

- MARCH 25, 2020 -

Trees for Livestock Food and Medicine



- PRESENTED BY -
Steve Gabriel

- HOSTED BY -



Food Animal Concerns Trust

Introductions



Food Animal Concerns Trust (FACT) is a national nonprofit organization that advocates for the safe and humane production of meat, milk, and eggs.



Larissa McKenna

Humane Farming Program Director

Email: lmckenna@foodanimalconcerns.org

Website: foodanimalconcernstrust.org/farmer

FACT's services for livestock and poultry farmers include:

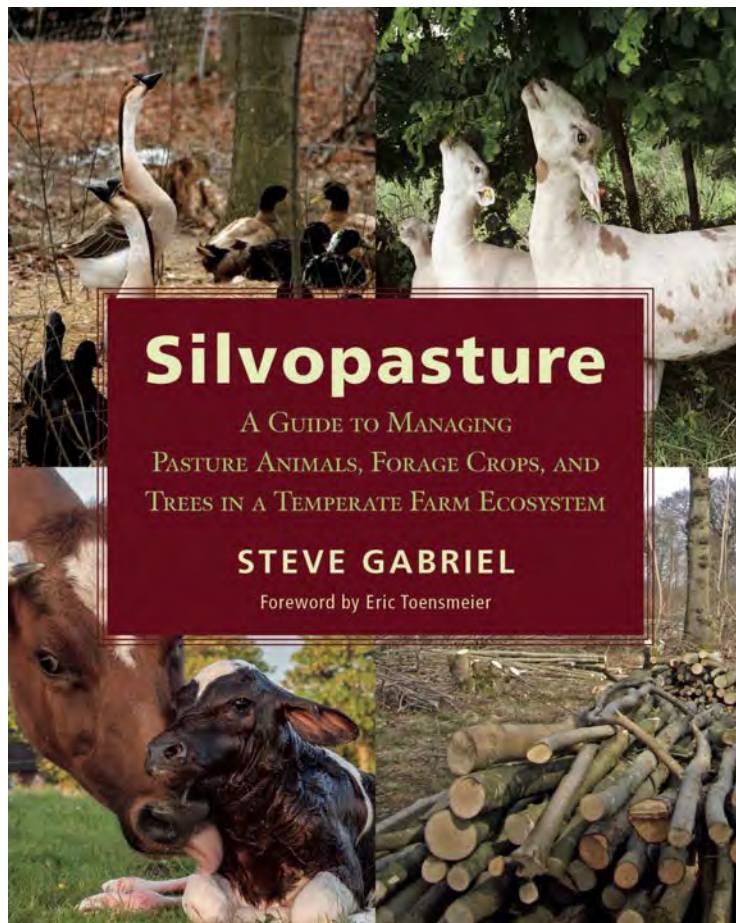
- Fund-a-Farmer Grants
- Conference scholarships
- Free webinars
- Humane Farming Mentorship Program

Our Presenter



Steve Gabriel

Wellspring Forest Farm
Cornell Small Farms Program



Silvopasture

A GUIDE TO MANAGING
PASTURE ANIMALS, FORAGE CROPS, AND
TREES IN A TEMPERATE FARM ECOSYSTEM

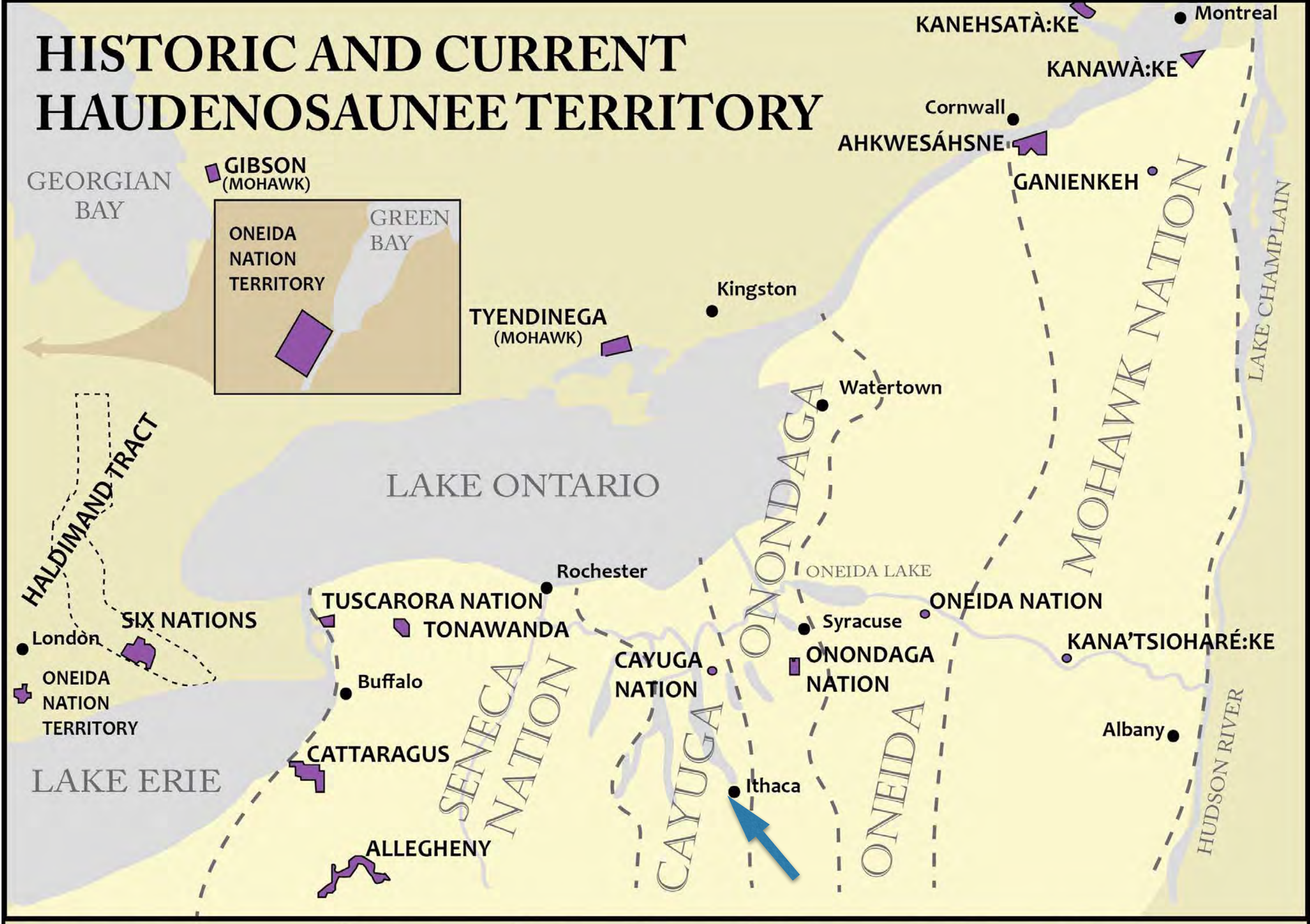
STEVE GABRIEL

Foreword by Eric Toensmeier

Trees For Livestock Food & Medicine



HISTORIC AND CURRENT HAUDENOSAUNEE TERRITORY

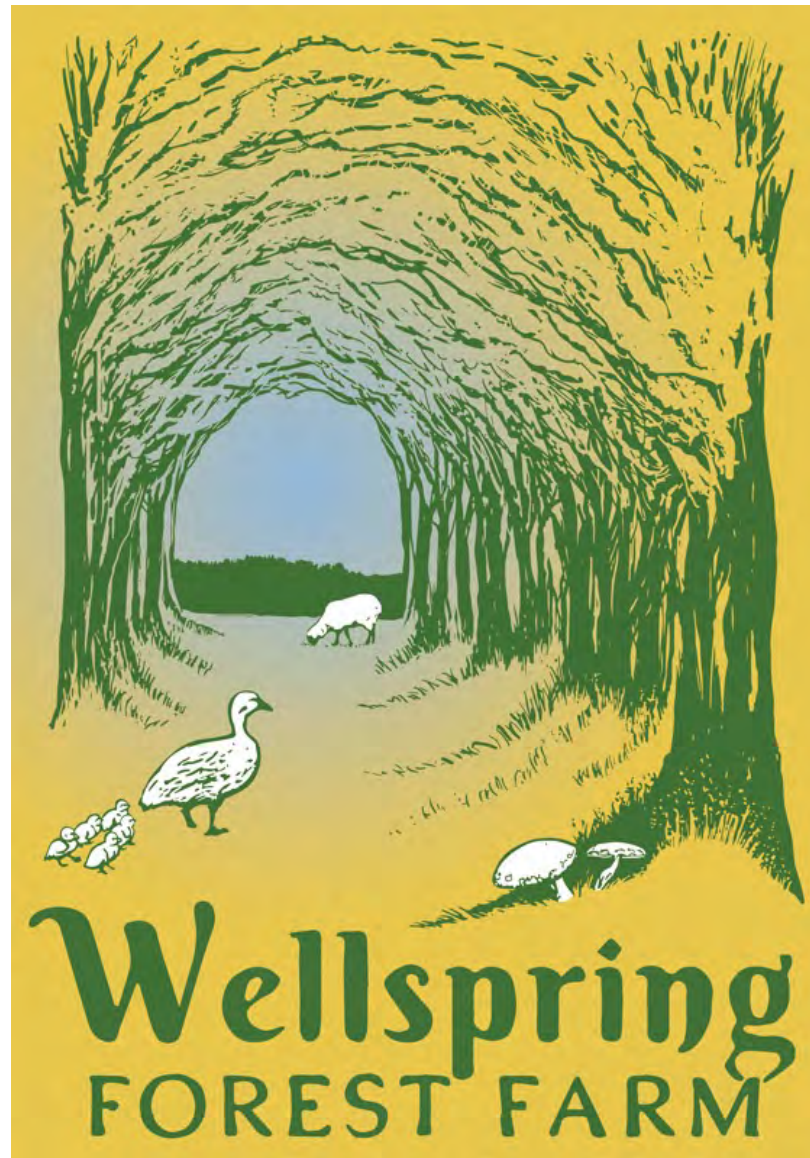


We are on Gayogohó:no' (Cayuga) lands.



Agroforestry
used to be
called
Farming

*honoring
indigenous
wisdom*



Mushrooms
Maple Syrup
Pastured Lamb
Duck Eggs
Elderberry Extract
Education
Agritourism





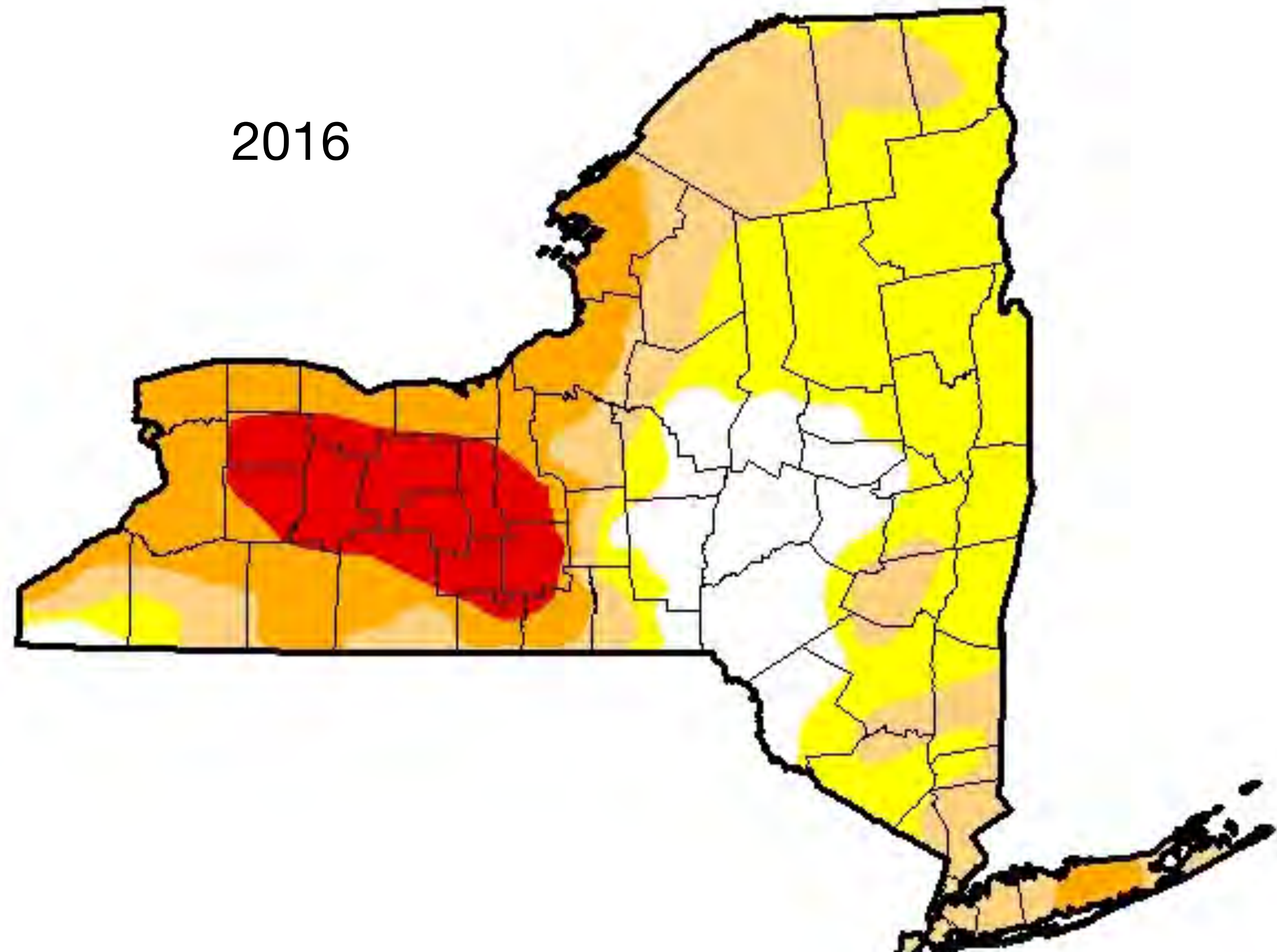
farming in the image of a forest...



Deer-Run Ln

Buck-Hill Rd

2016









Tree Fodder = Nutrition and medicine



Drought & Flood reliance

Forage



Soft ← **Mast** → Hard

Browse



Fodder

Best species to utilize
for multiple yields

**Research
as
Fodder**

Adaptable

**Fast
Growing**

**Easy to
Propagate**

**Many
Secondary
Products**



Willow



Black Locust



Poplar

**Research
as
Fodder**

Adaptable

**Fast
Growing**

**Easy to
Propagate**

**Many
Secondary
Products**

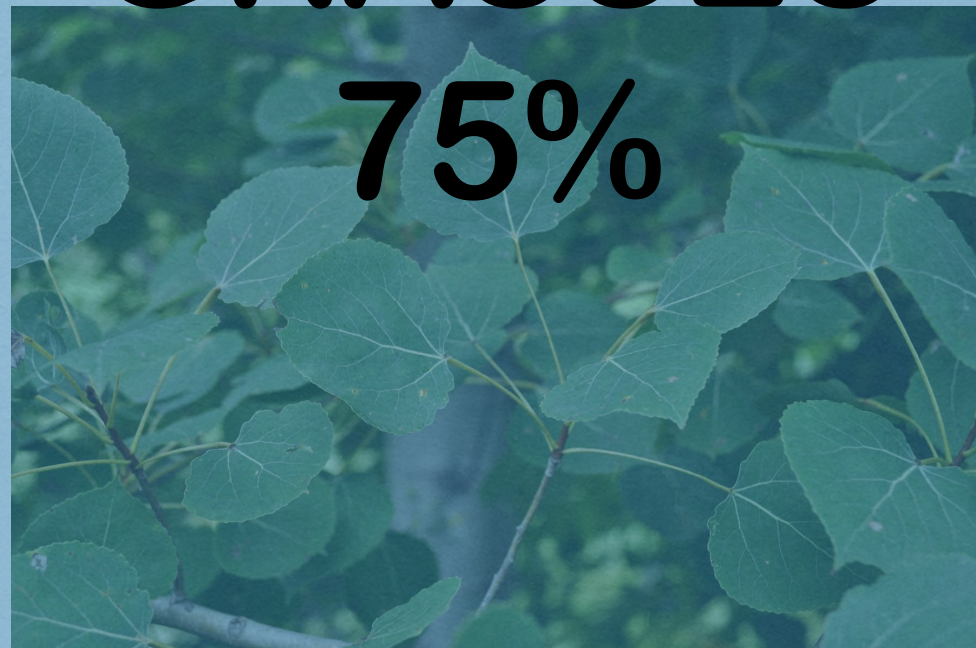


Mulberry



Willow **GRASSES**

75%



Poplar

**Research
as
Fodder**

Adaptable

**Fast
Growing**

**Easy to
Propagate**

**Many
Secondary
Products**



LEGUMES **15%**

Black Locust



FORBS **10%**

Mulberry



**High Biomass
& Tannins**

Willow



**High Protein
(tree alfalfa)**

Black Locust



**High Biomass
and balanced
nutrition**

Poplar



**High Digestibility
Minerals, Fruit
(Pigs and Poultry, too)**

Mulberry

Willow

(Salix spp.)

High Biomass

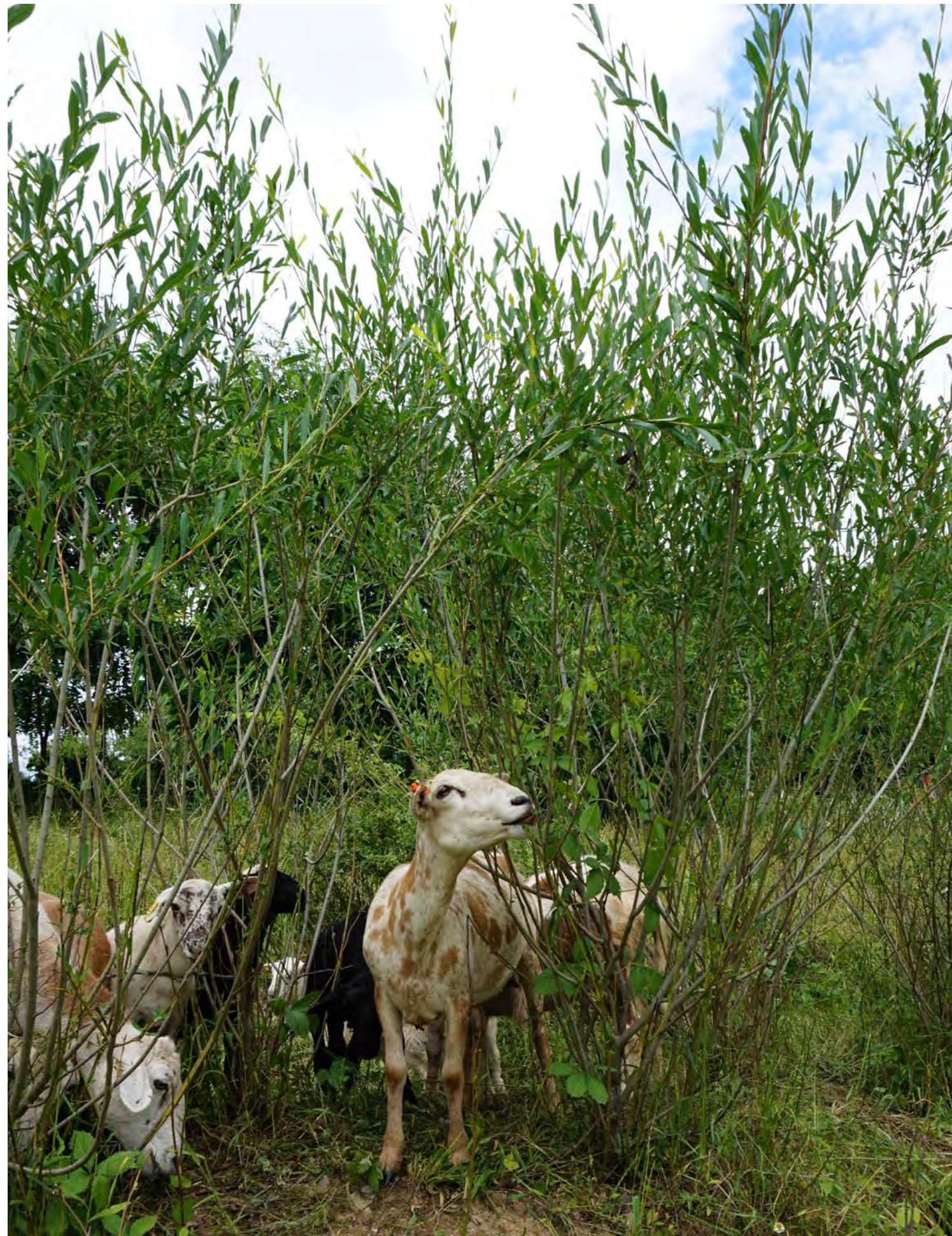
**High Condensed Tannins
=
Methane Emission Reduction
Parasite Control**

Rapid Carbon Sequestration

Nutrient Runoff Capture

Early Spring Pollen Source

Windbreak & Riparian Applications











Over a four year period a one kilometer long Salix buffer intercepted and accumulated 584 kg N and 45 kg phosphorous.

The majority of the N was removed through the biomass harvest whereas the phosphorous was sequestered in the willow root system.

Schroeder, W., et al. "Willow riparian buffers for biomass feedstock and nutrient export.

" Proceedings of the 13th North American Agroforestry Conference, June 19-21, 2013, Charlottetown, Prince Edward Island, Canada. Agriculture & Agri-Food Canada, 2013.

Willow



Salix purpurea 'Fish Creek'



Salix matsudana x *alba*.

Nurseries for Willow

Karston Nursery, MN <http://www.growfastwillows.com/>

Vermont Willow Co <https://www.willowsvermont.com>

Bluestem Nursery, BC/WA <http://www.bluestem.ca>



Propagation:

Dormant
Hardwood
Cuttings

Black Locust

(Robinia pseudoacacia)

Rapid Growth

Nitrogen Fixing

Nutritional equivalent of Alfalfa

Rot resistant wood

Best cash crop tree for NE?

Rapid Carbon Sequestration

Early Summer Pollen Source



“Tree Alfalfa”

Constituents	Black locust	Alfalfa
DM, g Kg ⁻¹	599	951
CP, g Kg ⁻¹	150	156
NDF, g kg ⁻¹	404	484
ADF, g kg ⁻¹	211	278
Lignin, g kg ⁻¹	79	64
Gross energy, Mcal Kg ⁻¹	4.3	4.1

Papachristou, T. G. "Assessing the value of black locust (*Robinia pseudoacacia* L.) browse for animal feeding." Grasslands and Woody Plants in Europe. International Symposium. Vol. 4. 1999.

PLANT DENSELY...



2013



THEN THIN...

2017







Black Locust as cash crop?



\$1 - 3 per liner foot for 8, 10, 12 foot posts

\$45 - 60 for a Hop Pole (22+ feet)

\$2.50 - 4.00 per board foot (milled)

(via online searches)



Black Locust (*Robinia pseudoacacia* L.) Improvement in Hungary: a Review

Károly RÉDEI* – Zoltán OSVÁTH-BUJTÁS – Irina VEPERDI

Hungarian Forest Research Institute, Budapest, Hungary

Abstract – Black locust (*Robinia pseudoacacia* L.) was the first forest tree species introduced and acclimated from North America to Europe at the beginning of the 17th century. It is a fast growing, nitrogen fixing, site tolerant, excellent coppicing species with frequent and abundant seed production and relatively high yielding potential. It has a durable and high quality wood, which is used for many purposes. Although native of North America, black locust is now naturalized and widely planted throughout the world from temperate to subtropical areas. In Hungary, this species has played a role of great importance in the forest management, covering approximately 23% of the forested area and providing about 19% of the annual timber output of the country. Due to the increasing interest in black locust growing in many countries, this study has been compiled with the aim of giving a summary on the basis of research and improvement connected with the species over the past decades.

Black Locust



Nurseries for Black Locust

Twisted Tree Nursery, NY <http://www.twisted-tree.net/>

Musser Nursery, PA <http://www.musserforests.com>

Cold Stream Nursery, MI <https://www.coldstreamfarm.net>

Propagation:

Seed

Root
flares?



soaked

soaked & swollen

sprouting

Poplar



Similar in productivity and nutrition to willow,
but with lower tannins and thus higher intake.





Late grazing season fodder?



In vivo work showed that the digestibility of tree fodder declined from late spring to autumn ($p < 0.05$) and that this decline was much smaller than the decline in digestibility of grass-based pastures in New Zealand over the same time period.

Columnar Poplars - VISUAL SCREENS AND WINDBREAKS

Lombardy poplar (*Populus nigra* ;Italica'), and the Bolleana poplar (*Populus alba* 'Pyramidalis') .

Aspen Poplars - SLOPES AND HIGH ELEVATION

quaking aspens (*Populus tremuloides*) , bigtooth aspens (*Populus grandidentata*) as the most common variety.

Cottonwood Poplars - DROUGHT AND FLOOD

eastern cottonwood (*Populus deltoides*), narrowleaf cottonwood (*Populus angustifolia*), Rio Grande cottonwood (*Populus wislizeni*), and Fremont cottonwood (*Populus fremontii*).



OP-367 hybrid poplar cutting



OP-367 in Grow Bag

<http://www.hybridpoplars.com/freeopcuttings.htm>

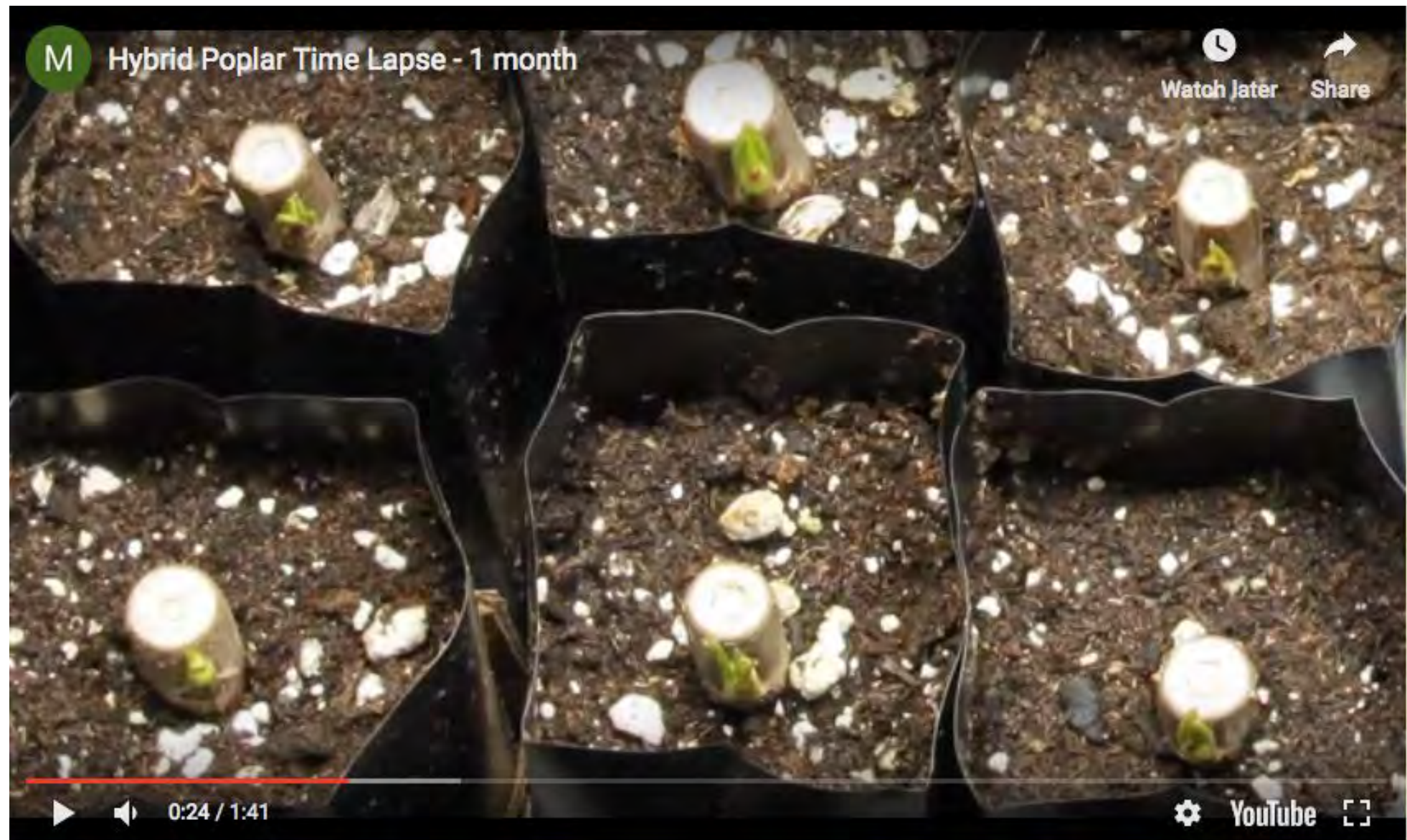
Hybrid Poplar

Cold Stream Nursery, MI <https://www.coldstreamfarm.net>

<http://www.hybridpoplars.com/freeopcuttings.htm>

Propagation:

Dormant
Hardwood
Cuttings +
Root Hormone

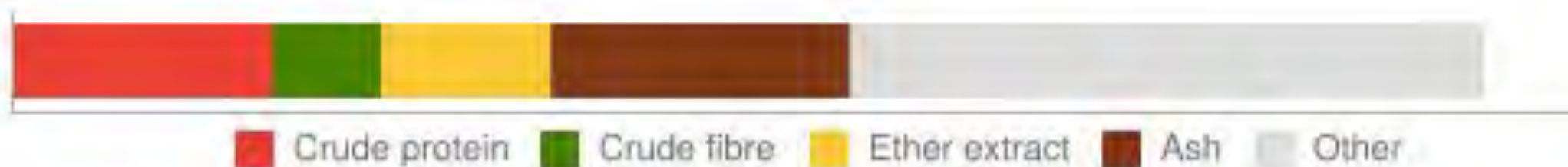


Mulberry



Mulberry

Black mulberry (*Morus nigra*), leaves, fresh



Main analysis	Unit	Avg
Dry matter	% as fed	38.3
Crude protein	% DM	17.6
Crude fibre	% DM	7.4
Ether extract	% DM	11.5
Ash	% DM	20.4
Gross energy	MJ/kg DM	17.4
Minerals	Unit	Avg
Calcium	g/kg DM	21.5
Phosphorus	g/kg DM	1.3

Mulberry



Yao, J., et al. "Nutritional evaluation of mulberry leaves as feeds for ruminants." *Livestock Research for Rural Development* 12.2 (2000): 9-16.

Mulberry

Twisted Tree Farm

Articles

A GIVING TREE

PROPAGATING
MULBERRY TREES

THE WHITE WALNUT

PIPPINS

BENEFITS OF BARE
ROOT

BARE ROOT VS.
POTTED

THE COST OF MOSS

UNEVEN GROUND

HACKBERRY

PERSIMMON: KING OF
FLAVOR

CHESTNUT: THE BREAD
TREE PART 1

CHESTNUT: PART 2
THE EPIC SAGA OF THE
AMERICAN CHESTNUT

CHESTNUT: PART 3
HOW TO GROW
CHESTNUTS

CHESTNUT: PART 4
EATING CHESTNUTS

NATIVE PLANTS AND



Propagating Mulberries

Mulberries have been one of my favorite trees for a long time. I have always been so amazed at how much fruit they are capable of producing. I love that the fruit can leave a purple stain on fingers, mouths, and cars, that it can feed a million birds and still leave huge amounts of delicious berries for the rest of us. After a lifetime of generously dropping copious amounts of fruit from the

Mulberry: an exceptional forage available almost worldwide!

Manuel D. Sánchez

Animal Production and Health Division. FAO, Rome

Summary

Mulberry (*Morus* spp), the traditional feed for the silk worm, has been selected and improved for leaf yield and quality in many environments and is spread throughout the world. Mulberry leaves are highly palatable and digestible (70-90 %) to herbivorous animals and can also be fed to monogastrics. Protein content in the leaves profile, varies from 15 to 28 % depending on nutritional factors or toxic compounds have been found. Forage is through stakes or seed, and it is harvested from stems. Yields depend on variety, location (altitude, density, fertilizer application and harvesting method). It produces more than most traditional forage concentrates for dairy cattle, as the main feed for monogastric diets.

Introduction

Mulberry (*Morus* spp.) leaves have been traditionally used as feed for silkworms. There is evidence that sericulture started a long time ago. At Agricultural University, personal communication. Mulberry has been selected and improved for many production projects, mulberry has been taken from the temperate areas of northwest and south of Asia, Africa and Latin America, America). There are mulberry varieties for 4,000m (FAO, 1990), and from the humid tropics with 250mm of annual rainfall and southwest of Asia under irrigation. Although the majority of silk production projects have had limited duration due to silk processing constraints and limited market opportunities, mulberry trees have remained in most places where they had been introduced.

Mo' Mulberry — The Essential Guide to all you need to know about Mulberry



Paul Alfrey [Follow](#)

Oct 11, 2017 · 19 min read

Not many plants offer so much to the grower while demanding so little in return. A tree that requires so little attention and care, that even if there were an RSPP—Royal Society for the Protection of Plants (which there should be judging by the amount of tortured house and garden plants I come across) no-one would ever get prosecuted for *Morus* neglect :)

Nurseries for Mulberry

Twisted Tree Nursery, NY <http://www.twisted-tree.net/>

Cold Stream Nursery, MI <https://www.coldstreamfarm.net>

Burnt Ridge Nursery, WA <http://www.burntridgenursery.com>

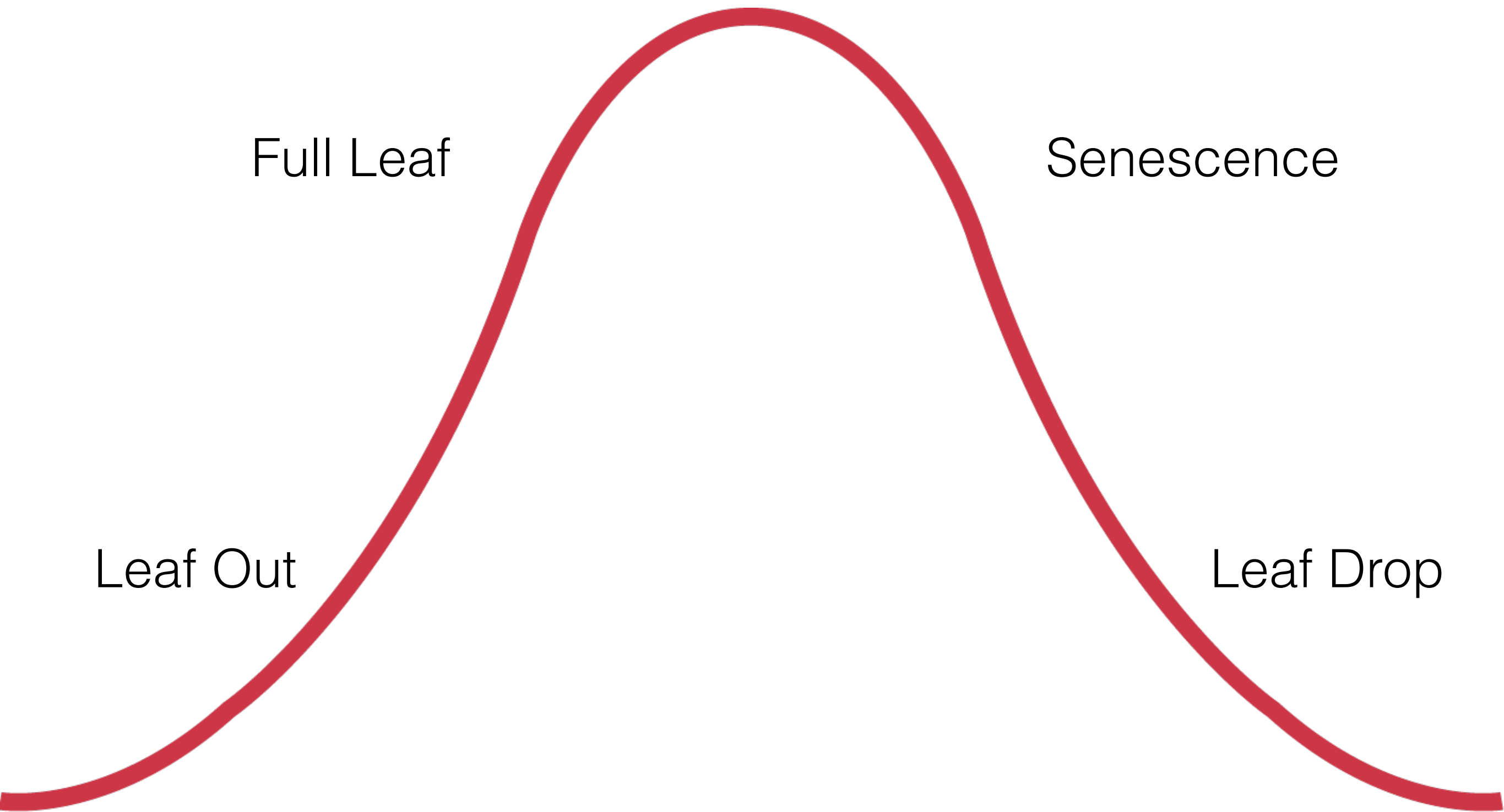


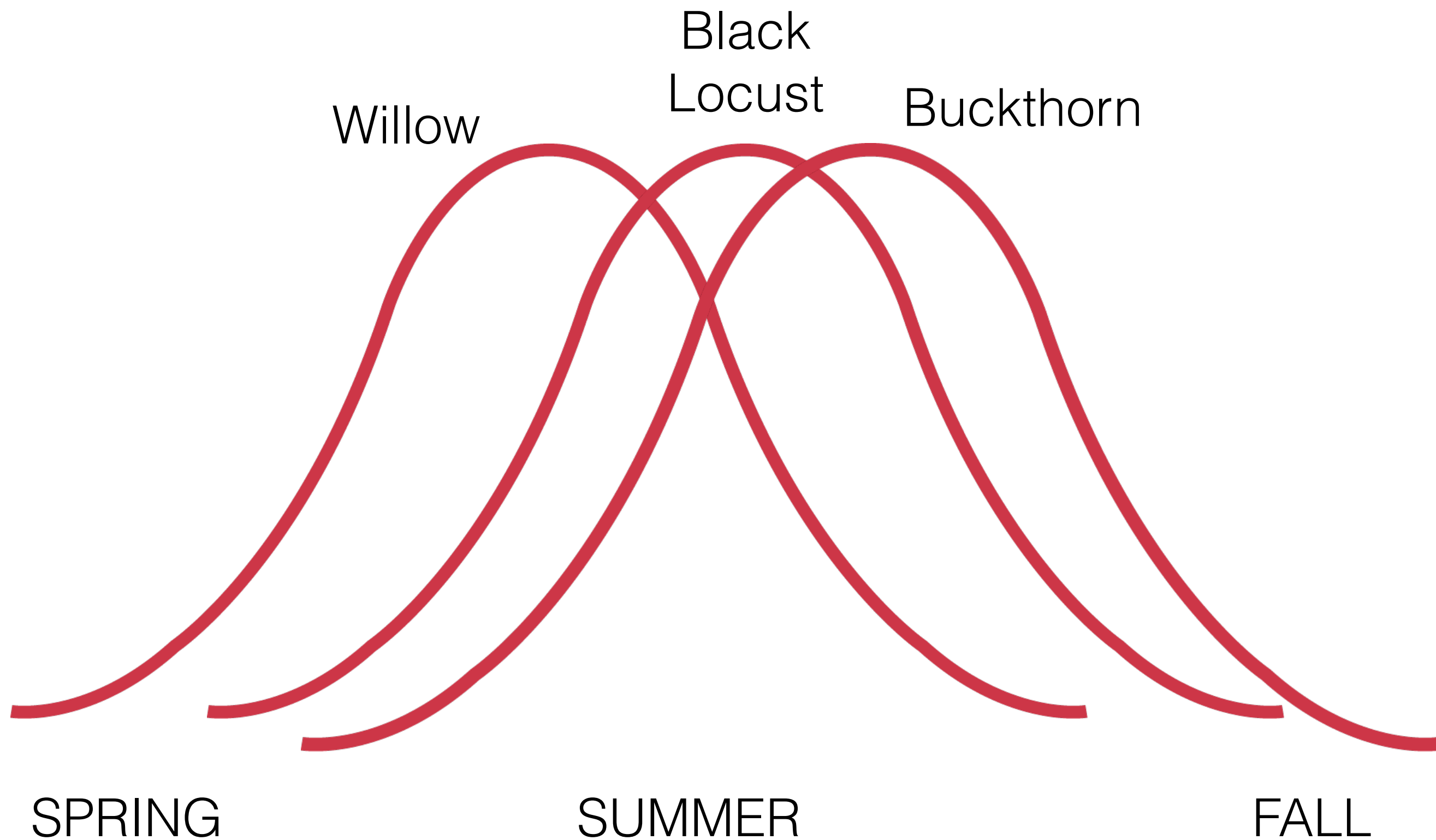
Propagation:

Softwood
Cuttings +
Root Hormone
+ Mist

Seed from fertile trees

Nutritional content of
fodders + changes
over the season





Some databases indicate differences throughout the season...

Group	Species	Tree part	Moment of sampling	DM Dry Matter [%]	Crude Ash [%DM]	Crude protein [%DM]
Black Locust	Locust <i>Robinia pseudoacacia</i>	leaf	winter	57.0	6.0	14.0
"	"	"	spring	61.0	9.0	23.0
"	"	"	august			20.0
"	"	"	august			19.0
"	"	"	july			22.0
"	"	"	june			23.0
"	"	"	september			17.0
"	"	"			13.0	16.0

www.voederbomen.nl/nutritionalvalues/

Luske B., Meir I. van, Altinalmazis Kondylis A., Roelen S., Eekeren N. van (2017). Online fodder tree database for Europe. Louis Bolk Institute and Stichting Duinboeren, the Netherlands.

Tree Forage Nutrition Analysis @ Wellspring



NORTHEAST
SARE
Sustainable Agriculture
Research & Education

Species	% Crude Protein	%ADF	%NDF
Black Locust	23.61	18.7	32.89
Buckthorn	18.35	14.58	41.05
Honeysuckle	12.71	20.04	39.99
Poplar	14.99	22.55	35.73
Wild Cherry	13.84	17.49	39.56
Willow	15.63	21.49	37.78
<i>Legume Pasture</i>	<i>26.23</i>	<i>27.75</i>	<i>35.96</i>
<i>Grass Pasture</i>	<i>15.79</i>	<i>35.65</i>	<i>60.89</i>

(ADF), a measure of the forage components that are least digestible by livestock, mostly cellulose and lignin.

(NDF), which accounts for the structural components of the plant cell walls and is a predictor of voluntary intake

In general, LOW ADF and NDF values are desired.

	NDF	CP
General	under 70%	more than 8%
Reproduction	under 50%	10 – 12%
Growth	30 – 40 %	16 – 18%
Lactation	under 55%	12 – 14%

Table 2: Recommended NDF and CP values for various ruminat life stages.

Calcium: Buckthorn and Honeysuckle

Magnesium: Honeysuckle and Willow

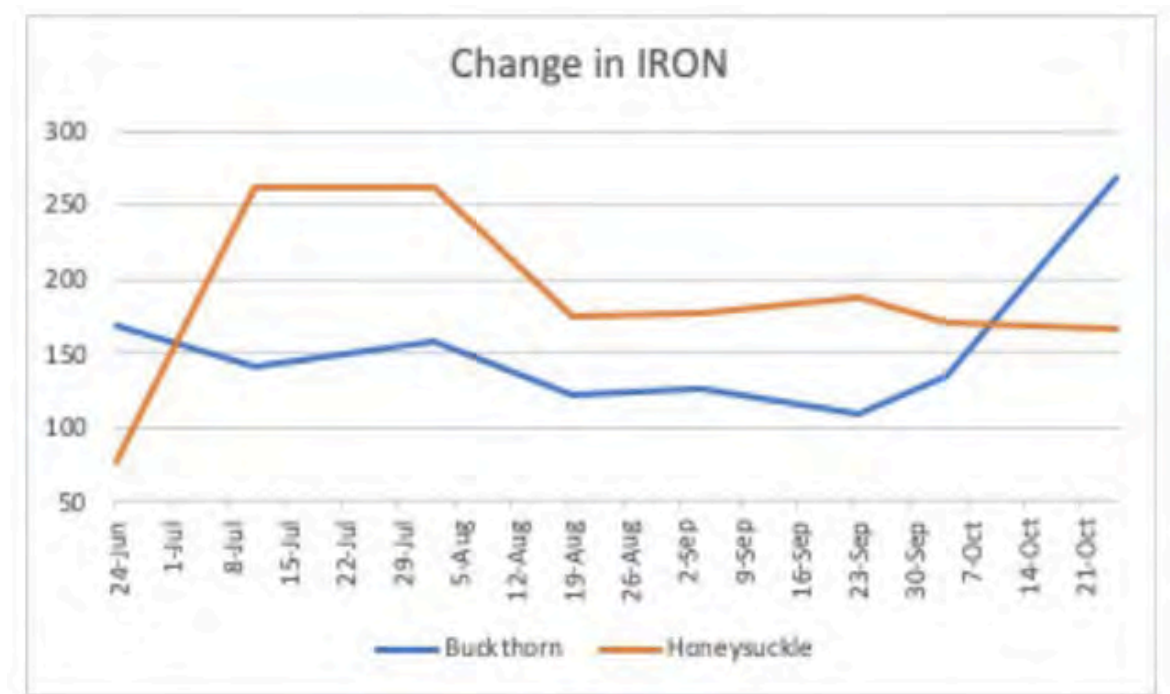
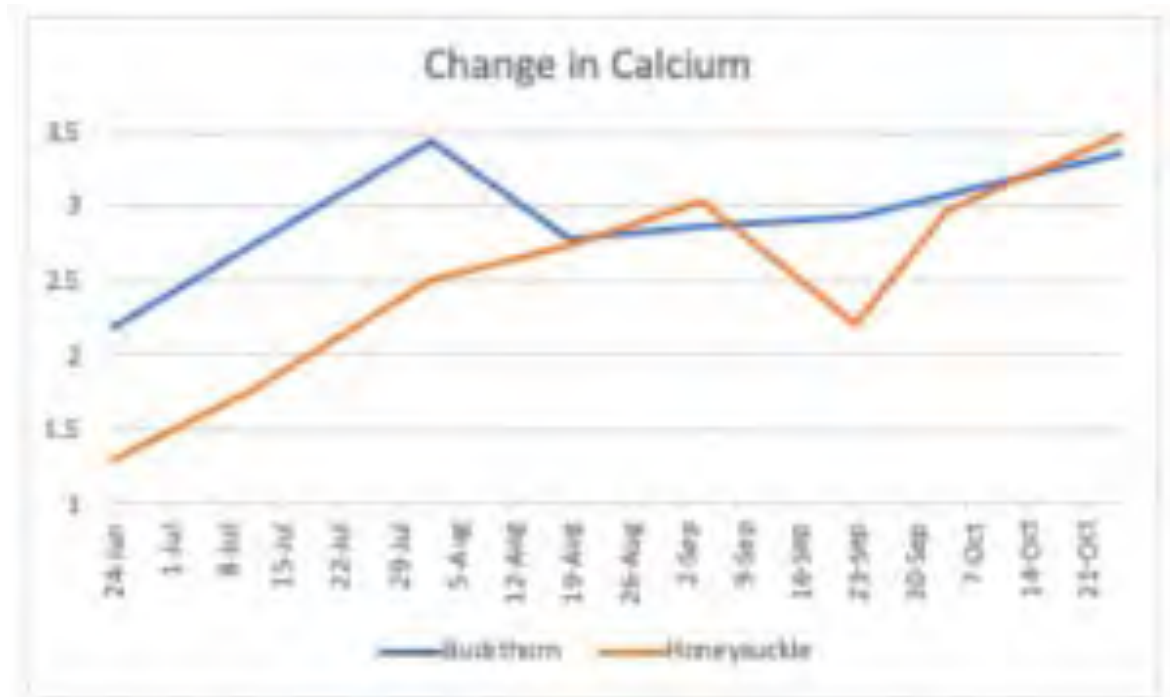
Potassium: Buckthorn

Iron: Buckthorn and Honeysuckle

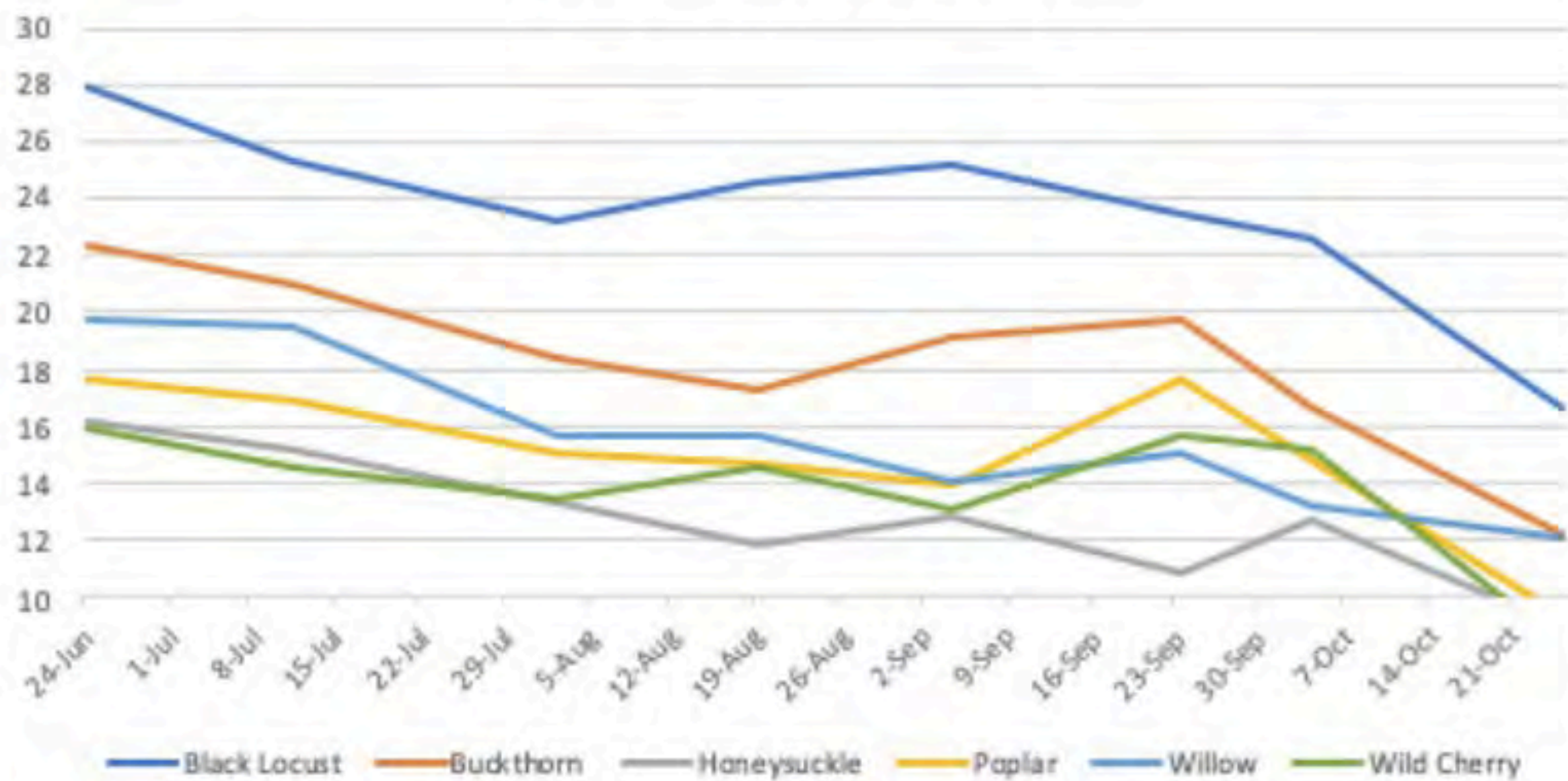
Zinc: Poplar and Willow

Manganese: Wild Cherry

Molybdenum: Honeysuckle



Change in Crude Protein (%)



Black Locust is highest valued for its high crude protein content which declines over the season, as well as values for Potassium (little change during the season) and Manganese highest in early July but also spiking in early Sept and Oct, with lowest values of ADF and NDF from early August through early September. **Early September**, overall, looks to be the best timing to maximize benefit based on this dataset.

Buckthorn offers a good crude protein content, along with elevated levels of Potassium, Calcium, and Iron, which are highest in the latter end of the season (early October) while NDF and ADF are lowest in September and Crude protein really drops toward the last week of September. So, early to **mid September into early October** is possibly best timing-wise, though protein levels are lower then.

Honeysuckle offers a great source of Calcium and Magnesium which is highest toward the end of the season, and Iron which appeared highest in July. Not a clear best time, might depend on the value placed on the different nutrients. It appears substantially larger amongst the sample species in Iron, which might make it prioritized for this offering.

Poplar provides good levels of Calcium, Zinc, and Manganese. While the calcium is greater in the end, the levels of Zinc and Manganese appear relatively dispersed through the season, though since its contribution as far a calcium is not as significant as other species, it might suggest this one is good for **anytime in the growing season**.

Wild Cherry's contributions are Manganese and Calcium, both of which **improve toward the later part of the season**, which suggests greater benefit, though this foliage doesn't stand out substantially in comparison with the others, and so it may not matter as much. It's pretty low value.

Willow is a nutrient sink, offering good values for Calcium, Magnesium, zinc, and Manganese, all trending toward the later part of the season, peaking **around late September/early October** as the best time to harvest.



Systems for managing as
a substantial forage



Prune overgrown



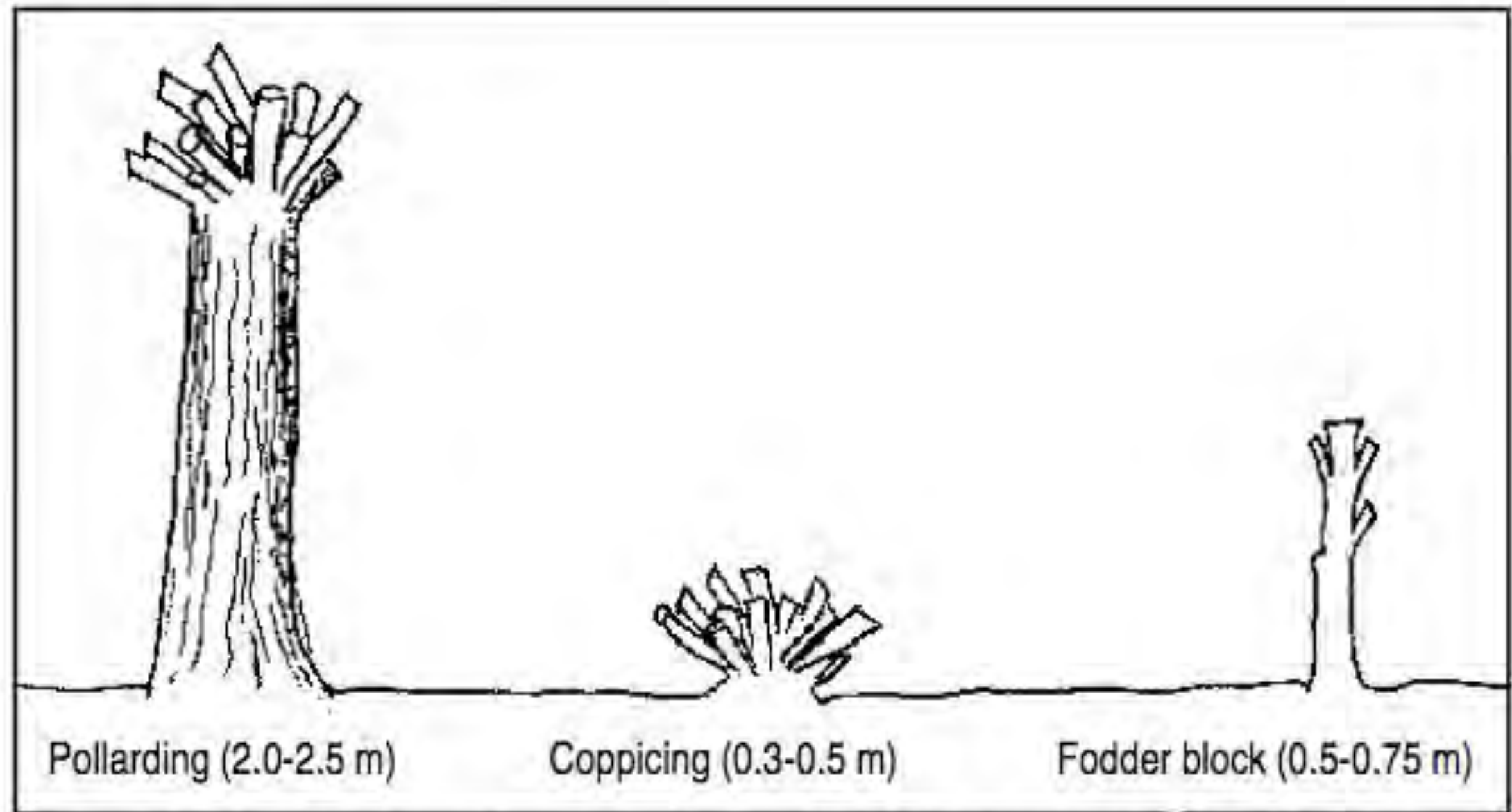


Figure 1. Commonly used tree-pruning methods for harvesting tree fodder.

Charlton, J. F. L., et al. "Farmer experience with tree fodder." Using trees on farms. Grassland research and practice series 10 (2003): 7-15.

Coppice



Pollard



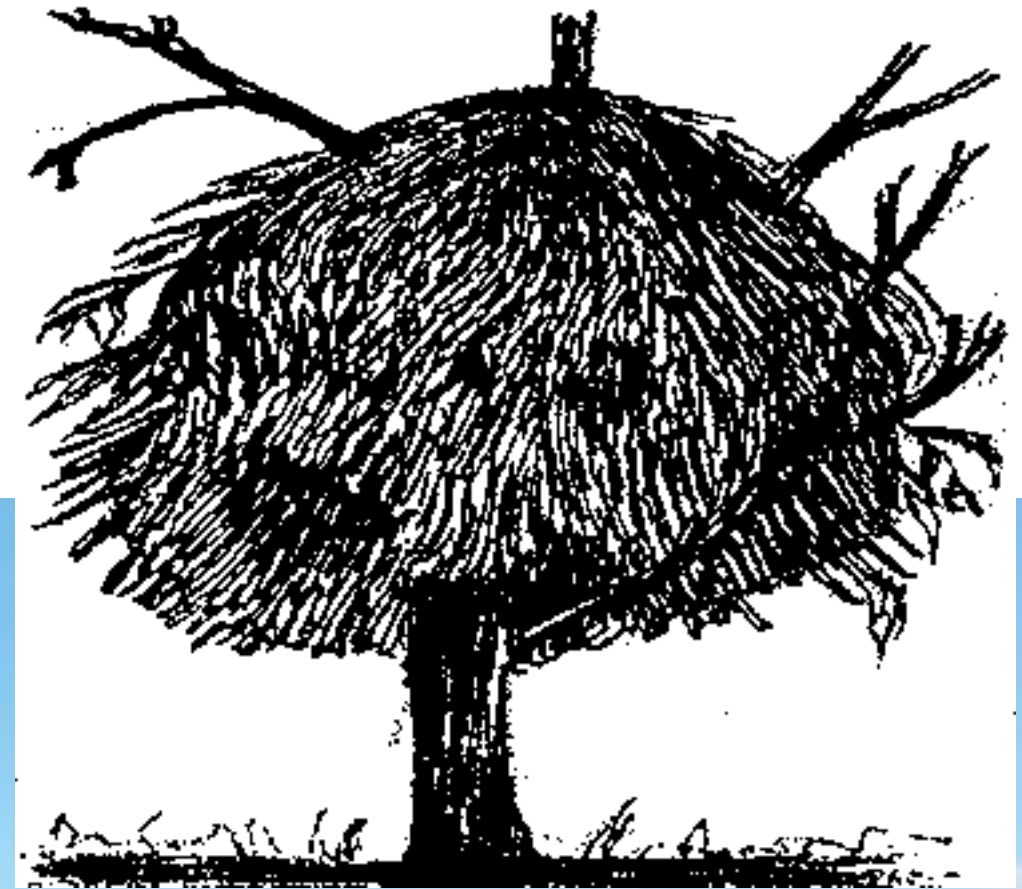
Fodder Blocks / Intensive Silvopasture



<http://agenciadenoticias.unal.edu.co/detalle/article/silvopasture-improves-meat-quality-in-colombia.html>

Tree Hay

increases nutrient density



**“Cut
and
Carry”**



Willow silage?



Willow silage?

Code: BHGP13

Potential Good Practice Note

Willow Silage: An Alternative to Winter Fodder

Introduction

Bhutan has a traditional farming system within which livestock production plays a very crucial role. Availability of adequate quality feed and fodder, therefore, is the single most important factor in livestock development in Bhutan (NFFDP¹ 2006). The importance of trees as fodder sources is well established, and, especially for Bhutanese, tree fodder remains an important resource, providing approximately 20% of the fodder requirement. Tree fodders used vary with elevation and other climatic factors, but mostly consist of *Ficus*, *Bambusa*, *Quercus* and *Salix* species (Roder 1992). In Bhutan, Willow (*Salix babylonica*) is the most popular species, which is found in abundance throughout the country at elevations ranging from 800 to 3,000 masl. It is by far the most important tree fodder species at elevations above 2,500 m (Roder 1981). In fact, it is the most common species in high altitudes throughout the Himalayas. In Lehi, an Indian state of Kashmir, it is the only tree available and a very important source of fodder for ruminants.

Willow grows well under harsh climatic condition and even in poor soil type over a wide range of altitudes starting from sub-tropics to alpine areas. The plant normally grows up to the height of 8 – 12 meters and branches well with clustered long leaves. One of the reasons for its selection as fodder tree is that it can survive well under both dry and wet conditions and produce more biomass for silage making. Beside fodder, the tree is widely used for live fencing, protection of river bank and preventing soil erosion. The easiest way of propagation is through semi hard cuttings of desired length. Prior to planting, the cuttings are dipped in water to prevent desiccation under dry condition.



¹ National Feed and Fodder Development Programme



Tolerance for grazing and recovery period?





Browse not more
than 50% of the material



Skip during spring rotation

Browse in summer

Skip in fall

What we know:

1. Start with Willow, Black Locust, Poplar, and Mulberry
2. Establish and protect until browse height is sufficient and bark is hardened
3. Work with animal wisdom so fodder is a safe part of their diet

Needs More Work:

1. How nutritional and medicinal values vary seasonally, over time?
2. Fodder species tolerance for grazing, sufficient rest and recover periods
3. Cost-effective (efficient) management systems for getting high value from tree fodders



THANK
YOU!!

**ONLINE COURSE
(archived)
at
www.Silvopasturebook.com**

Steve Gabriel - stevegabrielfarmer@gmail.com
www.WellspringForestFarm.com

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