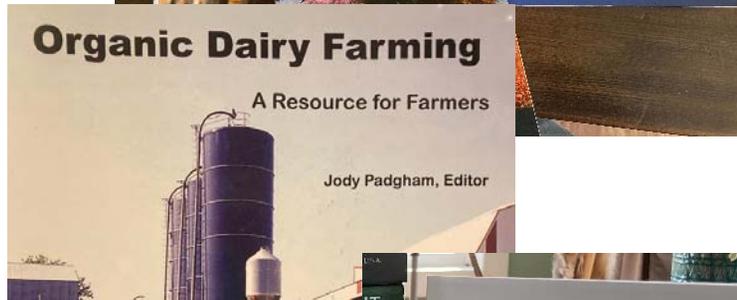
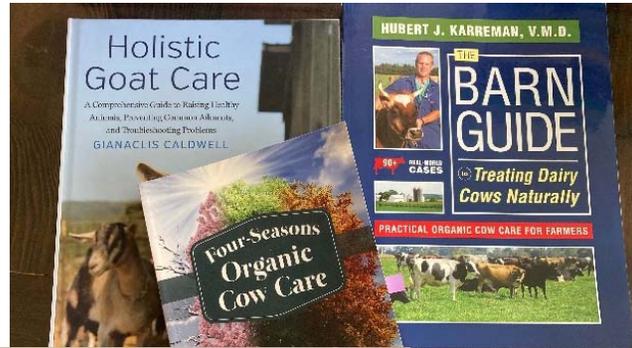
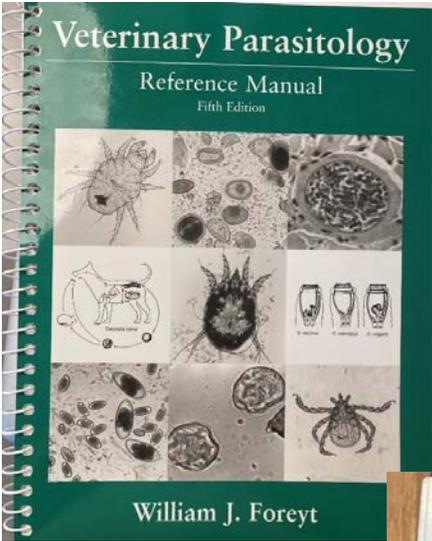


# Risks

- Non-conventional food for most Americans
  - Direct marketing limitation
  - Value-added limitation
  - No organic premium
- Learning curve to successful production
  - Safer to start with small herd and grow from within
  - Learn along the way, not all at once
- Quality at marketing time is key
  - Goat structure, muscling
  - Body condition
  - Size

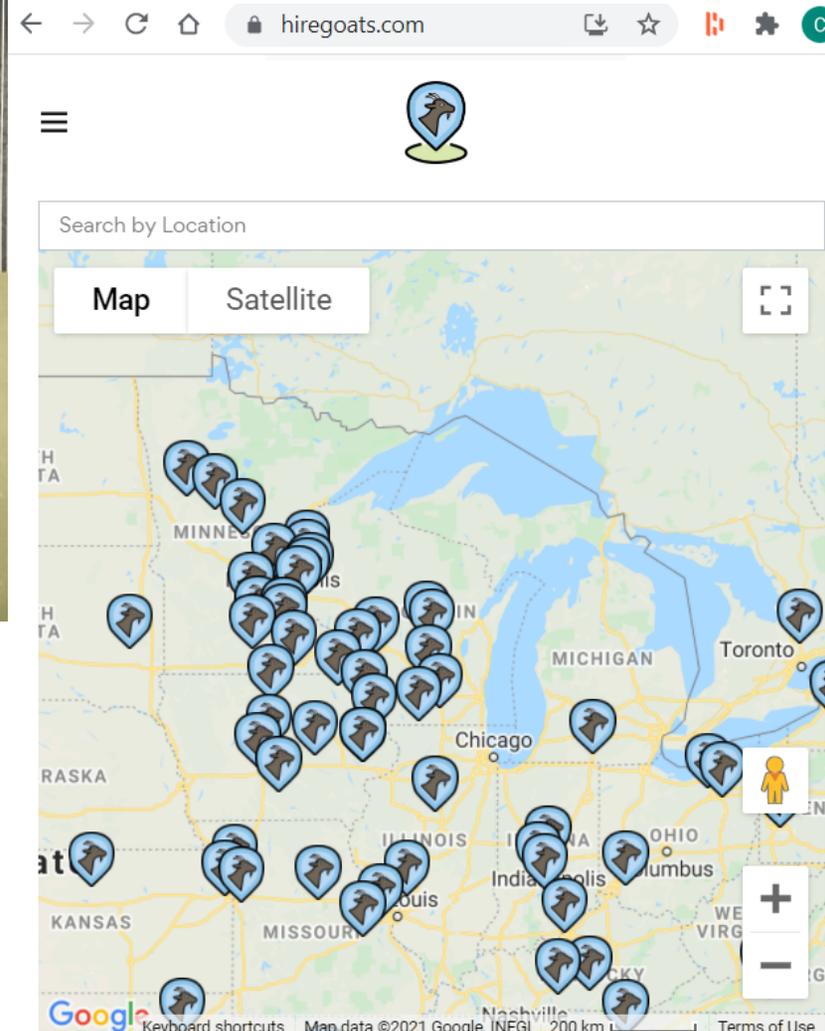
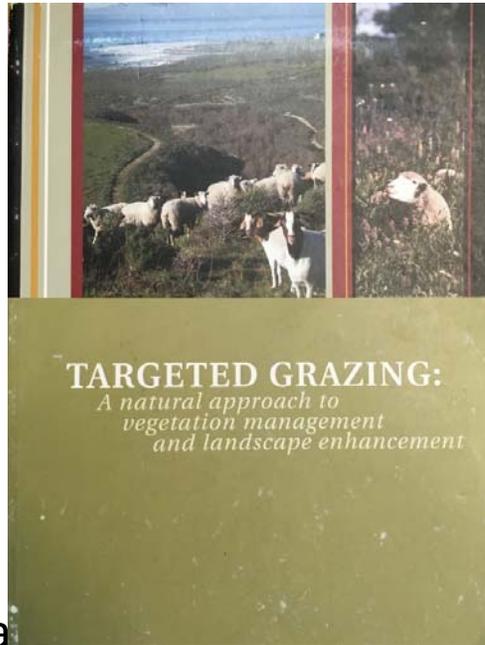


# Resources



# Resources

- Facebook Groups
  - Goats in cold climates
  - Kiko goat groups
  - WI/MN Kiko group
  - WI Sheep & Goats
  - Regenerative ag groups
  - Buffet mineral group
  - Goat health groups
- Goats/Sheep On The Go affiliates
- HireGoats.com
- Society for Range Management
- American Sheep Industry's (ASI) Targeted Grazing handbook
- SAN Building a Sustainable Business book
- American Solar Grazing Association
- Savanna Institute, Canopy Farm Management



# Questions?

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