Ecological Site Applications at Landscape Scales

Jonathan Haufler

EMRI

- Independent, non-profit institute providing large-scale conservation planning and implementation assistance to ecosystem management, biodiversity conservation, and landscape assessment initiatives

Ecosystem-based Emphasis

- Components:
  - Ecosystem distributions based on physical environment
    - Need for mapping of physical site similarities
  - Ecosystem (plant community) responses to historical disturbance processes
  - Ecosystem responses to anthropogenic influences

ESD Contributions

- In grass and shrub ecosystems, classification and mapping of ecological sites provides for the understanding of the inherent diversity of landscapes
- MLRA's help bound landscape considerations
- State and transition models allow for effects of historical disturbance processes to be described
- S&T models also allow for anthropogenic changes to be described

Example application of ESD's

- South Dakota Wildlife Action Plan (WAP)
- Sagebrush Mitigation Metrics
- Sagebrush Restoration Tool
- Lesser Prairie Chicken Management Plan for Oklahoma
- Blackfoot Watershed Montana Terrestrial Ecosystem Assessment

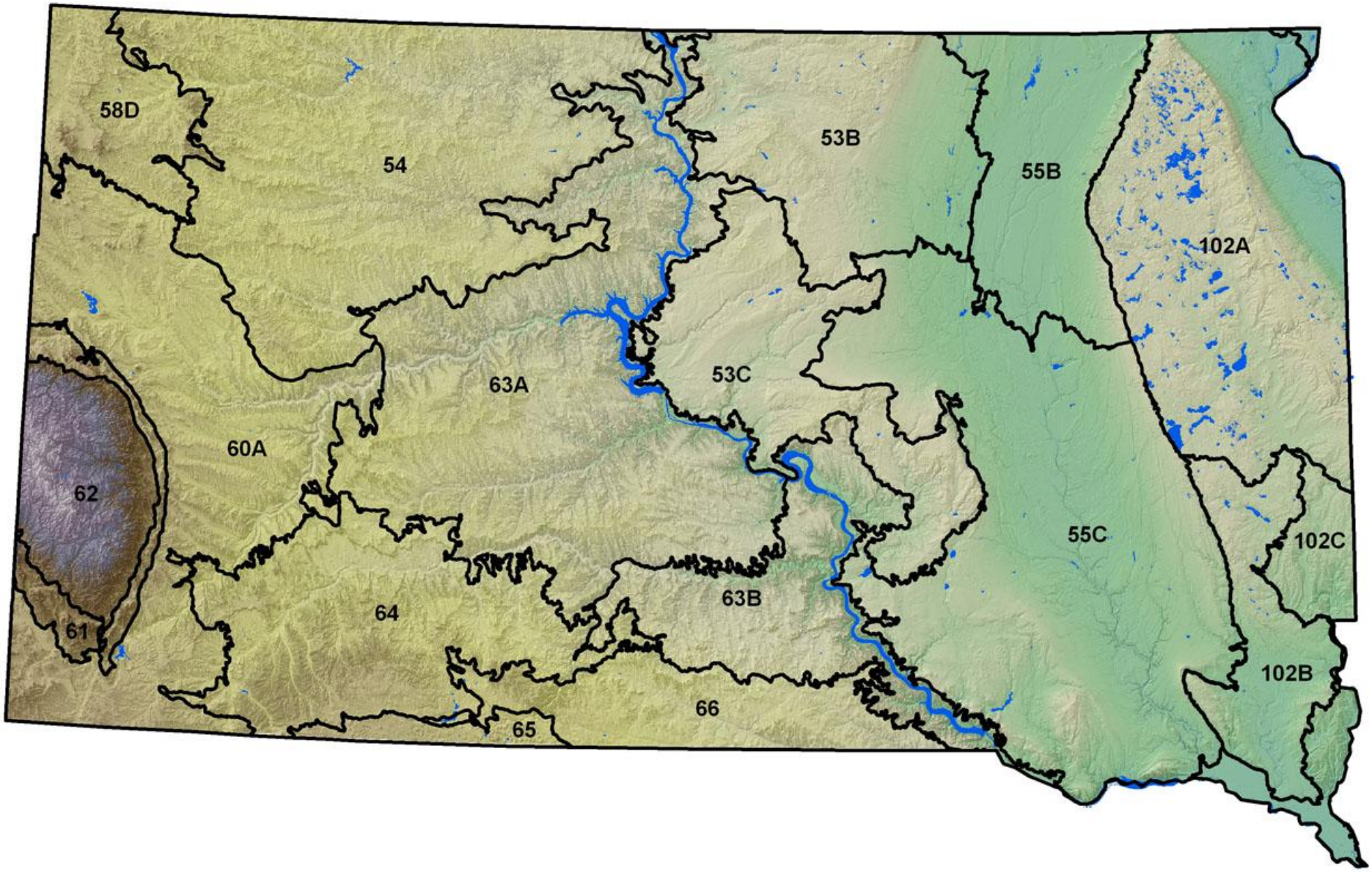
SD WAP

- Addresses conservation planning by focusing on ecosystem diversity
  - Maintain and restore 10% of each ecological site in conditions similar to predominant historical plant community
- Address Species of Greatest Conservation Need in relation ecosystem diversity
  - Link species habitat needs to ecological sites and plant communities

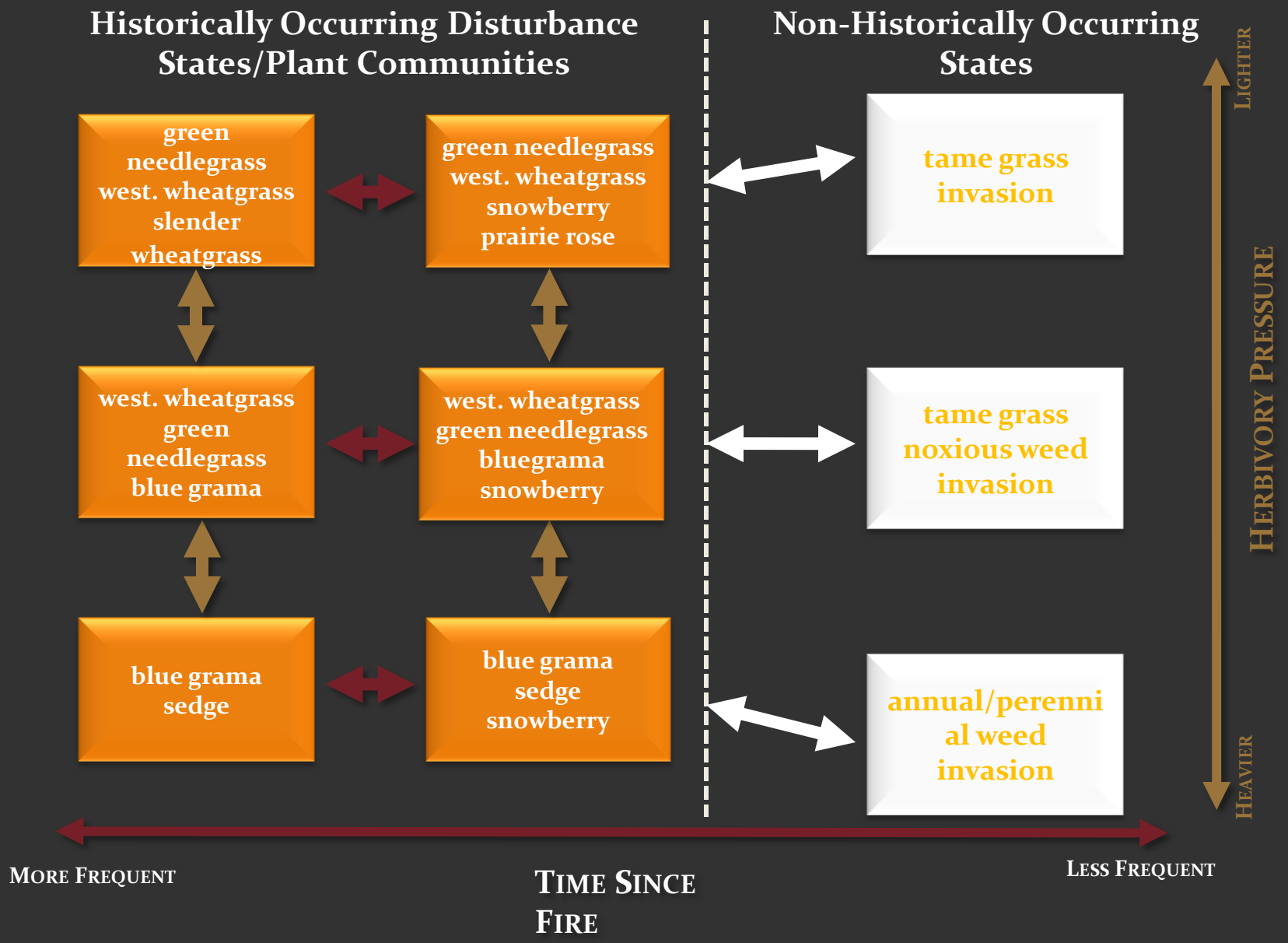
Goal of Approach

- Provide adequate amounts of all SD native ecosystems to provide for the habitat needs for all species

Major Land Resource Areas of South Dakota



Loamy STM


Historically Occurring Disturbance States/Plant Communities
Non-Historically Occurring States
green needlegrass west. wheatgrass slender wheatgrass
green needlegrass west. wheatgrass snowberry prairie rose
tame grass invasion
west. wheatgrass green needlegrass blue grama
west. wheatgrass green needlegrass bluegrama snowberry
tame grass noxious weed invasion
blue grama sedge
blue grama sedge snowberry
annual/perennial weed invasion
Lighter
Herbivory Pressure
Heavier
More Frequent
Time Since Fire
Less Frequent

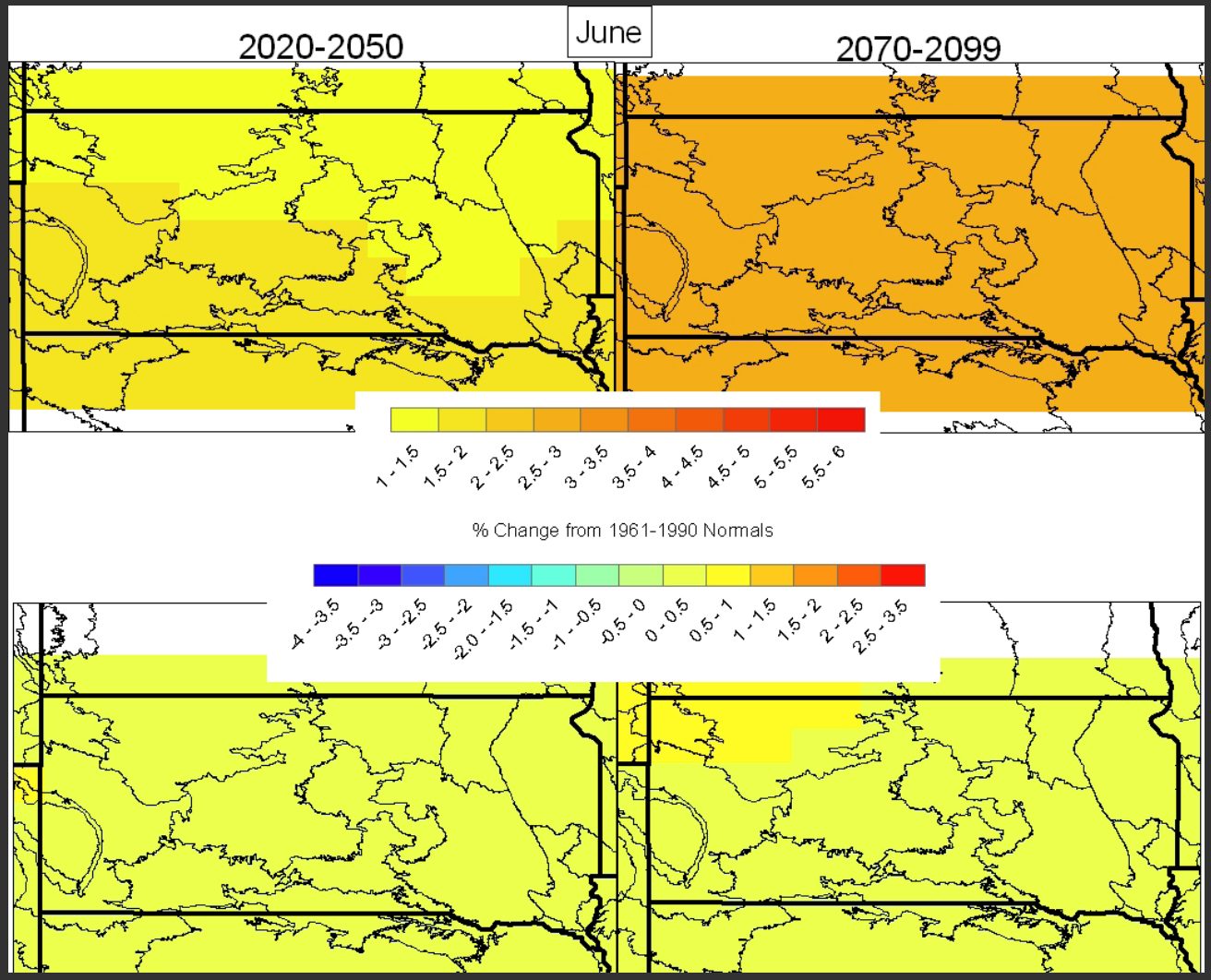
REFERENCE COMMUNITIES
Preferred Species Lists

CLAYEY	LOAMY	SANDY
western wheatgrass	**green needlegrass**	**prairie sandreed**
green needlegrass	**needleandthread**	**needleandthread**
big bluestem	**western wheatgrass**	**sideoats grama**
shortbristle needleandthread	**big bluestem**	**big bluestem**
blue grama	slender wheatgrass	slender wheatgrass
thickspike wheatgrass	porcupine grass	western wheatgrass
sideoats grama	little bluestem	green needlegrass
porcupine grass	sideoats grama	threadleaf sedge
slender wheatgrass	bearded wheatgrass	sand bluestem
needleandthread	shortbristle needleandthread	blue grama
prairie dropseed	needleleaf sedge	hairy grama
buffalograss	threadleaf sedge	porcupine grass
plains muhly	plains reedgrass	little bluestem
white sagebrush	blue grama	leadplant
plains reedgrass	prairie dropseed	sun sedge
prairie Junegrass	prairie Junegrass	Cuman ragweed
goldenrod	western snowberry	tarragon
western yarrow	western yarrow	prairie sagewort
prairie sagewort	prairie sagewort	white sagebrush

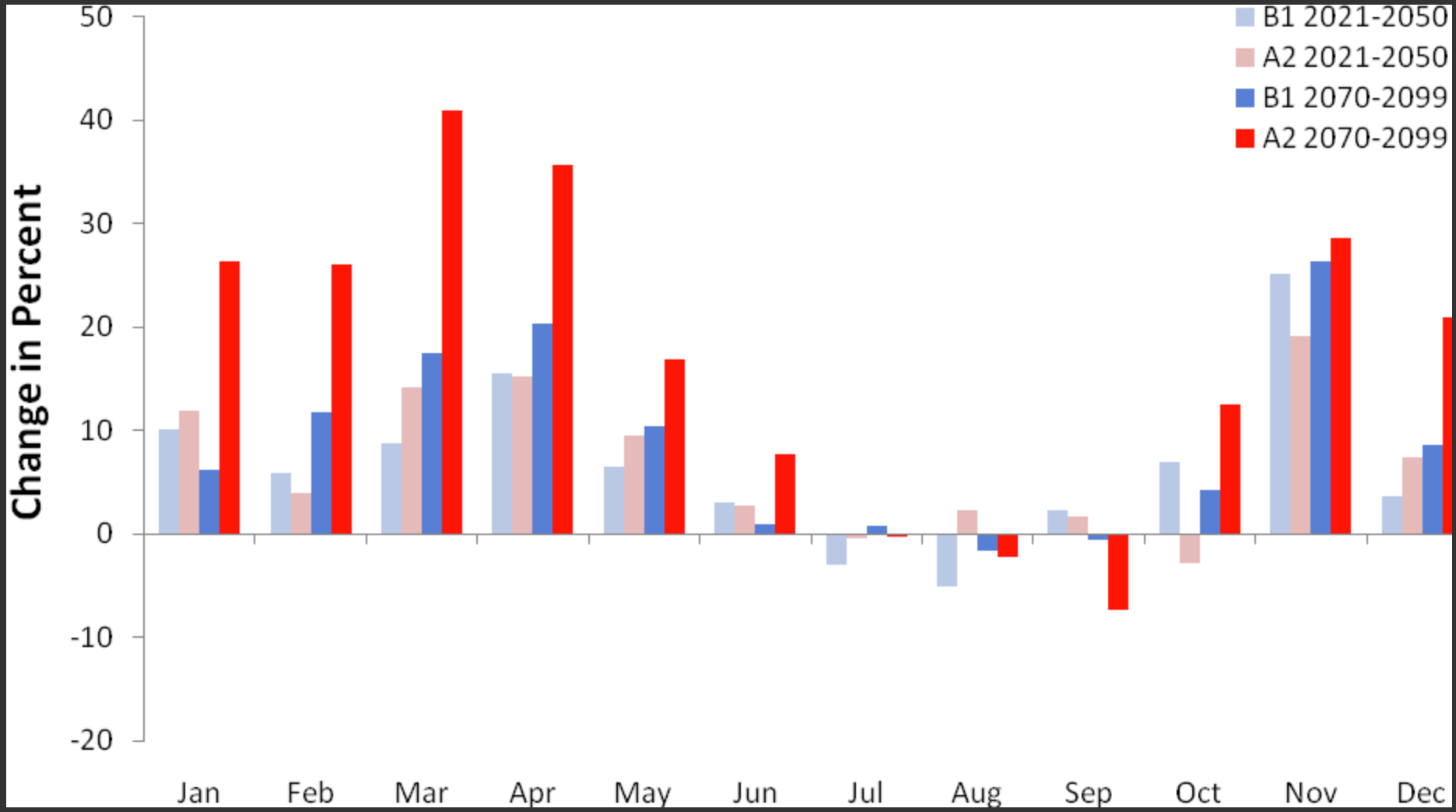
Clayey Ecological Sites, Short Fire Return, Light Grazing, Missouri Coteau

Fire Return Interval: averaging less than 15 years
Grazing: long-term light grazing (25-35% utilization)
Dominant Species: *grasses* - western wheatgrass, green needlegrass, and porcupine grass; *forbs* – white sagebrush, goldenrod, scurfpea, purple locoweed, scarlet globemallow, and western yarrow.
Other Characteristic Species: shortbristle needle-and-thread, prairie dropseed, sideoats grama, and big bluestem
Productivity Estimate: range = 1,300 to 3100 lbs/acre; representative value = 2,300 lbs/acre
Structure: mixed grasses, 11-20" average vegetation heights

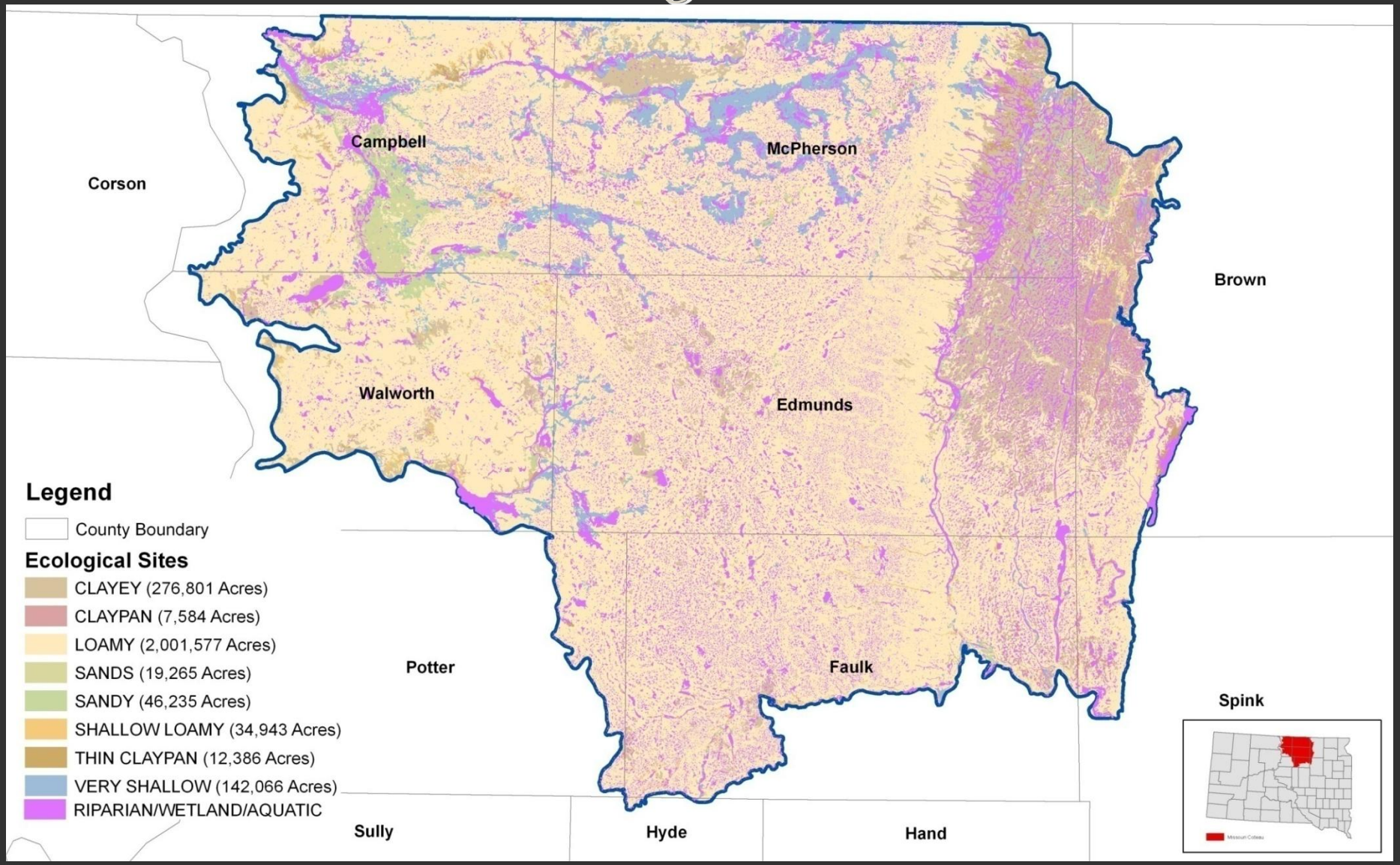
Adjust for climate change



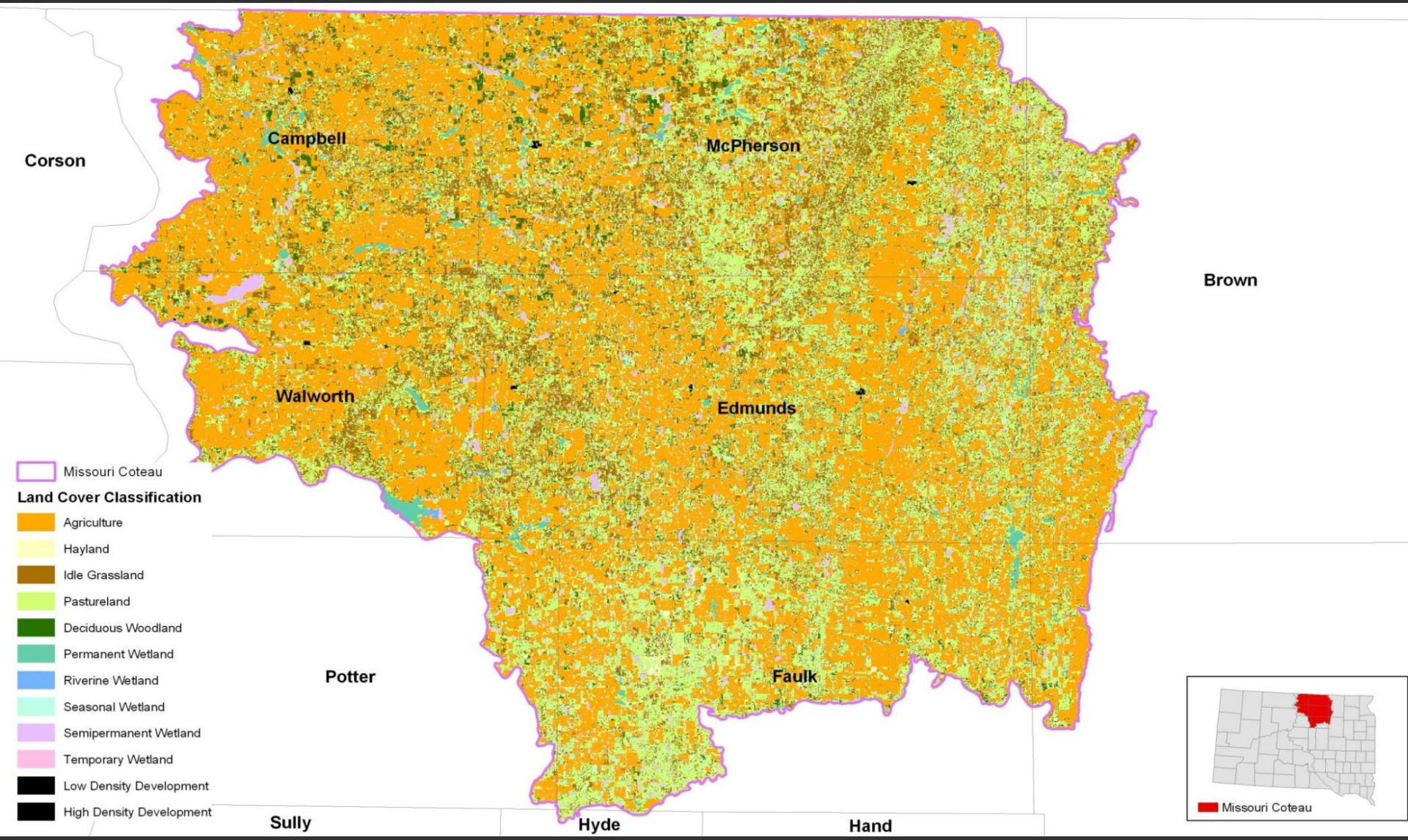
Precipitation change for MLRA 53B



Ecological Sites - Missouri Coteau ecoregion



GAP Land Cover Classification



Ecological Sites x Corrected GAP

Ecological Site	Total Acres	Corrected GAP Grasslands Acres
Clayey	271,298	96,342 (-32%)
Claypan	36,360	15,521 (-31%)
Thin Claypan	12,386	5,670 (-24%)
Loamy	2,001,577	225,854 (-68%)
Shallow Loamy	34,943	18,553 (-18%)
Sandy	46,235	16,730 (-37%)
Sands	19,265	4,210 (-56%)
Very Shallow	142,066	56,928 (-28%)

Species of Greatest Conservation Need

Table 4.1. List of species of greatest conservation need developed for the South Dakota Comprehensive Wildlife Plan.

Scientific Name	Common Name	Selection Code
BIRDS		
Pelecanus erythrorhynchos	American White Pelican	2
Cygnus buccinator	Trumpeter Swan	2
Pandion haliaetus	Osprey	1
Haliaeetus leucocephalus	Bald Eagle	1
Accipiter gentilis	Northern Goshawk	3
Buteo regalis	Ferruginous Hawk	3
Falco peregrinus	Peregrine Falcon	1
Centrocercus urophasianus	Greater Sage-Grouse	3
Tympanuchus cupido	Greater Prairie-Chicken	2
Grus americana	Whooping Crane	1
Charadrius melodus	Piping Plover	1
Catoptrophorus semipalmatus	Willet	2
Numenius americanus	Long-billed Curlew	2
Limosa fedoa	Marbled Godwit	
Phalaropus tricolor	Wilson's Phala	
Sterna antillarum athalassos	Interior Le	
Chlidonias niger	Black	
Athene cunicularia	Burrowing	
Melanerpes lewis	Lewis's Woodpecker	
Picoides dorsalis	American Three-toed Woodpecker	3
Picoides arcticus	Black-backed Woodpecker	3
Cinclus mexicanus	American Dipper	1
Anthus spragueii	Sprague's Pipit	2
Calamospiza melanocorys	Lark Bunting	2
Ammodramus bairdii	Baird's Sparrow	2
Ammodramus leconteii	Le Conte's Sparrow	3
Junco hyemalis aikeni	White-winged Junco	2
Calcarius ornatus	Chestnut-collared Longspur	2
MAMMALS		
Myotis thysanodes pahasapensis	fringe-tailed myotis	2
Myotis septentrionalis	northern myotis	3
Corynorhinus townsendii	Townsend's big-eared bat	3
Spermophilus franklinii	Franklin's ground squirrel	2

Chestnut-collared Longspur

Chestnut-collared Longspur

Habitat needs

- Native grass ecosystems
- Short and mid-statured grasses, particularly bunchgrasses
- Prefers heterogeneous grazed conditions
- Avoids dense litter accumulation
- Avoids shrubby areas

Loamy STM

torically Occurring Disturbance States

Non-Historically Occurring States

green needlegrass
west. wheatgrass
slender wheatgrass

green needlegrass
west. wheatgrass
west. snowberry
prairie rose

tame gras
invasion

west. wheatgrass
green needlegrass
blue grama

west. wheatgrass
green needlegrass
bluegrama
snowberry

tame grass
noxious weed
invasion

blue grama
sedge

blue grama
sedge
snowberry

annual/perenni
al weed
invasion

LIGHTER

GRAZING PRESSURE

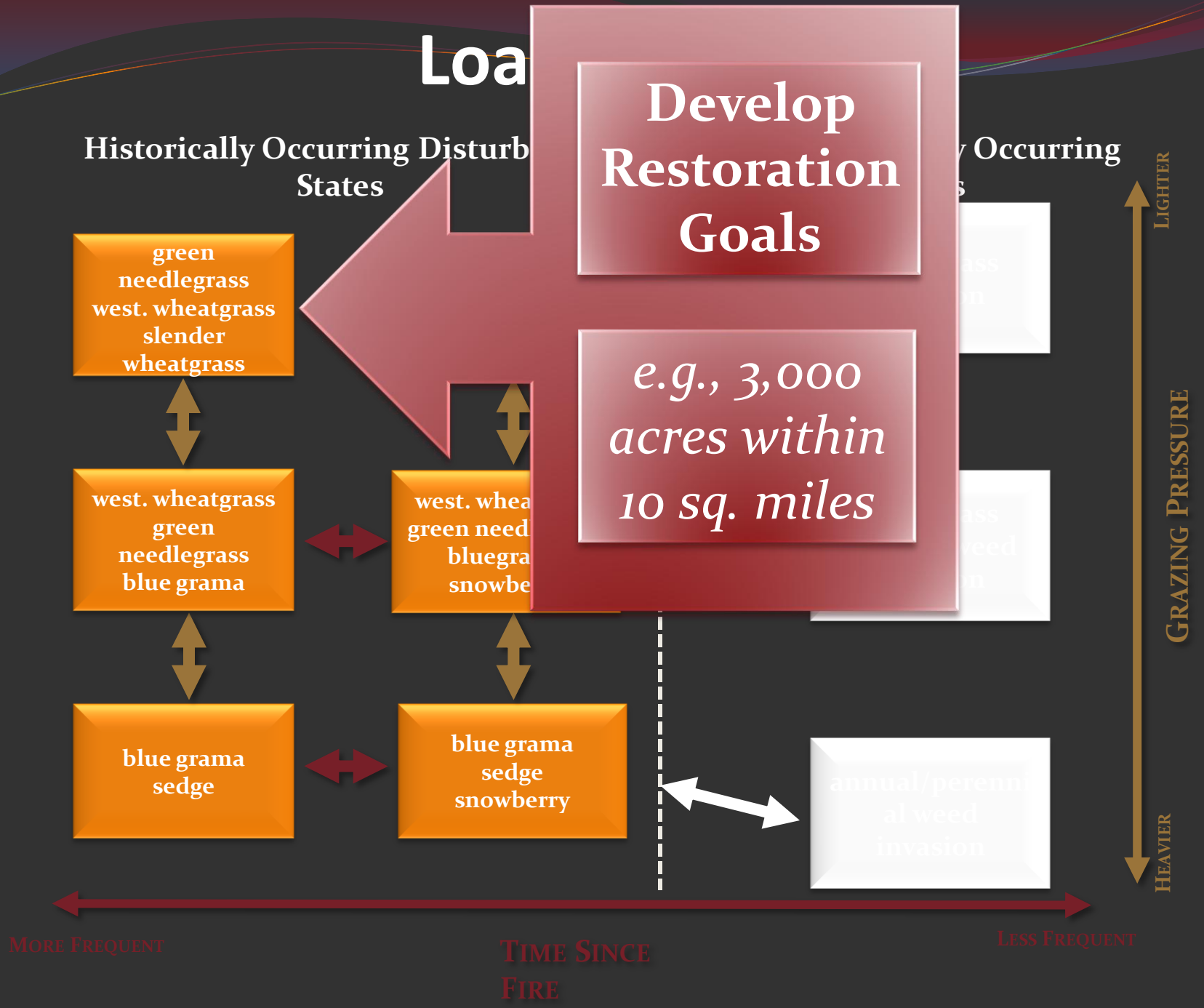
HEAVIER

MORE FREQUENT

TIME SINCE FIRE

LESS FREQUENT

Loa


Develop Restoration Goals
e.g., 3,000 acres within 10 sq. miles
Historically Occurring Disturb
States
y Occurring
s
green needlegrass west. wheatgrass slender wheatgrass
west. wheatgrass green needlegrass blue grama
west. whea green need bluegra snowbe
blue grama sedge
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annual/perenn al weed invasion
Lighter
Grazing Pressure
Heavier
More Frequent
Time Since Fire
Less Frequent

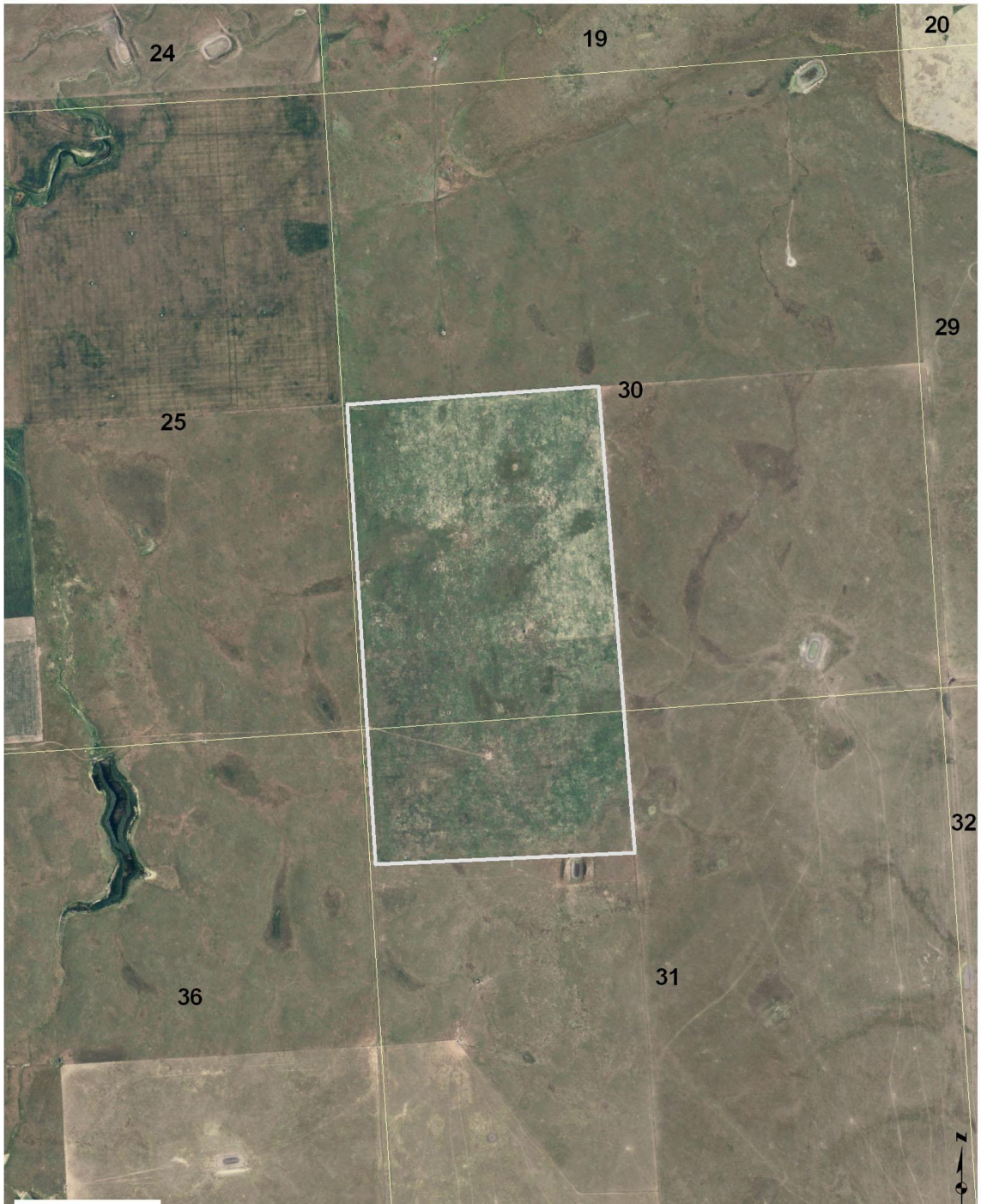
Identify best conservation areas

- Combining factors:
  - Ecological site distributions
  - Past disturbance/ existing conditions
  - Land ownership
  - Projected climate change
  - Other

Web-based Planning Tool

- Identify WAP priorities and their general locations
- Click on any location to see a reference plant community description
- Links back to what species would be helped through site improvements

Faulstich Property



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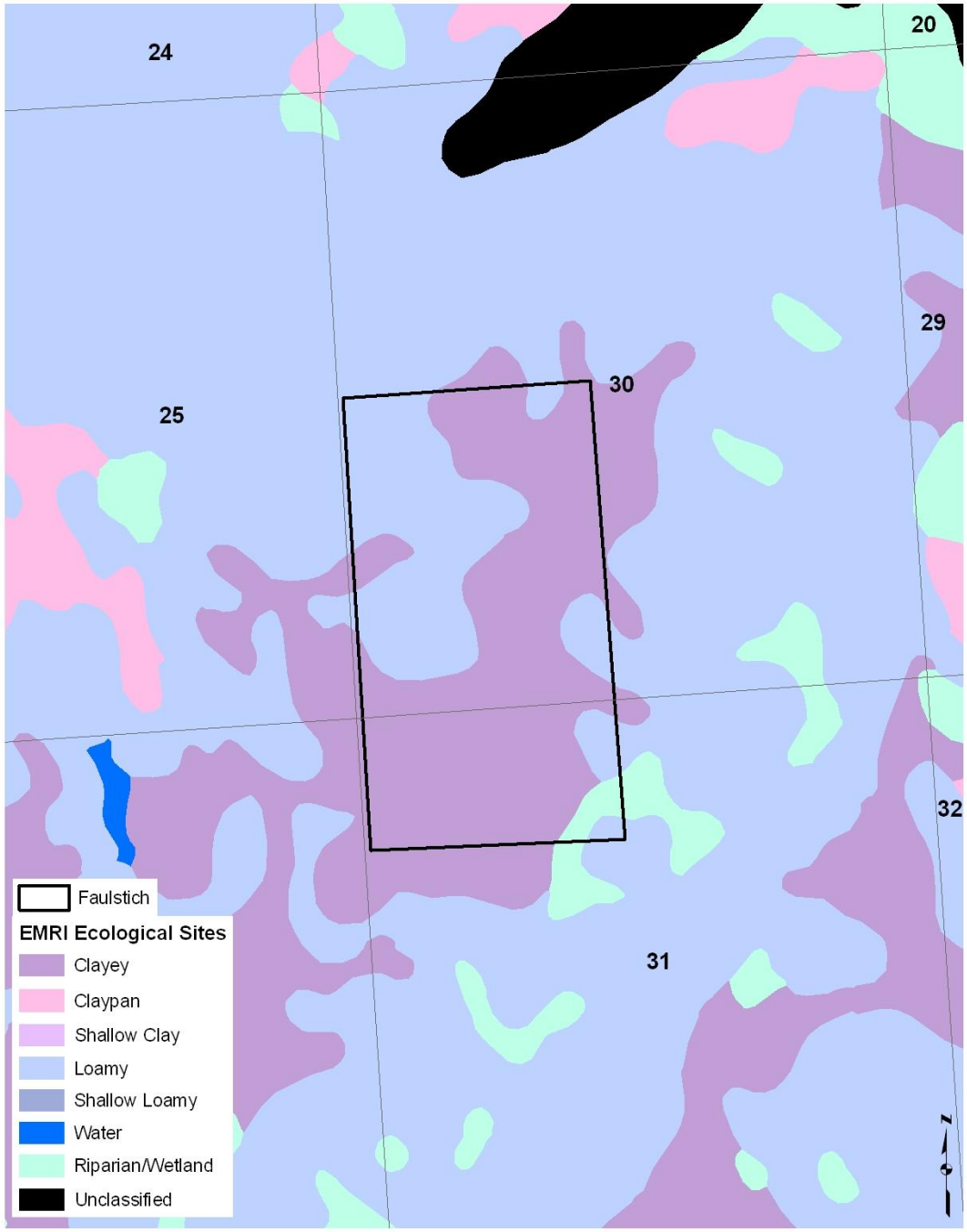

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Productivity Estimate: range = 1,300 to 3100 lbs/acre; representative value = 2,300 lbs/acre
Structure: mixed grasses, 11-20" average vegetation heights

Implementation

- Existing conditions:
  - Kentucky bluegrass and big and little bluestem dominated pasture
- Desired condition:
  - Big and little bluestem, with other native warm and cool season grasses and forbs
- Proposed treatments:
  - Early spring fire and/or herbicide treatment, early season grazing, rest late May- August.

Metrics for Off Site Mitigation Quantification in Sagebrush Ecosystems

NRCS CIG grant with numerous additional funding partners conducted by Haufler and Esgate

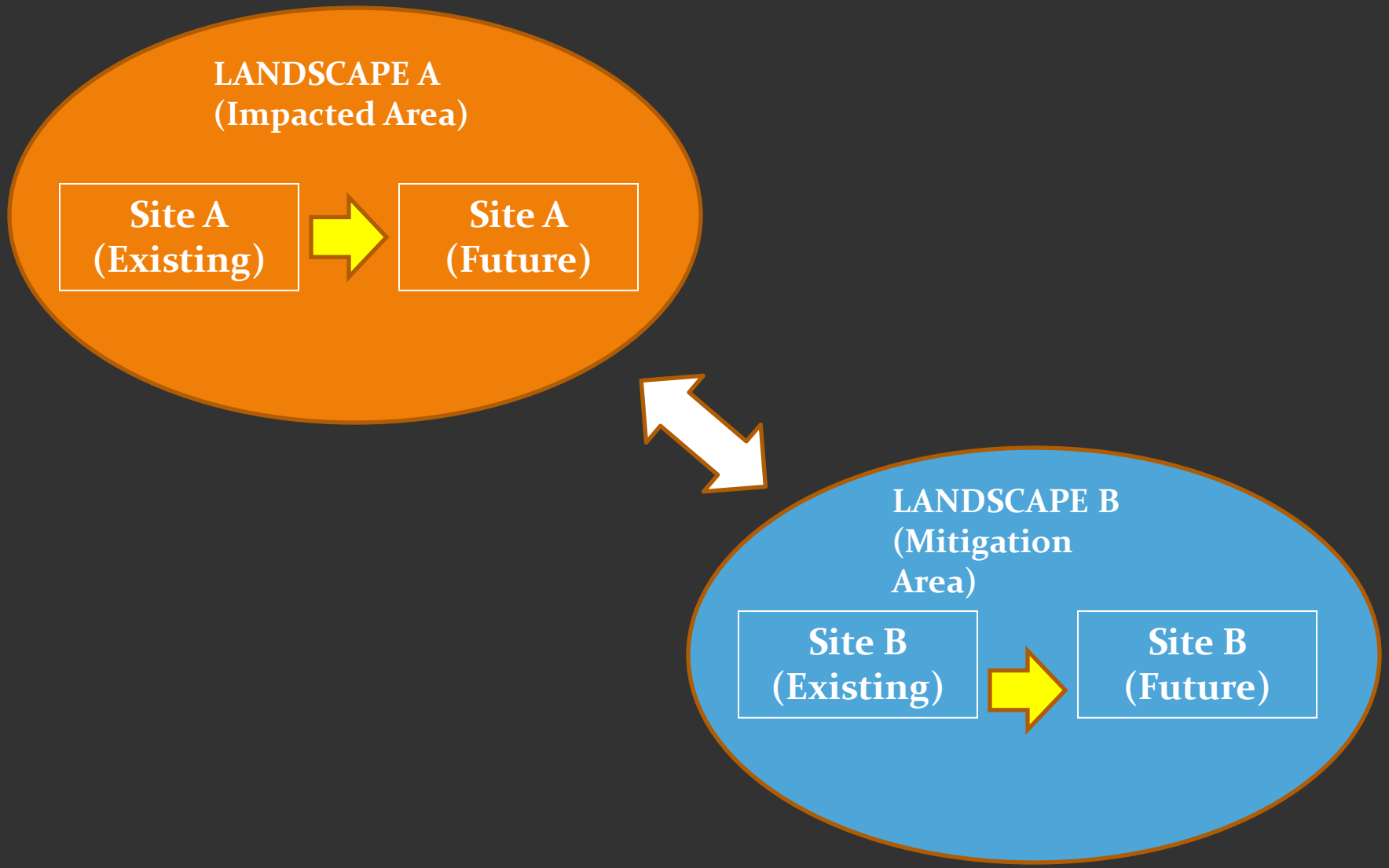
Develop and Test Metrics

- Metrics that can consistently quantify impacts and mitigation
  - Commensurate quantification of gains and losses

Scales to Measure

- Site level changes
  - Plant communities and site level ecosystem services
- Landscape influences
  - Wildlife responses

Credit Metric System



Site Considerations

- Ecological sites
  - Provide for equivalent comparisons
- Existing and future vegetation conditions
  - Compared to reference plant communities from ESD's
- Contributions to habitat of species
  - Evaluated through habitat models


Fidelity
Laidlaw Park
Ash Valley
TBGPEA
Anthro Mountain
Deadman Bench
Rock Springs
N
Miles
0 50 100 200 300 400


08/27/2010

Similarity indices for pre and post mitigation plots

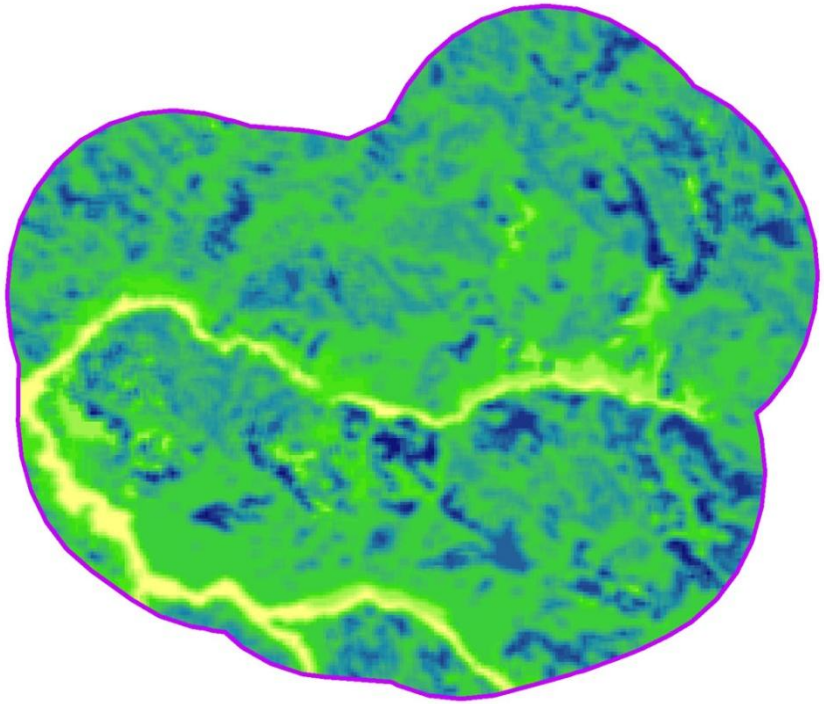
Pre-treatment		Post-treatment	
Loamy Ecological Site		**Loamy Ecological Site**	
Plot	Index	Plot	Index
1	72.78	1	93.43
2	46.11	2	81.77
4	79.54	4	86.57
5	71.72	5	81.96
10	85.62	10	96.27
11	76.17	11	84.03
12	52.59	12	90.50
MEAN	**69.22**	MEAN	**87.79**
STD ERR	5.46	STD ERR	2.16

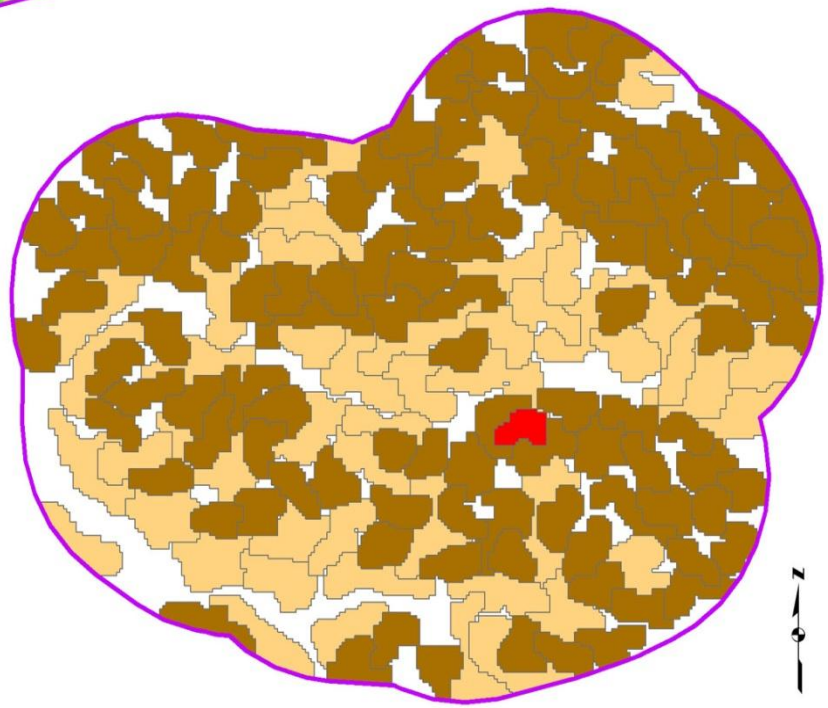
Benefits Produced

- Reduced invasive exotic species from 16.2% relative cover of vegetation to 1.9% relative cover
- Equated to a 10.8% improvement in site quality that produced a net gain of 39 mitigation “units” for 545 acres of loamy site and 83 mitigation “units” for 1157 acres of shallow loamy ecological site
- Can mitigate for impacts to similar sites being developed for energy

Habitat Suitability Index & Home Range Quality

Sage Thrasher





Modeling Area (1 mi. Buffer)

HSI Value

High : 100

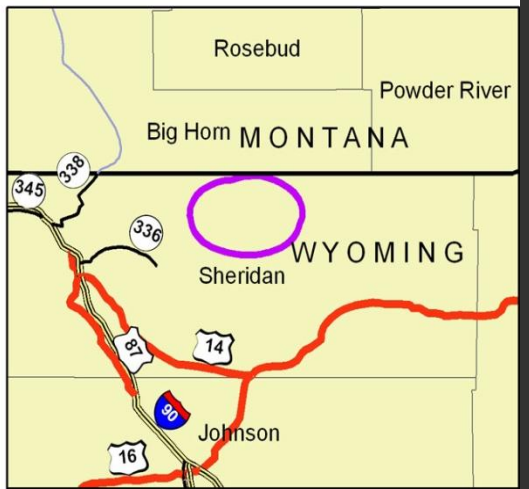
Low : 0

Mean HSI

Low (<0.5-0.25)

Medium (<0.75-0.5)

High (≥0.75)



Miles

0 0.5 1 2

N

Species	Pre-High*	Pre-Medium	Pre-Low	Post-High	Post-Medium	Post-Low
Pronghorn antelope	0	1	28	0	2	27
Sage thrasher	1	114	47	10	135	49
Sagebrush lizard	0	0	2449	0	0	1983
Sage sparrow	1	37	164	0	34	178
Sagebrush vole	30	3789	958	573	3708	730
Sage grouse- nesting	91	1015	958	79	1106	2384
Sage grouse brood-rearing	151	650	69	103	765	81
Sage grouse-wintering	0	6	106	0	6	109

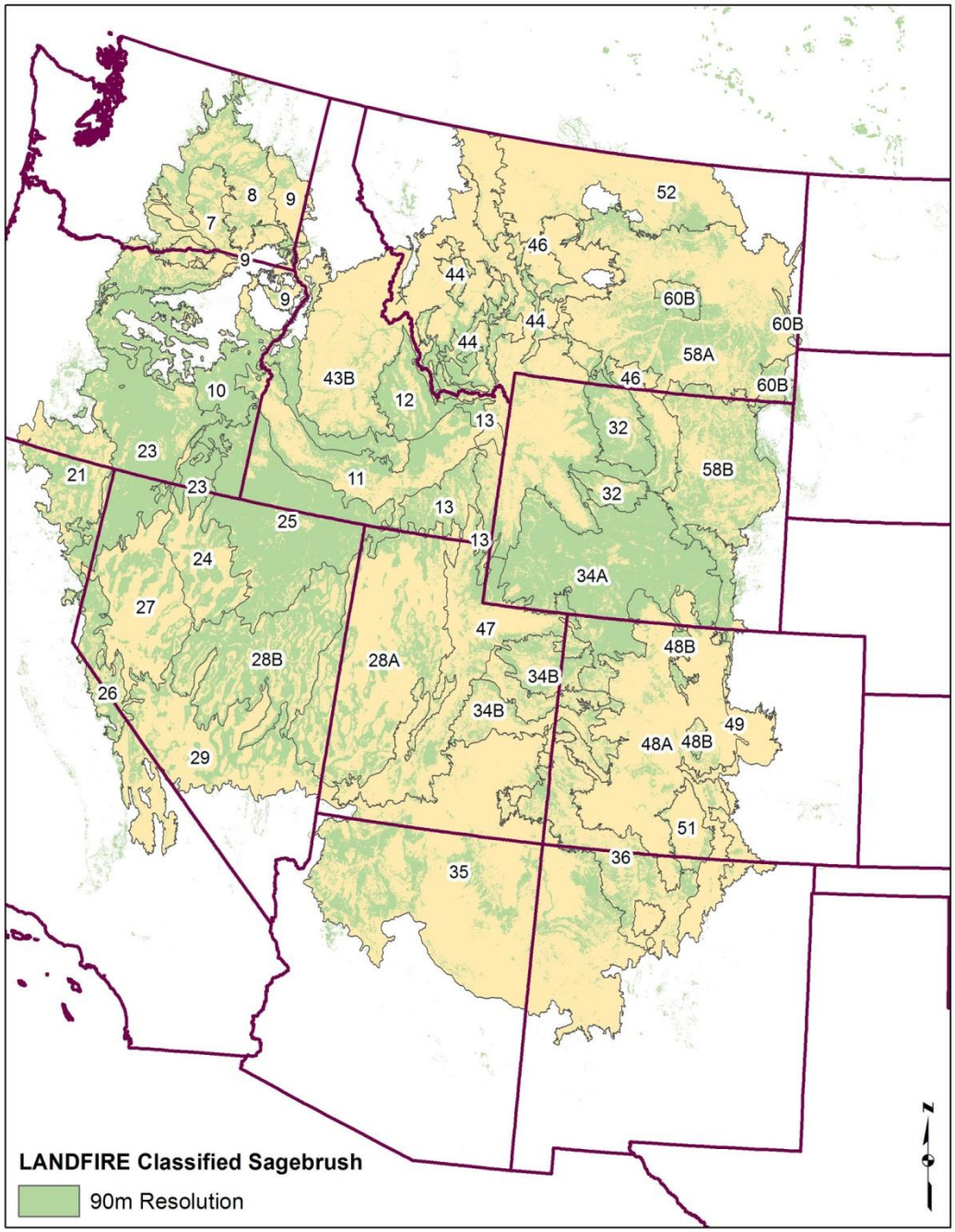
Sagebrush Planning Tool

An NRCS CIG project being conducted by EMRI

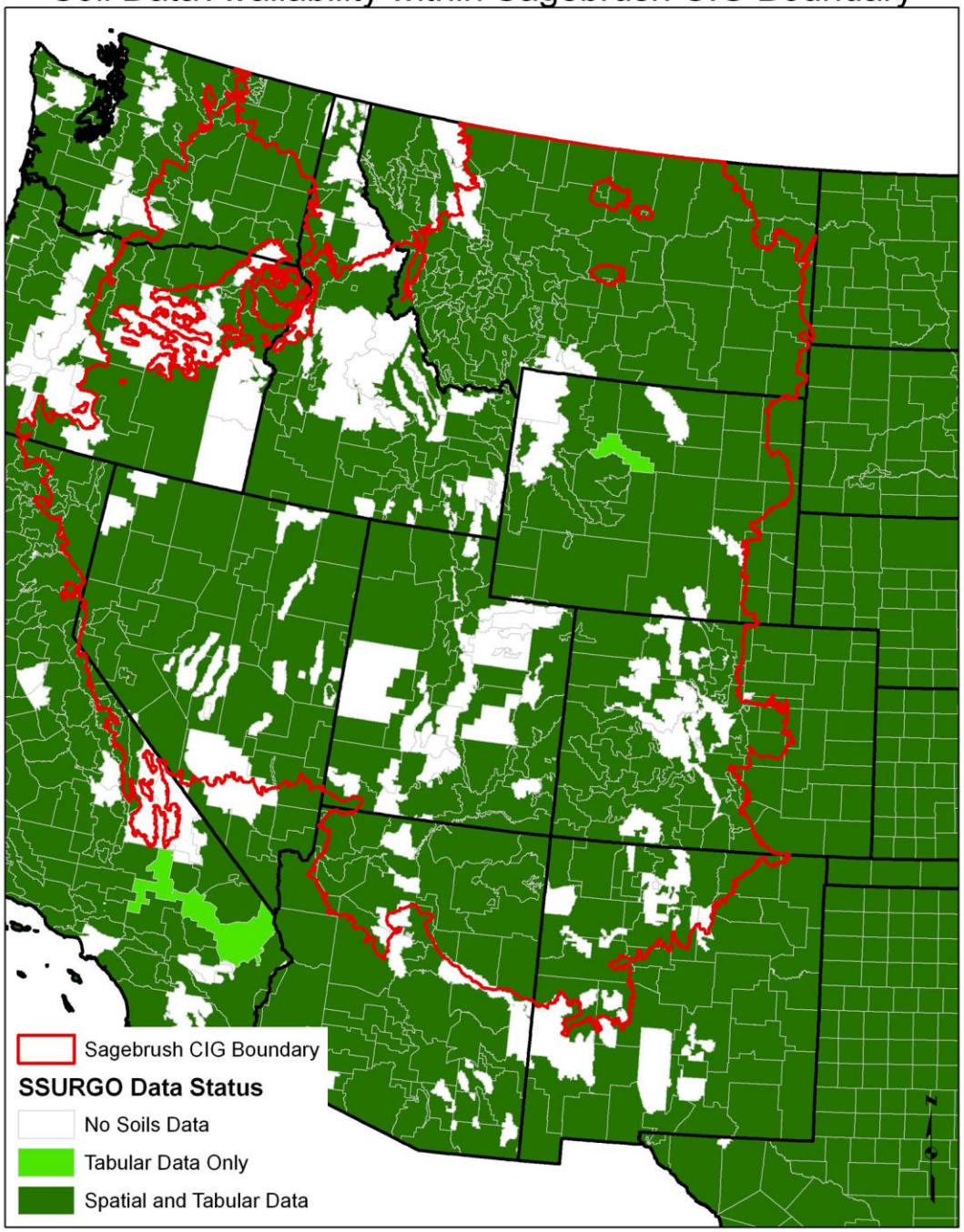
Objective

- Develop a web-based planning tool that will identify the desired plant community to restore at any selected site within the sagebrush biome that has been adjusted for predicted effects of climate change and will maximize benefits to sage-grouse and other sagebrush associated species.

MLRAs in the Sagebrush Biome



Soil Data Availability within Sagebrush CIG Boundary



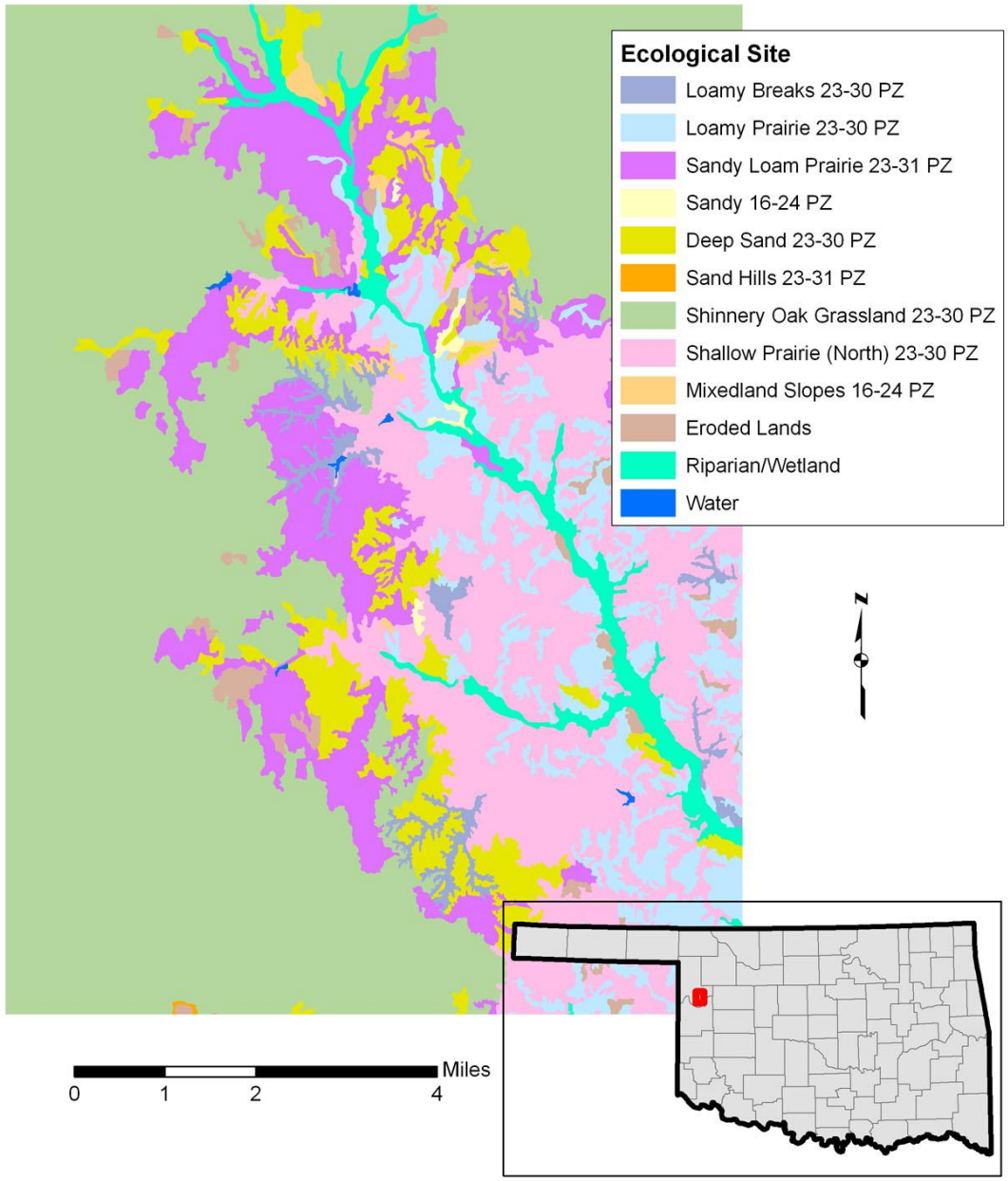
Ecological Site Contributions

- Locations of inherent conditions for plant communities
- Reference plant community(ies)
- Basis for adjustments for predicted climate change
- Potential of site to contribute to sage-grouse or other species habitat needs
- State and transition models to help guide management/restoration treatments
- Framework for mitigation quantification

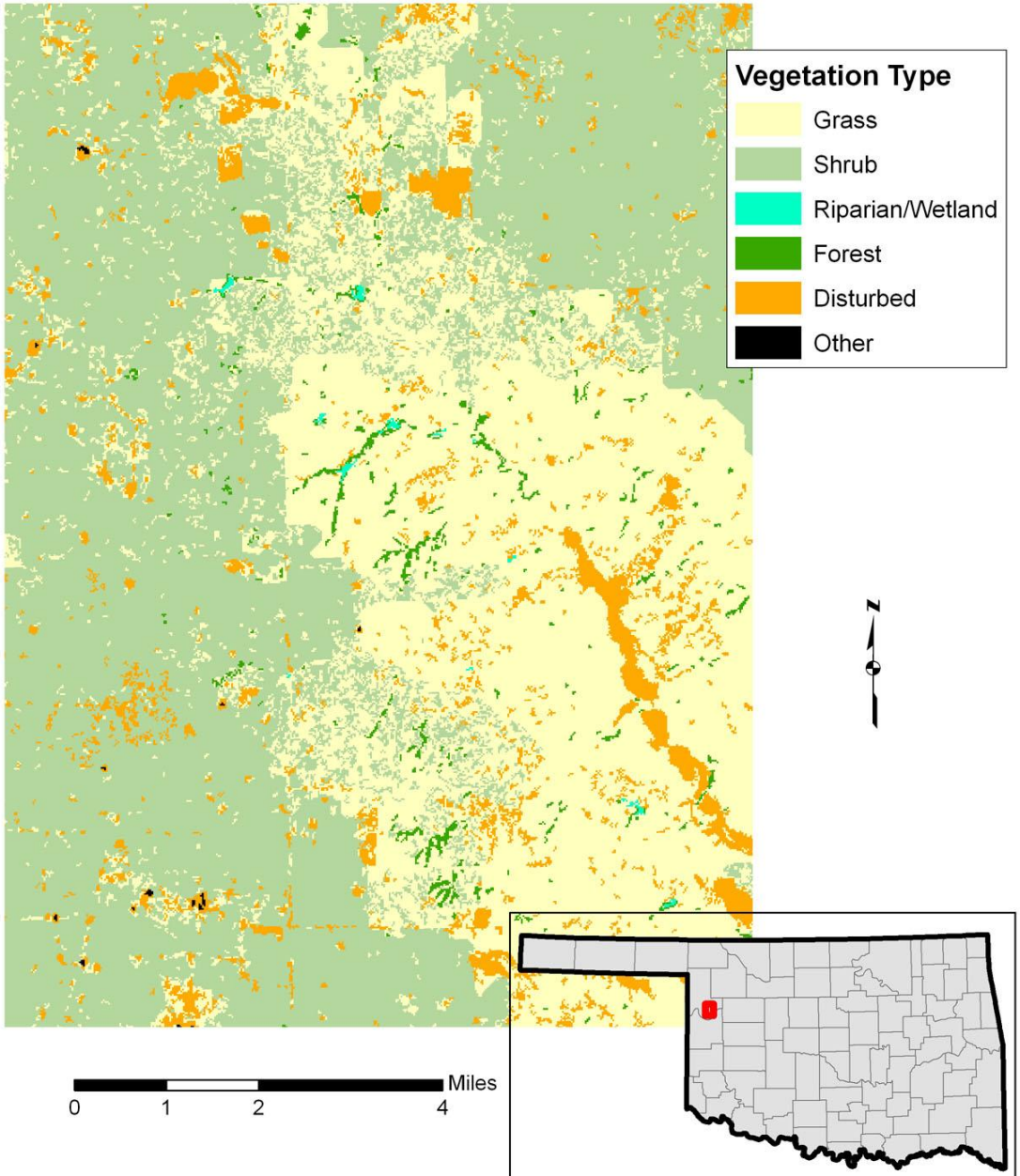
Development of Lesser Prairie Chicken Management Plan for Oklahoma

OK Dept. of Wildlife Conservation

Ecological Sites in a Portion of Ellis County, OK

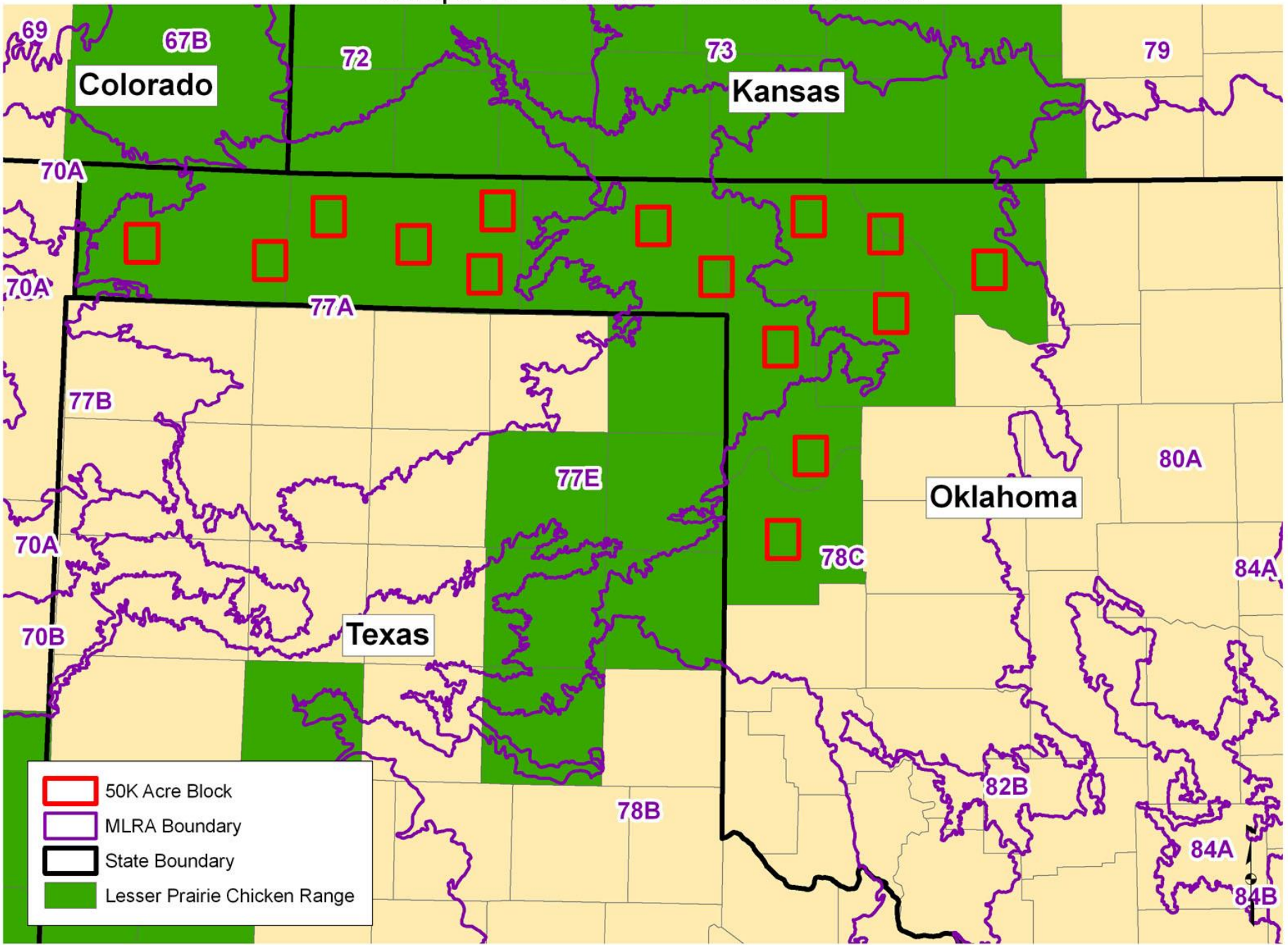


Vegetation Types in a Portion of Ellis County, OK



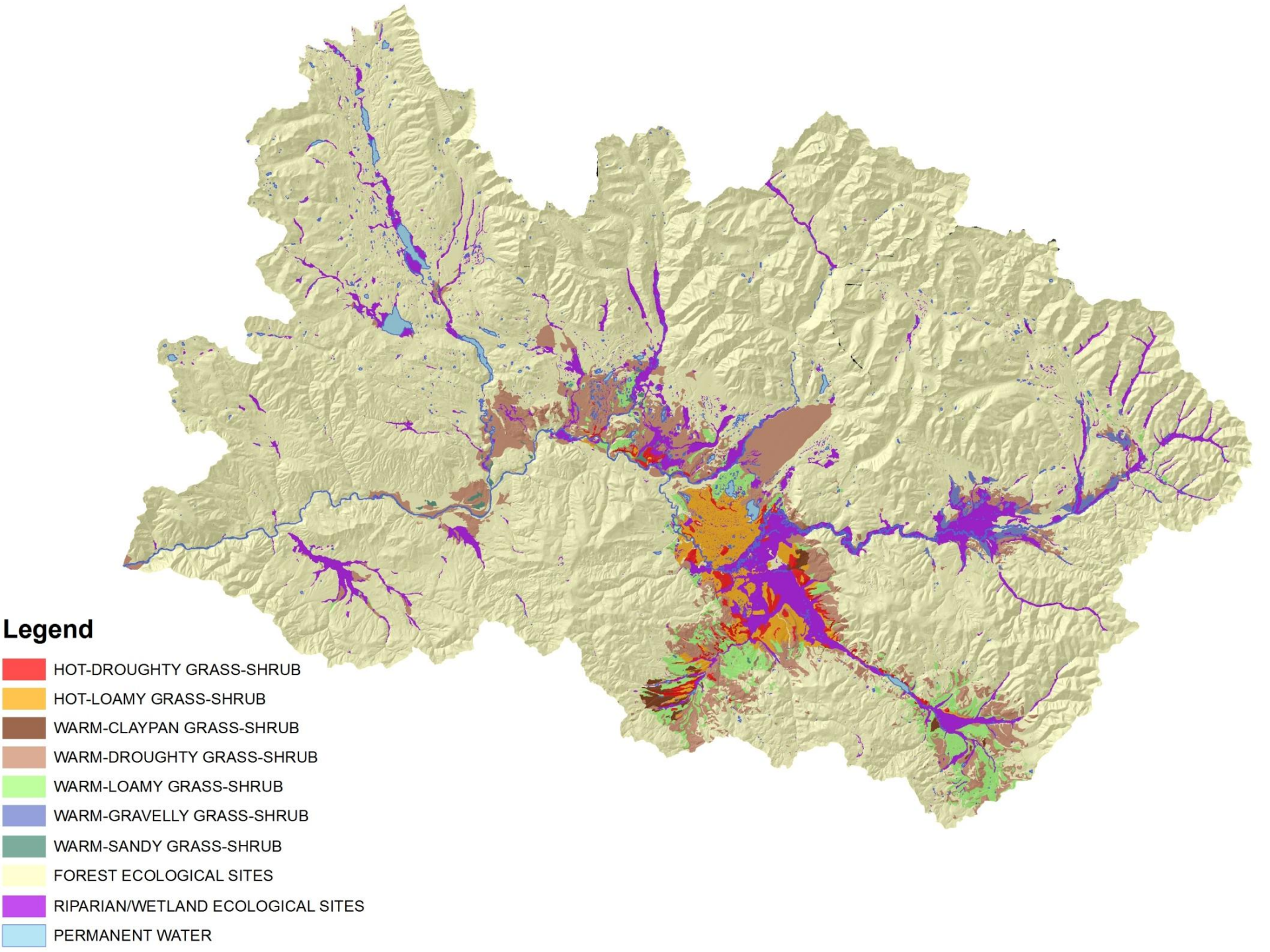
MLRA	Ecological Site	Precip. Zone-inches	Productivity Lbs/ac	Nest Value 1-10	Brood Value 1-10	Winter Value 1-10	Acres in OK	Conversion In OK %
70A	Shallow upland	14-16	376-1034	3	4	3	2,112	<1
70A	Shallow sandstone	14-16	424-1504	5	5	5	56,781	<1
70A	Malpais upland	14-16	650-1500	5	5	5	817	<1
70A	Malpais breaks	14-16	612-1316	5	5	5	46,054	<1
77A	Deep hardland	16-22	885-1890	2	2	2	1,445,363	74
77A	Draw	16-22	2765-4530	5	5	5	41,567	9
77A	Playa	16-22	1400-3000	1	4	4	10,303	98
77A	Limy upland	16-22	1085-1905	3	3	3	258,800	89
77A	Sand hills	16-22	1260-1760	10	9	9	8,488	<1
77A	Sandy loam	16-22	1400-1800	7	7	7	396,686	88
77A	Very shallow	16-22	590-1180	4	4	4	75,549	9
77A	Sandy	16-22	1400-1700	10	9	9	398,236	31

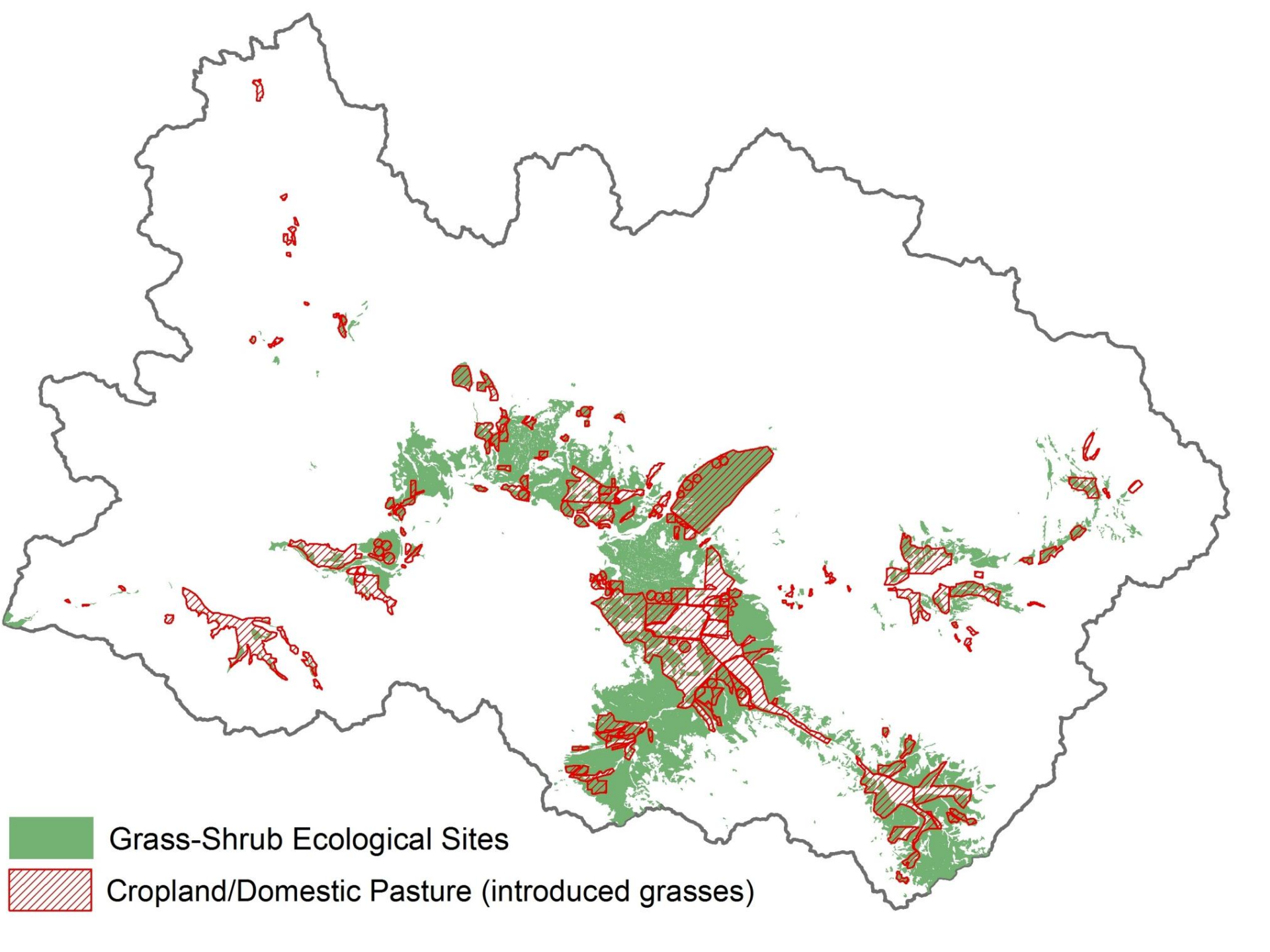
Example LPC Habitat Restoration Blocks



Assessment of Terrestrial Ecosystems in the Blackfoot Watershed.

NRCS MT CIG project


Legend
HOT-DROUGHTY GRASS-SHRUB
HOT-LOAMY GRASS-SHRUB
WARM-CLAYPAN GRASS-SHRUB
WARM-DROUGHTY GRASS-SHRUB
WARM-LOAMY GRASS-SHRUB
WARM-GRAVELLY GRASS-SHRUB
WARM-SANDY GRASS-SHRUB
FOREST ECOLOGICAL SITES
RIPARIAN/WETLAND ECOLOGICAL SITES
PERMANENT WATER


Grass-Shrub Ecological Sites
Cropland/Domestic Pasture (introduced grasses)

% Direct Conversion of Grass-Shrub Ecological Sites

Cropland/Non-native Pasture	5,353	14,680	44,796	13,031	1,054	1,563	3,591
Town/Residential Development	14	51	1,006	31	32	0	61
Rural Farm Development	75	69	393	93	9	3	35
Roads	114	105	452	142	33	2	49
Total acres converted	**5,556**	**14,905**	**46,647**	**13,297**	**1,128**	**1,568**	**3,736**
% of ecological site converted	**68.2%**	**69.7%**	**54.9%**	**45.0%**	**76.0%**	**54.6%**	**78.7%**

Blackfoot Uses

- Prioritize restoration needs
- Gain understanding of grass/shrubland diversity
- Incorporate into County planning considerations

Summary

- Ecological sites provide a valuable tool for planning at landscape scales
- Ecological sites can help assess and plan adjustments for predicted effects of climate change
- Ecological sites can help prioritize conservation needs and locations at landscape scales
- ESD's provide a fundamental framework for understanding ecosystem diversity and vegetation dynamics at landscape scales