TEXAS A&M AGRILIFE

An integrated vegetation management approach to controlling invasive plants in the urban sprawl environment

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7May2024

Introduction

D. Chad Cummings (chad.cummings@ag.tamu.edu)

- Live on a small ranch north of Bonham, TX
- 3-time graduate of Oklahoma State University
  - Agronomy Crop Production/Animal Science – B.S.
  - Forage Weed Science/Entomology - M.S.
  - Invasive Species Ecology and Management/Fire Ecology – Ph.D.
- Field Scientist in Southern US from 2007 to 2021 (AR, LA, MS, NM, OK, TX) for Corteva Agriscience LLC
  - Disciplines:
    - Range & Pasture, Land Management, Forestry ▪ Winter Cereals (2007-2017)
    - Habitat Management, Invasive Species Management, Integrated Pest Management
- Started with the Texas A&M AgriLife Extension Office in Grayson County in April 2022 (Ag and Nat Resources Agent)

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Topic overview

- Invasives and plant biology 101
- Integrated pest management options
- Pest identification and management
  - Is it invasive? Is it native, but encroaching?
- Educating the public and setting client/neighbor expectations
- Questions and discussion

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Definitions, so we are all on the same page

- **Exotic:**
  - plant species whose origin is outside the US, non-native to its current location
- **Invasive:**
  - non-native (or alien) to the ecosystem under consideration and
  - whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
- http://www.invasivespeciesinfo.gov/

- So, a plant species can be exotic and not invasive, but all invasives are exotic
  - Plants like huisache, mesquite, greenbriar, cedar can be **encroaching**, but not invasive (*may depend on who is describing them or their exact location*)

Why are invasives so impactful?

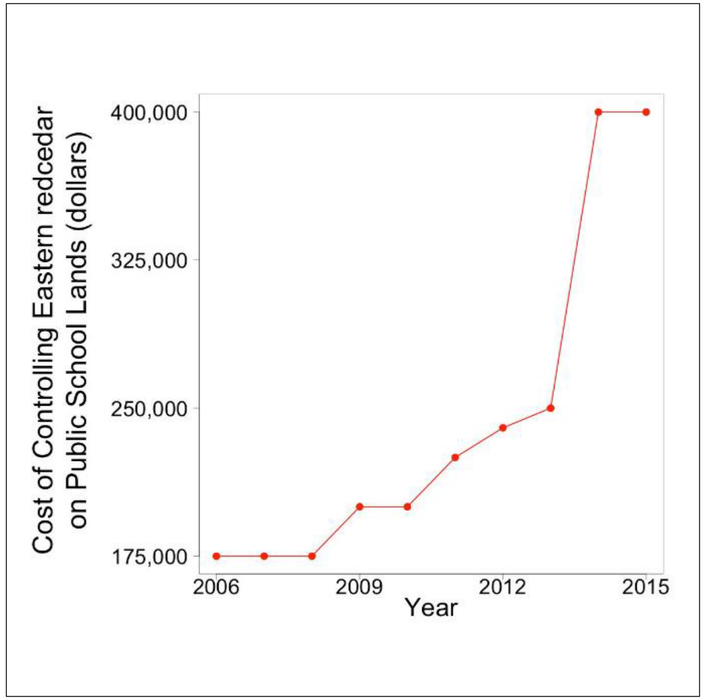
- Lack of natural population controls in the new territory
- Exploitation of resources that native organisms cannot access
- Wide range of conditions in which the species thrives
- High reproductive rates and high reproductive efficiency
- Invasive species can modify natural processes to select for their growth and development
- Changes in multiple ecosystem processes and functions impact multiple trophic levels around the invasives

Why is invasive species spread and establishment a negative?

- **Economic costs** – Increasing invasive or encroaching species = more cost
  - US - **$137 billion annually** (texasinvasives.org)

- **Biodiversity and productivity** decrease following invasion or encroachment

- **Biophysical processes** including soil moisture depletion, infiltration, and carbon sequestration change dramatically



- **Shrub and tree cover** above 30% can result in major shifts in prairie ecosystems

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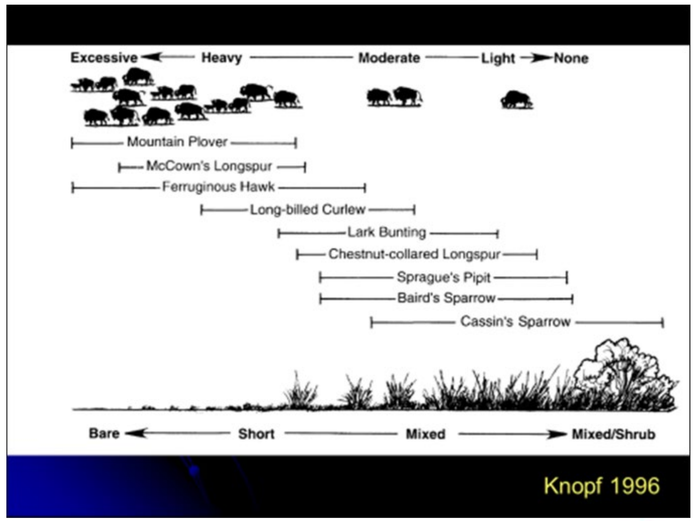
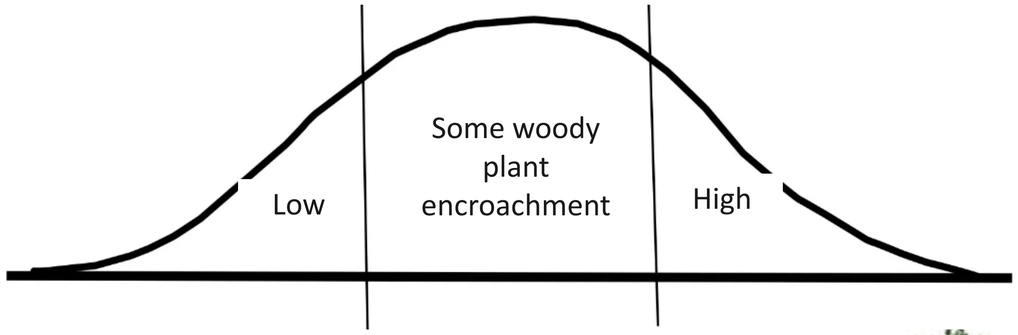
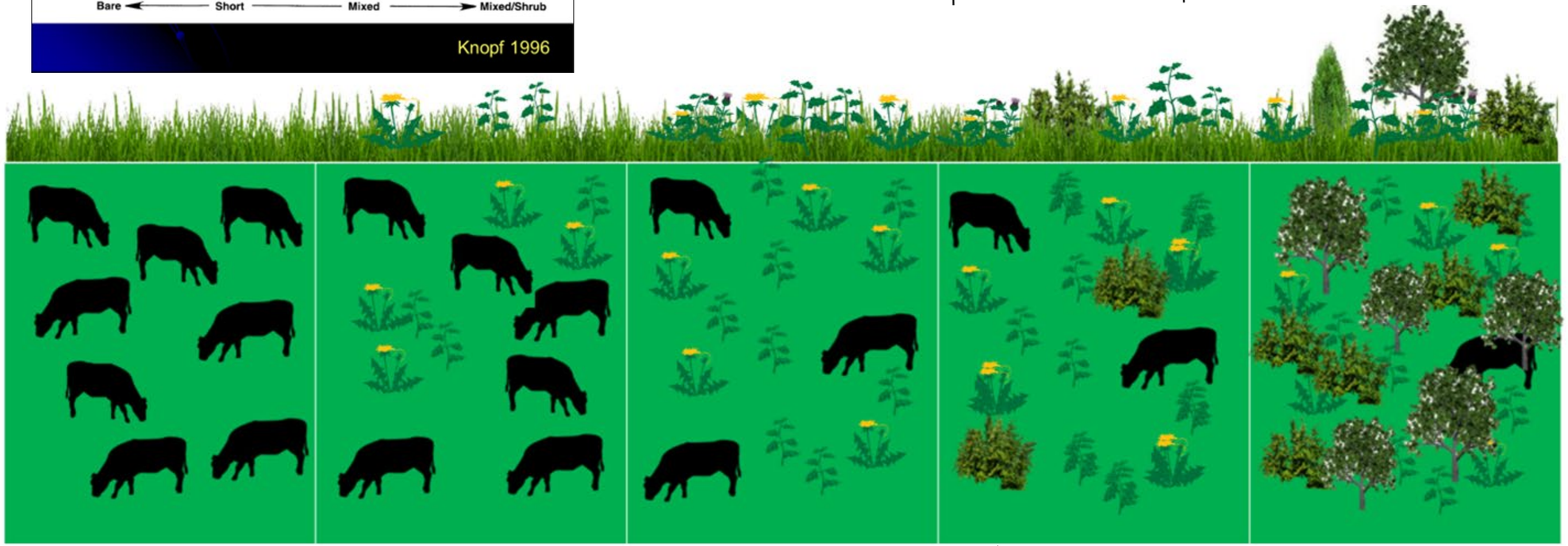
The management continuum



Biodiversity with increasing woody plant invasion





Increasing biodiversity

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Common plant species in north Texas

Native, but may increase

Weeds/Forbs
- Black-eyed susan
- Common broomweed
- Woolly croton

Trees
- Honeylocust
- Honey mesquite
- Eastern redcedar
- Sweetgum
- Cedar elm
- Winged elm

Grasses
- Silver bluestem
- Broomsedge bluestem

Non-native, Invasive (Country of Origin)

Weeds/Forbs
- Japanese honeysuckle (Asia)
- Sericea lespedeza (Asia, China)
- Kudzu (China)

Trees
- Chinese tallow (China)
- Tree of heaven (China)
- Chinaberry tree (East Asia, Australia)
- Callery pear, Bradford Pear (China)
- Chinese privet (Asia)

Grasses
- Johnsongrass (Asia, North Africa)
- Old world bluestem (Asia, Africa, Southern EU)
- Bermudagrass (EU, Africa, Asia)
- Giant reed (Asia)

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Understanding integrated pest or vegetation management

Useful IPM techniques

- Pest identification
- Pest population size
- Appropriate control measures? – **almost always multiple tools in the toolbox that you should use for sustainable management**

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Problems with reliance on herbicides

- Expense
- Resistance in some plant populations
- Elevations of secondary species to pest status
- Pesticide residues
- Environmental contamination
- Hazards to applicators

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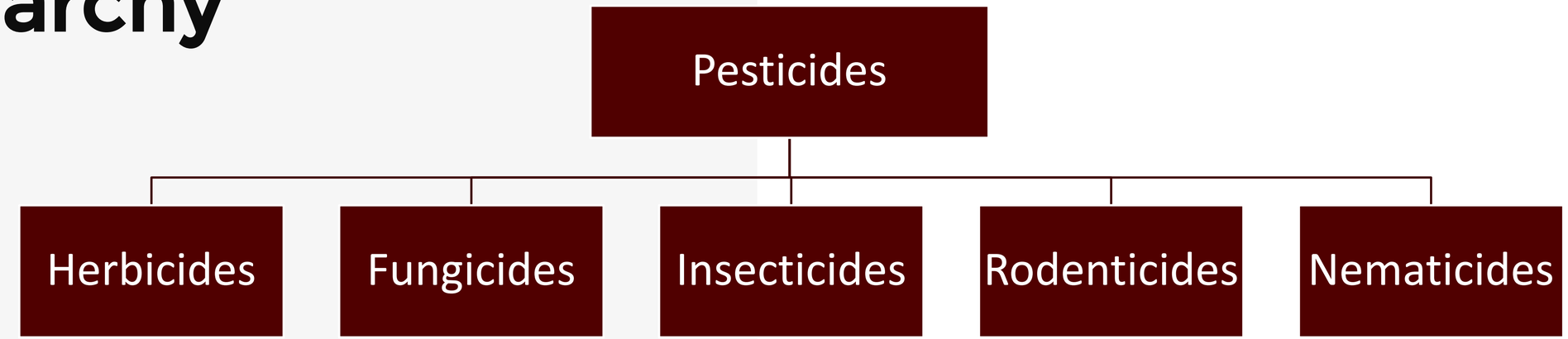
Pesticide hierarchy



Poisons are a common misnomer for pesticides

Carcinogenicity

Toxicity

A Rough Guide to

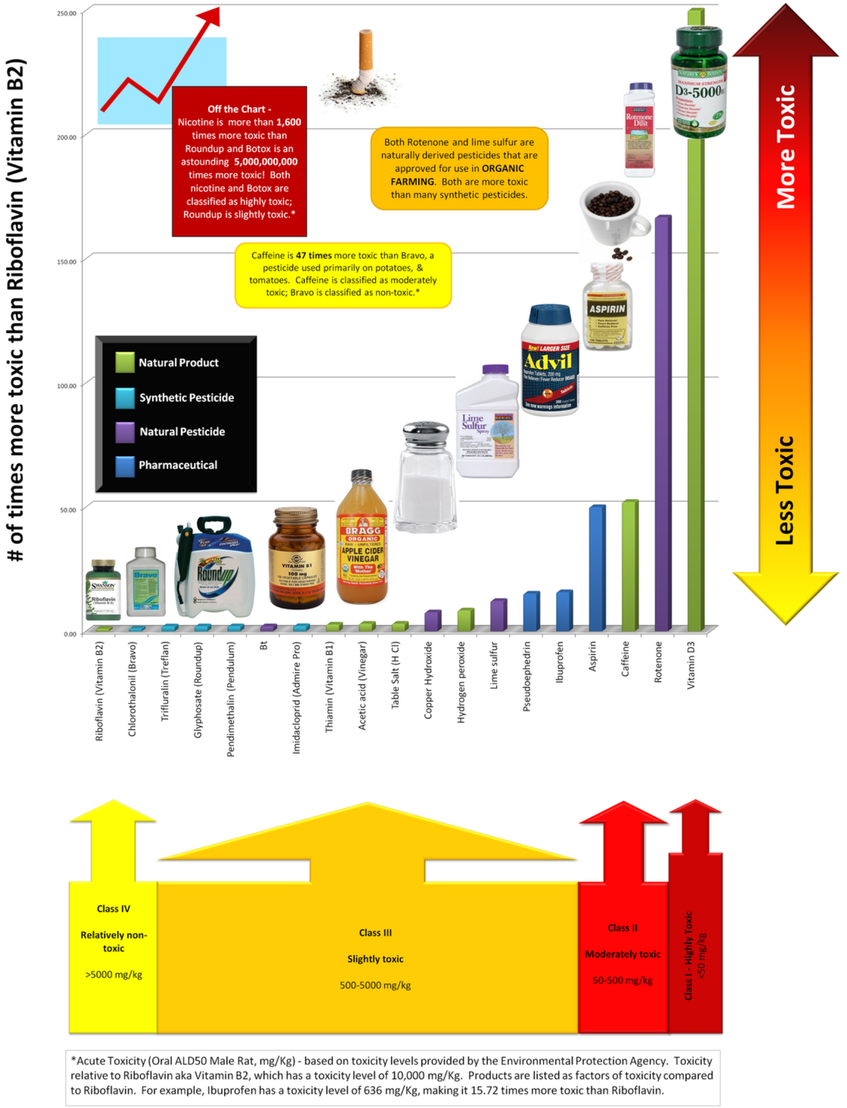
IARC CARCINOGEN CLASSIFICATIONS

The International Agency for Research on Cancer (IARC) classifies substances to show whether they are suspected to cause cancer or not. It places substances into one of five categories depending on the strength of evidence for their carcinogenicity.

GROUP	WHAT DOES IT MEAN?	WHAT DOES IT INCLUDE?
GROUP 1	CARCINOGENIC TO HUMANS	Smoking, exposure to solar radiation, alcoholic beverages and processed meats.
	Sufficient evidence in humans. Causal relationship established.	
GROUP 2A	PROBABLY CARCINOGENIC TO HUMANS	Emissions from high temp. frying, steroids, exposures working in hairdressing, red meat.
	Limited evidence in humans. Sufficient evidence in animals.	
GROUP 2B	POSSIBLY CARCINOGENIC TO HUMANS	Coffee, gasoline & gasoline engine exhaust, welding fumes, pickled vegetables.
	Limited evidence in humans. Insufficient evidence in animals.	
GROUP 3	CARCINOGENICITY NOT CLASSIFIABLE	Tea, static magnetic fields, fluorescent lighting, polyethene.
	Inadequate evidence in humans. Inadequate evidence in animals.	
GROUP 4	PROBABLY NOT CARCINOGENIC	1 ONLY 1 CHEMICAL EVER PLACED IN THIS GROUP, OF ALL SUBSTANCES ASSESSED
	Evidence suggests no carcinogenicity in humans/animals	Caprolactam, which is used in the manufacture of synthetic fibres.

THE IARC'S INDEX ONLY TELLS US HOW STRONG THE EVIDENCE IS THAT SOMETHING CAUSES CANCER. SUBSTANCES IN THE SAME CATEGORY CAN DIFFER VASTLY IN HOW MUCH THEY INCREASE CANCER RISK.

How Toxic Is It?



*Acute Toxicity (Oral ALD50 Male Rat, mg/Kg) - based on toxicity levels provided by the Environmental Protection Agency. Toxicity relative to Riboflavin aka Vitamin B2, which has a toxicity level of 10,000 mg/Kg. Products are listed as factors of toxicity compared to Riboflavin. For example, Ibuprofen has a toxicity level of 636 mg/Kg, making it 15.72 times more toxic than Riboflavin.

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Washington Friends of Farms & Forests

www.wafriends.org

Remember

- The. Label. Is. The. Law. [Period]
- Federal law
- State law

EPA United States Environmental Protection Agency

National Archives — Code of Federal Regulations
A point in time eCFR system


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Prescribed fire use for woody plant and invasive weed management

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Cummings – patch burn 2006, Stillwater, OK

Can woody plants be killed with fire?

IT DEPENDS on the fire and the species of tree

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Wood plant responses to fire

Susceptible species

- Usually result in top kill, and the tree/shrub lacks the ability to regrow from root crowns or lateral root systems

Tolerant species

- Minimal long-term effect
- Top kill, maybe – but root systems trigger many resprouts

Remember

- While the tree/brush top is the **visible portion** of our trees and typically where we apply the control measure, **the root system, lateral roots** or **root crown** are what we are trying to kill

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Woody plant response to prescribed fire or top kill (cutting down)

Susceptible Woody Plants

- **Eastern Redcedar** (*Juniperus virginiana*)
- **American elm*** (*Ulmus americana*)
- **Cottonwood*** (*Populus deltoides*)
- **Common hackberry*** (*Celtis occidentalis*)
- **Young pines** (*Pinus* spp.) (<2 years old)

* Depends on the age and size of the tree and fire intensity.

Tolerant Woody Plants

- **Honey mesquite** (*Prosopis glandulosa*)
- **Honeylocust** (*Gleditsia triacanthos*)
- **Sweetgum** (*Liquidambar styraciflua*)
- **Oaks** (*Quercus* spp.)
- **Green ash** (*Fraxinus pennsylvanica*)
- **Cedar elm** (*Ulmus crassifolia*)
- **Bois d'arc** (*Maclura pomifera*)
- **Dogwood** (*Cornus drummondii*)
- **Blackberry** (*Rubus* spp.) and **Most Rose Species** (*Rosa* spp.)
- **Greenbriar** (*Smilax* spp.)
- **Chinese privet** (*Ligustrum sinense*)
- **Common persimmon** (*Diospyros virginiana*)
- **Bradford pear** (Callery) (*Pyrus calleryana*)
- **Tree of heaven** (*Ailanthus altissima*)

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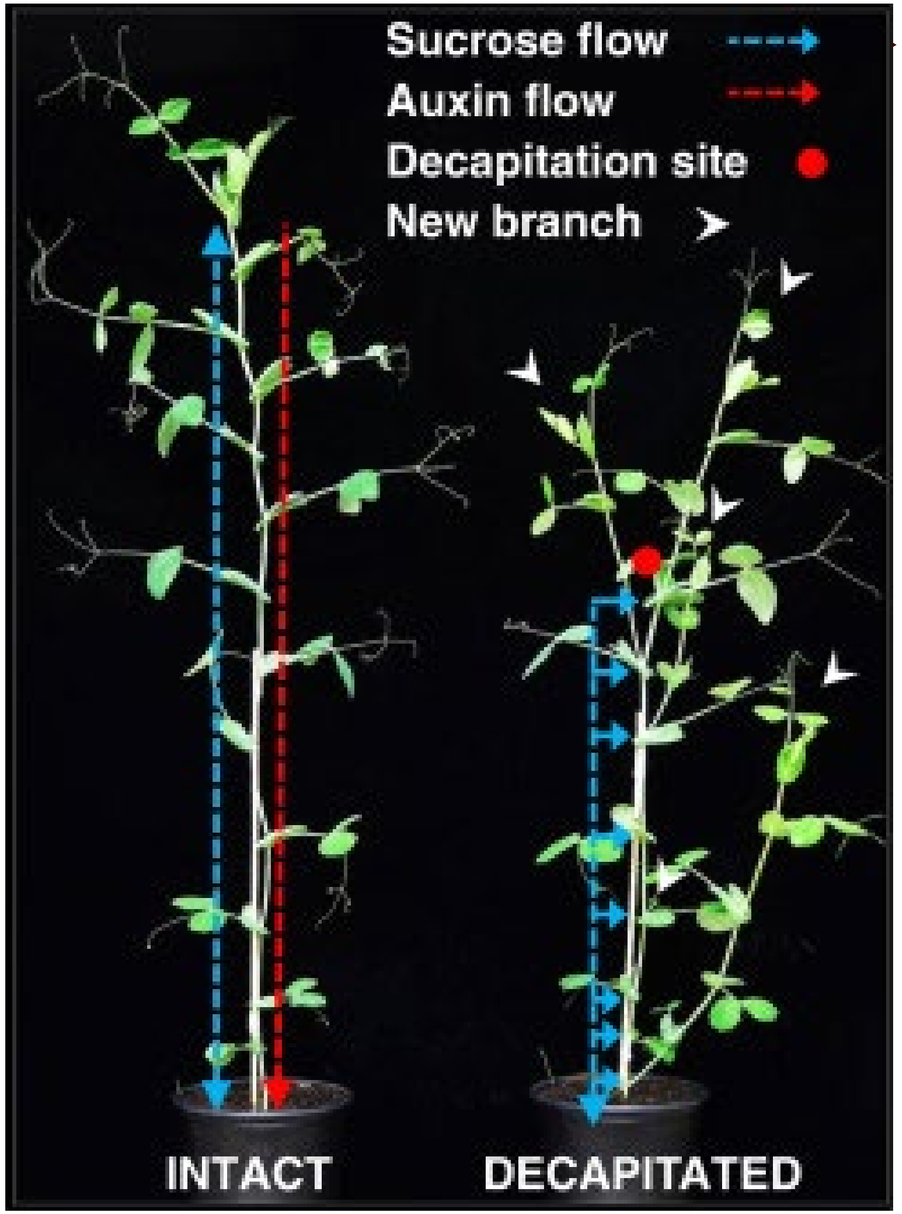
Apical dominance

- When a plant has apical dominance intact, axillary buds are suppressed by plant hormones flow (primarily auxin)
  - Branching/suckering generally will not occur
- When apical dominance is taken away (decapitated) the result is uncontrolled branching or suckering
  - Auxin depleted quickly, leading to axillary bud release



https://doi.org/10.1016/j.cub.2017.05.024
Current Cell Biology (Vol 27: Issue 17; Sept 2017)

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Apical dominance intact

Apical dominance lost – axillary bud growth released

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Pest identification is a key to effective management

Western ragweed

Marshelder

Lanceleaf ragweed

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Thistles - Musk, bull, nodding
(*Cirsium*, *Carduus*, *Onopordum* spp.)

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Croton, doveweed, goatweed
(*Croton capitatus*)

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Horsenettle
(*Solanum* spp.)

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Horsenettle

Silverleaf nightshade

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Woody plant ID and management

https://tfsweb.tamu.edu/InvasivePlantsinNorthTexas/

Non-native

Photos courtesy of Oklahoma State University

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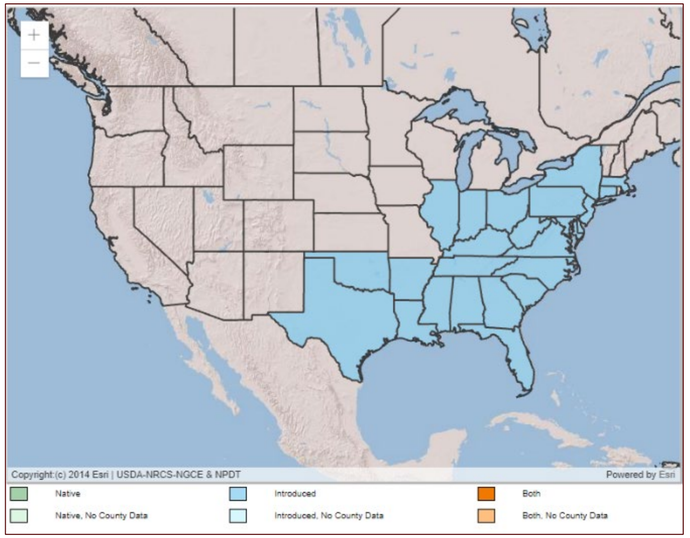
Bradford pear (Callery) (*Pyrus calleryana*)

- Rose family, Rosaceae
- Medium sized tree, introduced to combat fire blight in common pear
- Rapidly growing (and subsequently weak), commonly used in new urban settings
- Thorns are on some varieties
- Small pear fruit contains seeds which are quickly dispersed by birds
- Native to Asia

Photo courtesy of Oklahoma State University



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Bradford pear (Callery) (*Pyrus calleryana*)

- **Individual Plant Treatment** (IPT) with herbicide at the base of tree
  - Basal application of Remedy Ultra and Basal Oil or Diesel (25:75) mix all around the bottom 18 inches of stem 12 months prior to cutting down
- **Cut surface/stump treatment** with Remedy Ultra within 1 hour of cutting tree
- If you cut the tree down without chemical treatment you will get massive numbers of resprouts from lateral roots
- Alternate trees to plant to decrease spread of callery pear
  - Eastern redbud
  - American plum
  - Mexican plum
  - Carolina buckthorn

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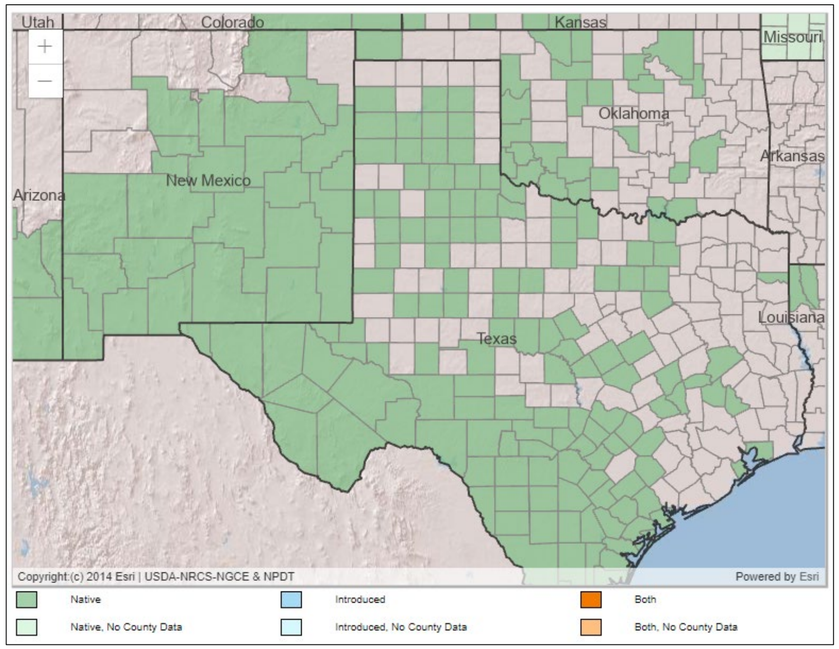
Honey mesquite (*Prosopis glandulosa*)

- Fabaceae, Legume family
- Plants, small to medium sub-shrubs, perennial from a crown
- Leaves small and numerous – pinnately compound; spatula shaped
- Flowers white to pale yellow and small, seeds very numerous (100K)



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Honey mesquite (*Prosopis glandulosa*)

- Cutting the tree down will result in large numbers of crown resprouts
- Best chemical treatments
  - Broadcast: Sendero® herbicide (aminopyralid + clopyralid) or Invora (aminocyclopyrachlor + triclopyr amine)
  - Timing and coverage are big keys to success
    - Apply before pod set – 40 to 90 days post bud break (Occurred March 28th in Grayson County)
    - >4 GPA by air; 10-20 GPA by ground
- Topkill or suppression can also be achieved with metsulfuron (MSM) containing products like Cimarron Plus; or GrazonNext HL, Grazon P+D
- Individual plant foliar treatments are most effective

Native

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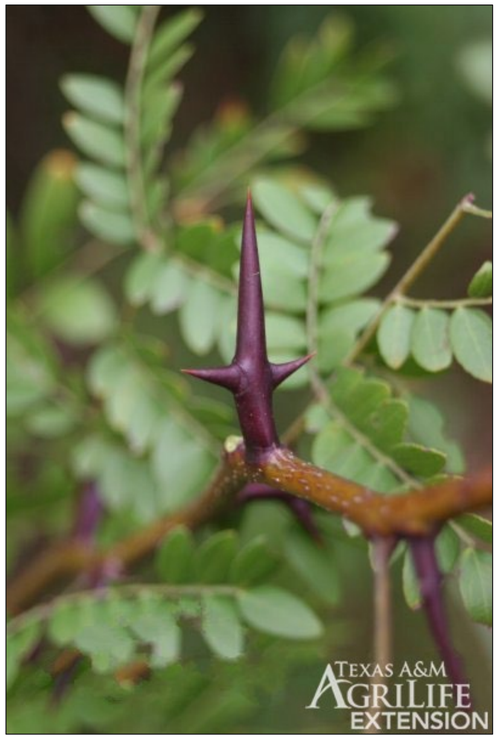
Honeylocust (*Gleditsia triacanthos*)

- Native to north and central America
- Fabaceae or bean family
- Woody plant species that resprouts vigorously when cut down, if no herbicide treatment is included
- Known as Espino de Cristo in Spanish speaking countries
- Capable of taking over pastures if left unmanaged



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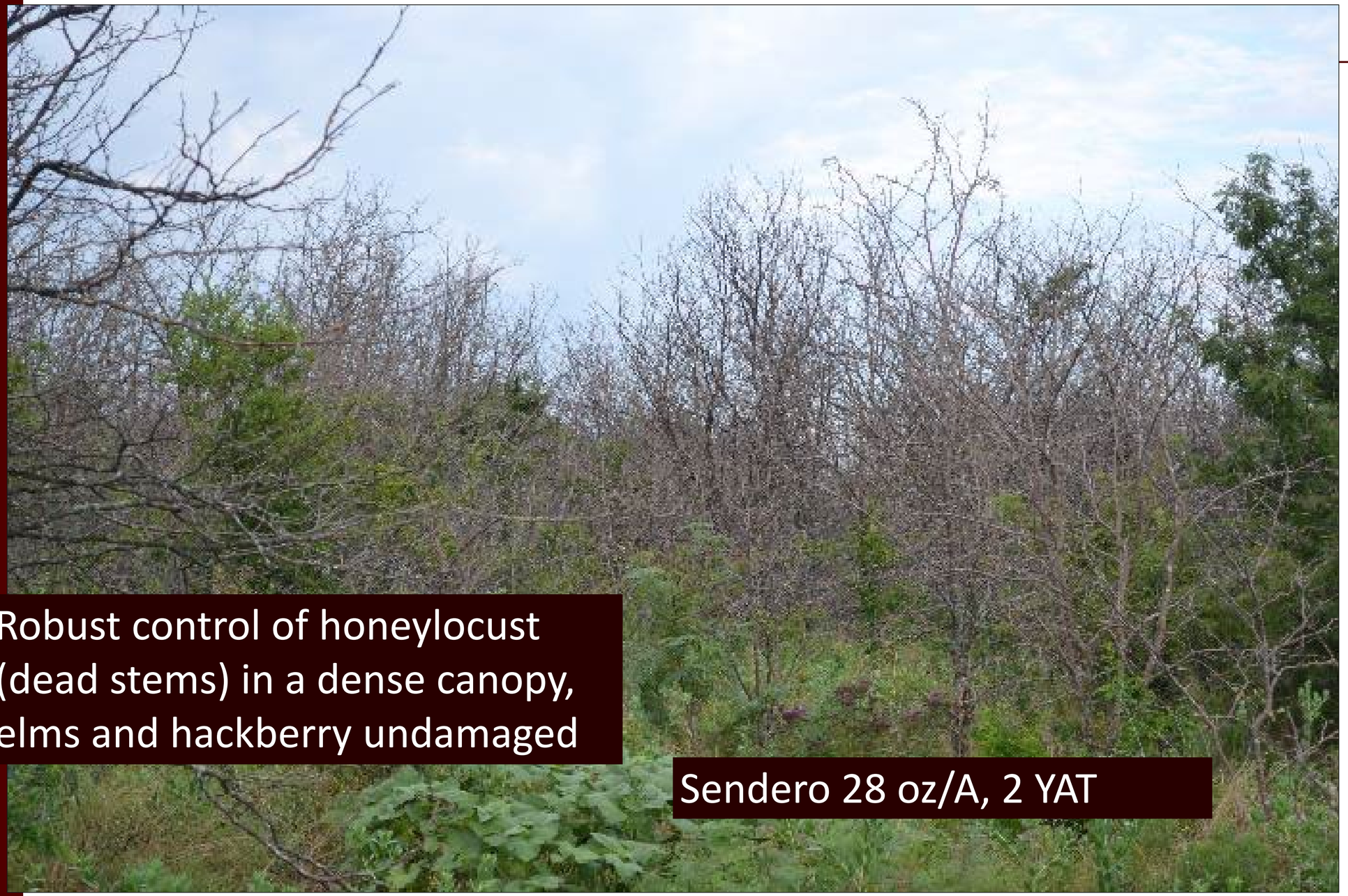

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Cedar elm (*Ulmus crassifolia*)

Native

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Cedar elm *(Ulmus crassifolia)*

- Small to medium sized tree
- Native, perennial
- Medium preferred browse for grazing animals
- Leaves are simple and arranged alternately on the stems

Native

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Sweet gum *(Liquidambar styraciflua)*

- Witch-Hazel family
- Large native tree
- Leaf shape is palmately compound
- Problematic in pastures and natural areas – difficult to control with herbicides

Native

Green ash *(Fraxinus pennsylvanica)*

- Oleaceae, ash family
- Large native tree
- Deciduous leaf shape
- Fall color is yellow
- Rapid growth rate, spreads quickly in pastures and natural areas

Native

Tree of heaven (*Ailanthus altissima*)

- Simaroubaceae family
- Large exotic invasive tree
- Massive resprouter
- Rapid growth rate, spreads quickly in pastures, urban, and natural areas

Non-native

Native

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Juniper (*Juniperus* spp.)

- Cupressaceae, Cypress family
- Plants, small to medium evergreen sub-shrubs, shallow rooted in most species
- Leaves small and numerous – appear as needle-like clumps
- Trees create a baron micro-climate around them due to shade and acidic needles
- Flowers pale yellow and very small, pollen is a major allergy concern, seeds very numerous and blue to red depending on species (100K)

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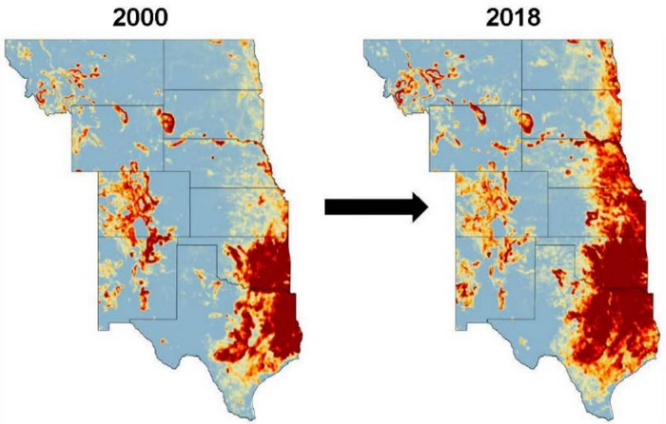
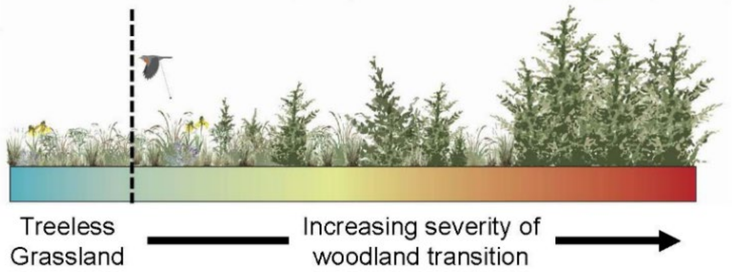
Junipers (*Juniperus* spp.)

- Best chemical treatments
  - Broadcast: No good options in rangelands and prairies
- Suppression can be achieved with picloram containing herbicides or hexazinone containing herbicides
- Individual plant ground treatments are most effective
- Prescribed fire on young plants is highly effective at control





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Non-native

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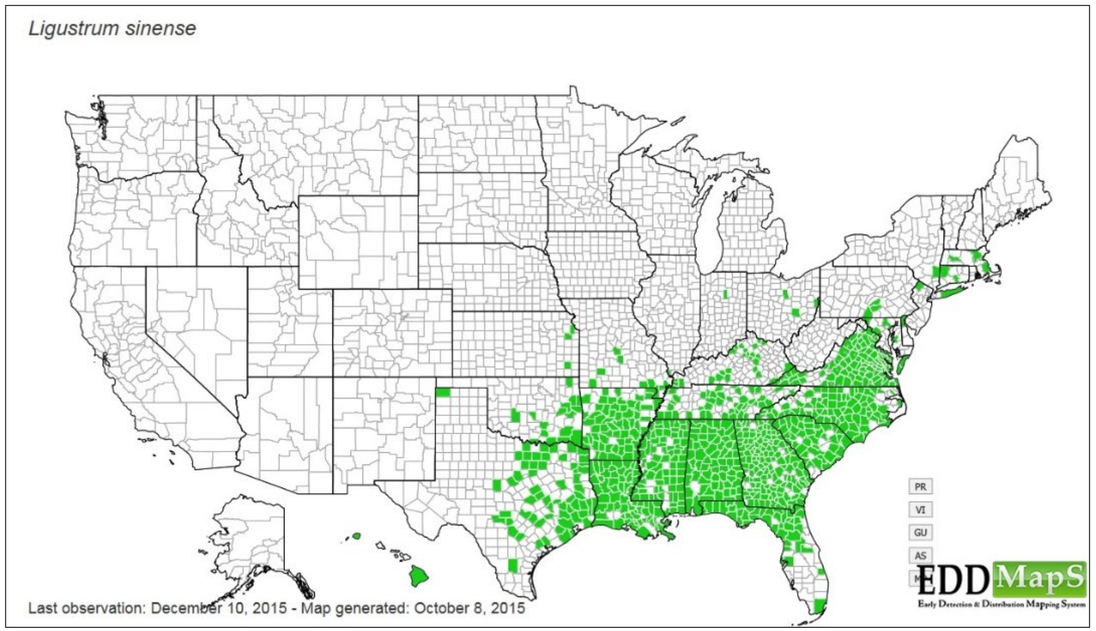
Chinese Privet (*Ligustrum sinense*)

- Oleaceae, oleander family
- Plants, small to medium shrubs, perennial from a crown
- Leaves small and numerous; opposite leaflets on the petiole
- Flowers white to pale yellow and small, fruits small purple berries
- Introduced from east Asia



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Chinese Privet (*Ligustrum sinense*)

- Control options include:
  - 1. Hand pulling – be sure to get entire root mass
  - 2. Weed wrenching
  - 3. Hand cutting – will result in rapid resprouting
  - 4. Brush mulching – will result in rapid resprouting
  - 5. Foliar herbicide treatment
  - 6. Cut surface herbicide treatment – following cutting (glyphosate or triclopyr amine)
  - 7. Basal bark herbicide treatment (triclopyr ester)

- No single treatment is highly effective at control of this species. It is imperative that an integrated vegetation management strategy with multiple tools is implemented to successfully manage this species.

- Be sure to properly identify this species. Native woody shrubs including Yaupon holly look relatively like privet but have red berries and alternative leaf arrangement.

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Educating the client, the neighbors, and the public

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A part of the whole

Traditional Perspective of Pest Management

Involves interactions of pests, habitats, and people

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Managerial Perspective

Addresses components that may include substance, processes and relationships

Understand principles of:

- Communications
- Stakeholder engagement
- Decision-making processes

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Ecosystem-based Approaches

Intersection between ecological, sociocultural, and institutional components of managed ecosystems

Community-based Management

Incorporates people and their local or regional communities and institutions into management

- Explicitly considers human livelihoods and sociocultural and economic goals along with the biological and ecological management goals
- Example – living in and working in a national park in ways that enhance the long-term stability of an ecosystem

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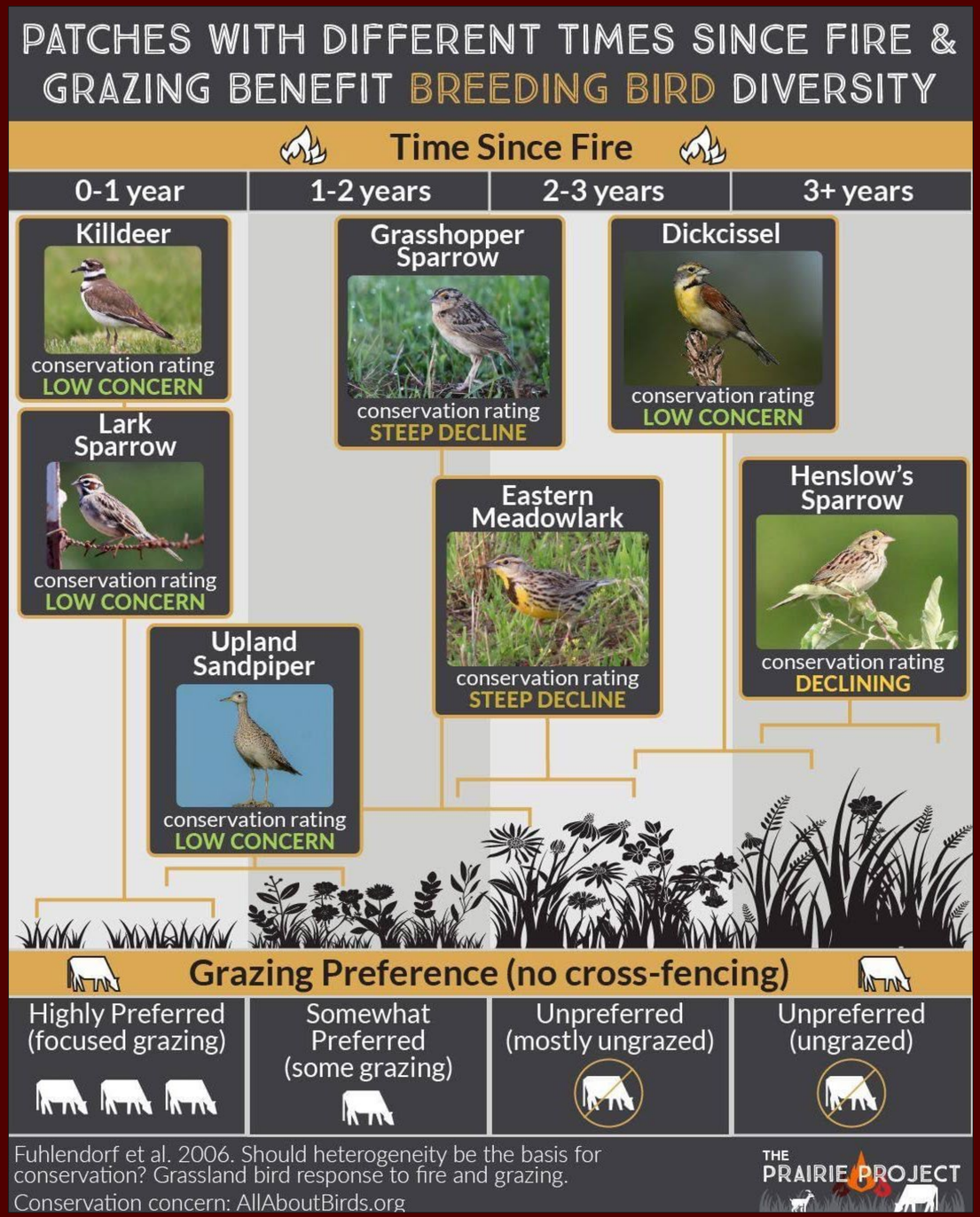
Wrapping Up



In Summary

- Vegetation management is a lifetime commitment, not a one-year solution
  - Make sure you have an annual plan in place for IPM success
- Use all the tools available in your toolbox to control pests in the urban environment
  - Pesticides can still be a tool in the urban landscape – when precautions and use instructions are followed
- Education is huge in customer satisfaction, neighbor relations, and general public understanding of why we control pests
  - Education is everyone's responsibility

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Questions and Discussion

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