The Job of Inventory and Evaluation for Fence (382) Concerns and Design

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Science and Technology webinar series
17 of February, 2015

Technical Assistance for 382 Fence Should:

Address the identified resource concerns

Comply with NRCS standards, technical criteria, and policies

*Function as planned, meeting the requirements of site-specific conditions

Context (1940) Missouri rail fence joining barbed wire fence (LOC.FSA)

Context Today (Alyson Shotz)

Fence Webinar rationale

Goal is to prepare planners for JAA certification in all states and be expert enough to accomplish your goals.

1. Background information is on the ‘Natural History of Fence’.

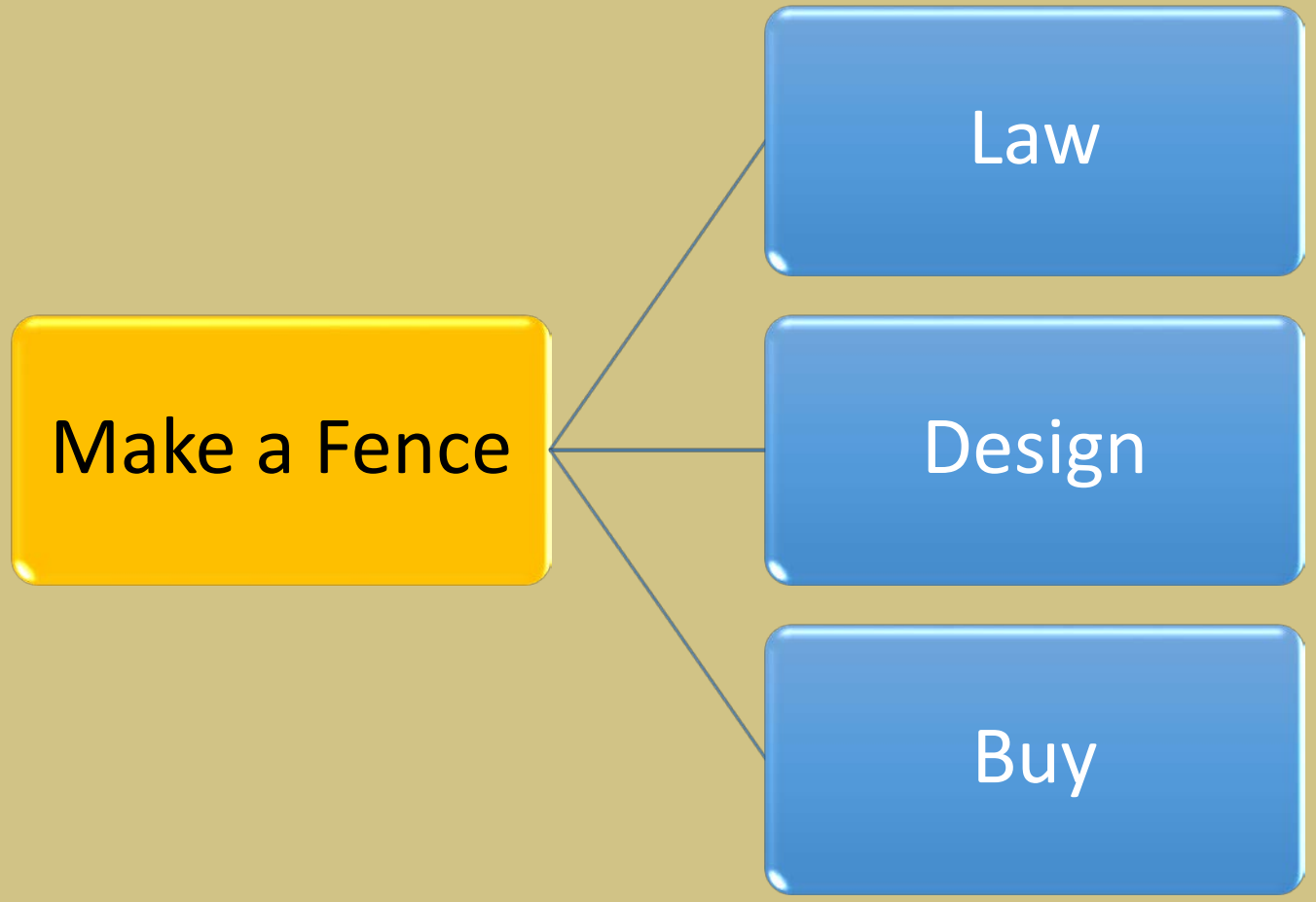
2. We will take a close look at the 2013 (382) Fence Standard.

3. Then look at the tasks you must perform before the fence can be built.

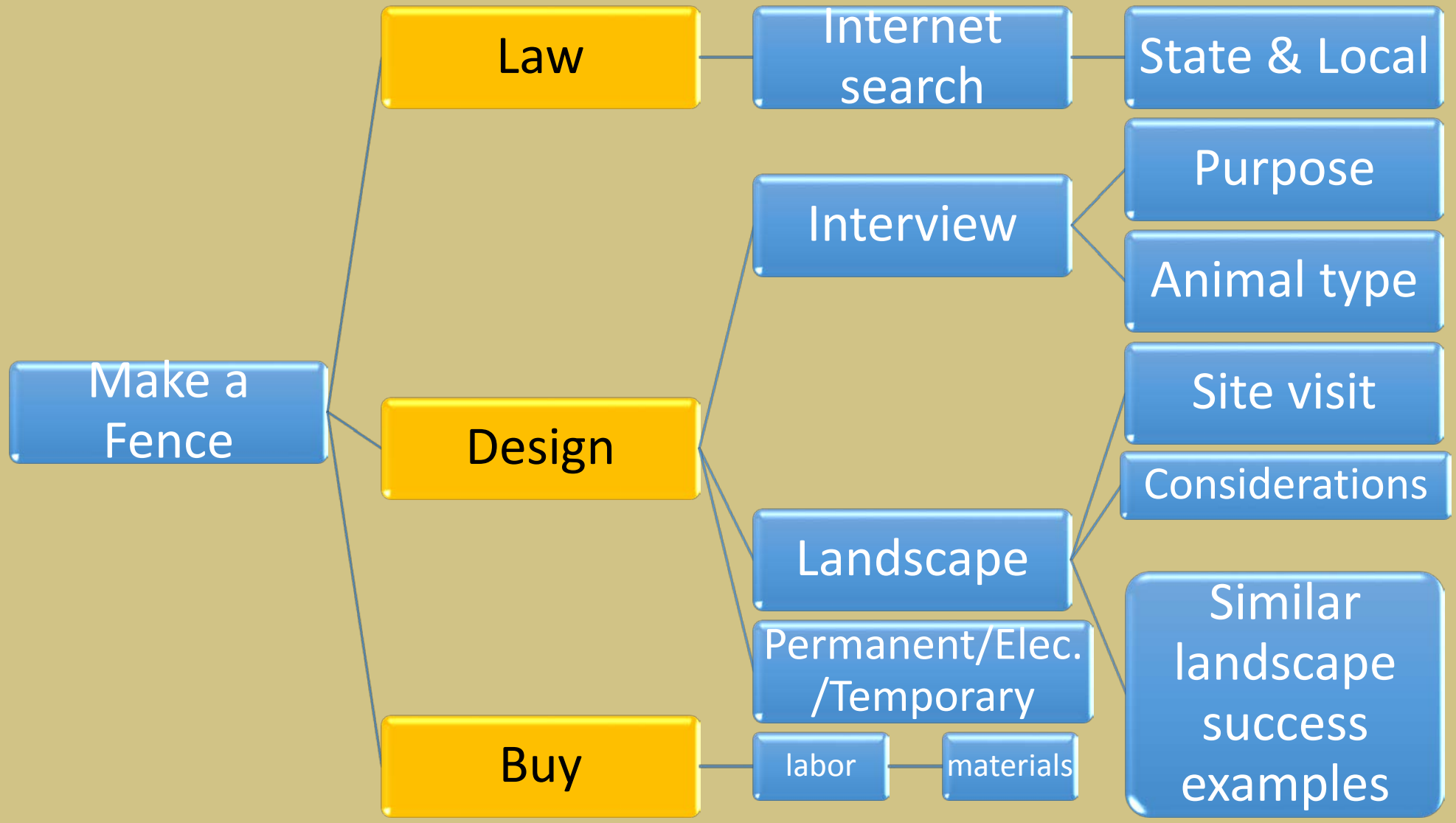
Only way to learn something new about a topic that everyone knows something about is to drill down.

Use a mix of movies, old photographs, dead Presidents, and recent science citations to review history and **context** of fence.

Fence Tasks



Fence Tasks


Make a Fence
Law
Internet search
State & Local
Design
Interview
Purpose
Animal type
Landscape
Site visit
Considerations
Similar landscape success examples
Permanent/Elec./Temporary
Buy
labor
materials

Fence Interview

Before you interview, you should make observations of fences in your service center area.

See how the fence was laid into topographically challenging areas.

Also observe levels of maintenance.

1. Ask during the interview ‘Who built the fence?’

2. Ask when it was erected?

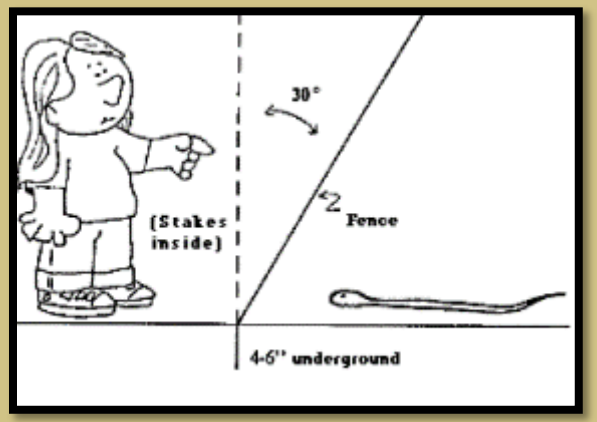
3. Ask what were the conditions under which it was erected?

4. Ask about the manner in which it was erected?

5. Ask about the purpose for its erection?

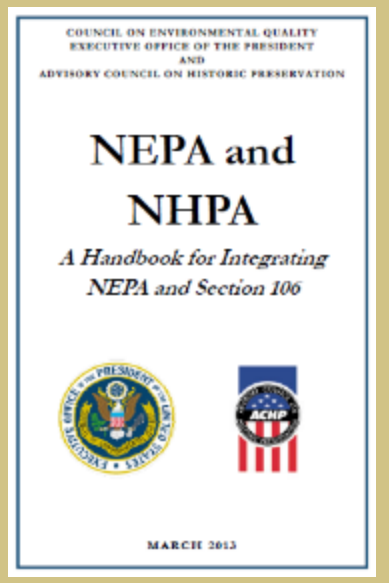
Conservation Purposes

- More pastures = more management.
- More pastures = more flexibility.
- More pastures = better vegetation management.
- Objectives must meet a Resource Concern
- Define property boundaries
- Control/Separate groups of domestic livestock
- Protect drivers from collisions with animals



SAFETY

The Context of FENCE as a Conservation Purpose



CEQ (2013) A Handbook for Integrating NEPA and Section 106.

In **1763** America, owning and farming land represented economic independence. A fence stood for the **freedom** that went with land ownership.

Around **1860**, farm fences represented one of the largest **investments** to raise crops. A farmer needed to invest two dollars in fences for every dollar in land.

The half life of barbed wire is 50 years. Fences are long-term vertical & horizontal features on the landscape.

Need to establish in the interview, '*How long will the present management purpose last?*'

A Natural History of Fence

Salem Virginia 1855

A View of Salem in Virginia in 1855 by Edward Beyer

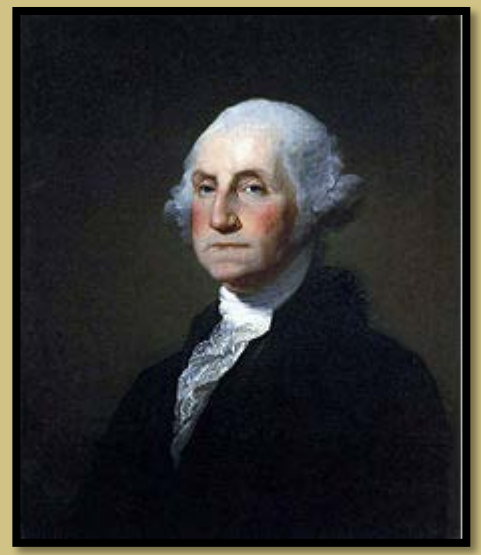
Enter Fullscreen More information

A

Town and Fence share a common word root. In Old English, town meant “enclosure, fortified place” or “fence.”

Similarly, the sport of fencing (1190 BC) represents the **two**-sided nature of fences via offensive and defended stances.

Living Fences - Mt. Vernon '...for no sort of fencing is more expensive or wasteful of timber." **George Washington**, July 15, 1797



- weeping willow
- yellow willow
- Lombardy poplar
- Cedar

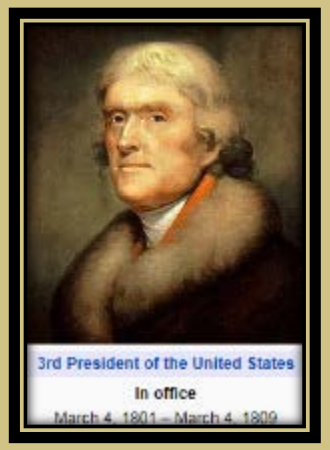
❖Honey locust

Duvall (2009) A maroon legacy? Sketching African contributions to live fencing practices in early Spanish America. Singapore Journal of Tropical Geography 30:2 pages 232-247.

Rail fence was temporary till living fence became established.

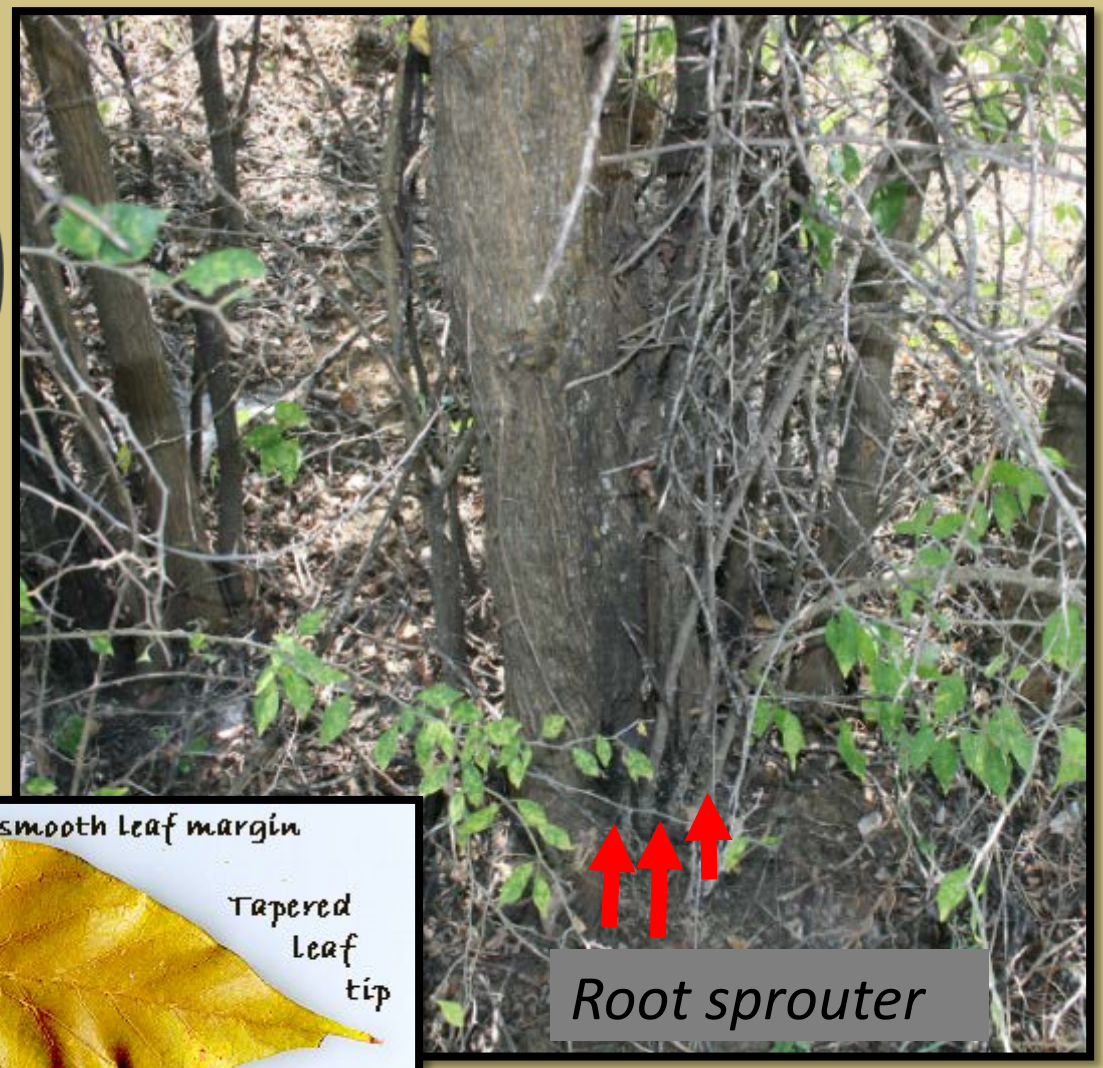
Thomas Jefferson

1803 Louisiana Purchase and the live fence. The Osage Orange tree.

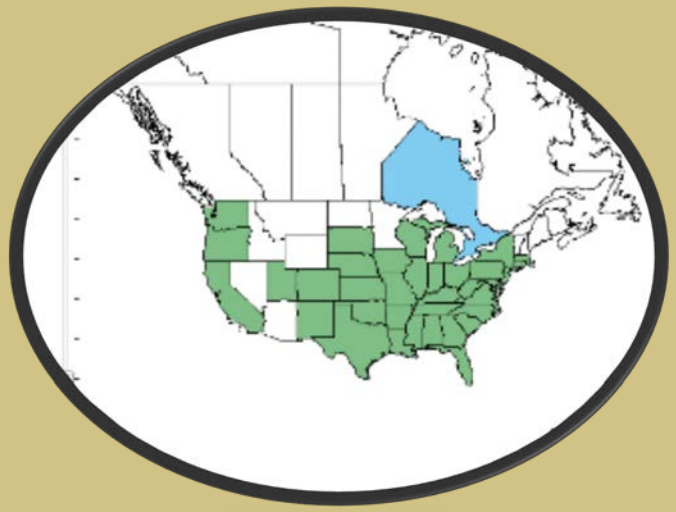


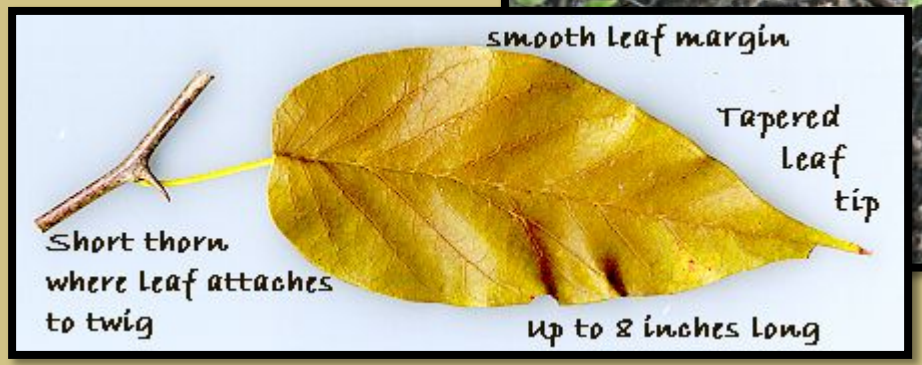
The first shipment of botanical specimens sent by **Lewis and Clark** to President Jefferson contained the seeds of thousands of miles of fences.

Living Fence *Maclura pomifera* Osage orange



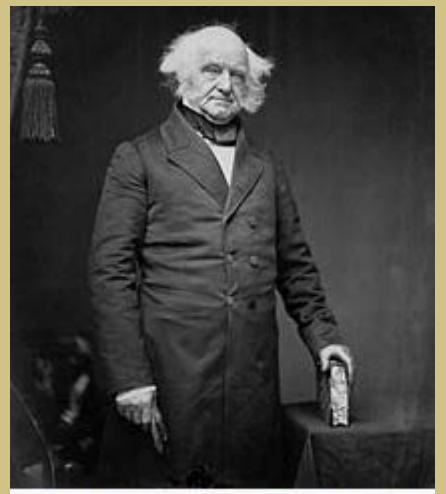
PLANTS.gov web site





1803 settlers valued the 25 year sustainability of fence posts. Up to 4,000 fence posts from a mile of old hedge row.

1837 ***President Van Buren*** *is depicted as indecisive and secretive about his treasury policy.*

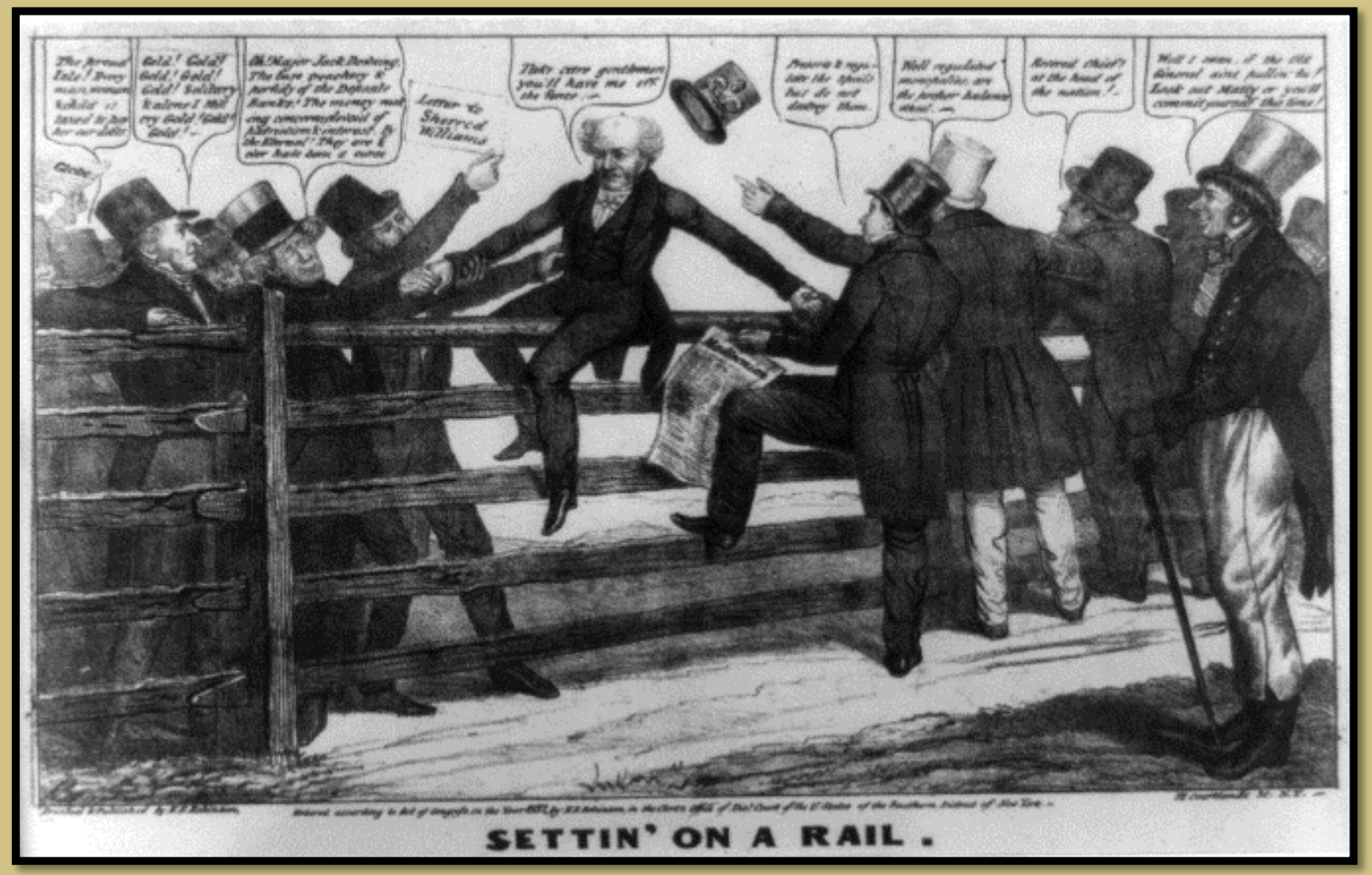


8th President of the United States

In office

March 4, 1837 – March 4, 1841

‘Mending Fences’



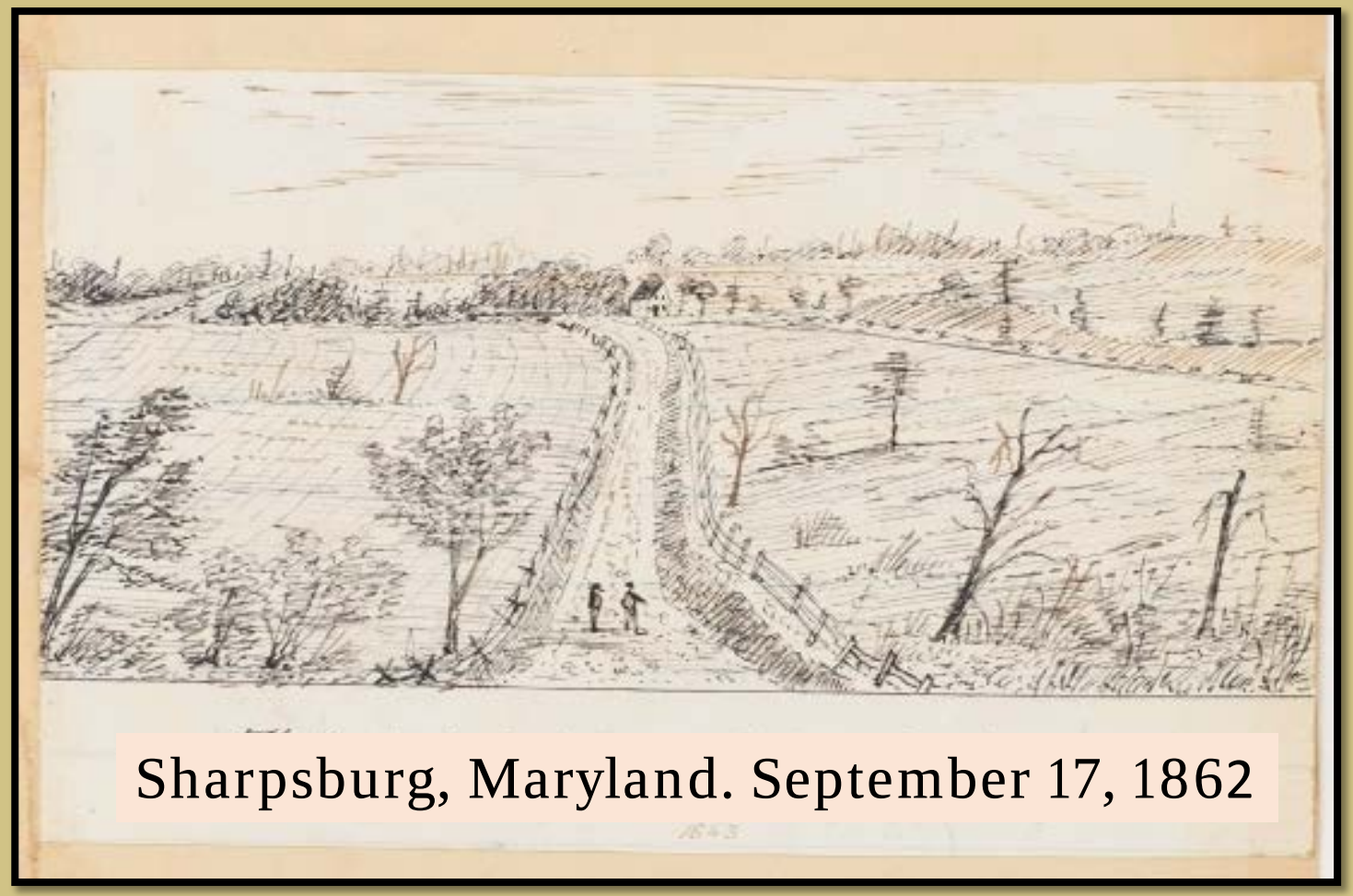
1837 Settin’ On A Rail

The ‘Great Rail Splitter’ was **Lincoln’s** campaign slogan in 1860. In 1862 Lincoln signed the Homestead Act which required more fencing.

A man could split 100 rails/day.

Fence in the Civil War 1861-1865

Army details were sent out to strip the wood from rail fences for fires at camp



Sharpsburg, Maryland. September 17, 1862

Rock Fences

New England, Kentucky, Texas, Kansas

- An **1870** survey conducted by the Department of Agriculture found that between 30% and 70% of all fences in New England were made of rock.

- Dry-laid rock fences in Kentucky began with early **1800** Plantations and were built with a Scottish influence. The fences ensured separation of the stock's bloodlines.

- German immigrants built stone fences in Texas and Kansas where timber was not common and suitable rock was available.

An experienced mason with materials at hand or with the aid of a helper could average 16.5 feet per day

Fences were constructed for the purpose of herd improvement. Kentuckians drove long lines of horses and cattle through the **Cumberland Gap** to the markets in the east.

*Early Kentucky livestock. Robert Moore painted this scene about **1850** of imported short-horn cattle grazing near Auvergne, in Bourbon County.*

Present day Short-horn cattle. Still prized as dual purpose breed.

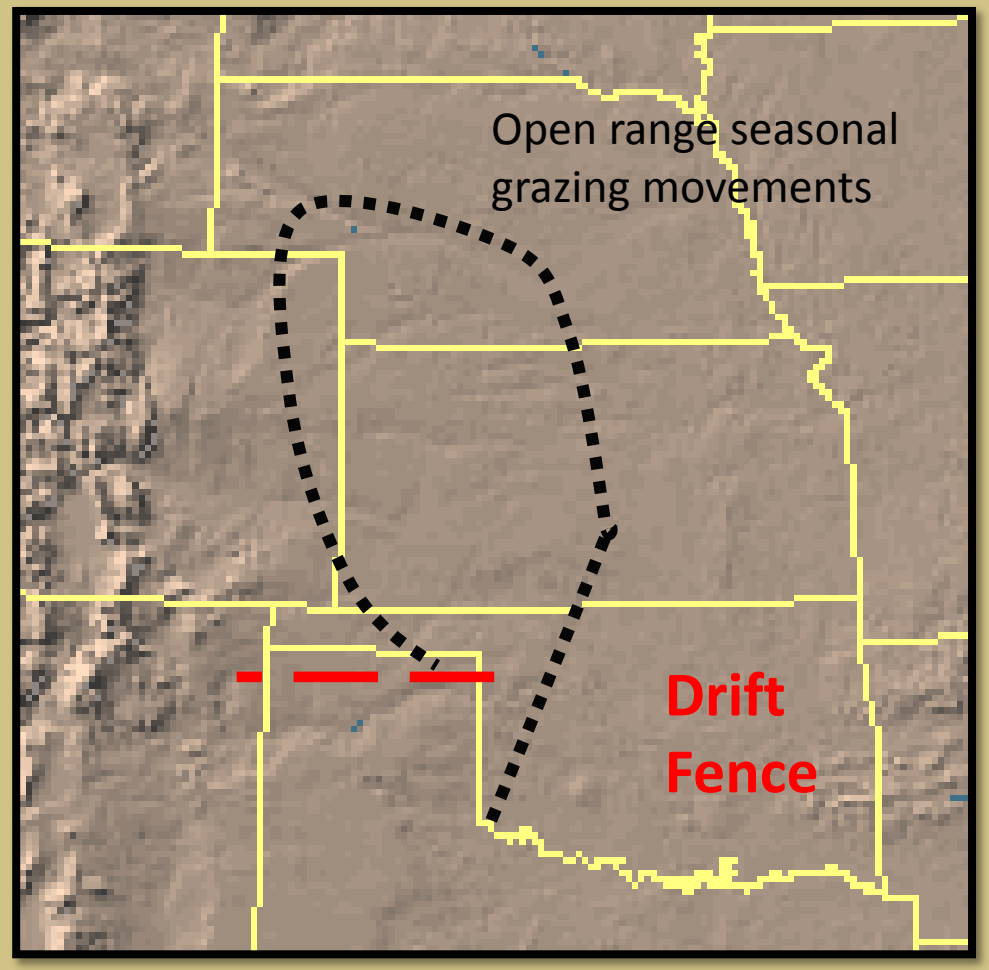
Barbed Wire: A Prairie Invention Because Supply of Stone and Timber was Insufficient

Many patents for barbed wire were invented by farmers at the edge of the prairie.

Leaving the eastern forest behind for the prairies and grasslands beyond.

Great Plains Fencing Ended Open Range

Viciously Cold Winters of the 1880s pushed large herds into the drift fences which led to Big Die-Ups .



1867 Kansas Law abolished open range. Included payment to landowners of $0.40 per rod to build and maintain fences.

Theodore Roosevelt jumping a rail fence in **1902**.

Theodore Roosevelt was a cattle rancher in the Dakota Territory

Woven Wire (sheep tight fence) 1906

- The barbed wire in the late **1870s** caused alarm because it injured livestock. Some states passed laws against its use.
- By **1906**, 80% of hardware stores in the West carried the gentler woven-wire fence as standard stock.
- Steel posts were invented around **1900**.

World War I and Barbed Wire 1914-1918

Conflict and Oppression

(2011)

1930's

Depression Era

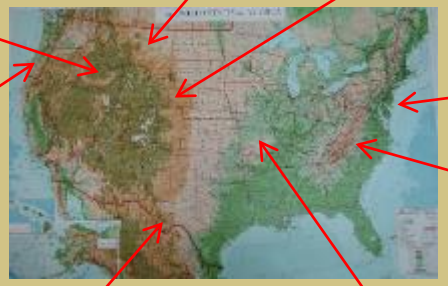
Library of Congress
1930 images of
Wood Rail Fences
LOC.GOV images

Idaho

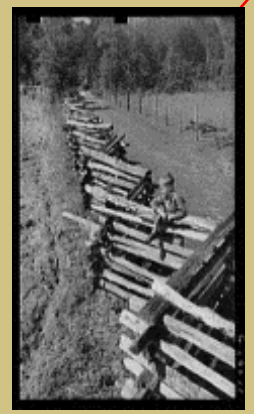
Montana

Nebraska

Maryland

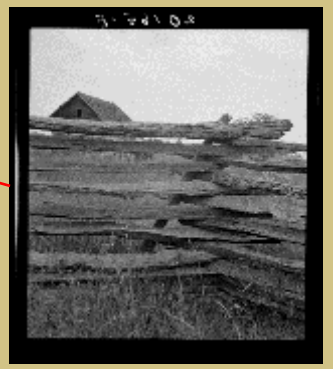


Oregon



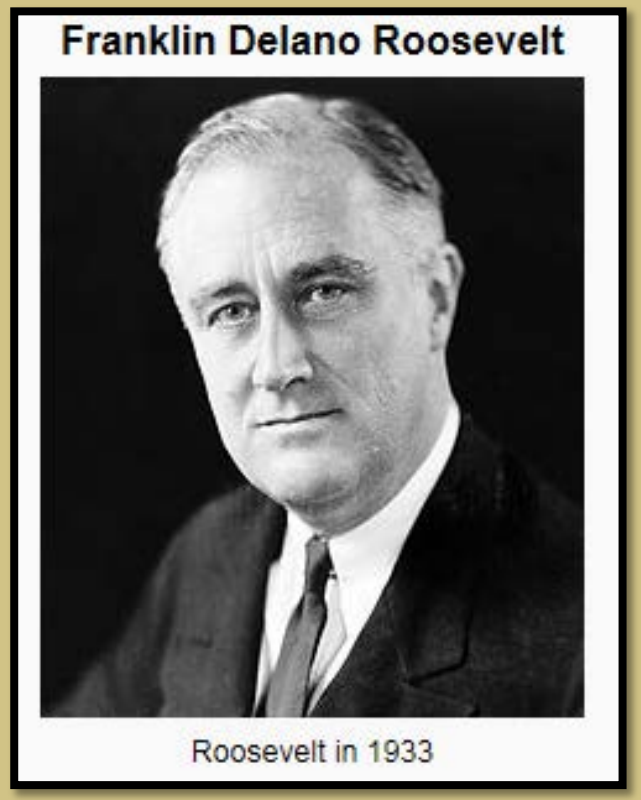
Texas

Missouri



North Carolina

Conservation programs have either provided economic incentives to plant fencerow-to-fencerow and even tear out the fencerows.



FDR and Henry A. Wallace (Sec. of Ag.) produced the first bill with agriculture legislation passed in **1933** encouraged agricultural production.

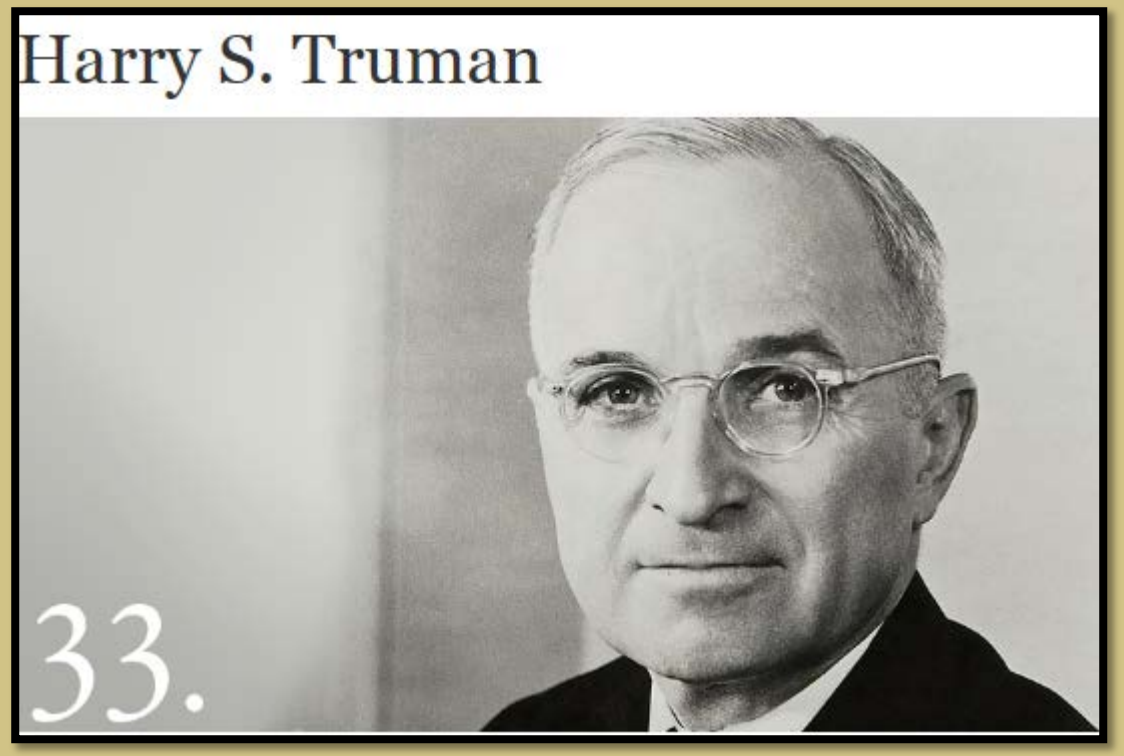
Over 30% of population was rural and farm in 1933. < 2% today.

World War II and Barbed Wire
1939-1945

Control and defensive measures

(1963)

1945 agricultural bills were paying for **woodlot** and **watershed** protection with fences



1945-1953

Richard Nixon

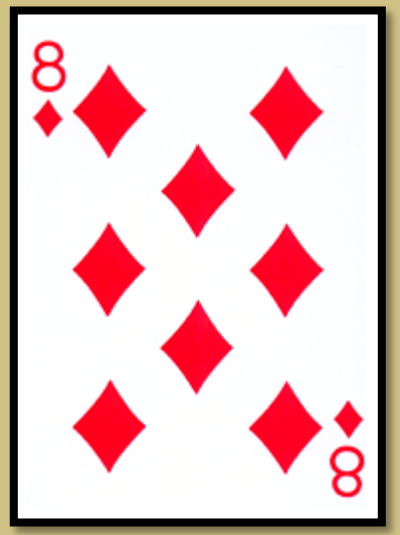
37th President of the United States

In office

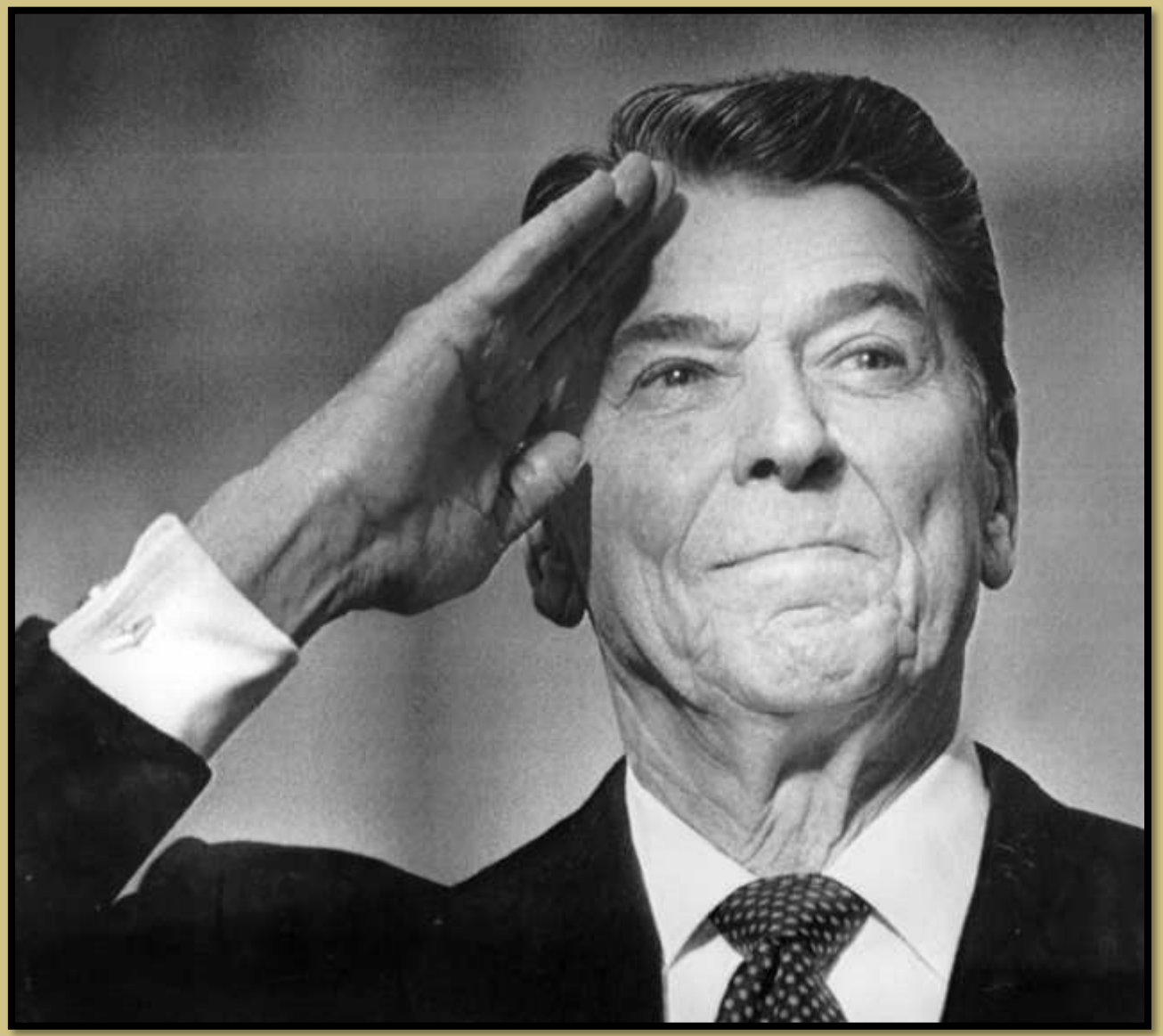
January 20, 1969 – August 9, 1974

1971 legislation mentioned
grasslands fenced for grazing

The 1985 Farm Bill became the first to have a specific title devoted to conservation.

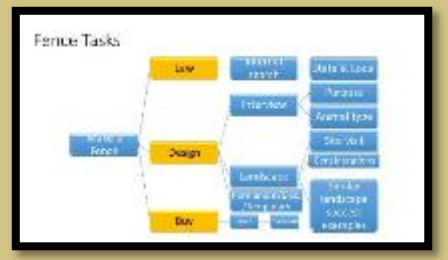


Natural History of Fence: During the past 250 years of American history, eight Presidents (Washington to Reagan) have had a historical connection to fencing.



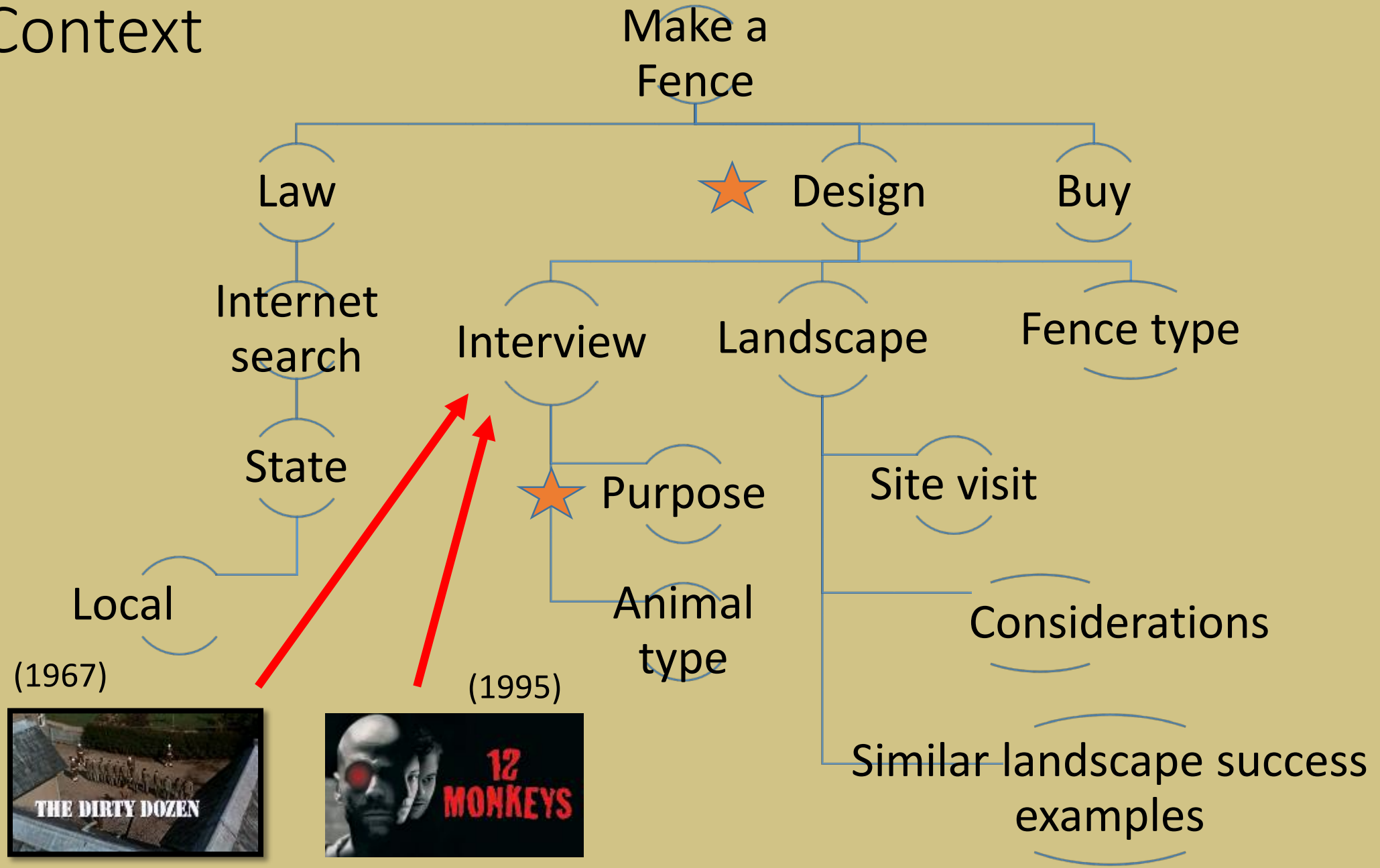
Ronald Reagan
1981-1989

Fence Tasks



- Make a Fence
  - Law
    - Internet search
      - State
        - Local
  - Design
    - Interview
      - Purpose
      - Animal type
    - Landscape
      - Site visit
      - Considerations
      - Similar landscape success examples
    - Fence type
  - Buy

12 Fence Tasks in Context



The **Federal Register** Notice process for all Conservation Practices have a 5 year review cycle. Fence (Code 382) review began on December 14, 2012 and ended with the present National Standard with a date of April 2013. Next review is 2018.

DEPARTMENT OF AGRICULTURE

Natural Resources Conservation Service

[Docket No. NRCS–2012–0004]

Notice of Proposed Changes to the National Handbook of Conservation Practices for the Natural Resources Conservation Service

AGENCY: Natural Resources Conservation Service (NRCS), USDA.

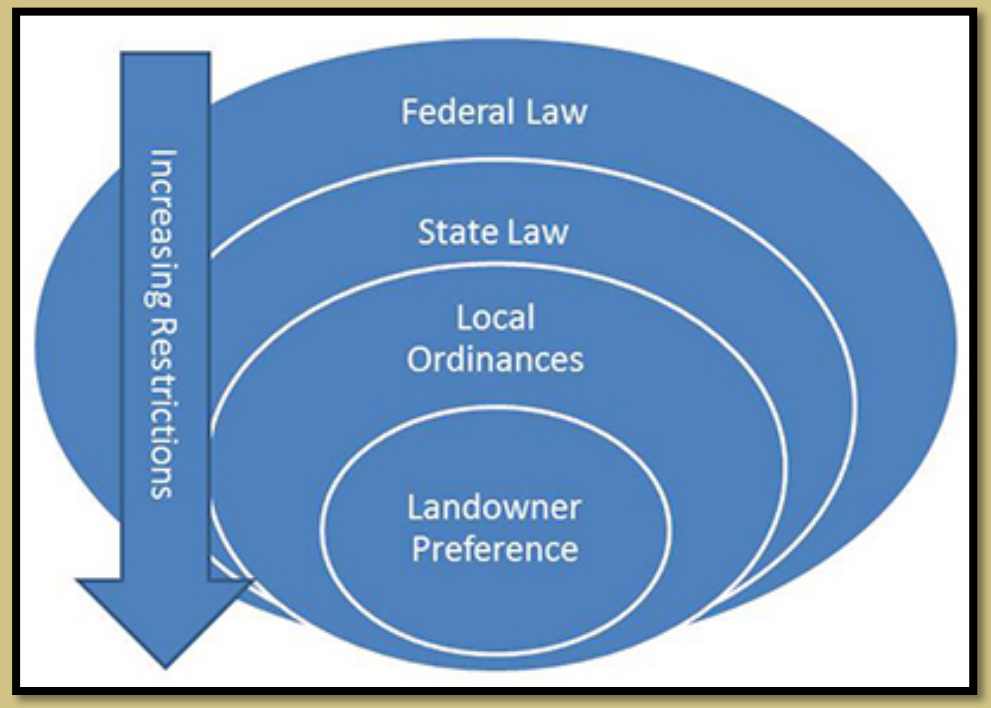
ACTION: Notice of availability of proposed changes in the NRCS National Handbook of Conservation Practices for public review and comment.

SUMMARY: Notice is hereby given of the intention of NRCS to issue a series of revised conservation practice standards in the National Handbook of Conservation Practices. These standards include: Amendments for the Treatment of Agricultural Waste (Code 591), Building Envelope Improvement (Code 672), Fence (Code 382), Lighting System Improvement (Code 670), Recreation Land Grading and Shaping (Code 566),

Basic Change

- Fence (Code 382)—Wildlife needs are now included under general criteria, being moved from the considerations section. This will ensure all fence design and placement is made with knowledge of potential impacts to local wildlife.

Wildlife Ownership Laws



The laws center on the State or Federal ownership of wild animals that exist on or cross private lands, which conflicts with the private citizen's "right" to control his/her property.

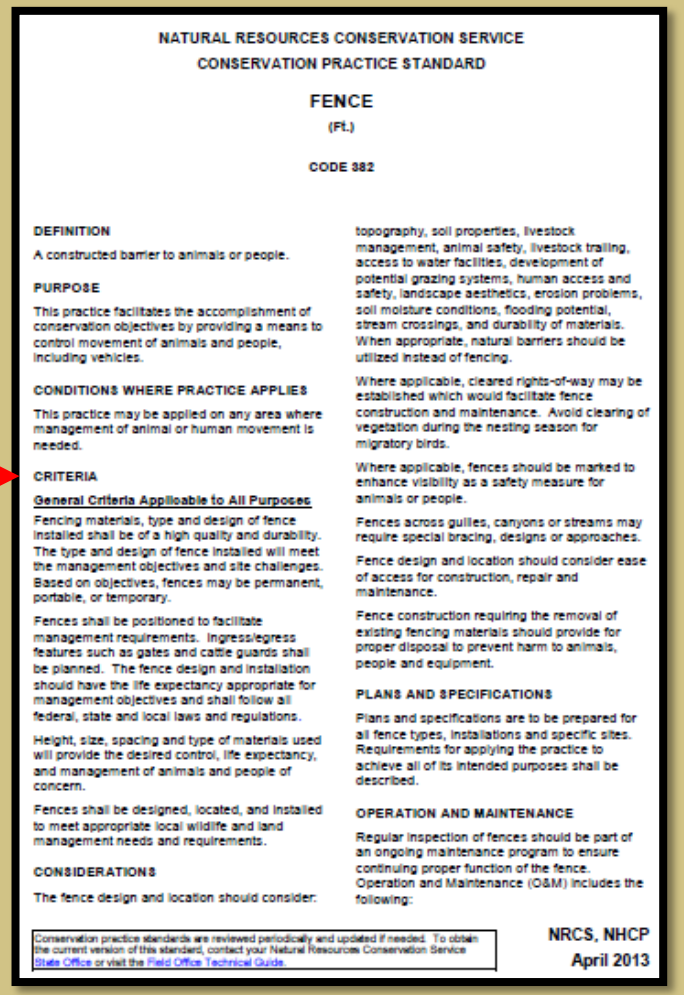
Wildlife management is a private landowner, state, and Federal agency relationship.

It requires dynamic balancing of an ecosystem with multiple species inter-related with each other and the property.

Standard FENCE (Ft.) CODE 382 NRCS, NHCP **April 2013**

- DEFINITION - A constructed barrier to animals or people.

- PURPOSE - This practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.



NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

FENCE
(Ft.)

CODE 382

DEFINITION

A constructed barrier to animals or people.

PURPOSE

This practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals and people, including vehicles.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on any area where management of animal or human movement is needed.

CRITERIA

General Criteria Applicable to All Purposes

Fencing materials, type and design of fence installed shall be of a high quality and durability. The type and design of fence installed will meet the management objectives and site challenges. Based on objectives, fences may be permanent, portable, or temporary.

Fences shall be positioned to facilitate management requirements. Ingress/egress features such as gates and cattle guards shall be planned. The fence design and installation should have the life expectancy appropriate for management objectives and shall follow all federal, state and local laws and regulations.

Height, size, spacing and type of materials used will provide the desired control, life expectancy, and management of animals and people of concern.

Fences shall be designed, located, and installed to meet appropriate local wildlife and land management needs and requirements.

CONSIDERATIONS

The fence design and location should consider: topography, soil properties, livestock management, animal safety, livestock trailing, access to water facilities, development of potential grazing systems, human access and safety, landscape aesthetics, erosion problems, soil moisture conditions, flooding potential, stream crossings, and durability of materials. When appropriate, natural barriers should be utilized instead of fencing.

Where applicable, cleared rights-of-way may be established which would facilitate fence construction and maintenance. Avoid clearing of vegetation during the nesting season for migratory birds.

Where applicable, fences should be marked to enhance visibility as a safety measure for animals or people.

Fences across gullies, canyons or streams may require special bracing, designs or approaches.

Fence design and location should consider ease of access for construction, repair and maintenance.

Fence construction requiring the removal of existing fencing materials should provide for proper disposal to prevent harm to animals, people and equipment.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for all fence types, installations and specific sites. Requirements for applying the practice to achieve all of its intended purposes shall be described.

OPERATION AND MAINTENANCE

Regular inspection of fences should be part of an ongoing maintenance program to ensure continuing proper function of the fence. Operation and Maintenance (O&M) includes the following:

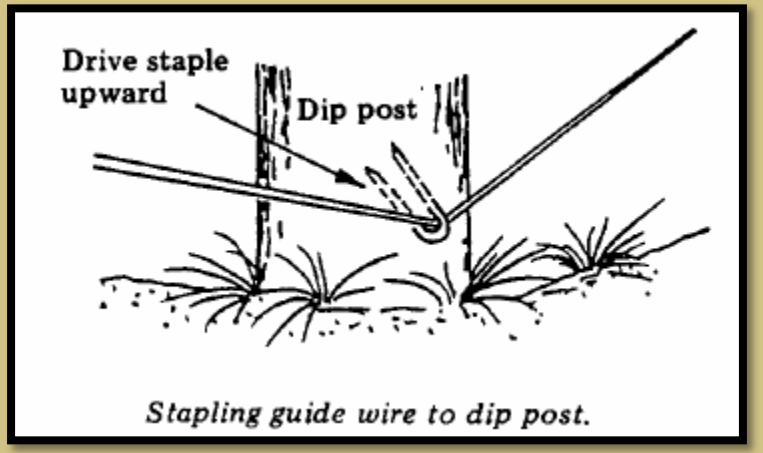
Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

NRCS, NHCP
April 2013

Standard FENCE (Ft.) CODE 382 NRCS, NHCP **April 2013**

- CRITERIA - General Criteria Applicable to All Purposes (selected)
  - Based on objectives, fences may be Permanent, Portable, or Temporary.
  - Fences shall be **Designed**, **Located**, and **Installed** to meet appropriate local wildlife and land management needs and requirements.
- CONSIDERATIONS (14)

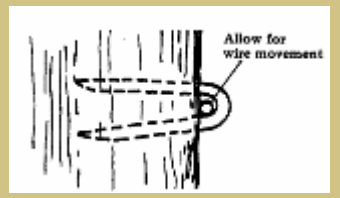
GM Part 401 – Technical Guides
Subpart B – Conservation Practice Standards

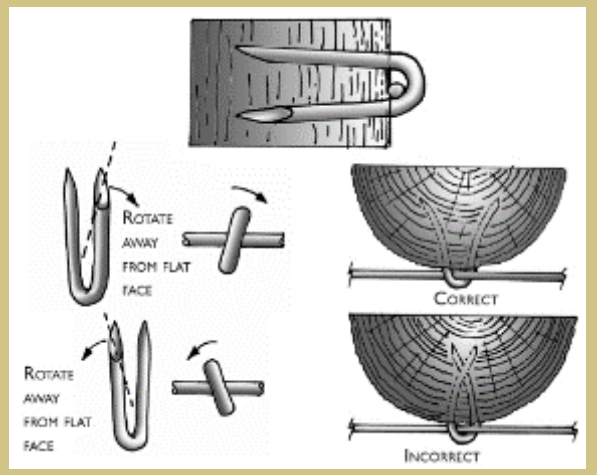


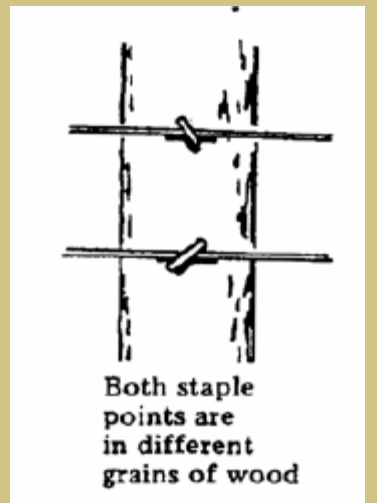
Stapling guide wire to dip post.

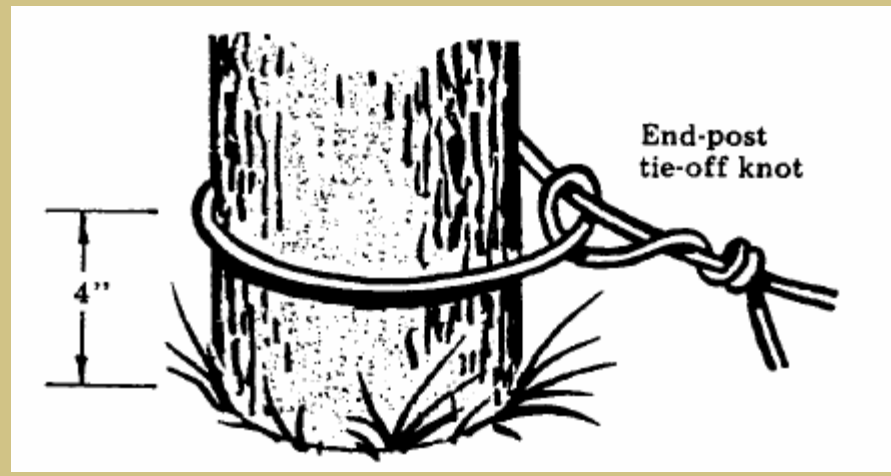
GM 401.13 **Practice Specifications (*design*)**

- Conservation practice specifications are **site-specific** guides that establish the technical details and workmanship required to install the conservation practice in accordance with the requirements of the conservation practice standard. Information in the conservation practice standard guides the development of the specification.









Poor et al (2014) Modeling Fence Location and Density at a Regional Scale for Use in Wildlife Management. PLoS ONE 9(1): e83912. **(location)**

Montana has bison and pronghorn antelope migration routes; concern over Sage-grouse fence collisions near leks and in nesting habitat. 65% of the area is private ownership.

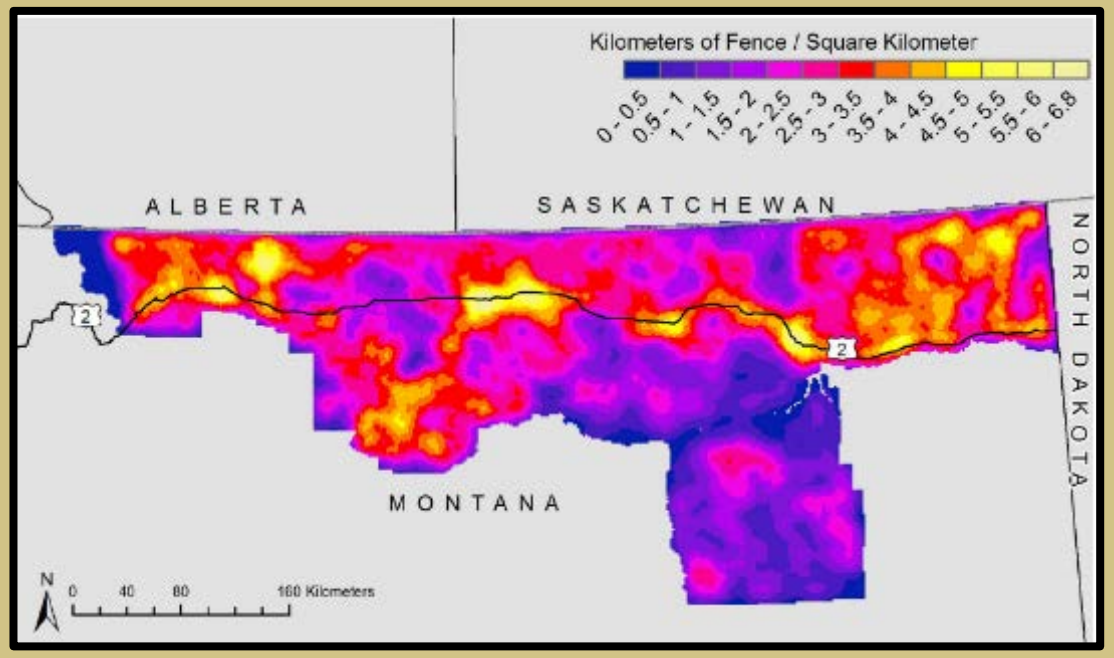
Maximum fence density was 10 miles of fencing per square mile.

Mean fence density was 3.7 miles/Sq.Mi.

Minimum density was 1.9 miles/Sq.Mi.

Oklahoma estimate 6 miles/Sq.Mi.
Wyoming average of 3 miles/Sq.Mi.

Yellow areas have high density fencing



Fence Ecological Impacts CPA – 52 (installed)

- **Direct impacts**: 1) wildlife mortality through collisions, 2) facilitation of predation, and 3) fragmentation of habitats for area-sensitive birds
- **Indirect impacts**: 1) vegetation heterogeneity 2) structure and composition 3) slow improvement in ecological quality via management
- **Adverse Effects** in NEPA need to be attenuated in some way. T & E or Candidate Species plans will have those listed

- Programmatic agreements with USFWS

Wildlife Habitat Along Fence Line (installed)

Laws; Call before you dig the first post hole.

Standard's guidance -All appropriate local, State, Tribal, and Federal permits and approvals are the responsibility of the landowners and are presumed to have been obtained.

Laws (Does the purpose of the fence need the legal protection afforded by state laws?)

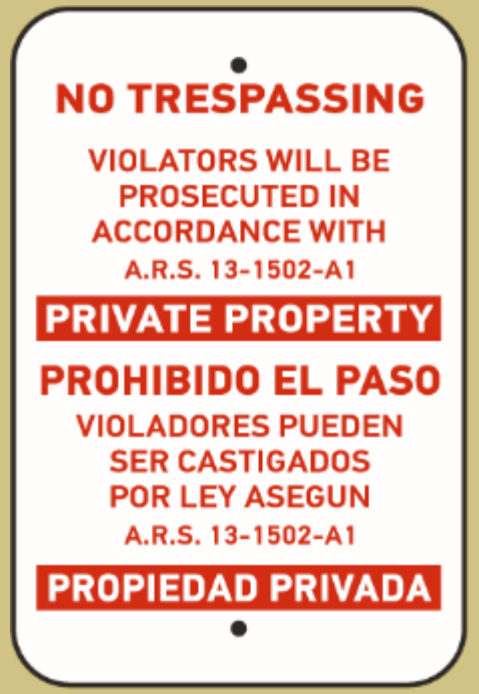
Missouri's first fence law was enacted in 1808 while still within the Louisiana Territory (Missouri became a state in 1821).

It required landowners to fence out the neighbors' livestock (open range). If a landowner constructed a "lawful fence," then he had certain legal remedies against the owner of trespassing livestock:

1. Actual damages for the first trespass;

2. Double damages and court costs for subsequent trespass; and

3. On the third and later trespass, the landowner was authorized to kill and dispose of the trespassing livestock without liability.



August 12, 2014 Sidney, Maine News

The goats were reported on Sunday and Monday, which means that under **Maine** state law the owner could be charged with animal trespassing and made to pay a fine if it were to happen again within the week.

› Sidney farmer says escaping goats 'have nothing else to do'

PHOTO GALLERY

NEWS Posted July 23, 2014 | Updated August 12, 2014 INCREASE FONT SIZE

State fixes Sidney fence to keep goats off highway

Transportation officials said it is still up to the farmer to keep his goats fenced in, but the fence was repaired for highway safety.

BY RACHEL OHM STAFF WRITER
rohm@centralmaine.com | @rachel_ohm | 207-612-2368

Share

SIDNEY — Crews from the Maine Department of Transportation repaired a section of fence along Interstate 95 Wednesday that goats from a nearby farm were escaping through a hole in the barbed wire.

Idaho open range **laws** have special instructions as how to decide **who maintains what** on a property boundary.

"Each adjoining land owner, unless both otherwise agree, or unless other arrangements have heretofore been made, must construct and keep in repair that half of the line fence which is to his left when standing on his own land facing the other."

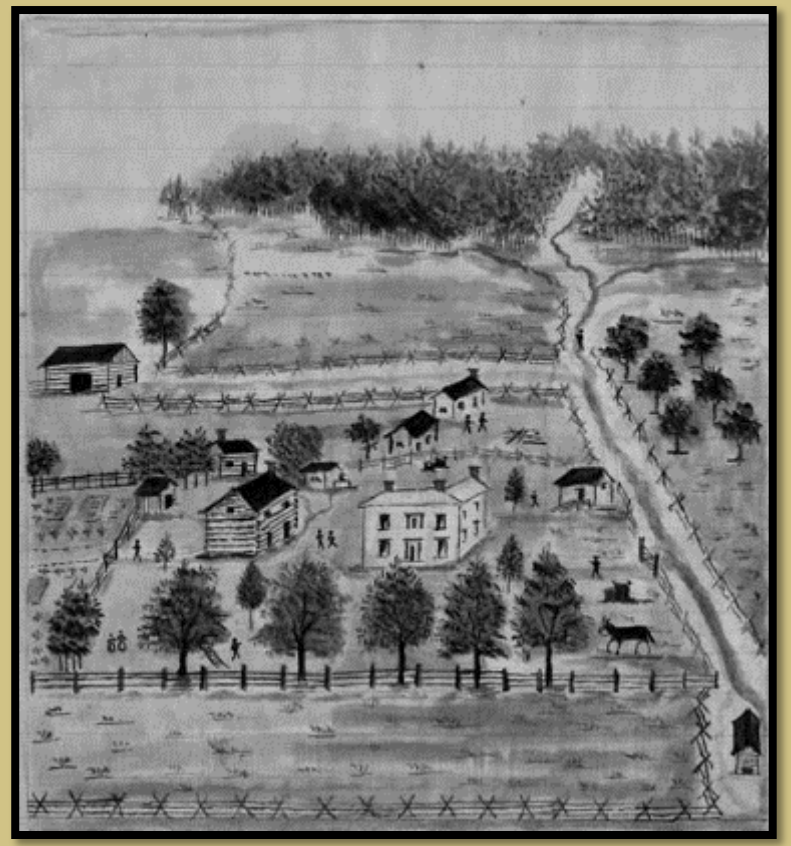
Maintenance (largely labor time) costs

8% annually of initial installation and labor

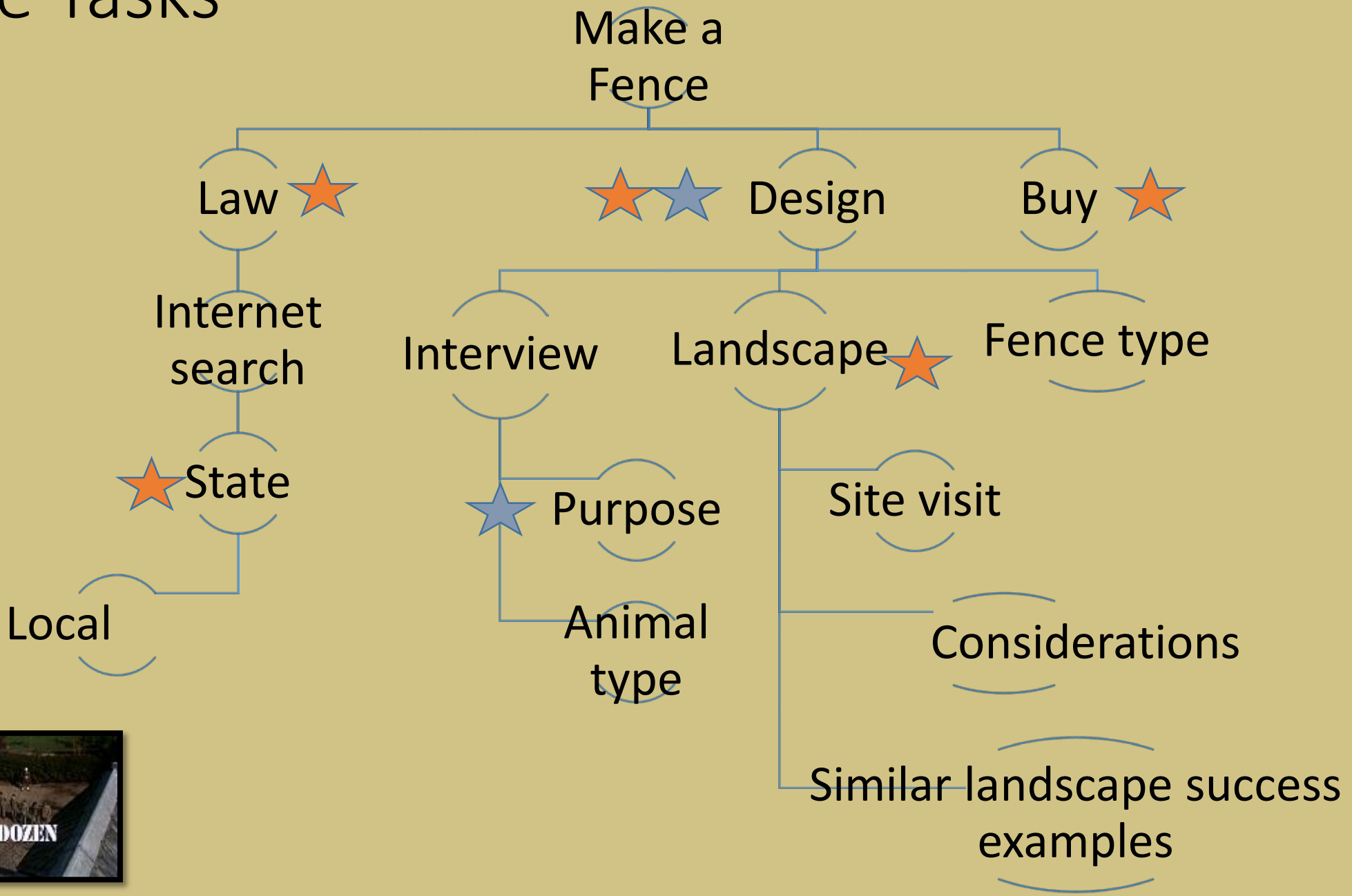
Knight et al (2011) Cross-Fencing on Private US Rangelands: Financial Costs and Producer Risks. Rangelands. April 2011, 41-44.

State Laws

- In **1790**, Delaware farmers established fence laws to defend their fields against marauding hogs.
- California's **1873** fence laws forced cattle operations in Nevada to be year-long.
- Florida, in **1949**, was the last state to establish a fence law.
- Federal Lands have 'unlawful enclosure' laws where fences can not impede animal movements to critical winter range.
- Wyoming law is a 'fence out' for cattle and 'fence in' for sheep.
- New Mexico has 'injuring fence' and 'failure to close gate' laws.



Fence Tasks


Make a Fence
Law
Design
Buy
Internet search
Interview
Landscape
Fence type
State
Purpose
Site visit
Local
Animal type
Considerations
Similar landscape success examples


THE DIRTY DOZEN

Types of Fence

- Live or Living
- Electric
- Permanent
  - Rail
  - Wire
    - Suspension
    - Barbed
    - Woven
- Temporary
- Portable

Live fences may be established all around the farm, but it is most common to establish such a fence around the homestead.

Traits of Live Fence Types

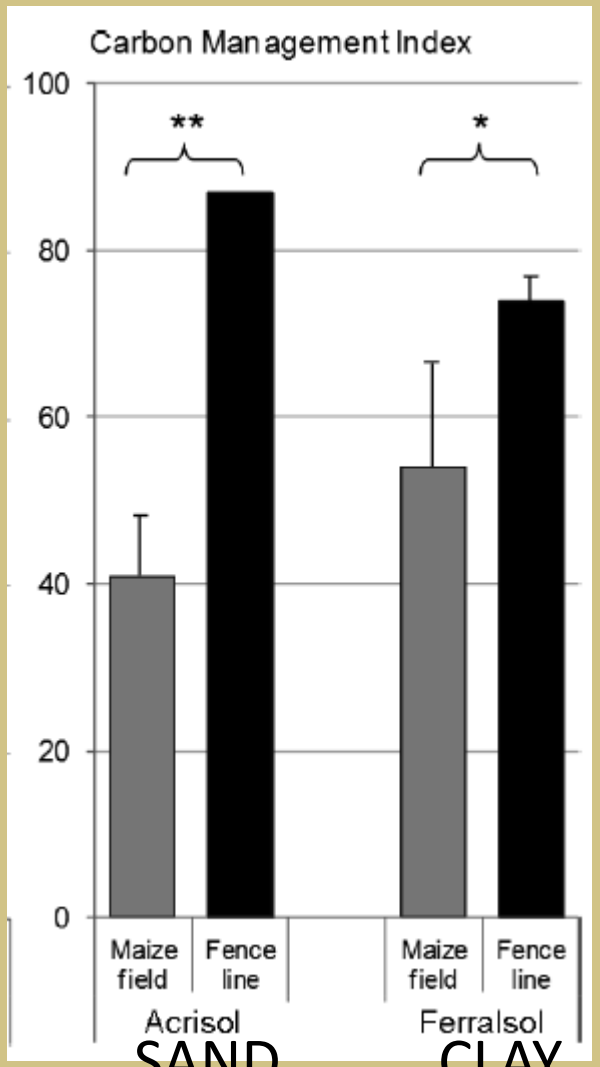
- Tree thorny: large, medium, or small
- Tree or Shrub Post, Hedge, Palisade
- Woven lattice, e.g. Honey Locust
- Shrub, succulent, very prickly hedge
- Deciduous or Evergreen

Soil Health Along Live Fence Line

Soil Measurement	Change in Sand sites	Change in Clay sites
Bulk Density	=	=
Aggregate Stability	+	+
pH	+	+
Carbon	+	=
Nitrogen total	+	+
Nitrogen supply	+	+
Phosphorous	=	=
Potassium	+	+

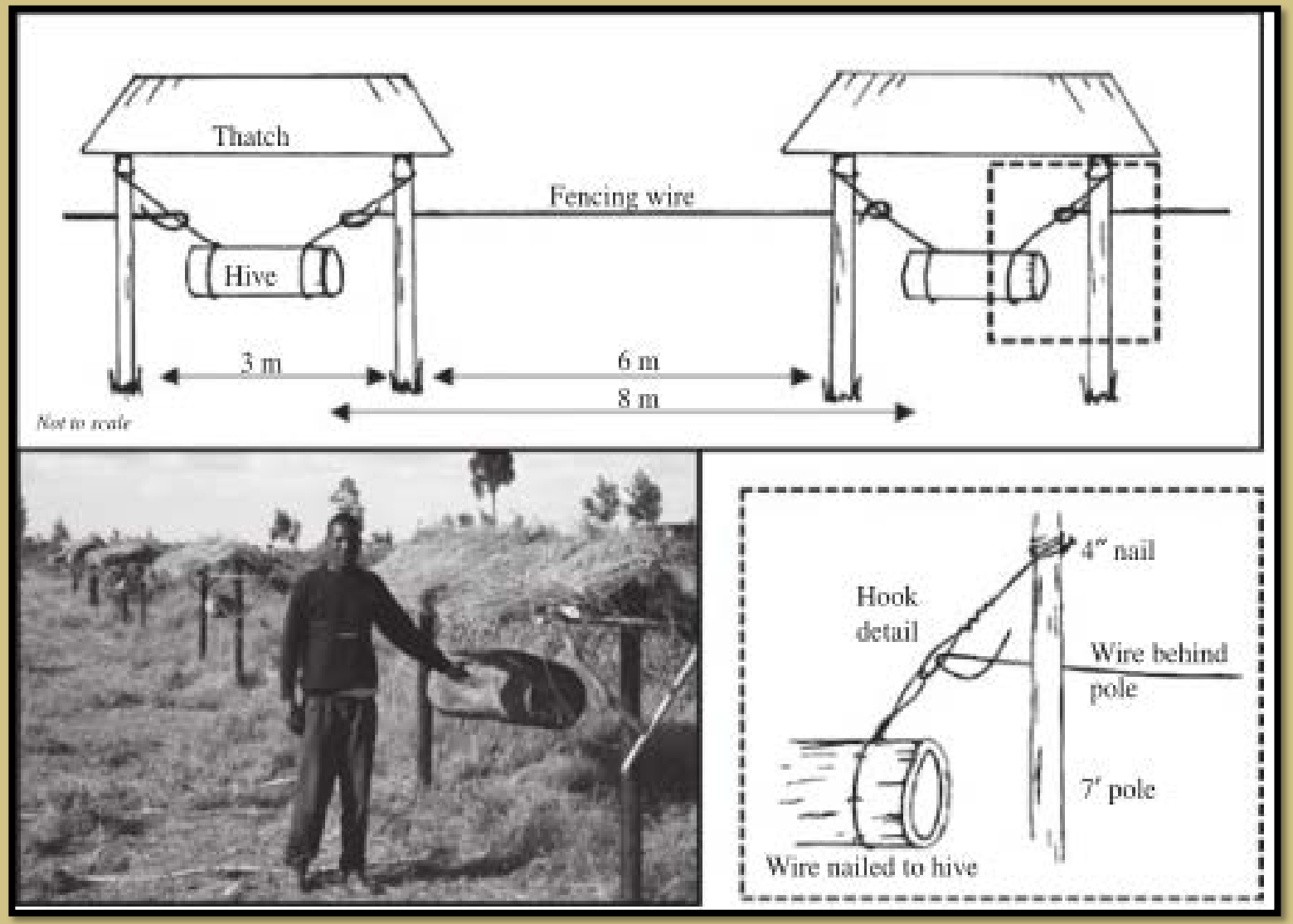
Theobald et al (2014) Live fences – a hidden resource of soil fertility in West Kenya.
J. Plant Nutr. Soil Sci. 2014, 177, 758–765

The Carbon Management Index (CMI) 100 = undisturbed forest soil.



Live Fence and Pollinators

African Bee Hives

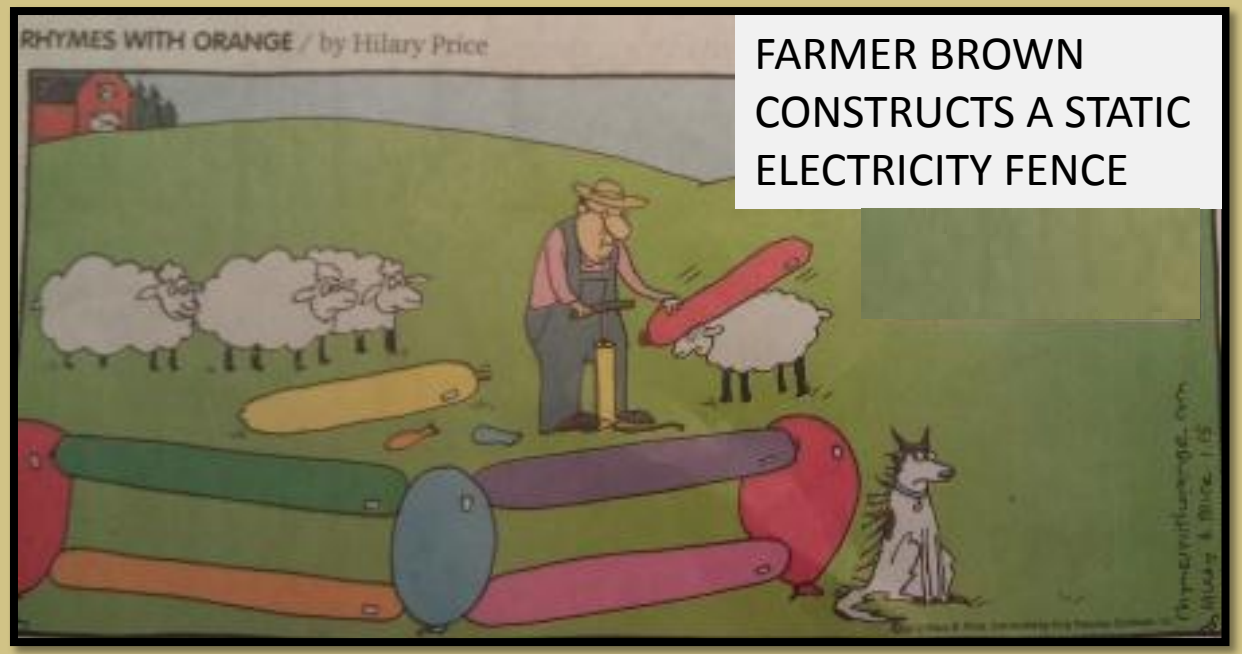


Beehive Fence Deters Crop-Raiding Elephants

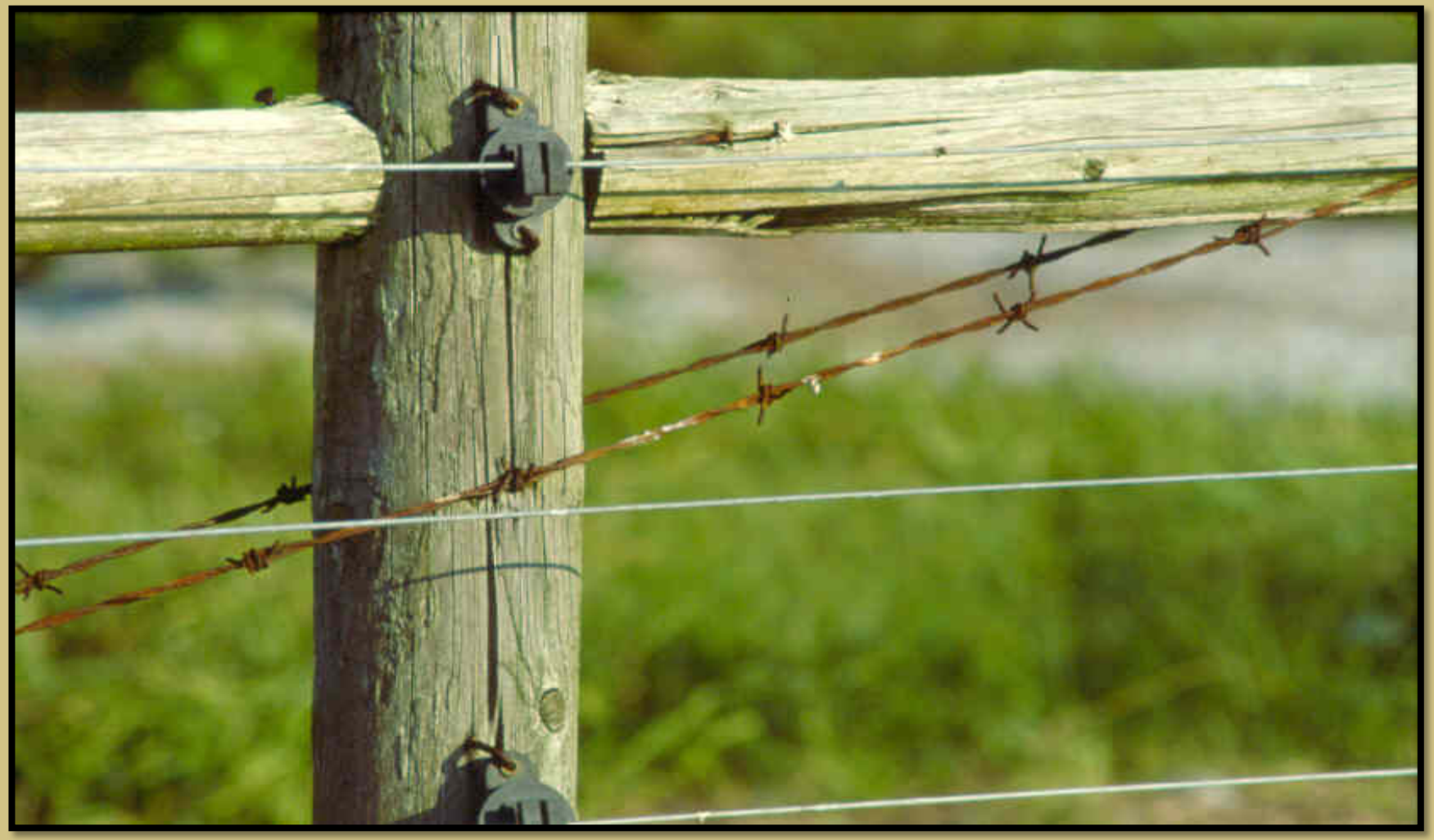
(2014) African Journal of Ecology 47: 131-137

10 Common Issues with Electric Fences

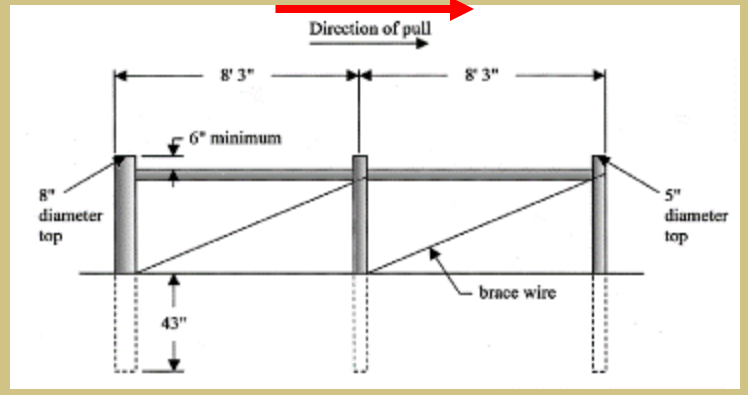
1. Poor grounding.
2. Undersized charger.
3. Lightning damage
4. Bad connections
5. Energy leakage
6. Induction
7. Voltmeter
8. Solar Fencing
9. Stapling
10. Livestock training

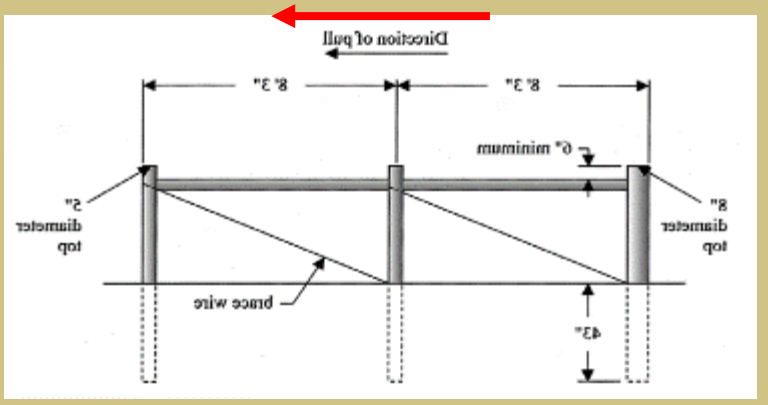


Electric Fencing: Connections; Leakage; Induction

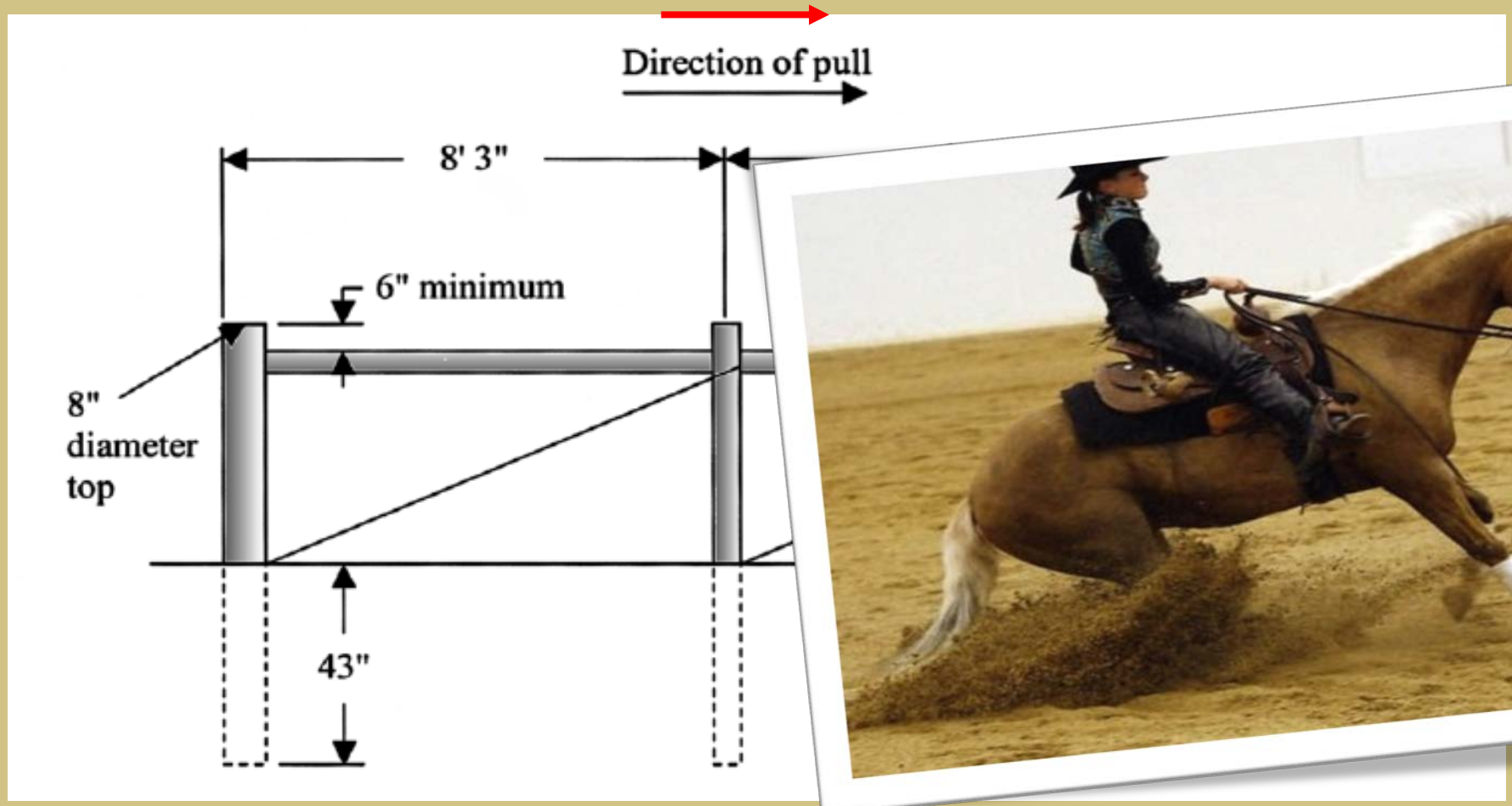


Does everyone understand the direction of pull relative to the H-brace wire assembly?





Think of a horse doing a sliding stop against the pull



Charger Electrical Sizes and Volts For Animal Type Control

• Cattle	2000 volts
• Horses	2000 volts or less
• Swine	2000 volts
• Sheep	>3000 volts
• Goats	>3000 volts
• Deer	>4000 volts
• Elk	>4000 volts
• Coyotes	>4000 volts

(1993)

The fence surrounding the **Tyrannosaurus rex** paddock is 24 ft. in height and spacing of 30 ft. between posts. There are also clear indications that **10,000 volts** of electricity run through the Tyrannosaurus‘ fence.

2 seconds of electric fence shock video

–On The Pasture -Kathy Voss 8-18-2014

0.0

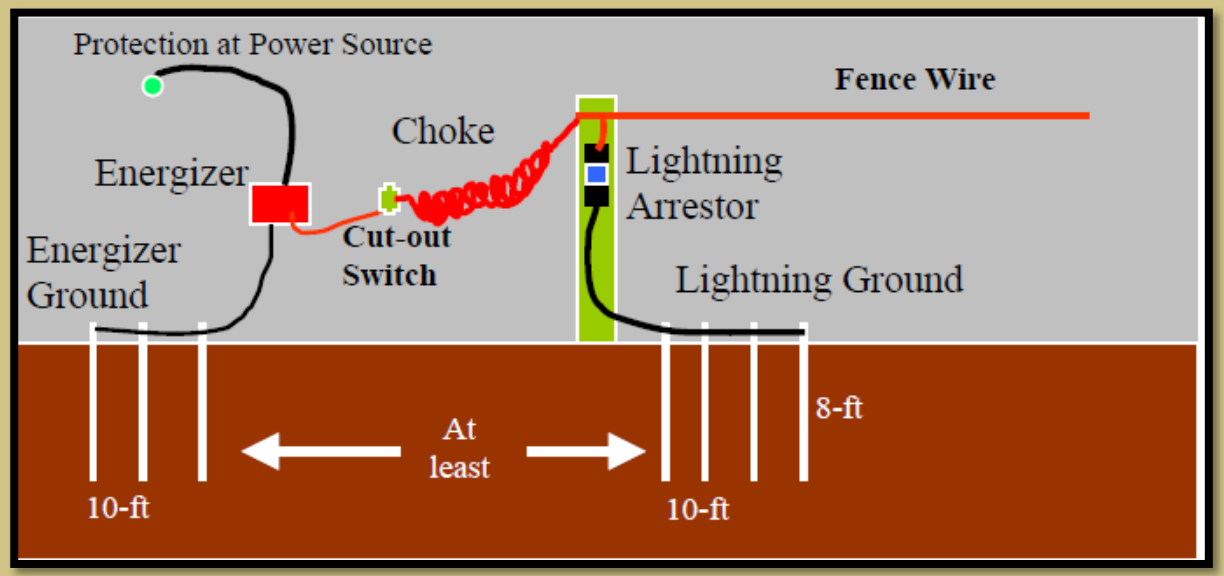
0.5

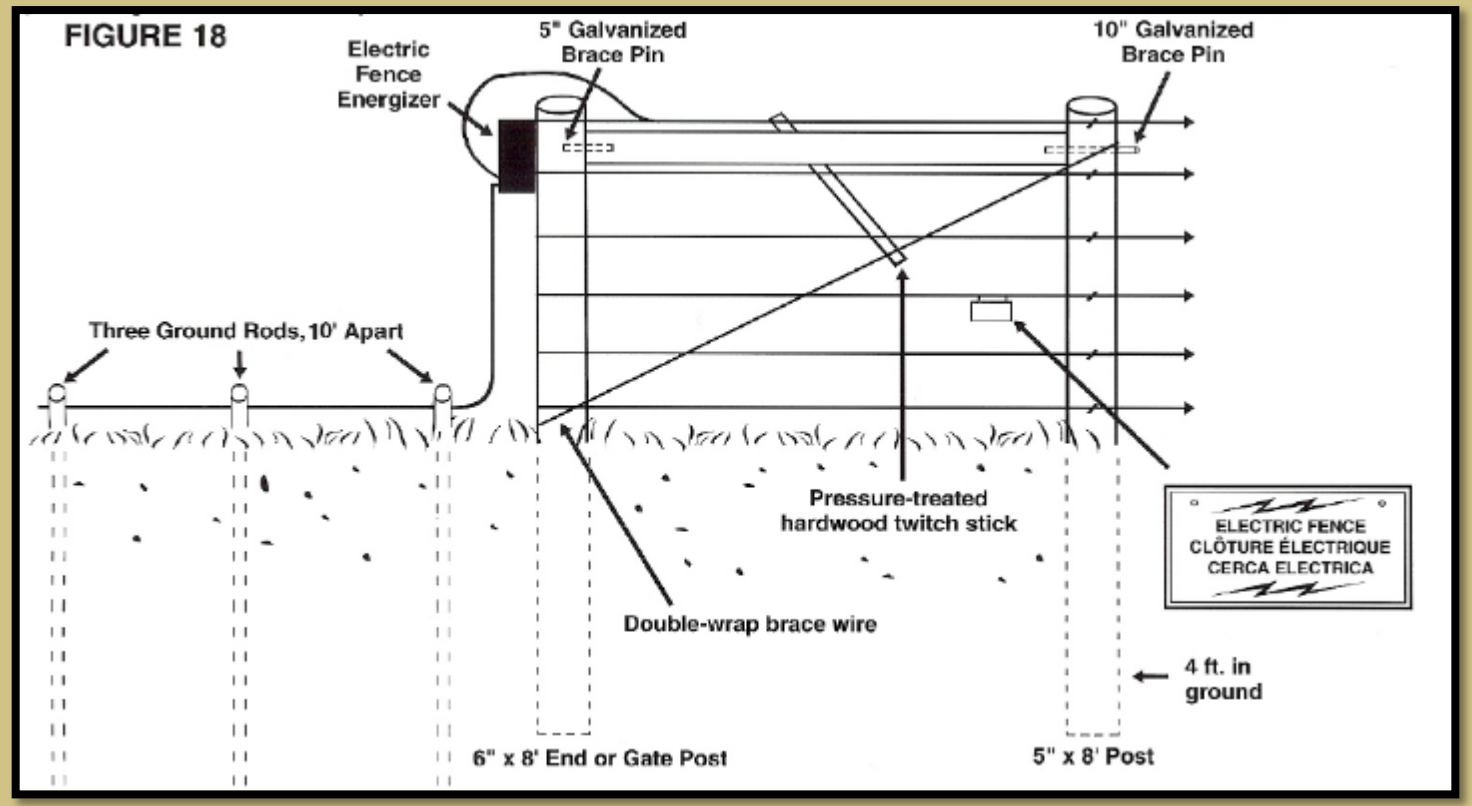
1.0

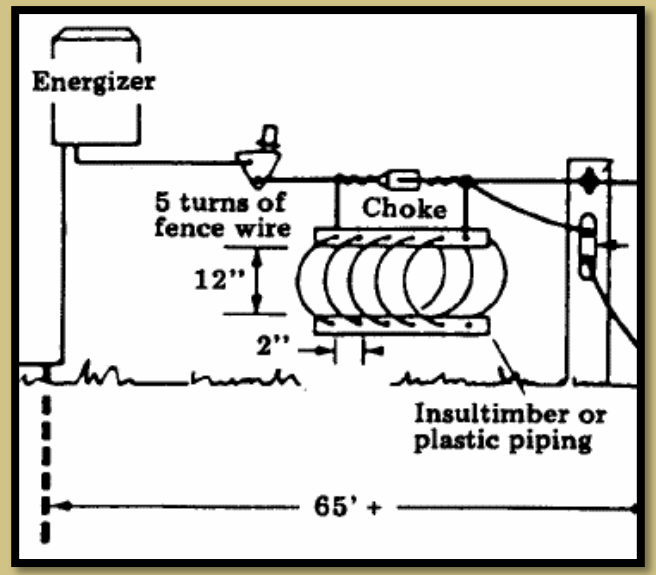
2.0

Grounding is how it works.
Notice bare foot.

The larger the charger, the larger the ground bed needs to be.







Lightning follows straight lines.
The 'CHOKE' disperses energy.

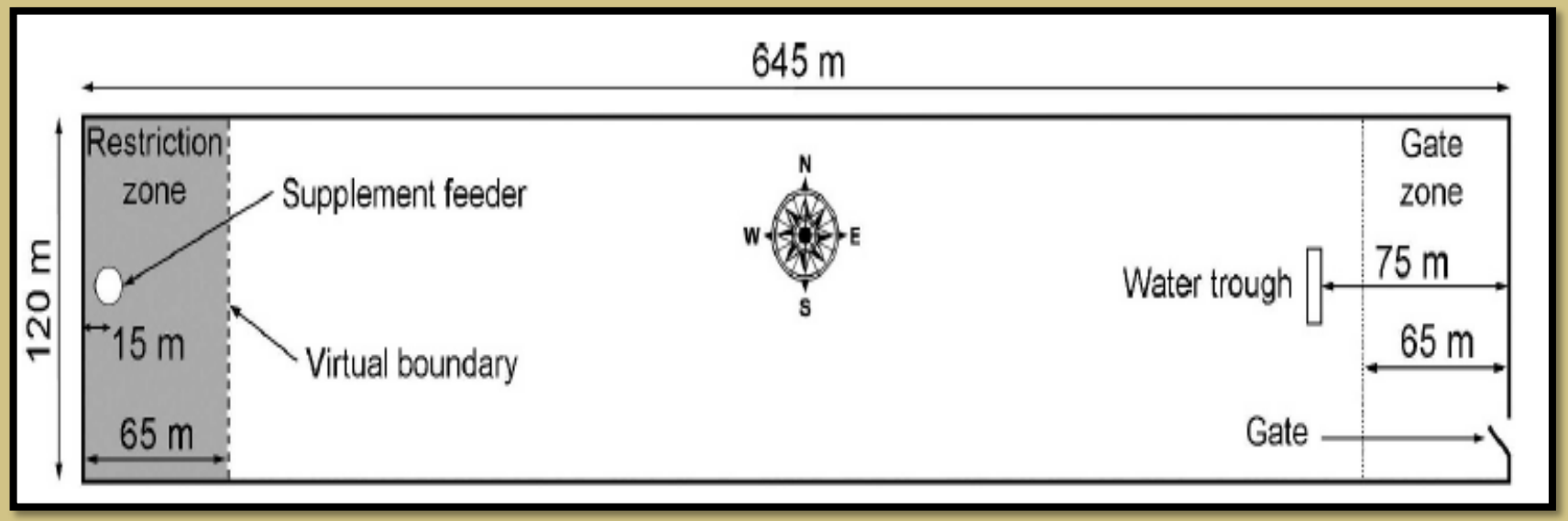
Electric – Animal Training

- If an animal receives a sufficiently unpleasant shock the first time it encounters an electric fence, then a drastic and long-term change in behavior can be observed.

- If an animal learns to cross a fence while it is not electrified, however, future crossings by this individual are likely, even when power is restored.

Training Animals; The Future Fence

- Automated Animal Control: Can Discontinuous Monitoring and Aversive Stimulation Modify Cattle Grazing Behavior? Ruiz-Mirazo (2011) Rangeland Ecol Manage 64:240–248



Permanent –Rail Fence

Zig Zag or Virginia

Russell

Log and Block

Permanent - Suspension Fences

Works well with level ground that has no depressions.

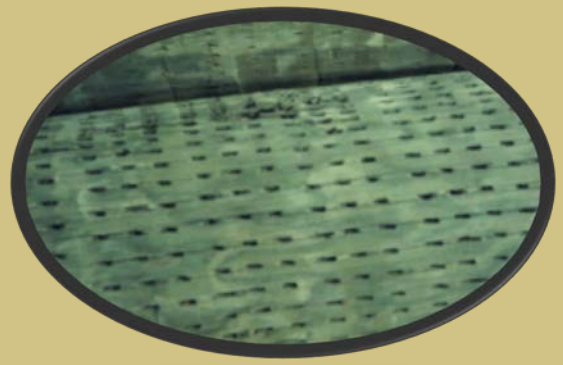
Fence	Spacing (feet)
Woven Wire	14 - 16
Barbed Wire	12 - 14
Suspension	100
Electric	40 - 75
High Tensile	40 -60
Board	8
Corrals	6

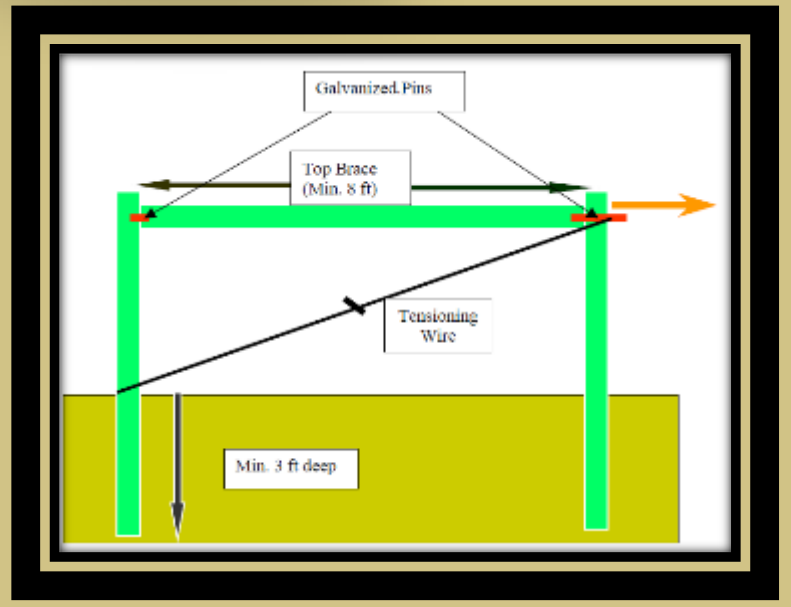
* Driven posts are 1.7 times as strong as tamped posts

*Table 5. Recommended Post Spacings**

Pressure treated posts

"Wolmanized" wood
is treated with CCA

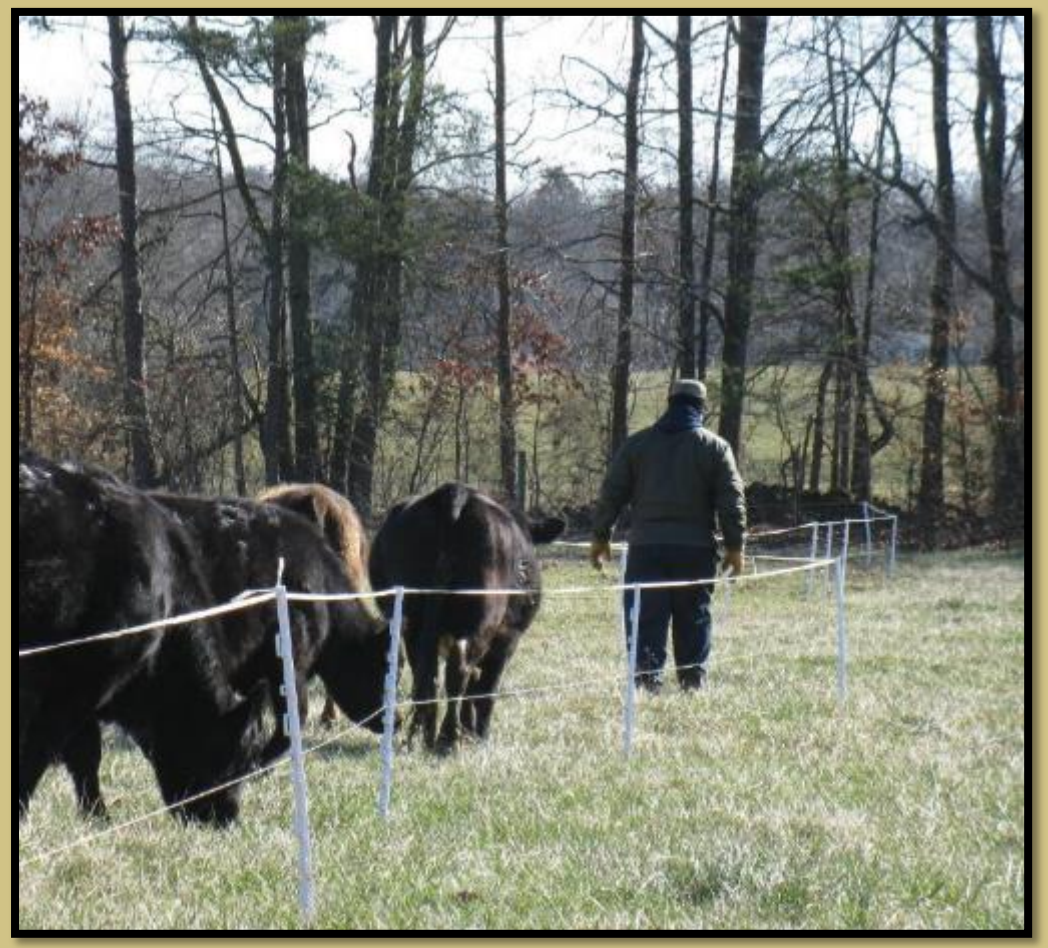




Longevity Threats to a Permanent Fence

Temporary Fence: General Definition

- Not four-season (e.g. Seasonal)
- Must be tested 75% effective
- Producer acknowledged effort and frequency of maintenance
- Material quality exceeds a seven year life expectancy or is consistently replaced for a 7 year management period.
- Material meets all safety requirements



VerCauteren et al (2006) Fences and Deer-Damage Management: A Review of Designs and Efficacy. USDA National Wildlife Research Center - Staff Publications. Paper 99.

FENCE TYPE	EFFICACY %	LONGEVITY YRS	MAINTENANCE
Woven wire	90-99	30-40	LOW
welded wire,	90-99	20-30	LOW
chain link	90-99	30-40	LOW
Polypropylene mesh	90-99	10-20	MEDIUM
Polypropylene rope	70-80	15-25	HIGH
woven wire with 3 high tensile	80-90	20-30	MEDIUM
Polypropylene snow fence	80-90	15-25	MEDIUM
offset high tensile (NH Figure 4)	60-70	20-30	HIGH
slanted 7 high tensile	70-80	20-30	HIGH
Pennsylvania State 5 high tensile	70-80	20-30	HIGH
Polypropylene tape	60-70	5-15	HIGH
baited electric	80-90	10-20	HIGH

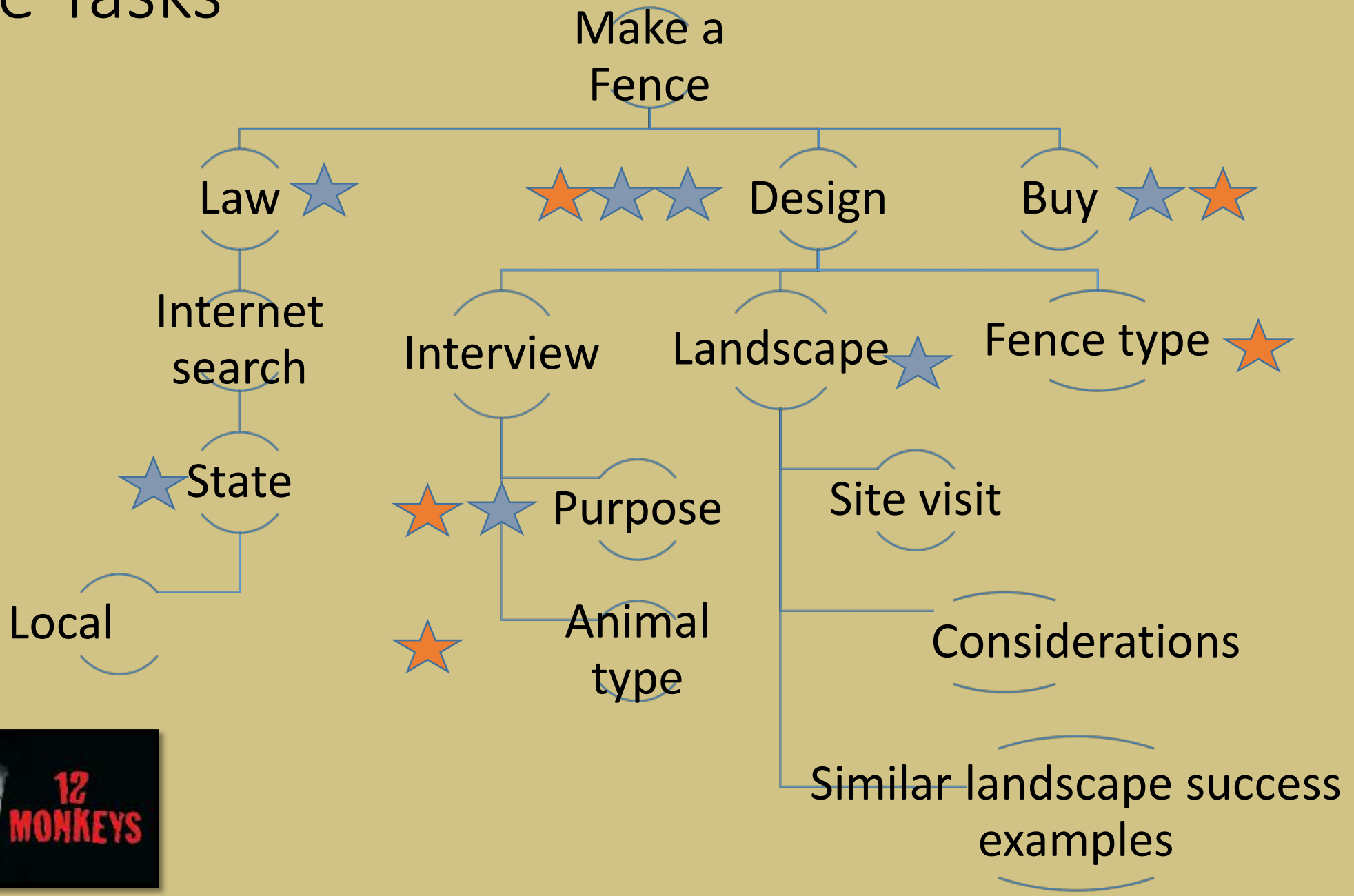

Use temporary portable fencing first


Then use permanent if desired

Factors That Drive Fence Cost Up or Down

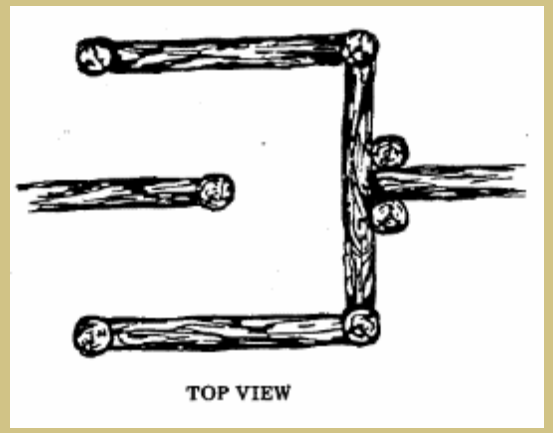
- Site preparation
- Fence layout (straight vs. curved, flat vs. up/down, short vs. long)
- Post spacing
- Post type
- Wire differences
- Number of energized wires

Fence Tasks

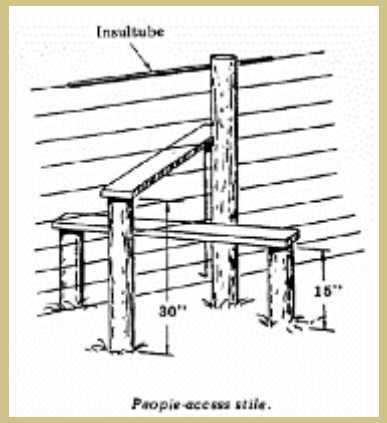

Make a Fence
Law
Design
Buy
Internet search
Interview
Landscape
Fence type
State
Purpose
Site visit
Local
Animal type
Considerations
Similar landscape success examples


12
MONKEYS

Species Considerations for Fences



People Access



Species Considerations for Fences

Horses

- the tendency to get hooves and legs caught in wires or brace assemblies “no climb”.
- the habit of chewing wooden boards.
- the need for good fence visibility.

Cattle

- Can easily see single strand of high tensile wire.
- Tend to go through or over a fence.
- Calving time and Breeding season are important considerations.

Progressive Cattlemen
June 2012

“While most ranchers want their fences to look good, they are more interested in the fence doing the job at the least cost.”

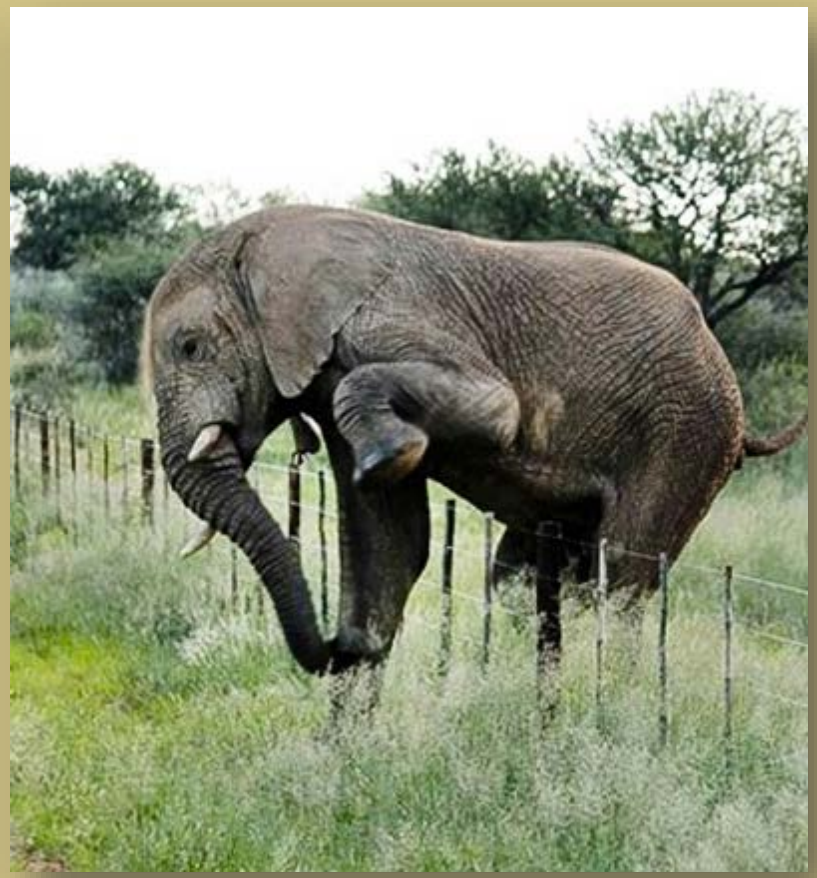
STAFF PHOTO.

Species Considerations for Fences

- **Goats**
  - Climbing habit
  - 12” X 6” woven wire instead of 9” X 6” to prevent getting head and horns stuck.
- **Sheep**
  - Thick wool insulates from electric shock.
  - Tend to go under fence.
  - Woven wire fence is recommended for exterior fence.
  - Know what you are fencing out as well.

“Horse-high, Bull-strong, and Hog-tight”
…now, **Wildlife-Friendly**

Fences should be considered carefully for their role in impeding or altering events essential to species persistence, like dispersal, seasonal movement, and range expansion.



Wildlife Friendly Fence Structures

When local wildlife species have a tendency to **jump**, lower a section of the top wire or board of the fence. Additionally, add extra space between top and 2nd wire.

When local wildlife species have a tendency to **crawl** , raise a section of the bottom wire or board of the fence. Additionally, use smooth wire.

When local wildlife species have a tendency to rely on **visual** queues, make the fence more visible.

When local wildlife species have strong nest **predators** in the area, make the fence go around the nesting site.

VerCauteren et al. (2010) Ability of **White-Tailed Deer** to **JUMP** Fences Journal of Wildlife Management 74(6):1378–1381

- 0% deterrence at 5 feet high
- 100% deterrence at 8 feet high
- Deer reacted as a herd at the 5 foot height and when the lead deer jumped the fence the herd followed. As the fence height increased the deer began acting independently.
- Deer crossed under fences through gaps less than 9 inches in height.

Leave 10-12 inches of extra space between top wires (Mule deer in photo)

Woven Wire Openness and JUMPING Wildlife

7-foot height is specified. This is for the 'openness' of a woven wire fence. If deer can see a very distinct line at the top of fence (such as a top rail) they can jump 7 feet.

Fences constructed of more solid material such as boards (i.e., holding yards at the barn) must be a minimum 8 feet in height, preferably 9 feet.

Snow pack should be considered if it may significantly reduce the effective fence height.

10 foot high exclosure fence

Wildlife JUMPS: designed to replace small sections (< 20 feet) of fence between posts. Seasonal electric; Adjustable top and bottom wires; cattle guards

CRAWL

Terrapin

Picture 6 - Adult female terrapin attempting to scale corrugated tube

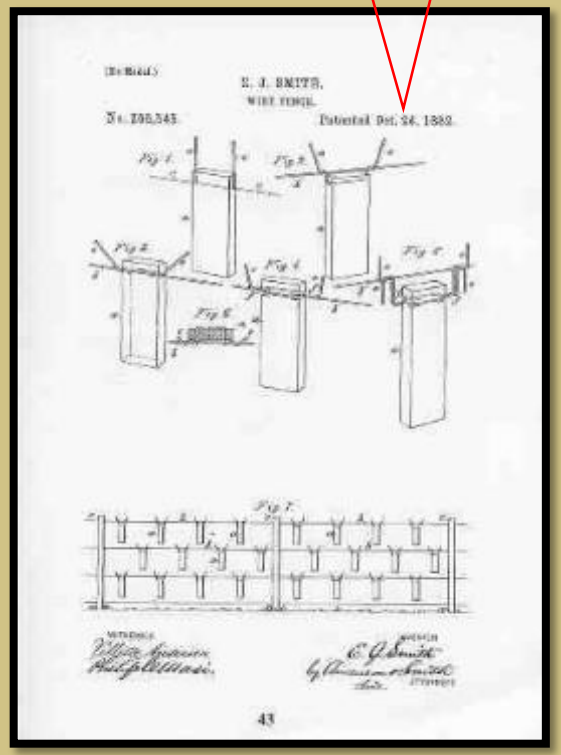
Woven-wire fencing design is restrictive to crawlers

Stevens et al. (2012)Modeling **Sage-Grouse** Fence Collision Journal of Wildlife Management 76(7):1370–1380

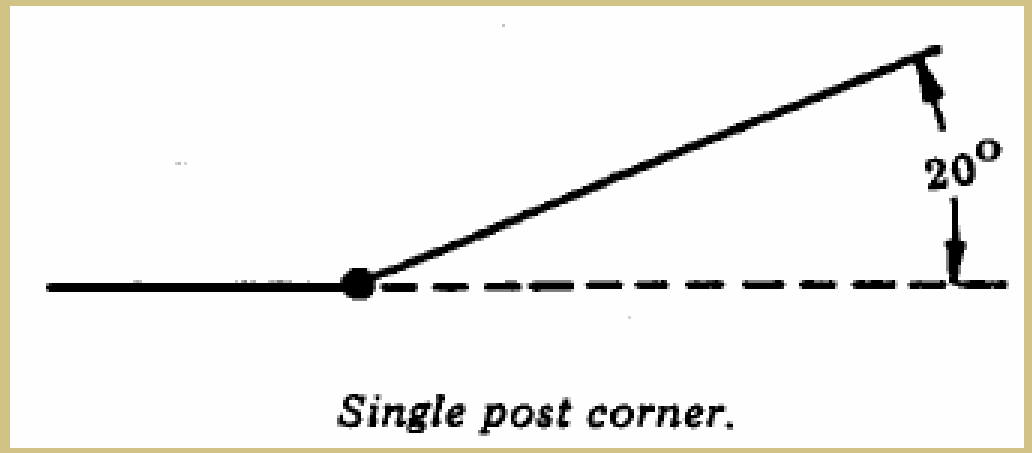
- Collisions common at fence segments absent wooden fence posts and with segment widths >4 m (13 ft).
- Mitigation in breeding habitats should start in areas with moderate-high fence densities (>1 mi/mi2) within 1.25 mile of active leks.
- Focus on flat gently rolling areas

VISUAL
fence marker cut from vinyl under sill (Wolfe 2009)

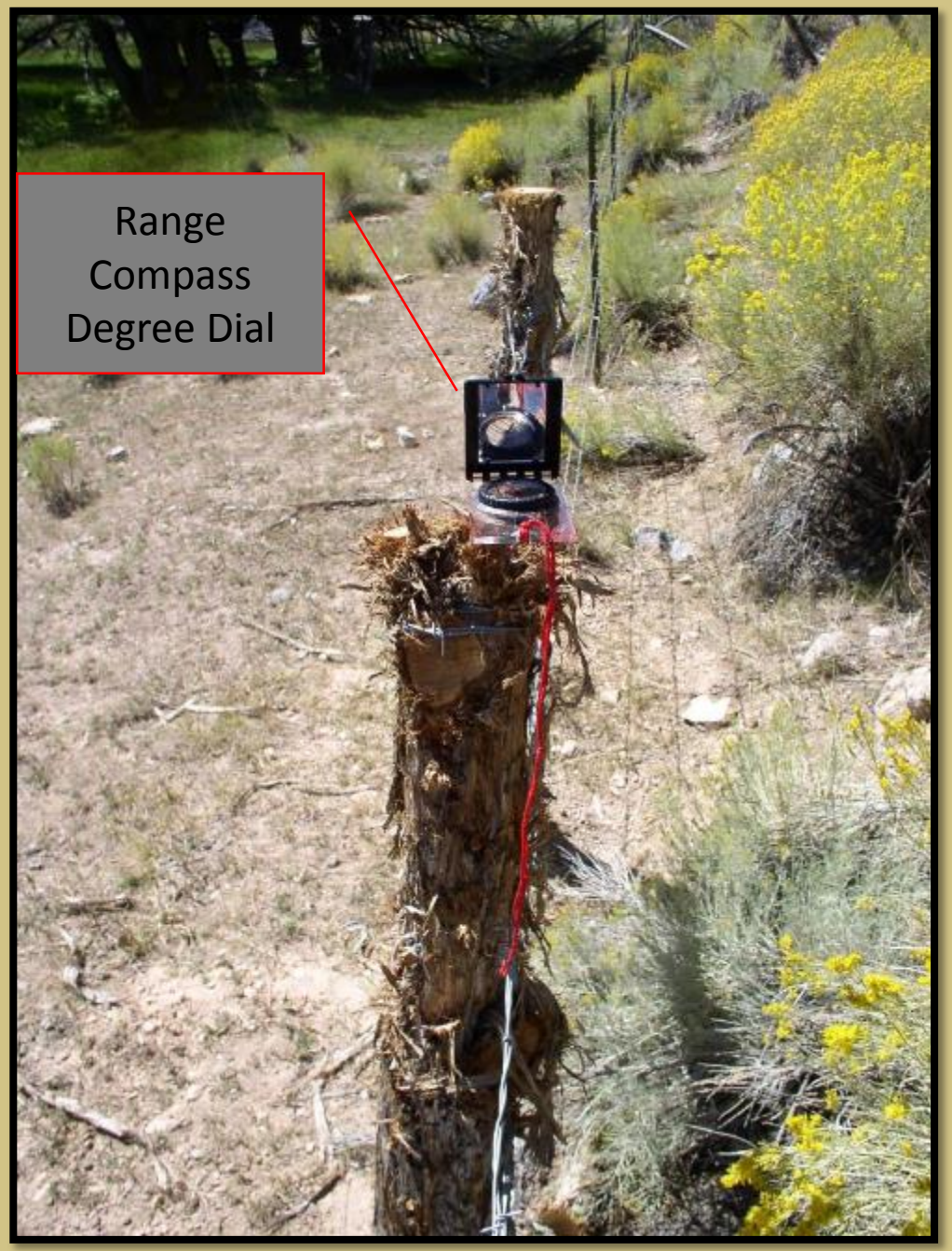
***Patented** Dec. 24 1882*

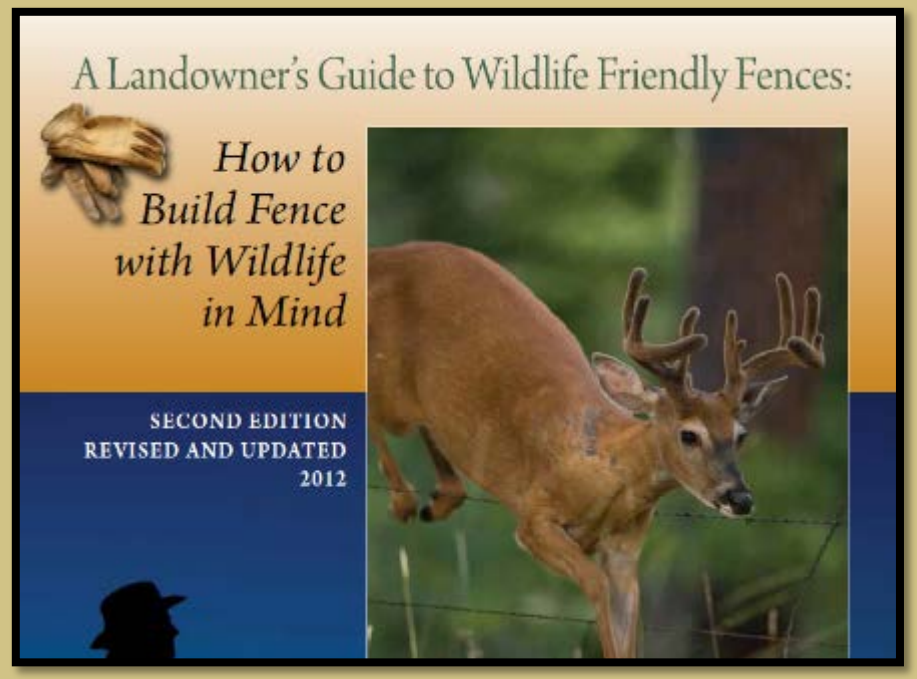


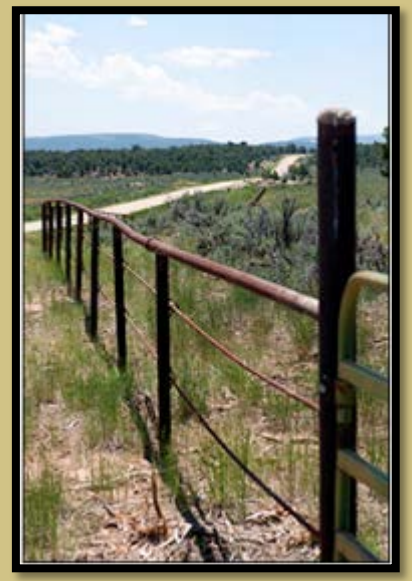
Single Post Corners Will Allow Up to 20 Degree Turns to Avoid a Linear **PREDATOR** Pathway Through Wildlife Habitat



Single post corner.







Paige, C. 2012. A Landowner's Guide to Wildlife Friendly Fences. Second Edition. Private Land Technical Assistance Program, Montana Fish, Wildlife & Parks, Helena, MT. 56 pp.

Local Regulations

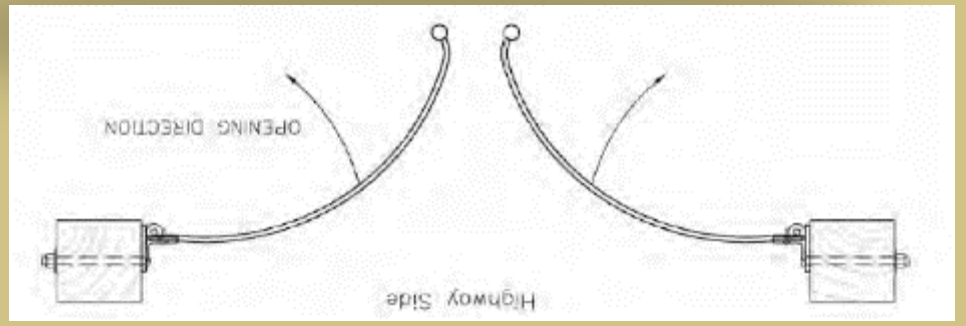
Fences can be built to accommodate or exclude wildlife

WILDLIFE

- Foxes
- Feral cats
- Feral rabbits
- Feral pigs
- Feral horses
- Feral dogs

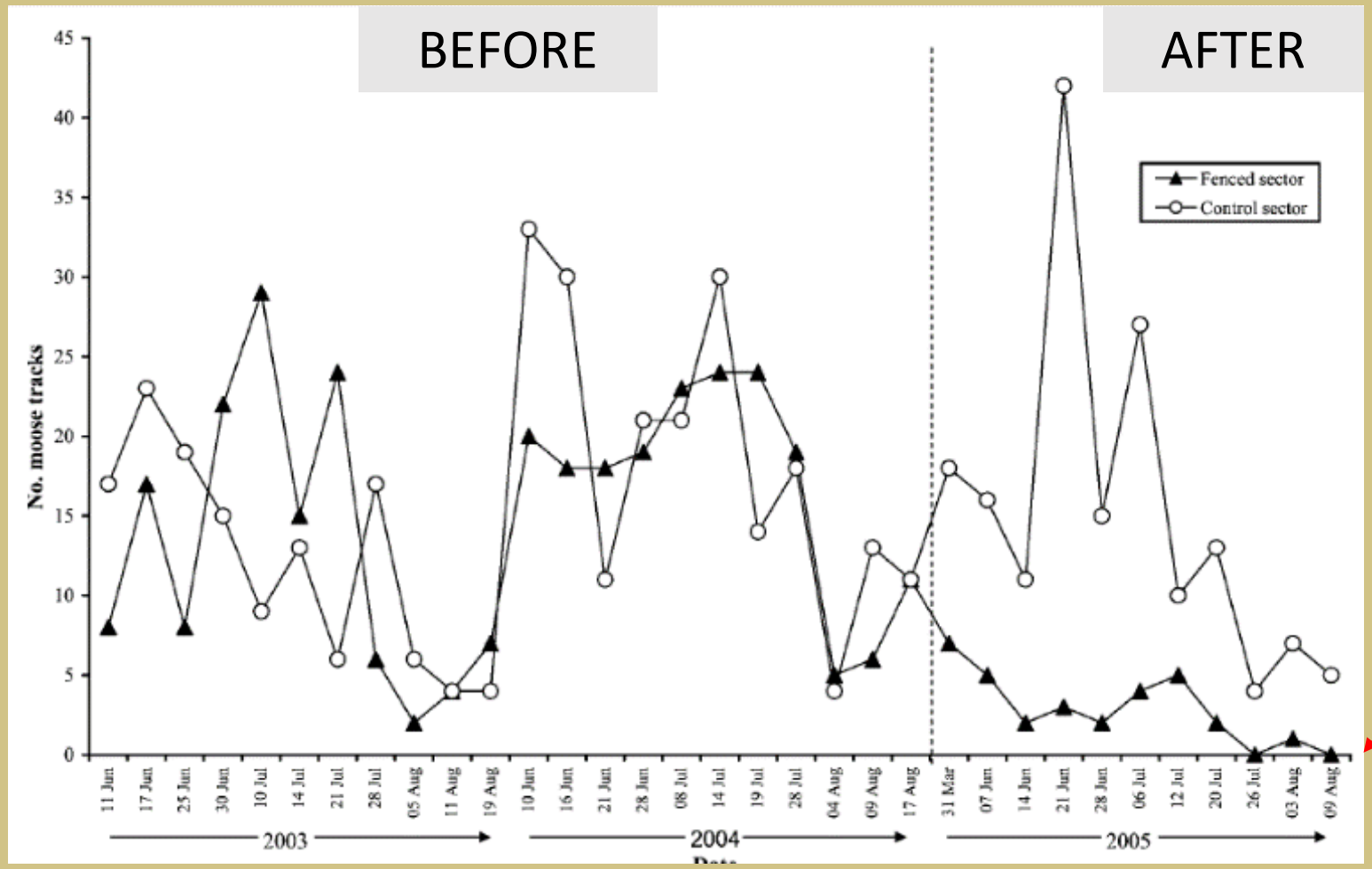
Criteria for exclusion

- Jumping height
- Digging
- Climbing
- Reaction to electrification
- Wire spacing/webbing size
- Chewing ability



Leblond et al. (2014) Electric Fencing and **Moose**–Vehicle Collisions

Journal of Wildlife Management 71(5) 1696-1703



Moose Tracks Along Electric Fenced Highway

First Predator-proof Fence on Hawaiian Island Kaua'i Completed at Kīlauea Point National Wildlife Refuge (2014)

Half mile of fence

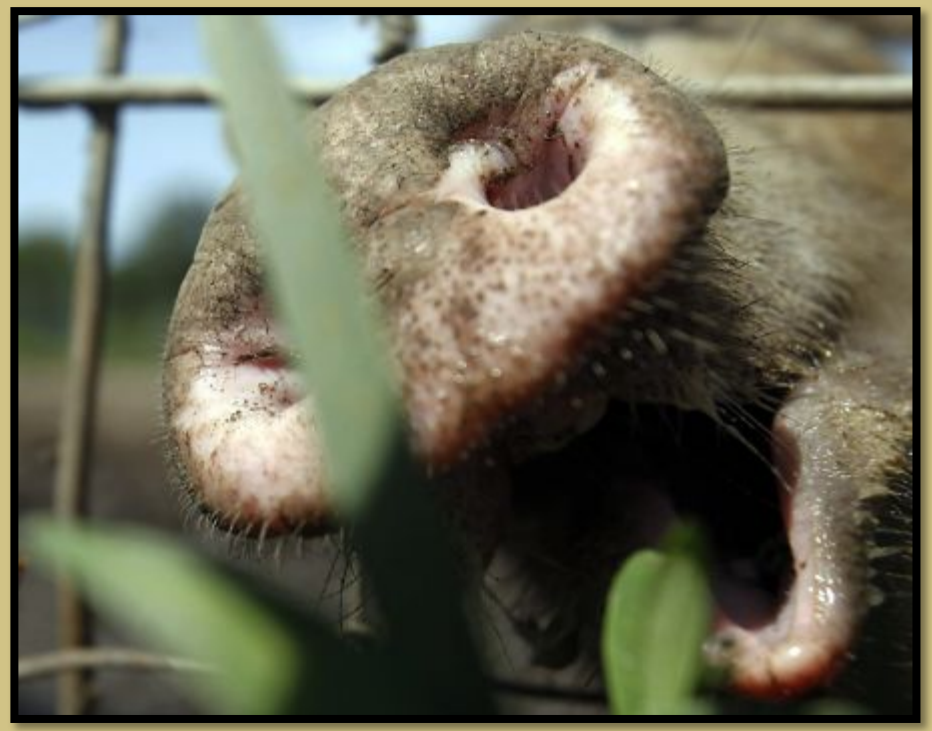
6.5 feet tall

Made of stainless steel mesh so fine a 2 day old mouse cannot enter.

Arched hood over the top.

Reidy et al. (2008) Electric Fence Evaluation for **Feral Pigs** Journal of Wildlife Management 72(4):1012–1018
Lavelle et al. (2011) Emergency **Feral Swine** Containment Journal of Wildlife Management 75(5):1200–1208

Pilot Conservation Activity 297 - Feral Swine Management Interim Conservation Activity



- Electric fencing restricted feral pig movements by alleviating feral pig damages to 40-60% **fewer intrusions**.
- Metal **mesh fences** (hog panel or woven wire) contained pursued feral swine.
- Feral swine under lower levels of **motivation** may be contained by electrified polywire or electrified mesh netting.
- Only 7 of 214 escaped a 2.8 foot high metal fence (**3.5 foot** is recommended).
- **Rounded** corners of containment improved forward progress around the fence perimeter.

VerCauteren (2007) A Fence Design for Excluding Elk Without Impeding Other Wildlife. Rangeland Ecol Manage 60:529–532

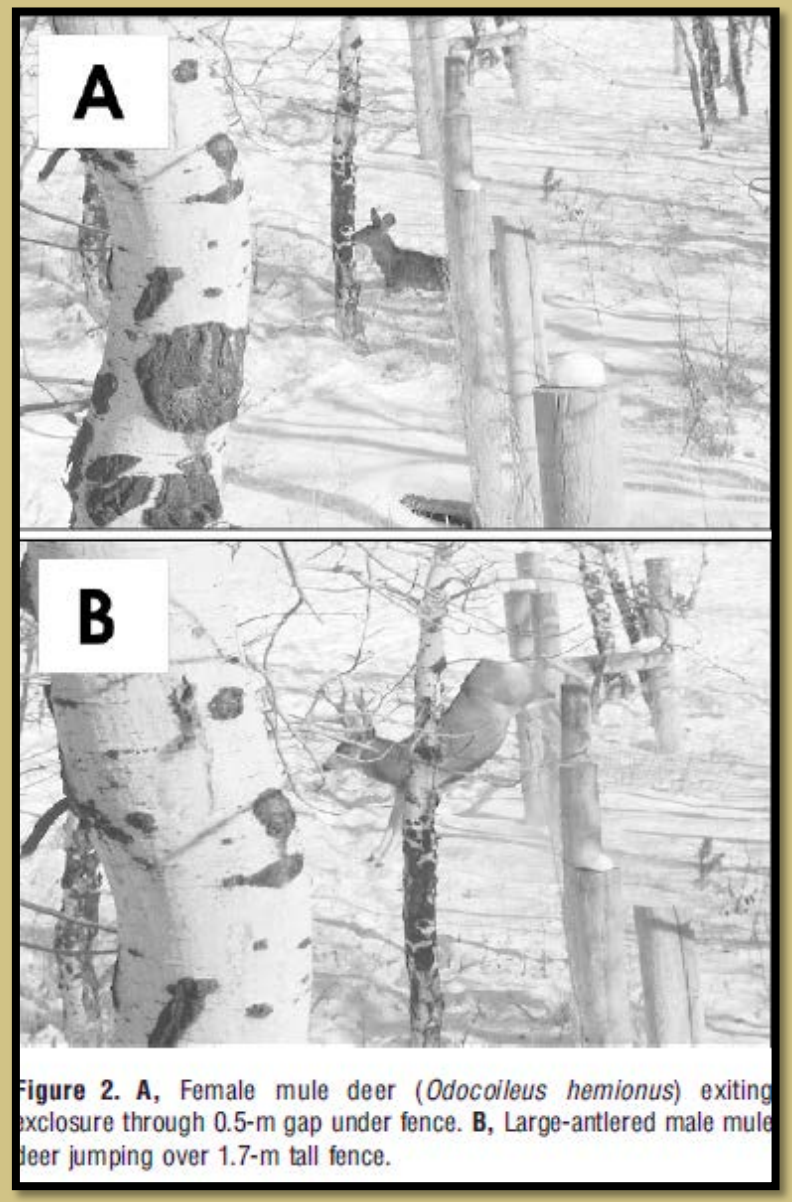


Figure 2. A, Female mule deer (*Odocoileus hemionus*) exiting exclosure through 0.5-m gap under fence. **B,** Large-antlered male mule deer jumping over 1.7-m tall fence.

Elk Browse Damage On Aspen

Non-impeded Wildlife:

- beaver (Castor canadensis)
- black bear (Ursus americanus)
- bobcat (Lynx rufus)
- coyote (Canis latrans)
- deer (Odocoileus spp.)
- mountain lion (Puma concolor)
- raccoon (Procyon lotor)
- red fox (Vulpes vulpes)
- lagomorph (Leporidae)

ELK in the Smoky Mountains


SMOKY MOUNTAIN news

HOME | NEWS | OPINION | A&E | OUTDOORS | EVENTS | TRAVEL | MARKET

Wednesday, 11 September 2013 14:16

Growing pains: Farmers pay the price as elk herd damage crops, fences

Written by Andrew Kasper

Elk disappeared from North Carolina in the late 1700s.

The reintroduction of elk to the Great Smoky Mountains National Park started with two small herds of 52 in 2000. After some difficulty establishing a breeding population, the herd jumped to more than 120 in 2009, the Park's last official count.

The Commission estimates that of the 140 or so elk in the region, between 50 and 75 spend a significant amount of time outside park boundaries.

Poor et al (2014) Fence **Permeability Ratings** for Ungulate Wildlife:

1 is most permeable

1. ≥ 16 in. lowest barbed-wire strand
2. Animal may travel ~ 300 feet to find gap ≥ 16 in. lowest barbed-wire strand
3. Animal may travel ~300-1000 feet to find gap ≥ 16 in. lowest barbed-wire strand
4. Challenging to cross except for topographic dips, typically < 16 in. lowest barbed-wire strand
5. Impermeable barbed-wire fence typically ≤ 12 in. lowest barbed-wire strand
6. Woven wire or picket fence

Fence Tasks

Make a Fence

- Law ★
  - Internet search
    - State ★★
      - Local ★
- Design ★★★
  - Interview
    - Purpose ★★
    - Animal type ★★
  - Landscape ★
    - Site visit
    - Considerations
    - Similar landscape success examples
  - Fence type ★
- Buy ★★

THE FENCE DESIGN AND LOCATION SHOULD CONSIDER:

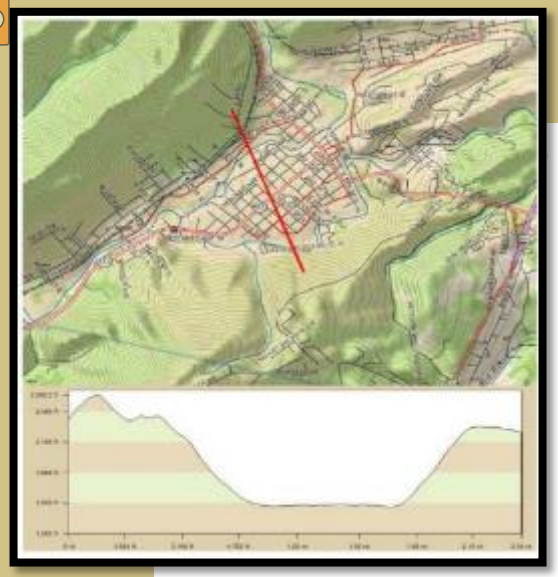
1. Topography (natural barriers should be utilized)
2. Soil properties
3. Livestock management and safety
4. Livestock trailing
5. Wildlife class and movement
6. Location and adequacy of water facilities
7. Development of potential grazing systems
8. Human access and safety
9. Landscape aesthetics
10. Erosion problems
11. Moisture conditions
12. Flooding potential
13. Stream crossings
14. Durability of materials.

Fence Consideration: 1. Topography

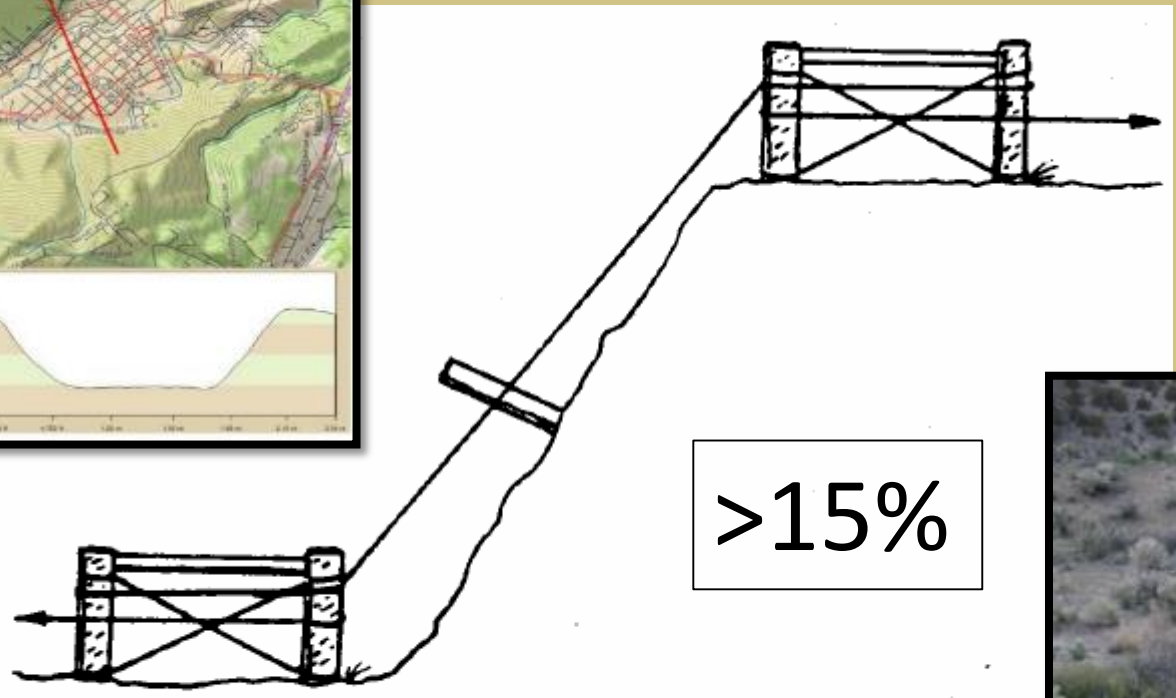
Treat depressions more than 15 feet long.

V-shaped dry swales.

Maintain fence height relative to surrounding roughness to avoid escape/jumping.



Importance of site visits



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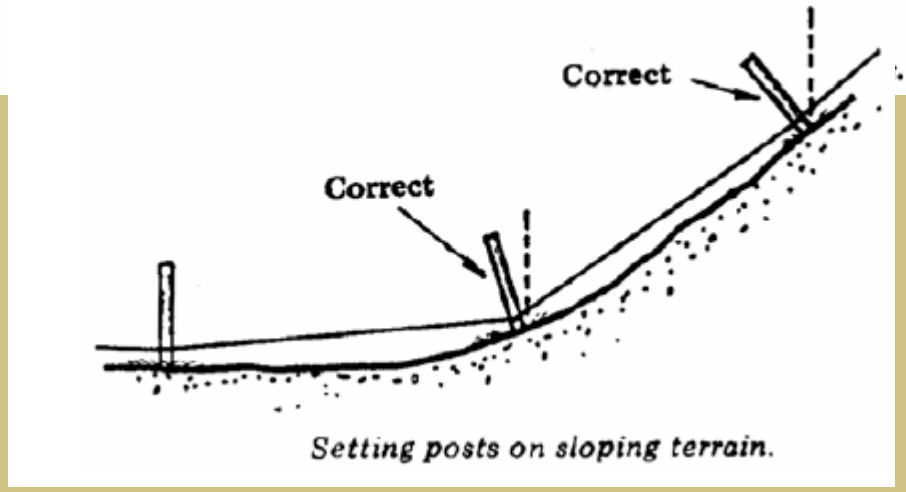


Setting posts on sloping terrain.

1. Topography cont.

Material amounts/ease of construction

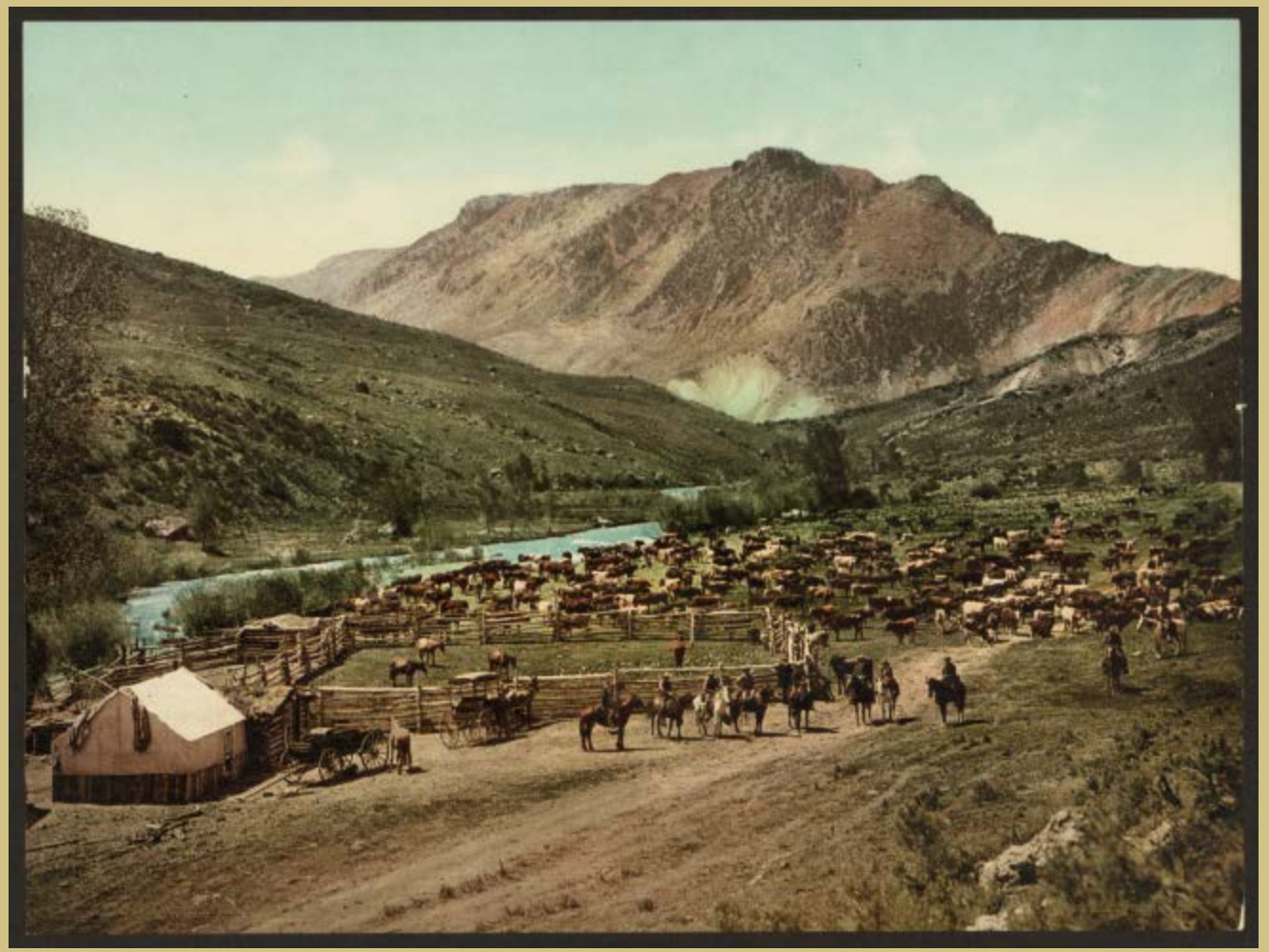
Erosion Problems

Fence Consideration:

1. Topography Natural Boundaries

Nevada today

Colorado ‘Round up on the Cimarron” (1898)



Fence Consideration: 2. Soil

Shifting sand, stones, salinity

Western Oklahoma

Maryland

Nevada

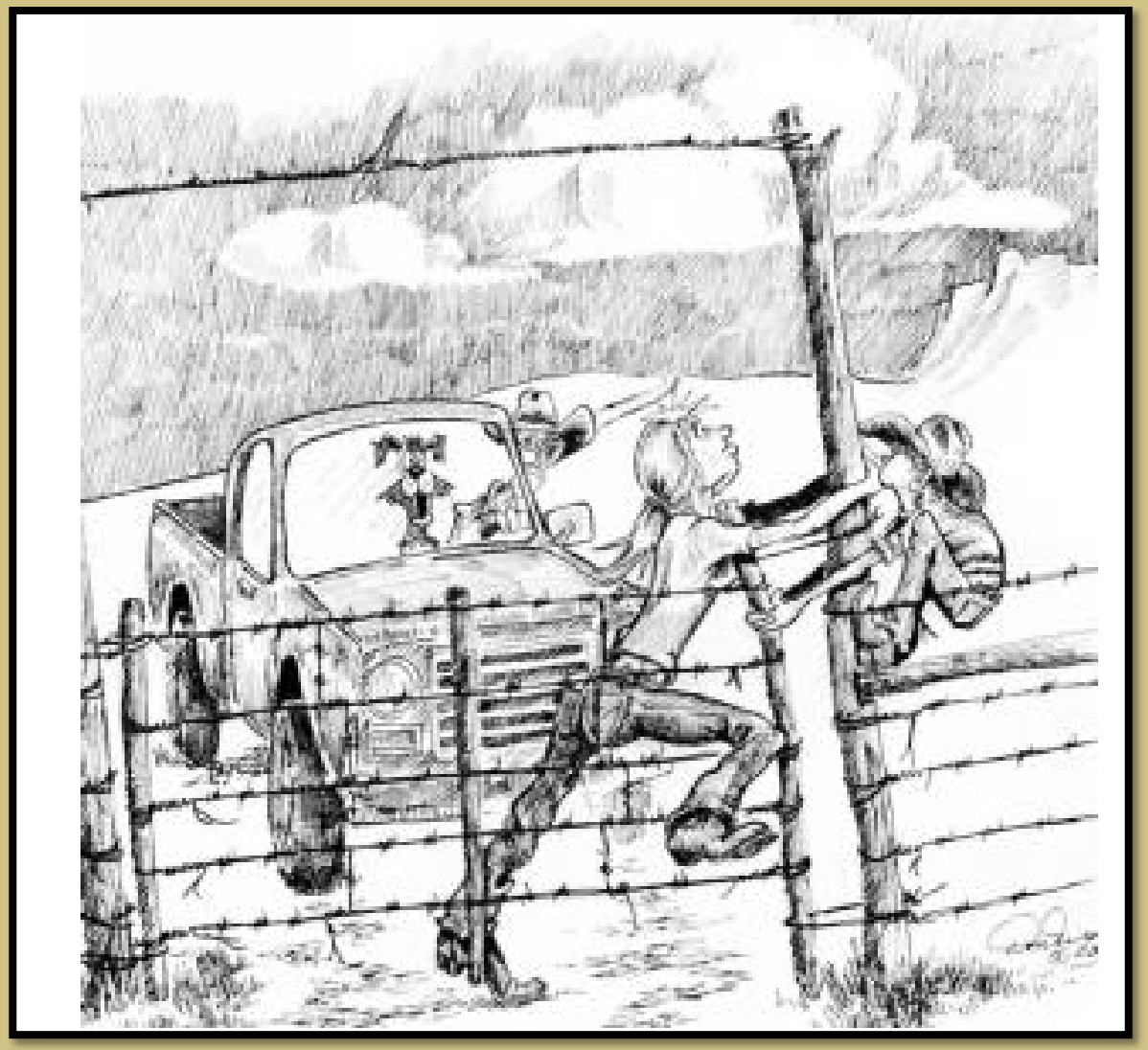
Fence Consideration: 3. Livestock safety 8. Human Safety 14. Trailing

- Food safety, animal safety, electric safety, highway safety, digging safety, history preservation safety
- 'Think before you post' – is just as important in your email safety as it is in building a fence!
- T – Post stepper.

Fence Consideration: 3. Livestock and 8. Human Safety

- Road side fences are often built with frequent brace assemblies due to the possibility that a vehicle may leave the road. Assemblies are not needed otherwise.

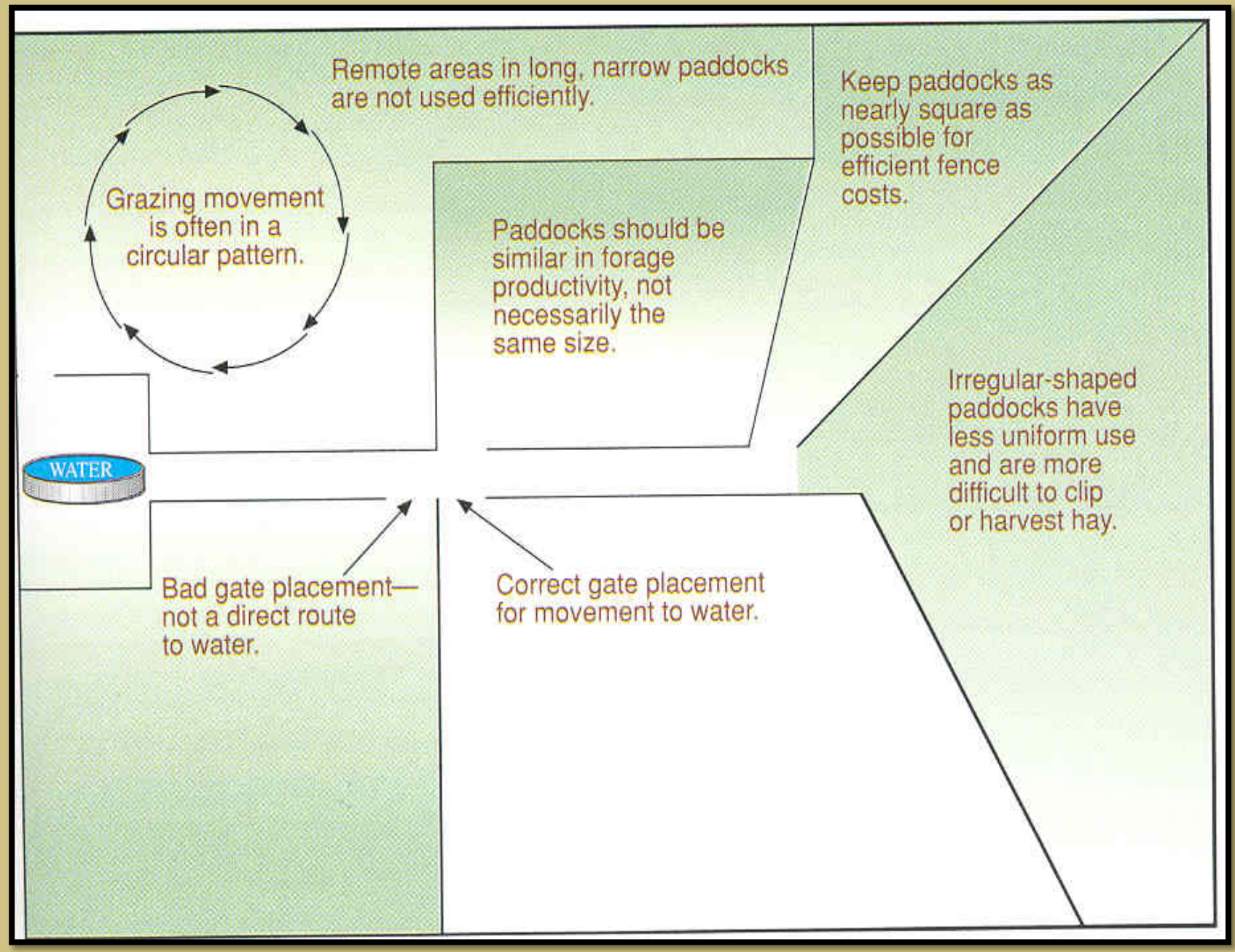
Fence Consideration: 8. Human access and safety



Fence Consideration:

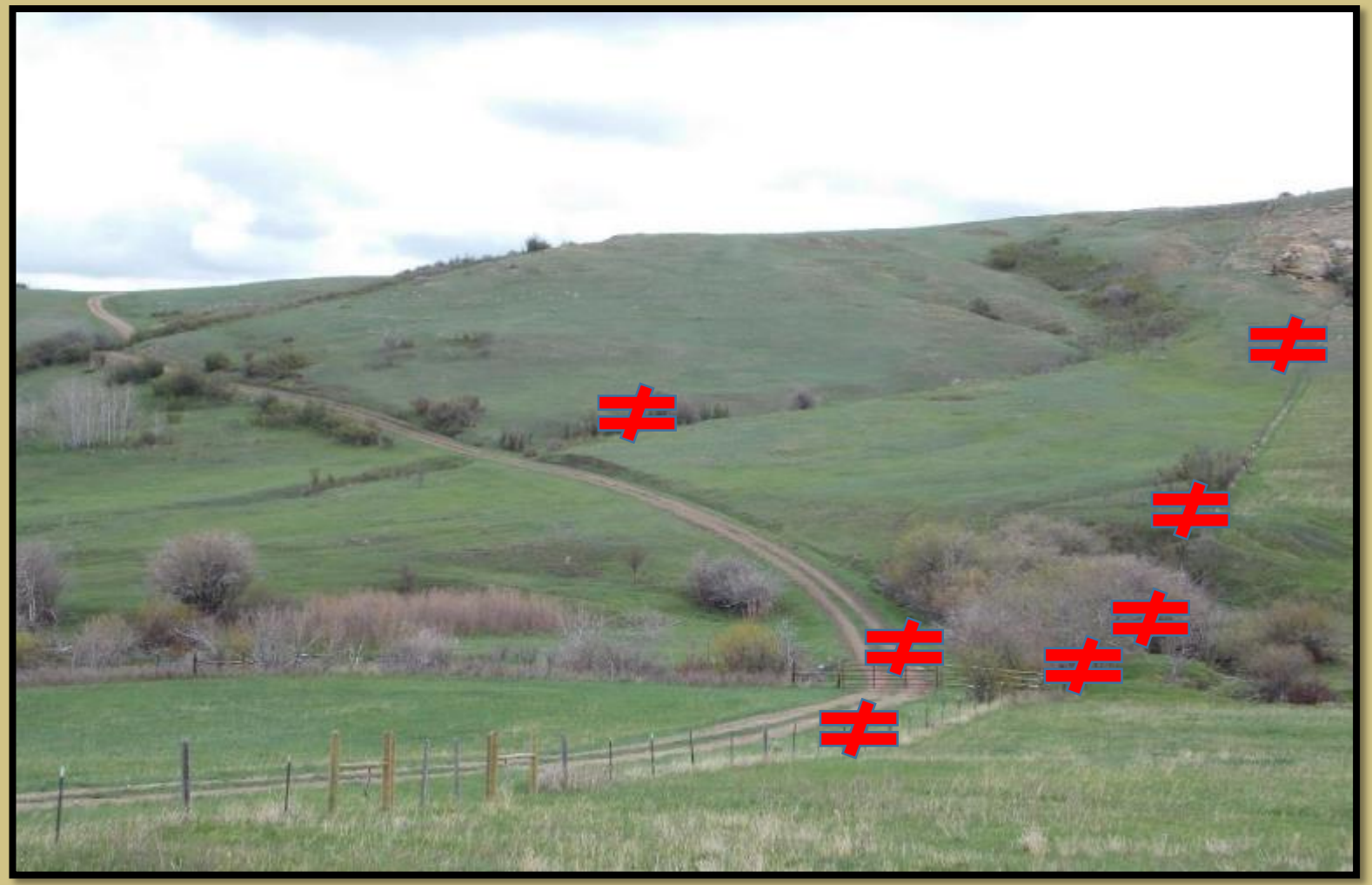
6. Watering facilities
7. Potential grazing systems

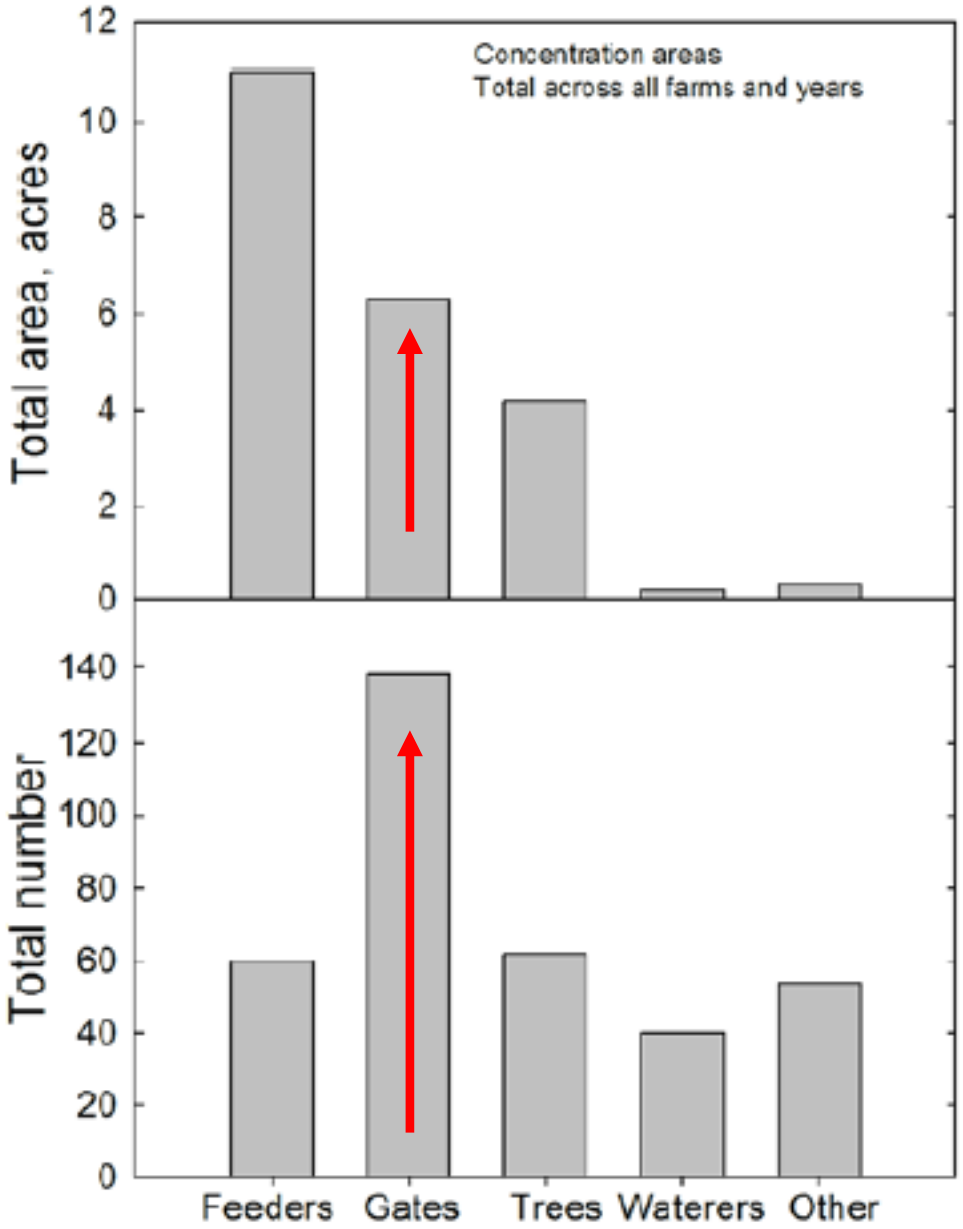
General behavior is to walk the fence lines when first moooved into a pasture.



Fence Consideration: 4. 5. 7. Gates on topography facilitate vehicle, people, livestock, and wildlife movements.

Fence Consideration: 4. 5. 7. Gates on topography ridges, saddles, draws, fence junctions.





Fence Consideration: 10. Erosion at Gates and Concentration Areas

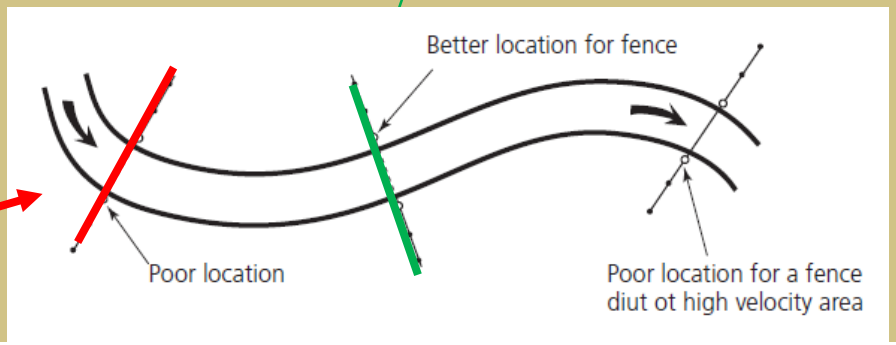
Matt **Sanderson** and Sarah **Goslee** ARS (2014) CEAP Science Note Livestock Concentration Areas on Intensively Managed Pastures

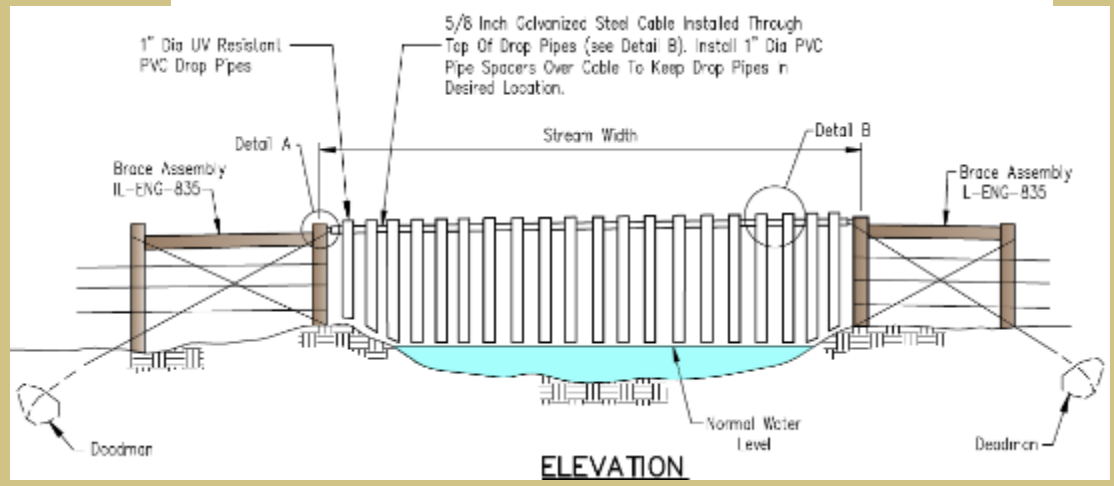
Fence Consideration: 9. Landscape aesthetics

Fence Consideration: 13. Stream Crossings 5. Wildlife class movement

Poor location for fence crossing due to channel migration

Better location is on straight runs of the channel





Design for <60 foot wide stream

Fence Consideration:

3. Livestock management and safety

4. Livestock trailing

5. Wildlife class and movement

6. Location and adequacy of water facilities

Fence Consideration:

12. Flooding potential, aquatic material choices

Fence Consideration:

14. Durability of Materials

Fence Consideration:

14. Durability of Materials

DURABILITY	SPECIES	LIFE EXPECTANCY
Very Durable	Eastern red cedar	30+
	Black locust	20-25
	Osage orange	20-25
	Redwood	10-30+
	Western red cedar	10-25
Durable	White and Bur oak	10-15
	Tamarack	8-10
	Northern white cedar	5-15

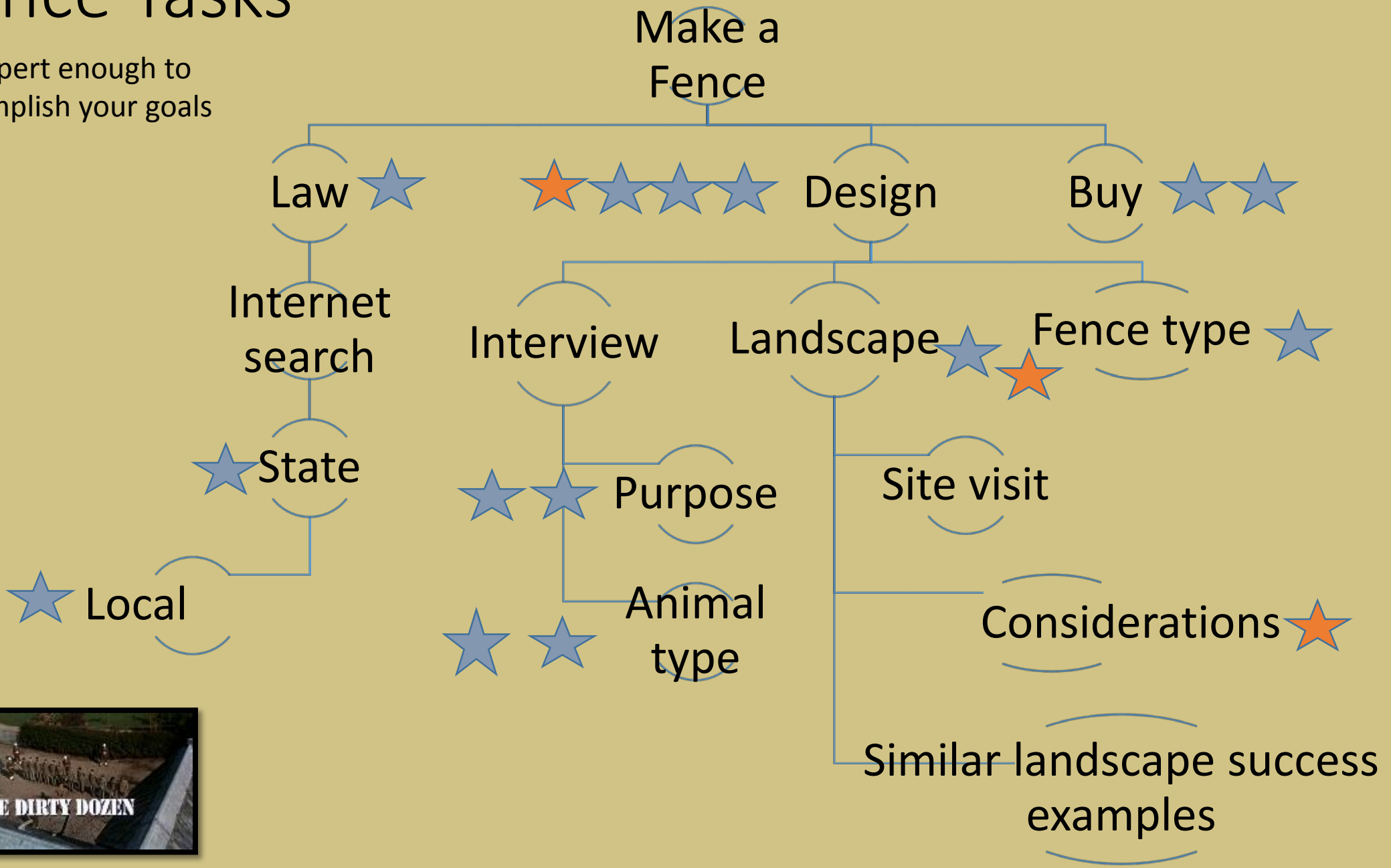
Life Expectancy of Wood Fence Posts

DURABILITY	SPECIES	LIFE EXPECTANCY
Non-Durable	Red oak	6-8
	Douglas fir	4-6
	Red and Jack pine	2-6
	Aspen and cottonwood	3-4
	Ponderosa pine	3-4
	White birch	3-4
	Spruce and Balsam fir	3-4
	Basswood	<5
	Maple	2-4
	Ash	<5
	Willow	<5
	Hickory	3-7
	Honey locust	3-7
	Southern pine	3-6
	Yellow-poplar (tulip tree)	3-7
	Southern Gum	3-6

Is prescribed fire part of the management plan?

Fence Tasks

Be expert enough to accomplish your goals



Fence Tasks

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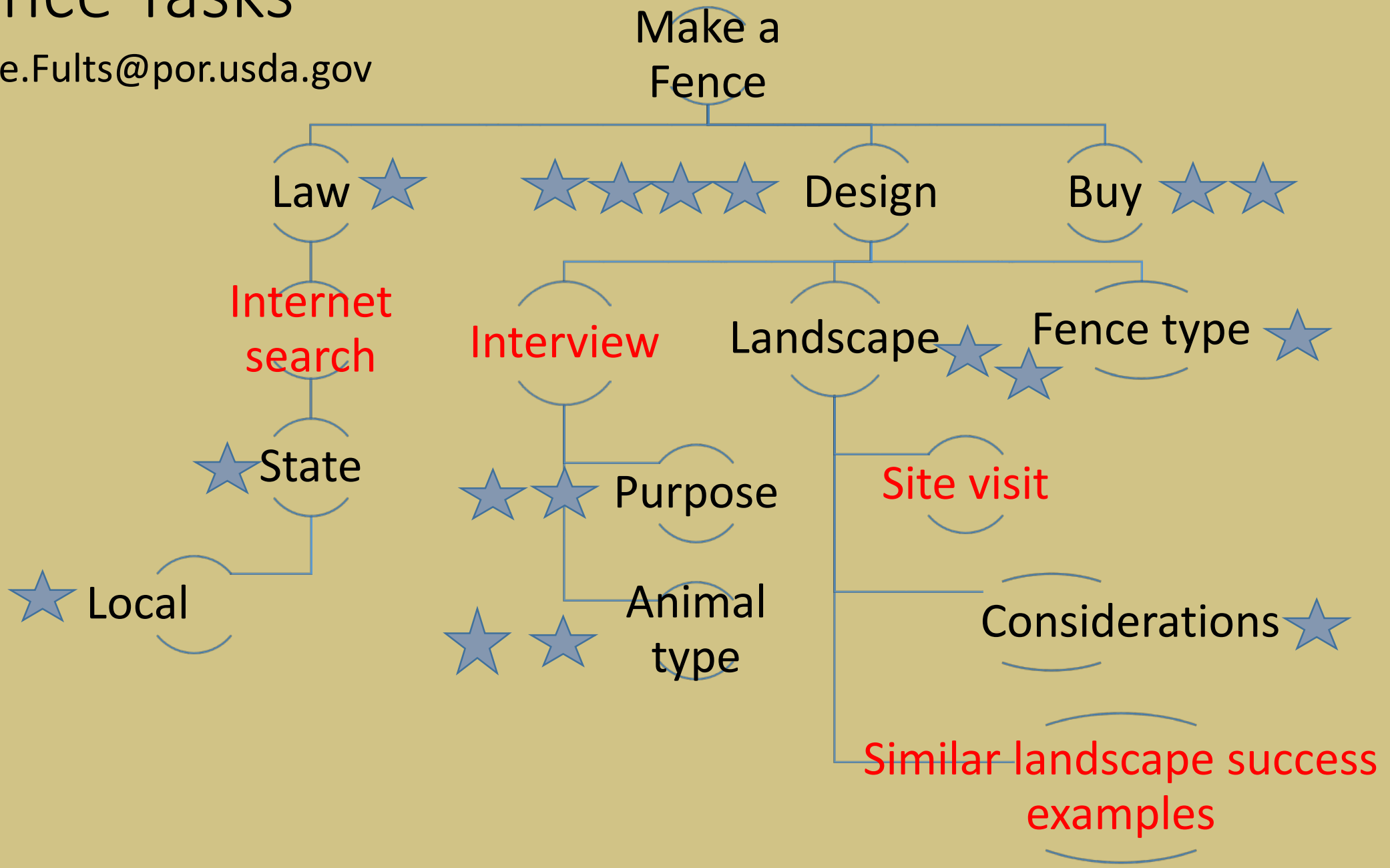

The Job of Inventory and Evaluation for Fence (382) Concerns and Design

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Science and Technology webinar series
17 of February, 2015