Developing a Sustainable Approach to Roadside Vegetation Management in the State of Arkansas

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Key project personnel

- Dr. Mike Richardson (Turfgrass)
- Dr. Dirk Phillip (Range ecology)
- Dr. Matt Bertucci (Weed science)
- Dr. Neal Joshi (Entomology)

- John McCalla (Research associate)
- Robert Rhein (Research associate)
- Rachel Woody-Pumford (Graduate student)
- Sarah Paschal (Graduate student)

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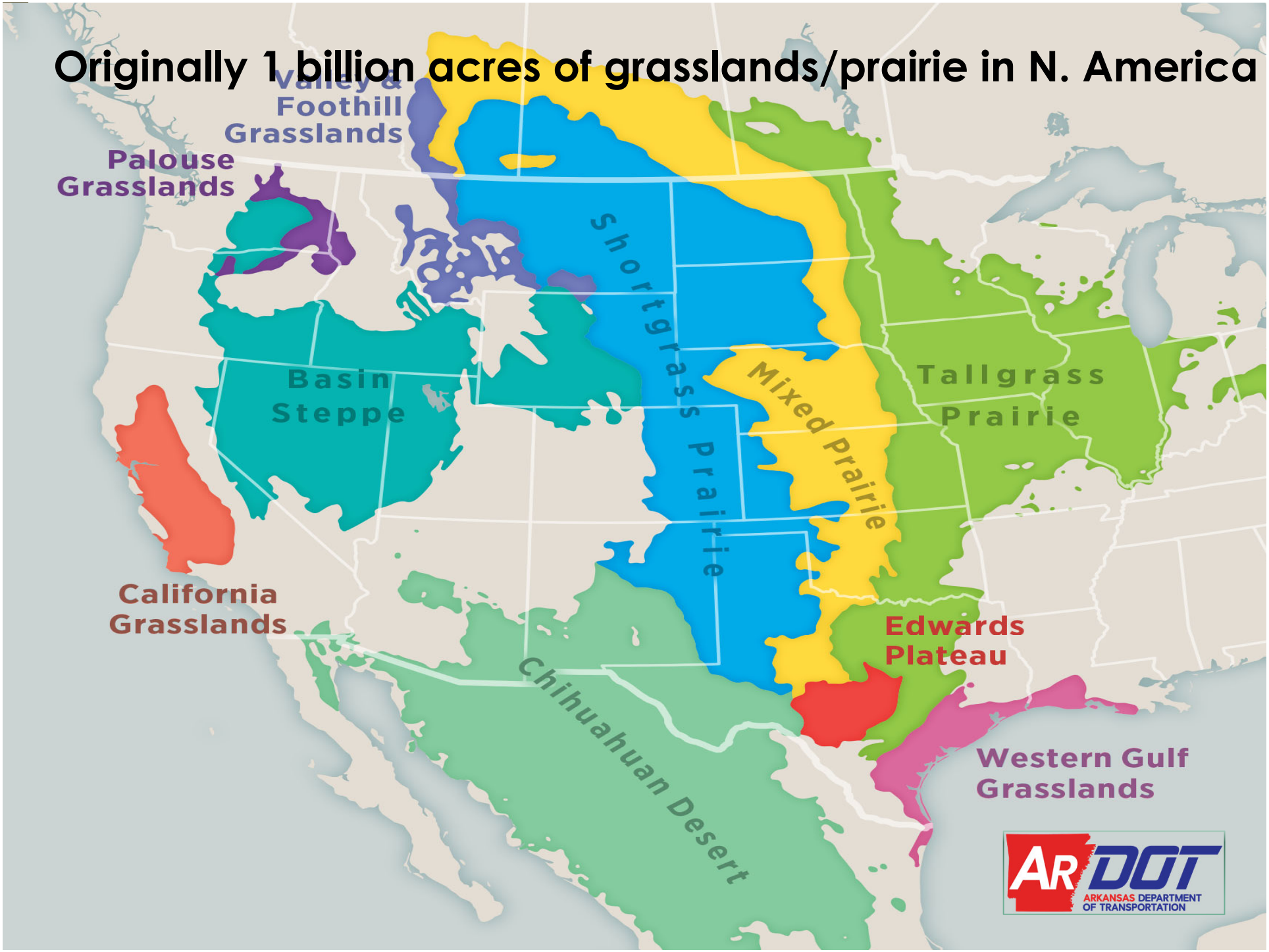
Originally 1 billion acres of grasslands/prairie in N. America
Valley & Foothill Grasslands
Palouse Grasslands
Basin Steppe
Shortgrass Prairie
Mixed Prairie
Tallgrass Prairie
California Grasslands
Edwards Plateau
Chihuahuan Desert
Western Gulf Grasslands
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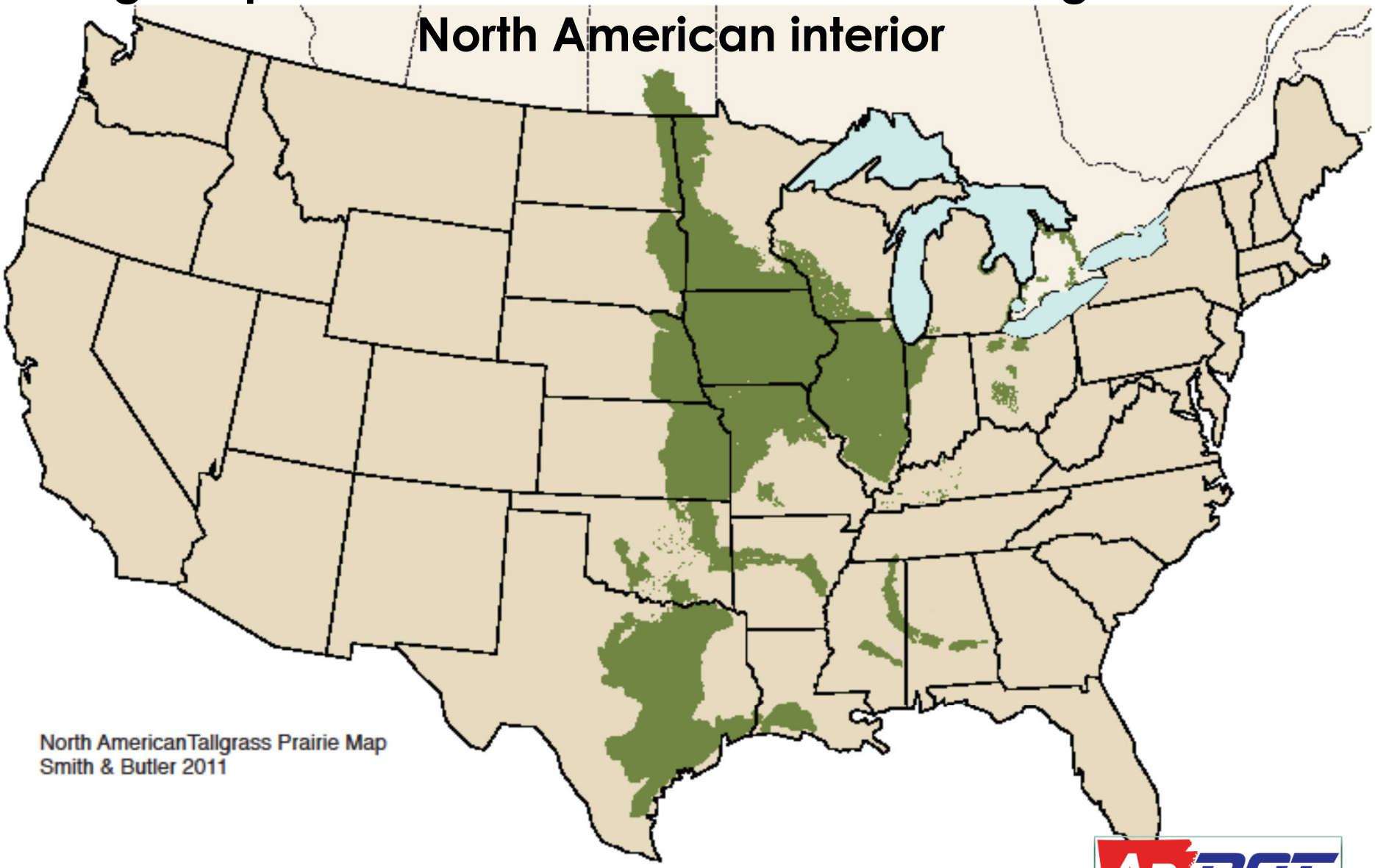
Tallgrass prairies were found in the eastern regions of the North American interior



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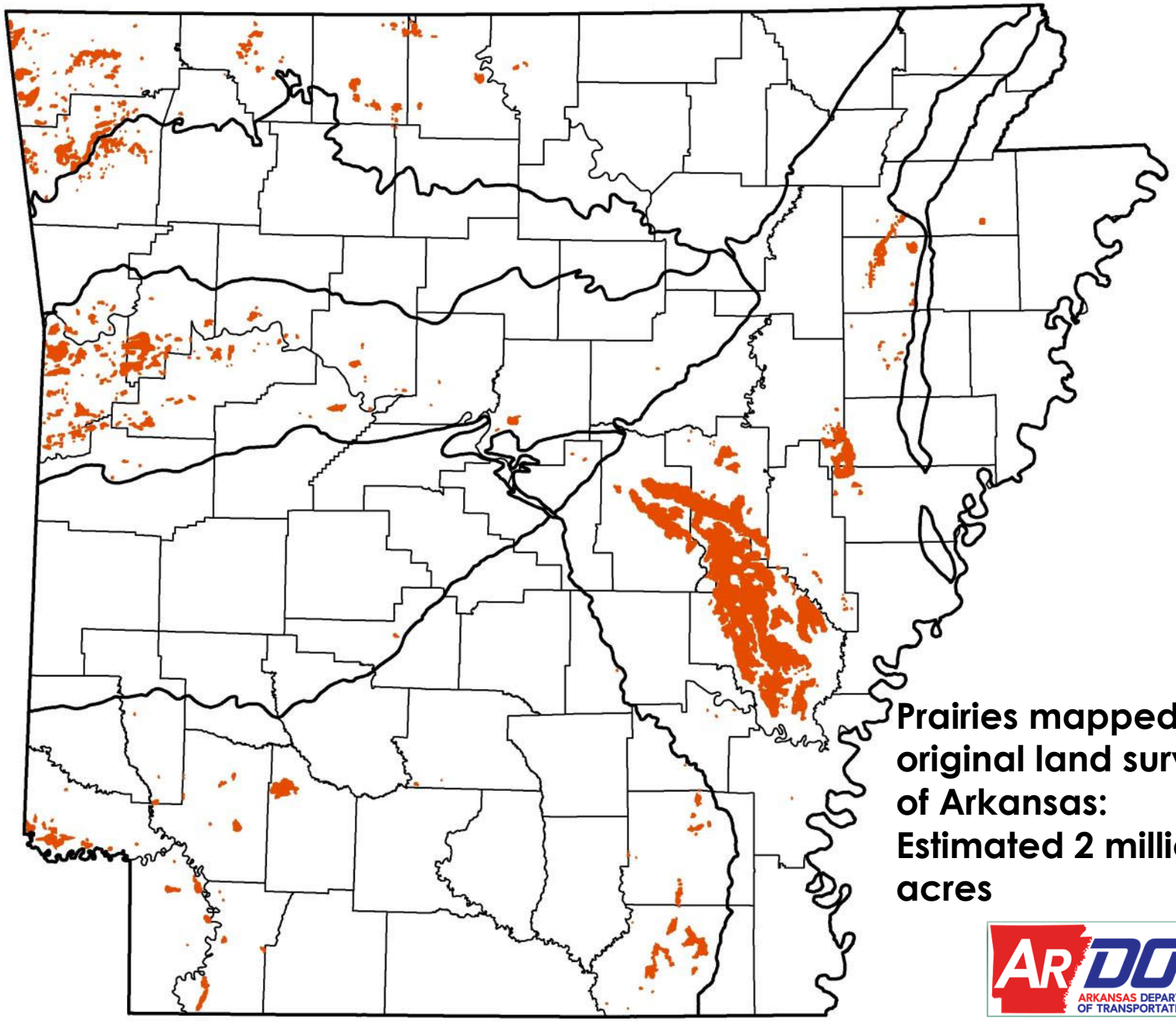

Prairies mapped in original land survey of Arkansas: Estimated 2 million acres

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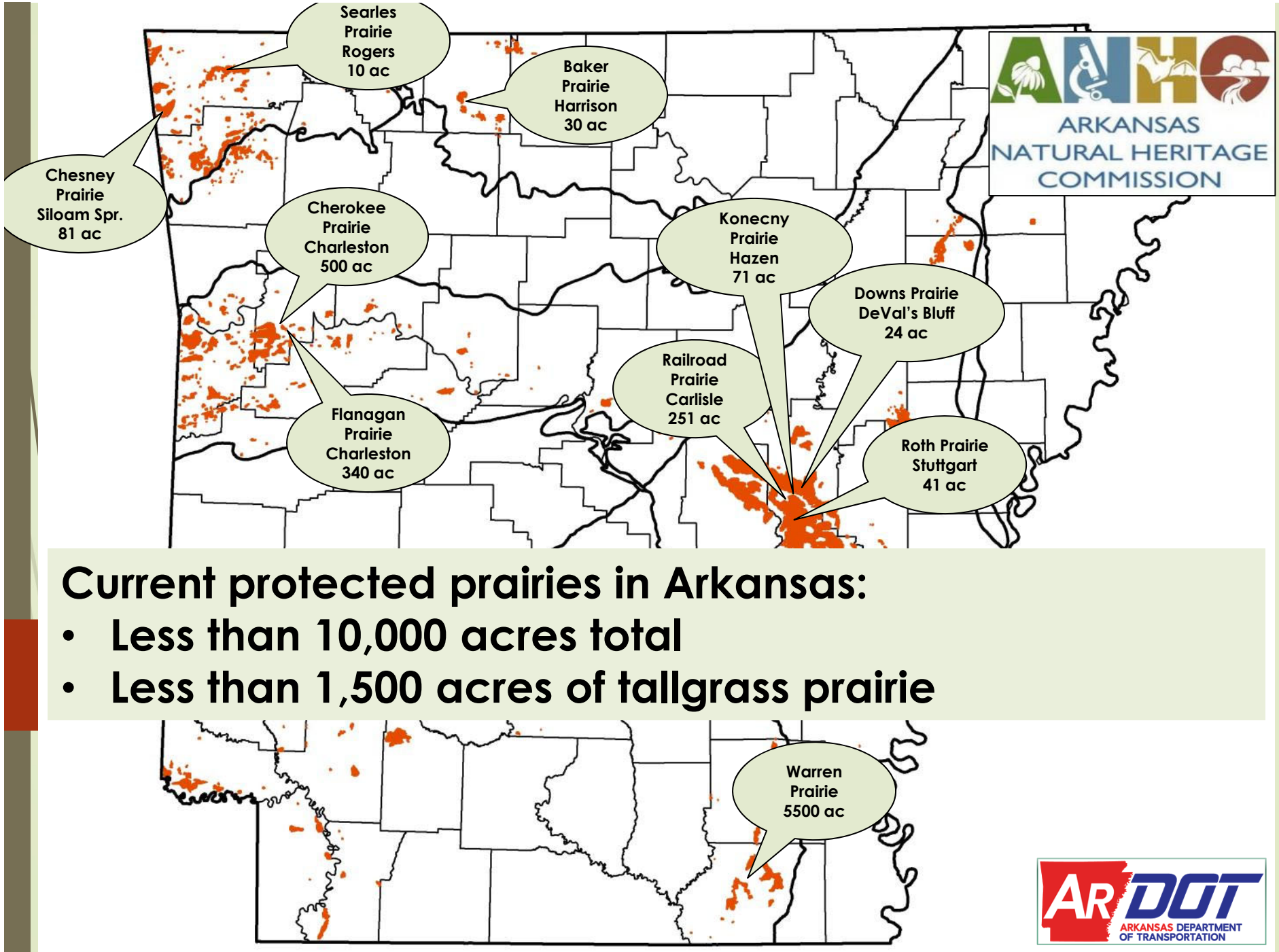

Current protected prairies in Arkansas:

- Less than 10,000 acres total
- Less than 1,500 acres of tallgrass prairie

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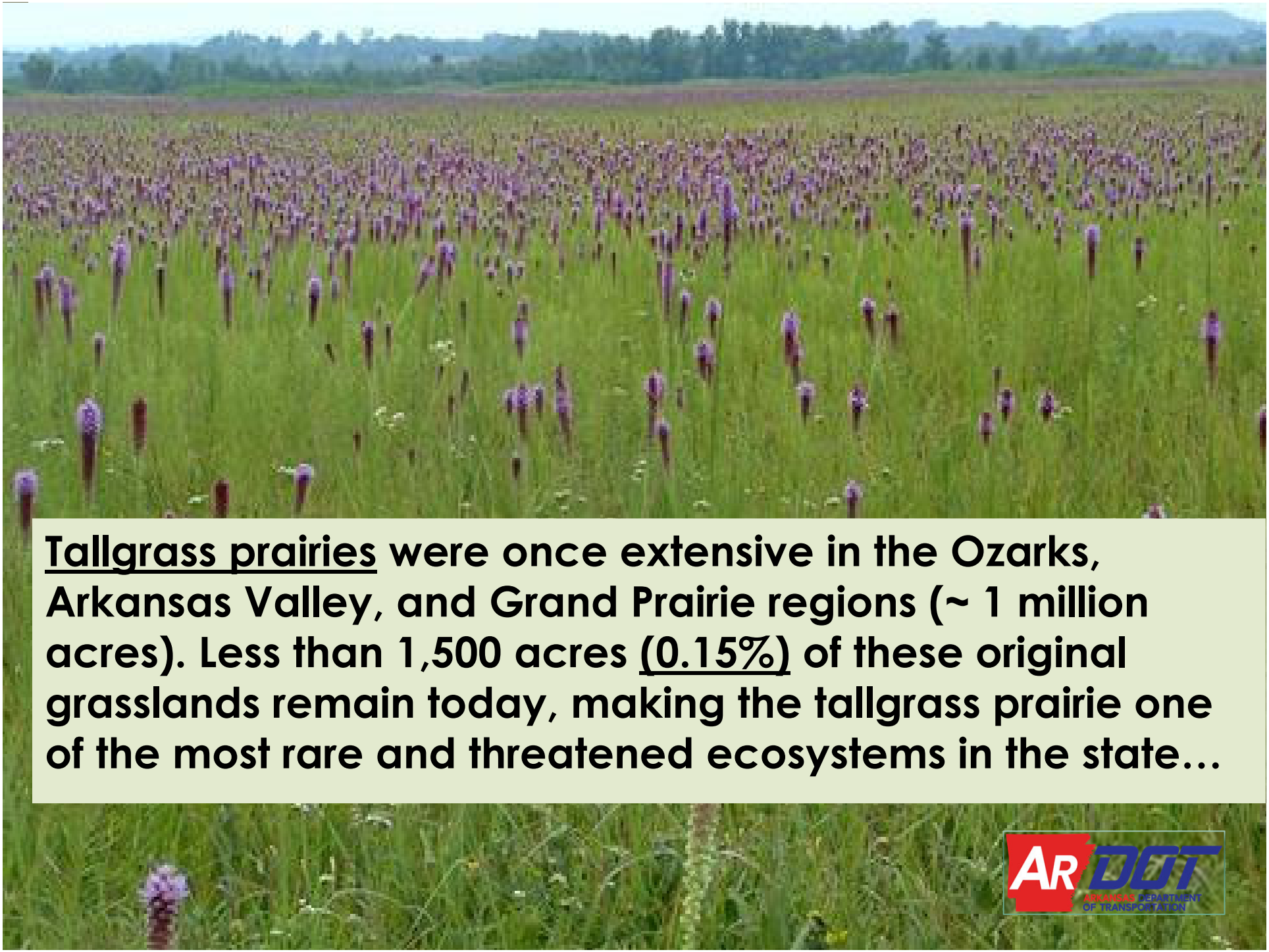

Tallgrass prairies were once extensive in the Ozarks, Arkansas Valley, and Grand Prairie regions (~ 1 million acres). Less than 1,500 acres (0.15%) of these original grasslands remain today, making the tallgrass prairie one of the most rare and threatened ecosystems in the state…

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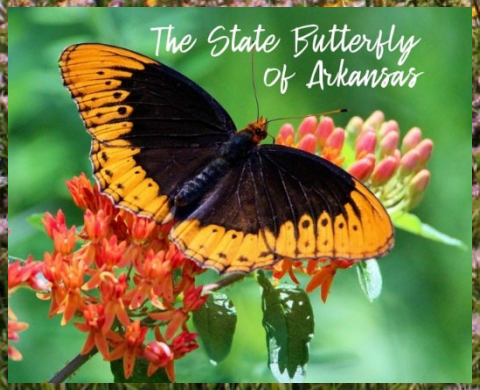
The few remaining are some of the most beautiful ecosystems in the state

(Pale pink and yellow coneflowers on Cherokee prairie in Charleston AR)

Many remnant prairies are also under heavy pressure from development

Why prairie ecosystems along roadways ??



- Prairie ecosystems are known to be resilient in dry/hot, changing environments
- Prairies provide natural beauty and provide habitat for unique flora and fauna

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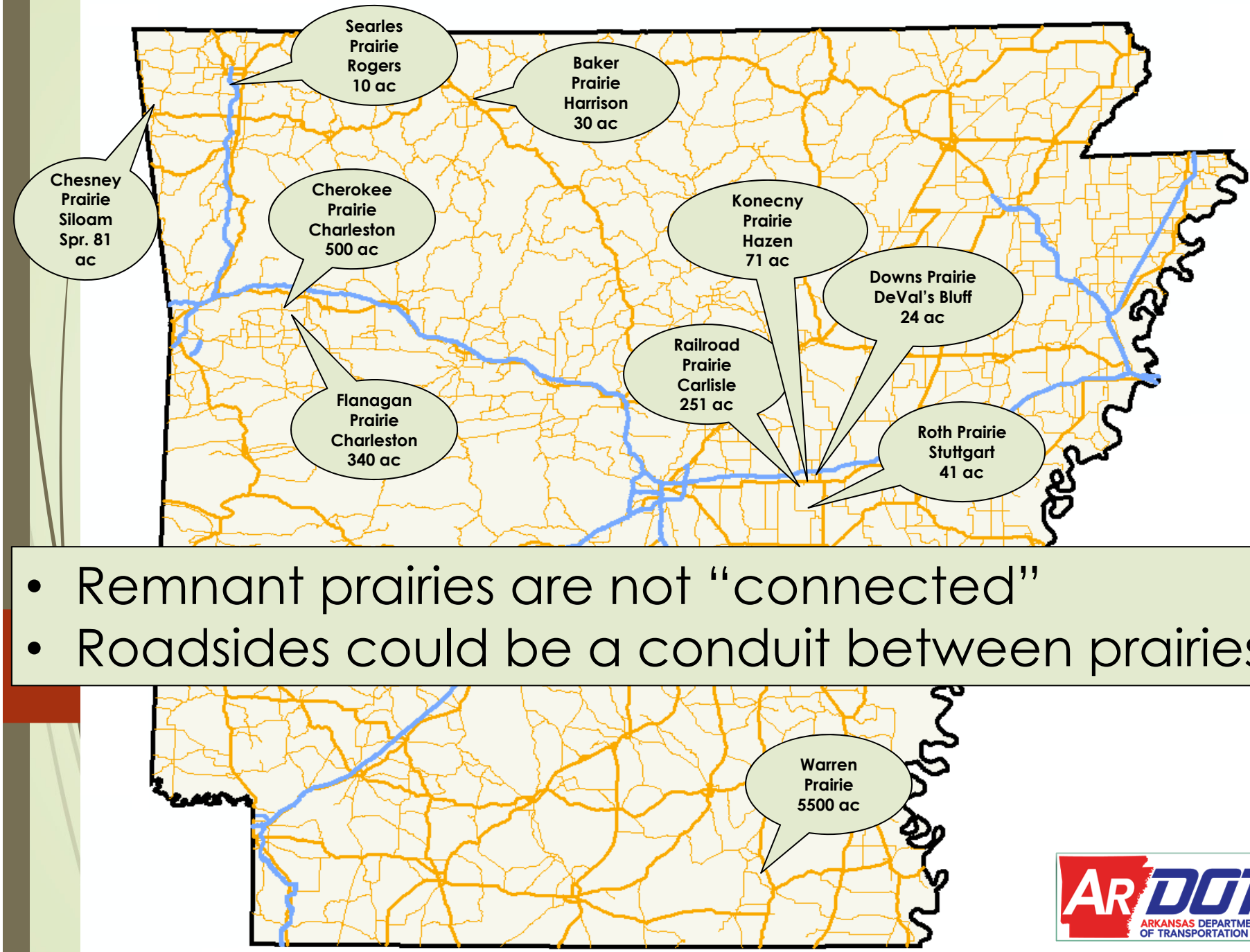

- Remnant prairies are not "connected"
- Roadsides could be a conduit between prairies

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Why prairie ecosystems along roadways ??

- Prairies and roadsides share many characteristics
  - Shallow or compacted soil
  - Erratic moisture availability
  - High temperature fluctuations

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Objectives

- Assess establishment of various prairie seed mixtures for roadside vegetation across 4 geographic regions in Arkansas
- Determine the effects of soil type, weed control and mowing management on the sustainability of various prairie roadside mixtures
- Assess aesthetics and pollinator value of various prairie seed mixtures across 4 geographic regions in Arkansas

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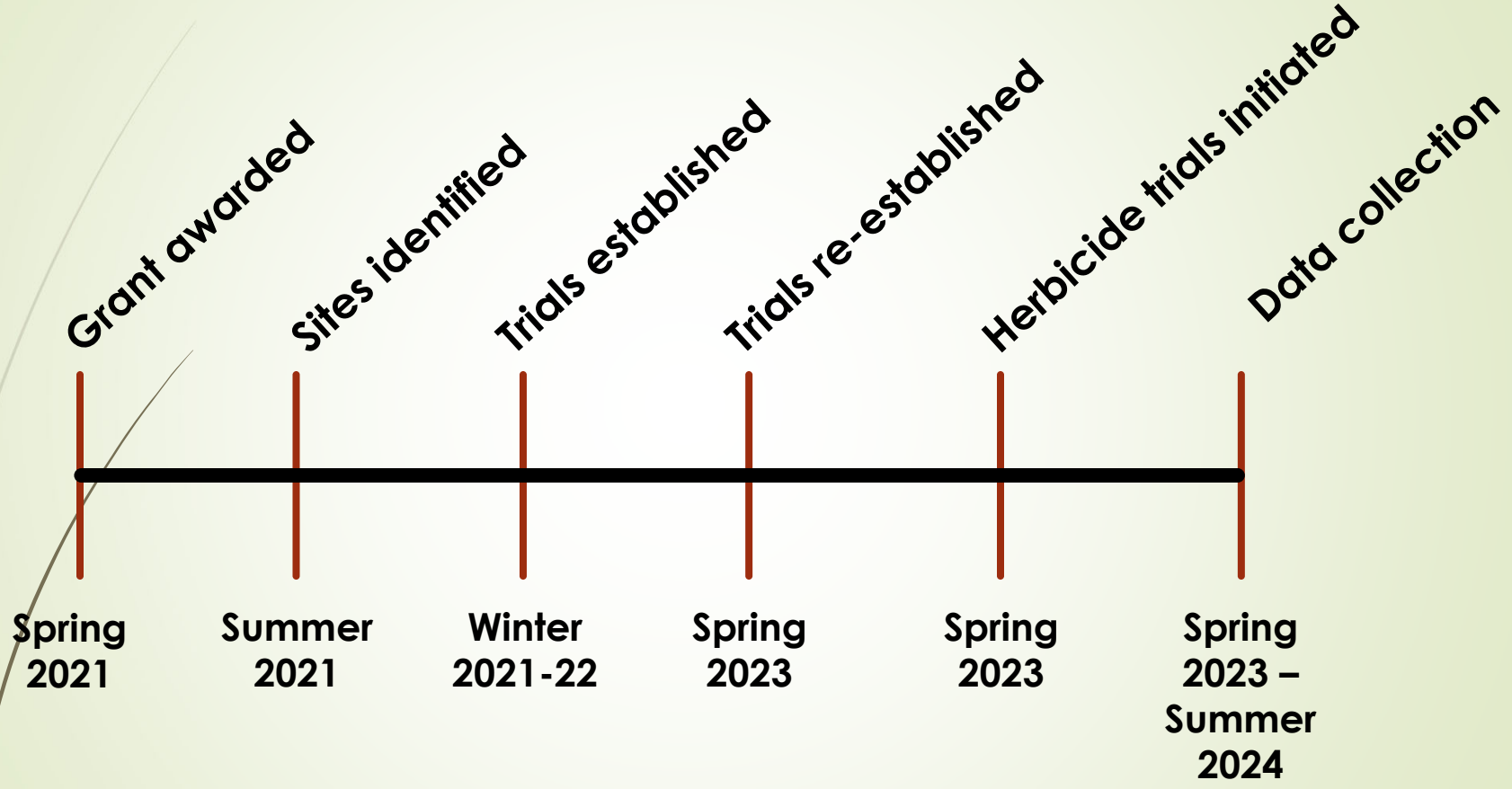
Project timeline



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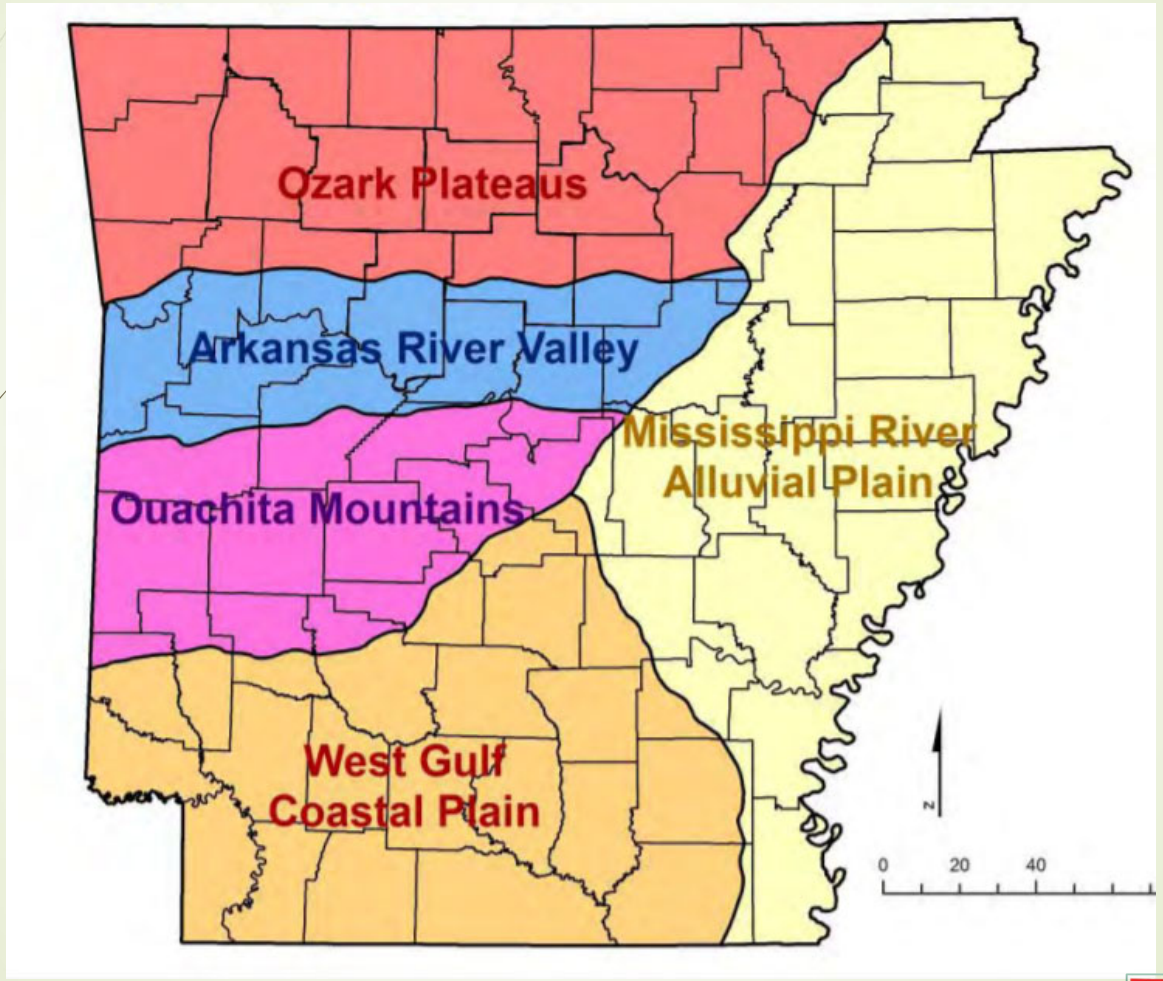
Establishment of native prairie mixtures along roadsides in Arkansas

- Lead graduate student on the project – Sarah Pascal (scwiebe@uark.edu)

Overview of major ecoregions in the state



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Overview of sites within each region

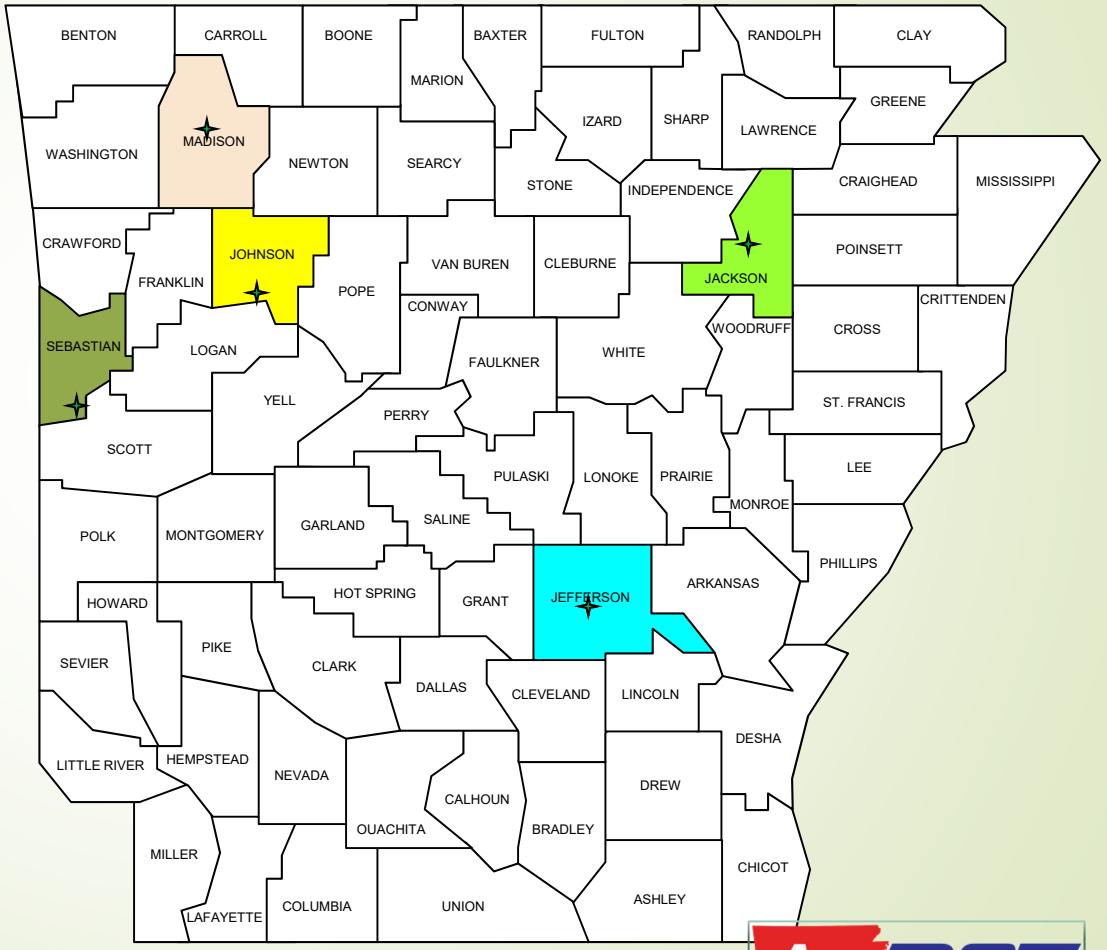
Ozarks
Madison County - Huntsville

Ouachita Mtns
Sebastian County - Mansfield

Arkansas River
Johnson County - Clarksville

Mississippi Alluvial
Jackson Country - Newport

Coastal Plain
Jefferson Country - Pine Bluff



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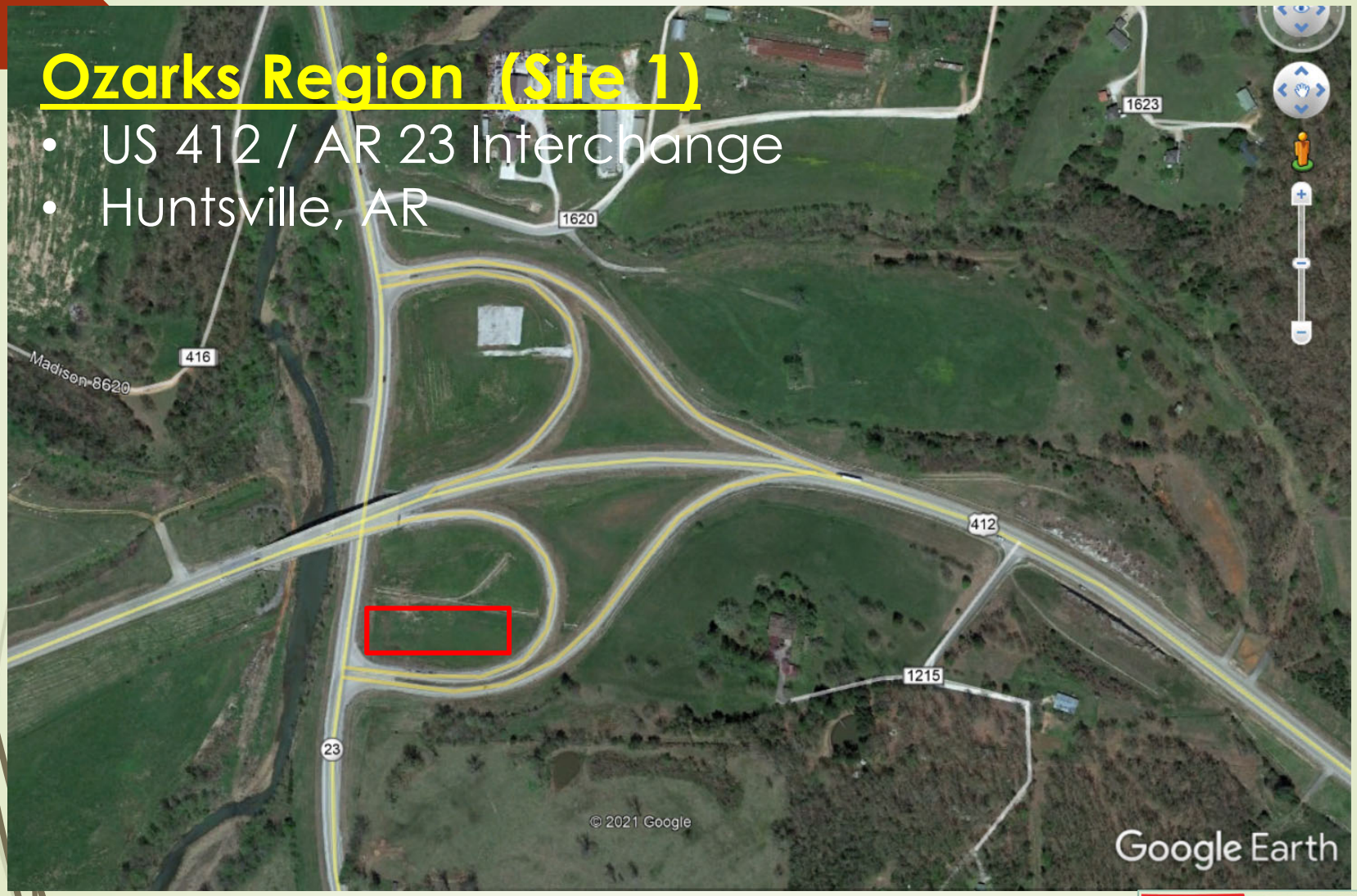
Ozarks Region (Site 1)

- US 412 / AR 23 Interchange
- Huntsville, AR



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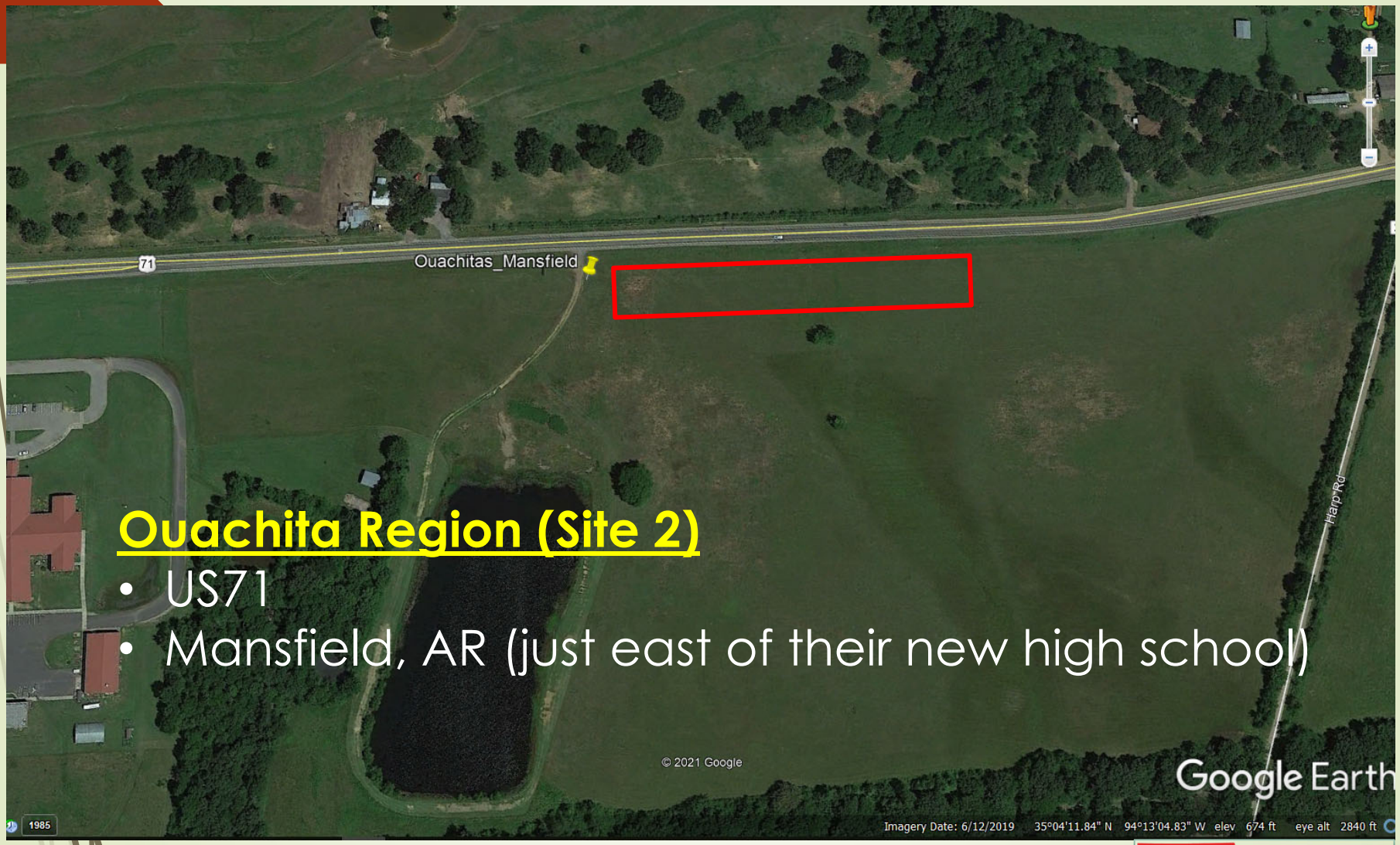

Ouachita Region (Site 2)

- US71
- Mansfield, AR (just east of their new high school)

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Arkansas River Valley Region (Site 3)

- East of Exit 58 on I-40
- Clarksville, AR

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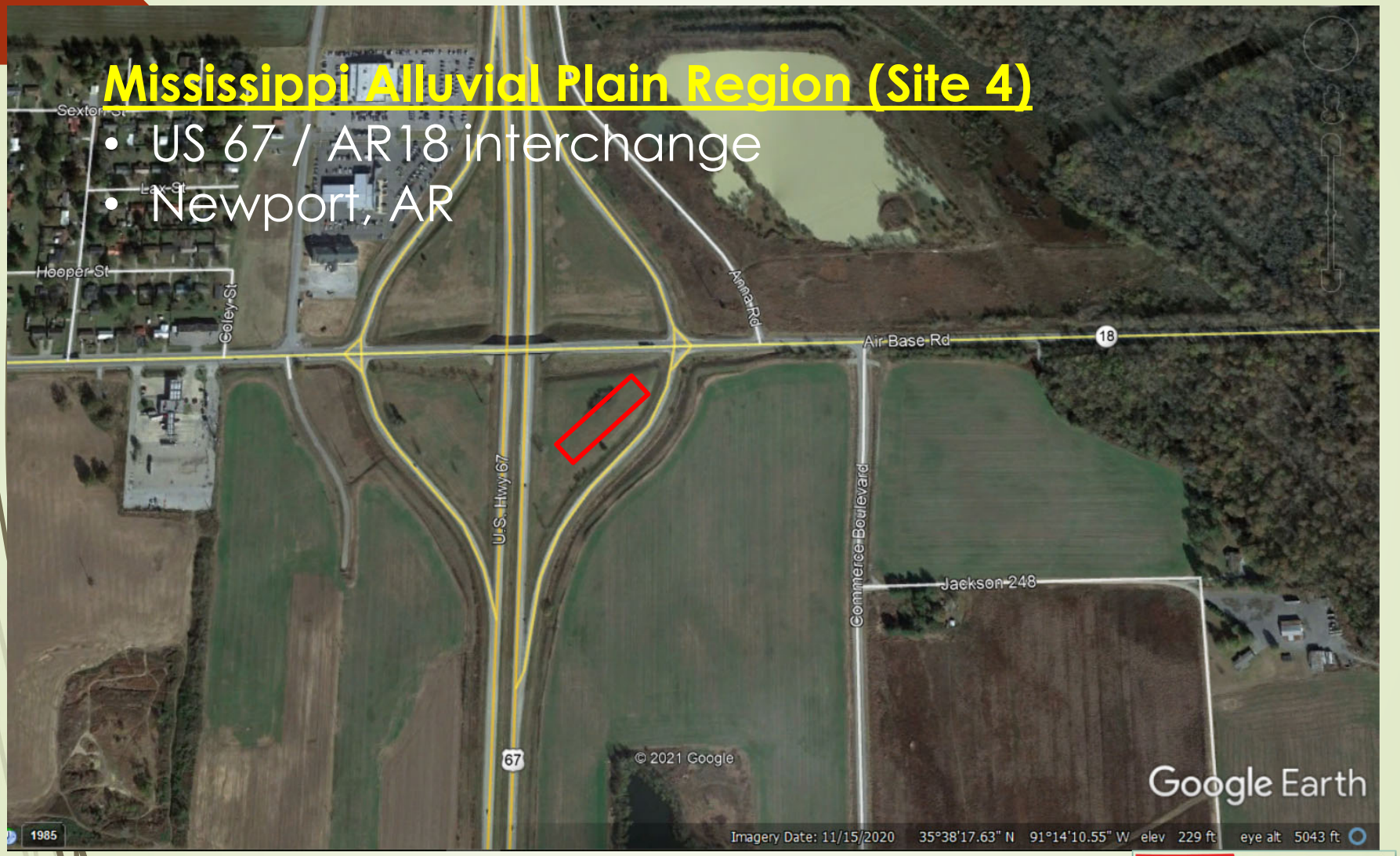
Mississippi Alluvial Plain Region (Site 4)

- US 67 / AR18 interchange
- Newport, AR



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Coastal Plain Region (Site 5)
I-530 / Old Warren Road Interchange
Pine Bluff, AR
79
Old Warren Rd
This site was not re-established in 2023 after heavy infestation of johnsongrass and barnyard grass in first planting
© 2021 Google
Google Earth
1985
34°10'55.15" N 92°02'32.60" W elev 233 ft eye alt 3694 ft

Mixtures tested at each site

- Seven prairie seed mixture treatments
  - Tall grass mixture
  - Short grass mixture
  - Forbs mixture
  - Tall grass + forbs
  - Short grass + forbs
  - Tall grass + short grass + forbs
  - Buffalo grass

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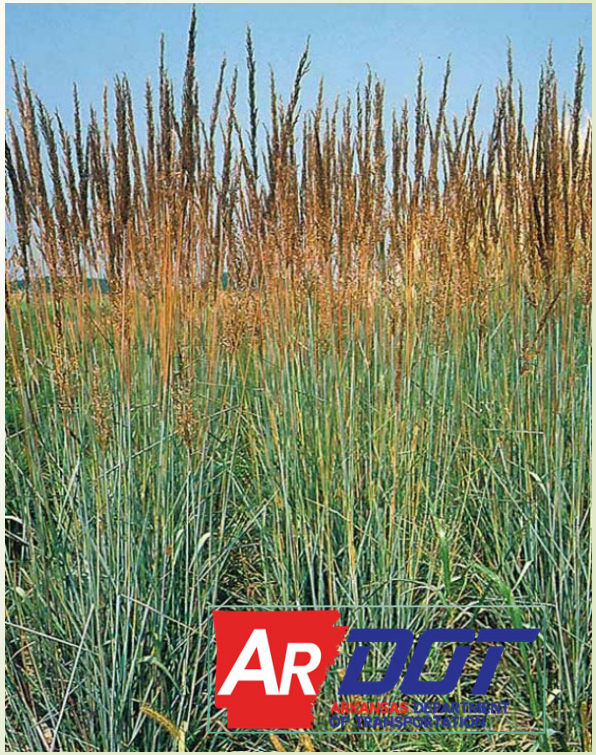
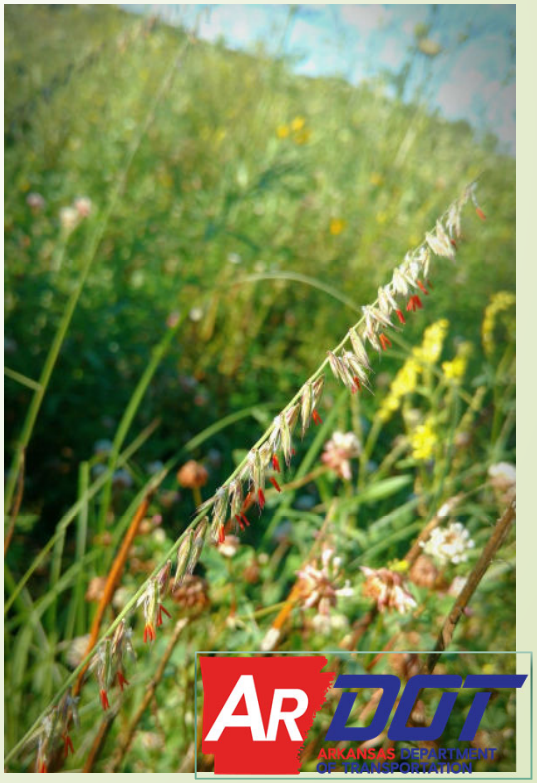
Native Grass Mixture

- Tall Grasses(1-2m+)
  - *Andropogon gerardii* - Big bluestem
  - *Panicum virgatum* - Switchgrass
  - *Sorghastrum nutans* - Indiangrass

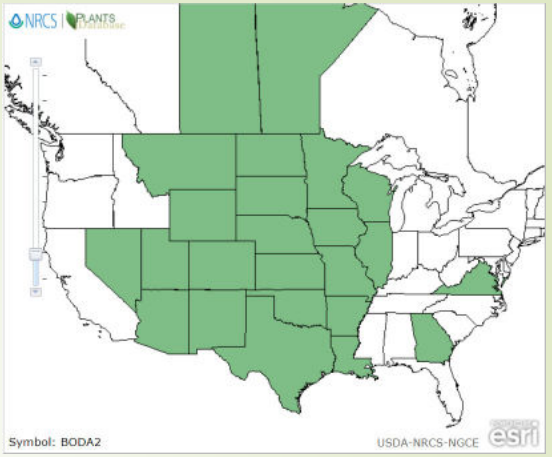


Native Grass Mixture

- Short Grasses (<1m)
  - *Bouteloua curtipendula* - Sideoats grama
  - *Buchloe dactyloides* - Buffalograss
  - *Schizachyrium scoparium* - Little bluestem



Why buffalograss?



Native US turfgrass

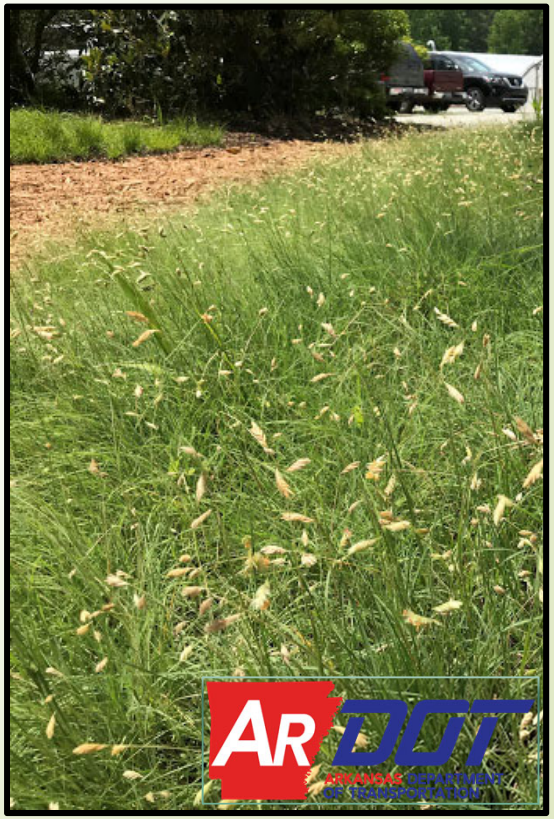
- Buffalograss (*Buchloe dactyloides*)

Other native grasses are available, but too tall for safe zone next to roadway

- Big/Little bluestem
- Eastern gama grasses
- Indiangrass

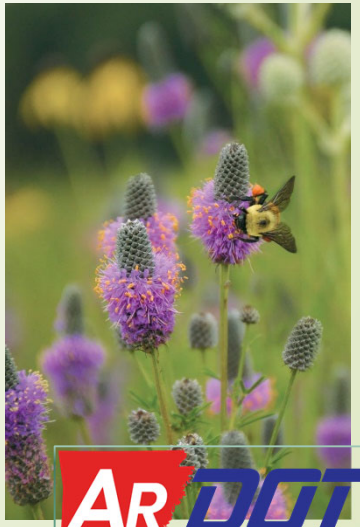
Buffalograss *(Buchloe dactyloides)*

- Maximum growth height is about 6 inches. Including seedheads
- Excellent tolerance to herbicides, including glyphosate
- Very drought tolerant



Native Forbs Mixture

- Fabaceae (legumes)
  - *Amorpha fruticosa* – Desert false indigo
  - *Baptisia alba* - White wild indigo
  - *Baptisia australis* - Blue wild indigo
  - *Chamaecrista fasciculata* – Partridge pea
  - *Dalea purpurea* - Purple prairie clover
  - *Desmanthus illinoensis* - Illinois bundleflower
  - *Lespedeza virginica* - Slender lespedeza



Native Forbs Mixture

- Lamiaceae (mints)
  - *Pycnanthemum tenuifolium* - Slender mountain-mint

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Native Forbs Mixture

- Apiaceae (umbellifers)
  - *Eryngium yuccifolium* - Rattlesnake master

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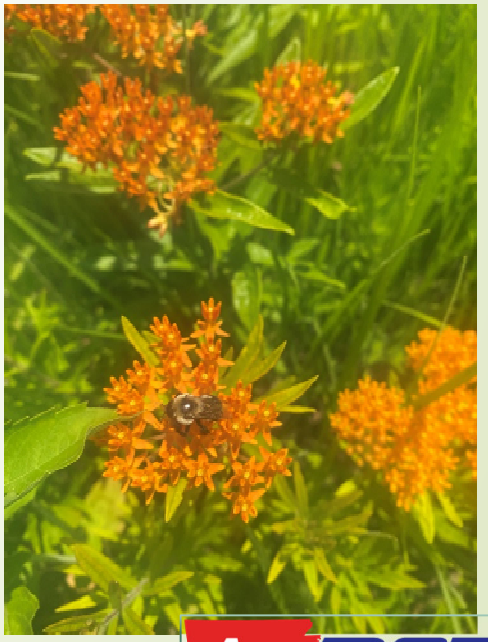
Native Forbs Mixture

- Asclepiadaceae (milkweeds)
  - *Asclepias incarnata* - Swamp milkweed
  - *Asclepias syriaca* - Common milkweed
  - *Asclepias tuberosa* - Butterfly milkweed



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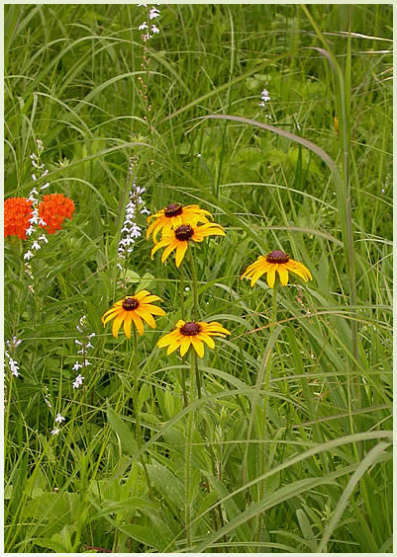
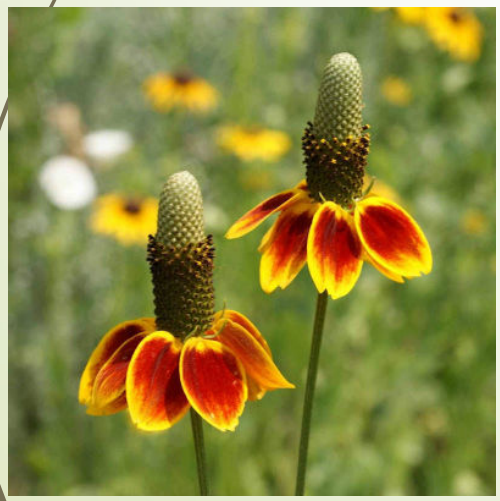
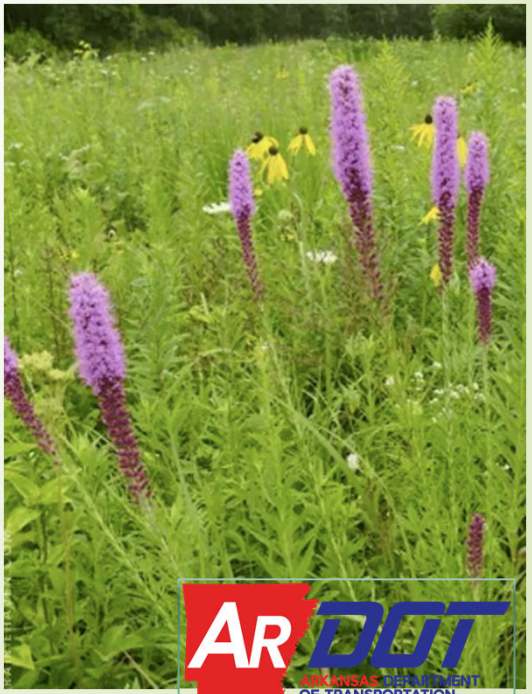
Native Forbs Mixture

- Asteraceae (asters or daisy)
  - *Echinacea pallida* - Pale purple coneflower
  - *Echinacea purpurea* - Purple coneflower
  - *Helianthus mollis* - Ashy sunflower
  - *Liatris pycnostachya* - Prairie blazing star
  - *Ratibida columnifera* - Mexican hat plant
  - *Rudbeckia hirta* - Black-eyed Susan







Site preparation

- Each location was sprayed 2 x with a non-selective herbicide (glyphosate) to control existing vegetation
- Sites were mowed at a low HOC to remove debris

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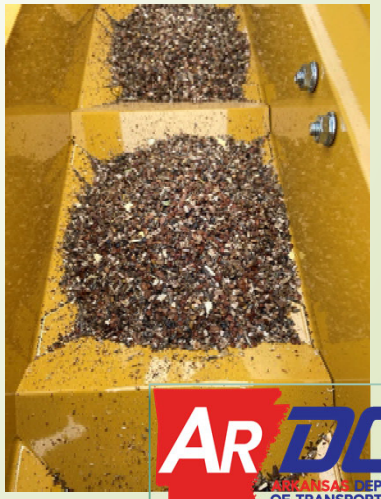
Truax "FLEX II" Drill

- Planted approximately ½ - ¾ inch deep
- Row space 16 in apart
- Planting width 5 ft



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Methods: Field Study Design

- Four replications of the seven seed mixtures at each location
- Individual plot size – 10 x 40 ft
- Randomized complete block design

Buffalo	SG	TG	TG+SG+ Forb	Forb	SG+ Forb	TG+ Forb	SG	TG+ Forb	Buffalo	Forb	TG	SG+ Forb	TG+SG+ Forb
301	*302*	*303*	*304*	*305*	*306*	*307*	*401*	*402*	*403*	*404*	*405*	*406*	*407*
SG	TG	Forb	TG+SG+ Forb	TG+ Forb	SG+ Forb	Buffalo	SG+ Forb	TG+ Forb	SG	Buffalo	Forb	TG	TG+SG+ Forb
101	*102*	*103*	*104*	*105*	*106*	*107*	*201*	*202*	*203*	*204*	*205*	*206*	*207*

SG – short grass
TG – tall grass

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Data collection
(4-5 times per season)

- Canopy coverage
  - Digital image analysis
- Species abundance
- Bloom counts for forbs
- Seed set for grasses

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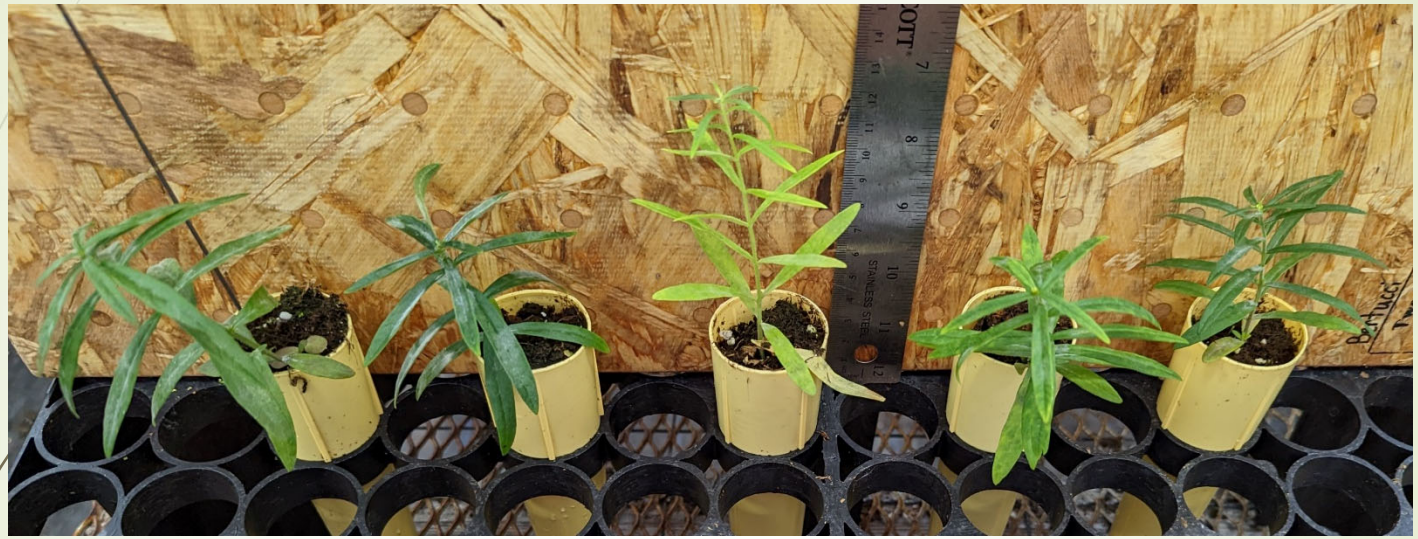
Overall results of this study

- First-year plantings in 2022 were a complete failure due to poor seed quality (<10% germ)
- Plots were reseeded in early 2023 with new seed
- Initial results look much better as numerous, desirable species have already been observed

Assessing the physiological response of Arkansas native plant species treated with common roadside herbicides



- Lead graduate student on the project
  - Rachel Woody-Pumford (rxw025@uark.edu)

Overall objectives

- Screen herbicides for safety on desirable native grasses and forbs
- Work is being done in both field and greenhouse systems

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Materials and methods
Greenhouse screening

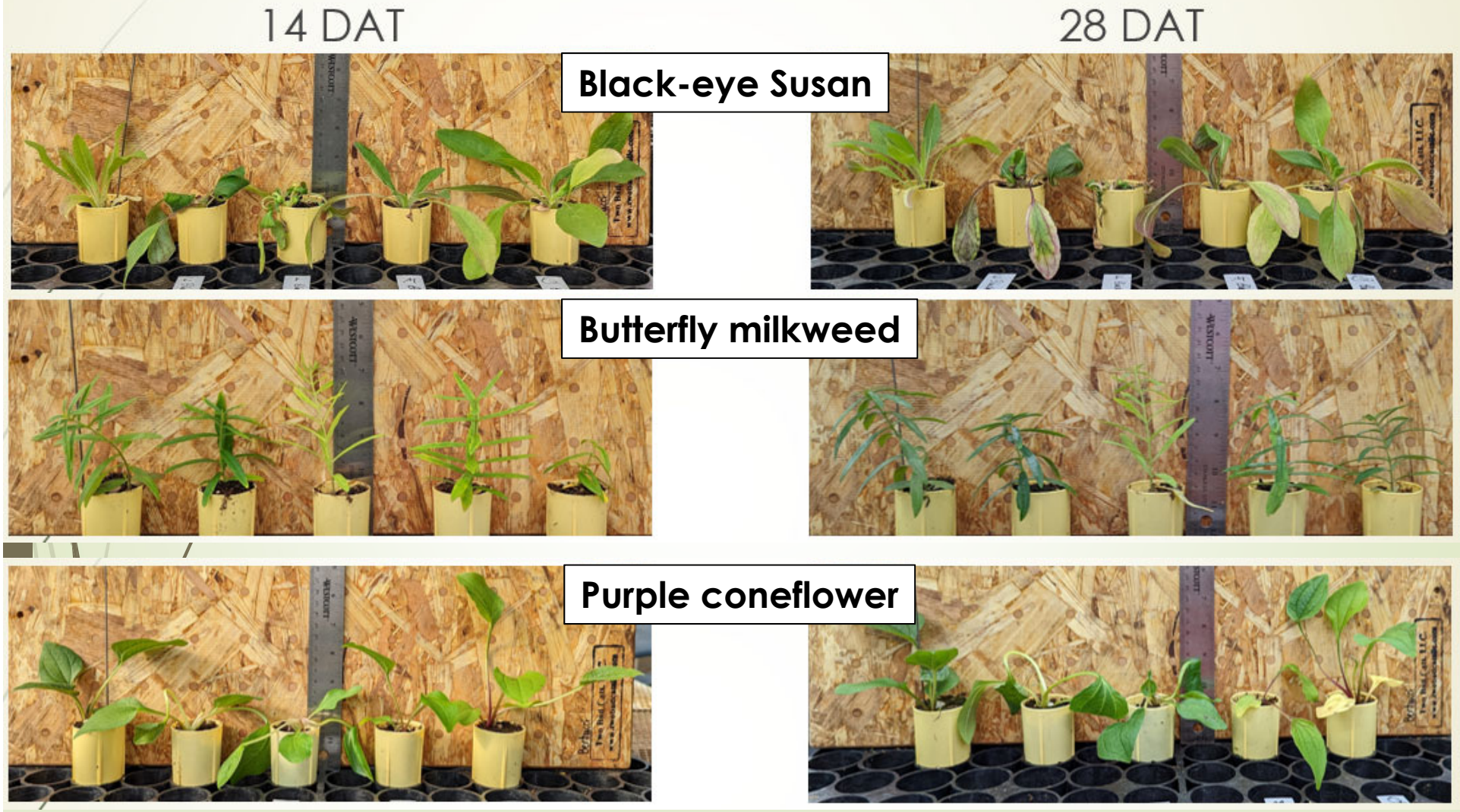
5 Plant Species

- **Forbs**
  - *Asclepias tuberosa* L. - Butterfly milkweed
  - *Echinacea purpurea* [L.] Moench - Purple coneflower
  - *Rudbeckia hirta* L. - Black-eyed Susan
- **Grasses**
  - *Buchloe dactyloides* [Nutt.] Engelm. - Buffalograss
  - *Panicum virgatum* L. – Switchgrass

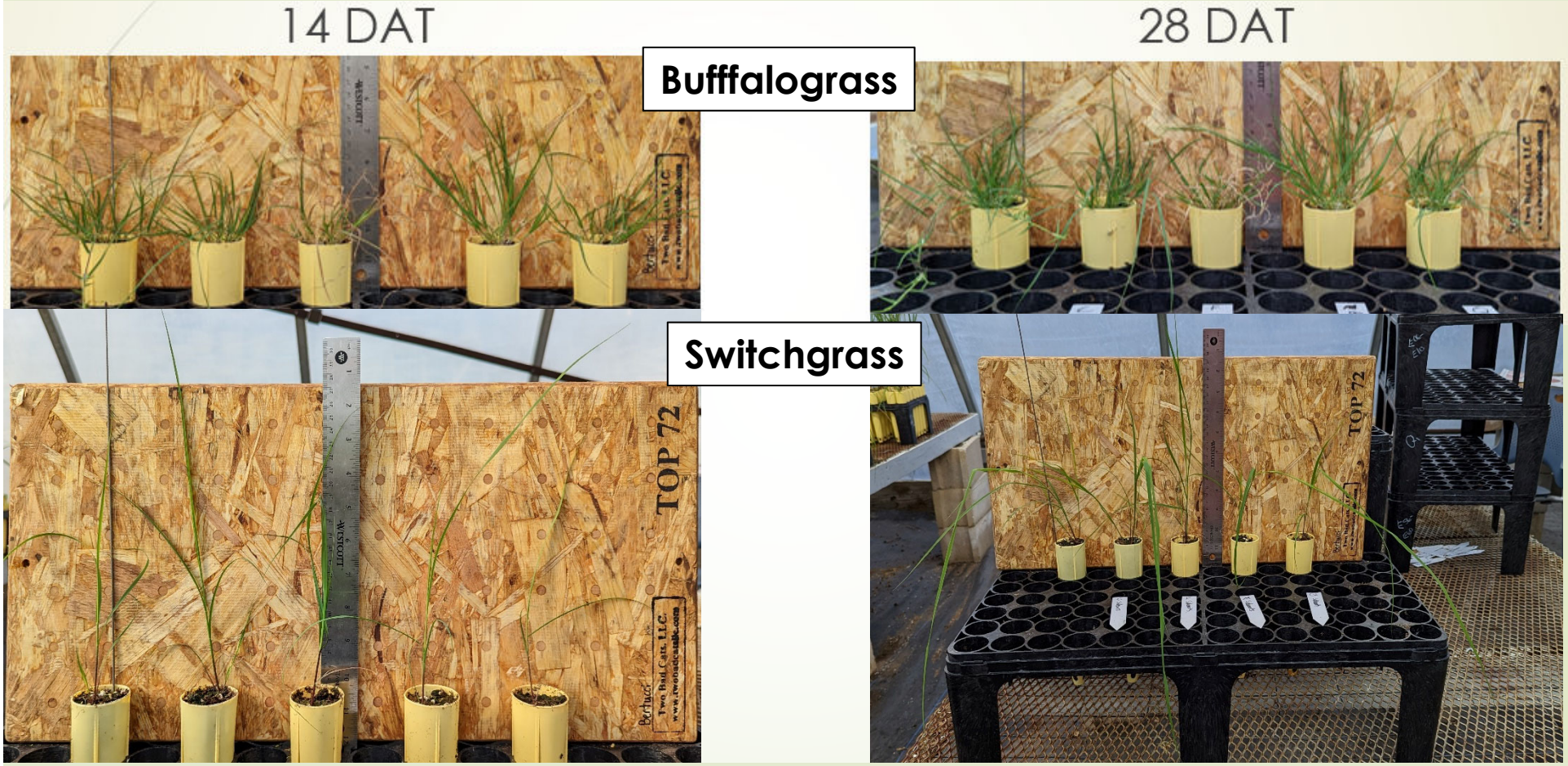
5 Herbicide Treatments

- Untreated Check
- Clopyralid (Stinger, Sonora, Reclaim, etc.) - auxin
- Florpyrauxifen-benzyl (Rinskor) - auxin
- Quinclorac (Drive, Facet, Quinstar, etc.) - auxin
- Metsulfuron (Patriot, MSM, Escort, etc.) – inhibits cell division

Observations from initial screening trials



Observations from initial screening trials



UTC Rinskor Drive Stinger MSM

UTC Rinskor Drive Stinger MSM

Initial observations

- Initial field screenings were also unsuccessful in 2022 due to poor establishment of field trials
- Several species are tolerant to herbicides in greenhouse screening, even at early growth stages (4-6 weeks after seeding)
  - Florpyrauxifen-benzyl (Rinscor), a synthetic auxin, had the most significant negative effects

Determine effect of management strategies on sustainability of native prairie mixtures

- Lead investigator – Dr. Dirk Phillip
- Three trial sites established with 3 grass/forb mixtures in Fayetteville
  - Wet site, dry site, and good soil
- Management treatments
  - a single, late August mowing
  - mowing in both early June and late August
  - burning in late fall
- **DATA Collection will begin in 2023**

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Pollinator value of native prairie mixtures on roadsides in Arkansas

- Lead investigator - Dr. Neel Joshi
- Assess the aesthetics and pollinator value of various prairie seed mixtures at roadside locations across Arkansas
- Measured in terms of biodiversity
  - Vane traps
  - Pan traps
  - Hand-net collection
  - Timed visual observation

- **DATA Collection will begin in 2023**

Thanks to a bunch of folks that have really helped with this project…

Joe Ledvina
Katy Ewing

Welcome to the University of Arkansas Herbarium

Jennifer Ogle

Theo Witsell

Jay Randolph

Ryan Deiner

Thanks to ARDOT for having me!!

Mike Richardson, University of Arkansas

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