Tools for assessing ecological potential of sagebrush ecosystems in Nevada

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Presented to the Sagebrush Ecosystem Council

March 13, 2018

Overview

- Rangeland ecology – climate, soils, veg
- How can we manage at reasonable scales for realistic goals?
- Land resource hierarchy
  - Example of MLRA differences in NV
  - Example of DRG differences in NV
- State and transition models
  - Overview
  - Examples of STMs in use
- Use of existing AIM data in conjunction with MLRA/DRGs to make inferences about plant communities

Climate

- Timing and amount of precipitation
  - Monsoons, snow
- Temperature
  - Min/max
  - Seasonal averages
  - Daily fluctuations

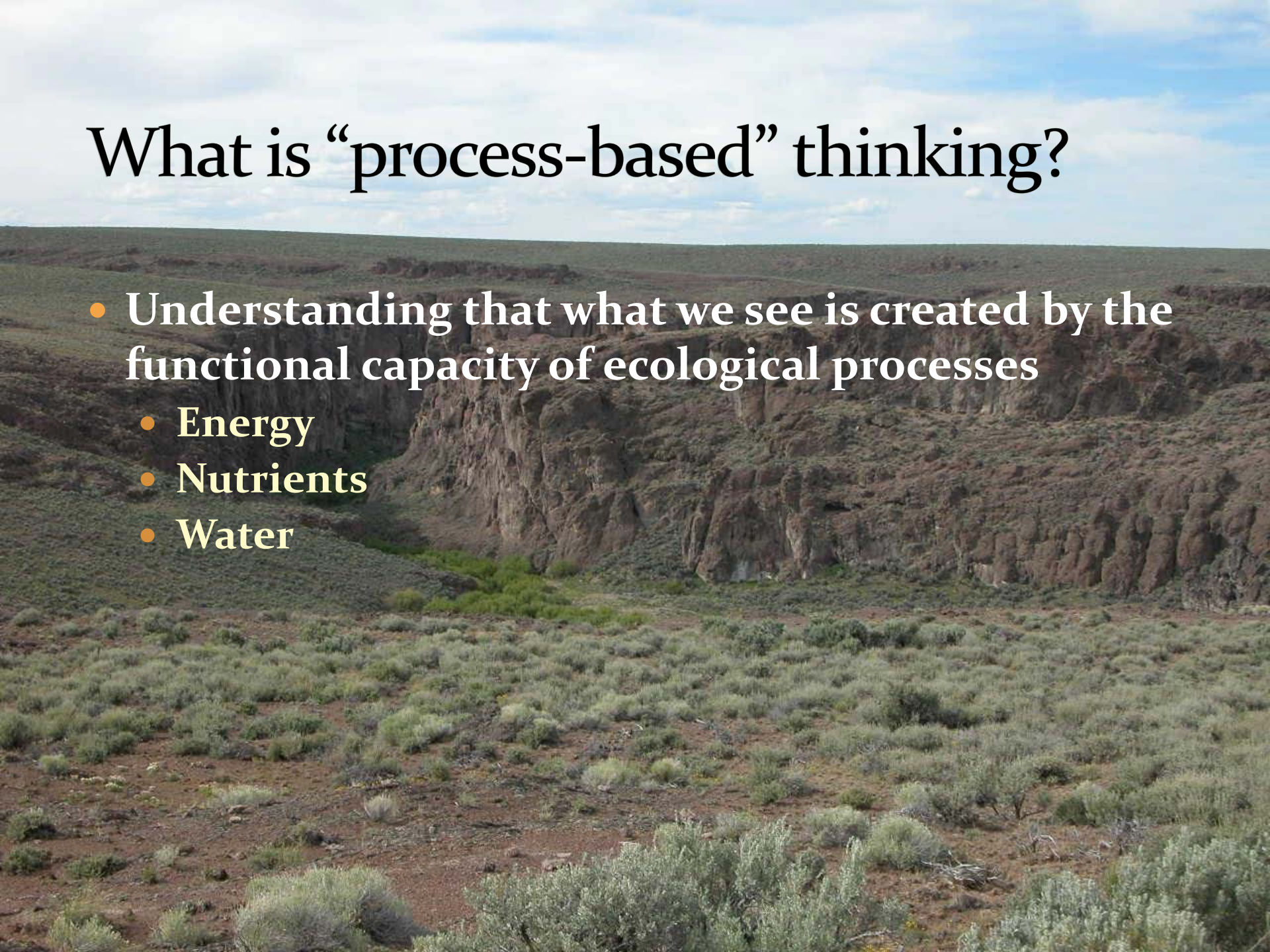
Soil

- Parent material
  - Limestone, basalt, granite, lake sediment…
- Landscape position
  - Concave/convex (Run-on, run-off)
  - Aspect: north/south
  - Slope

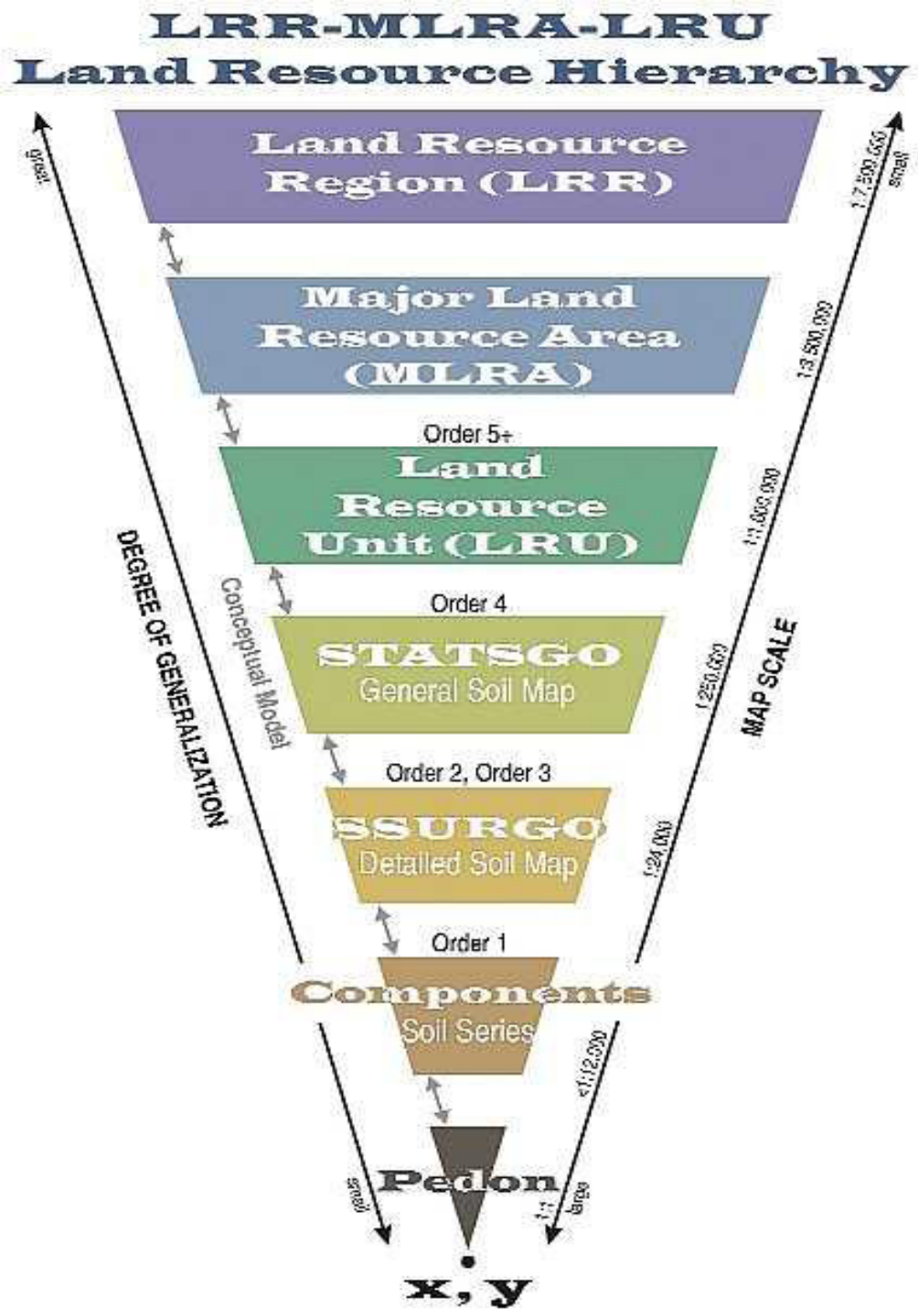
Properties important to plants

Rooting depth
Available soil moisture
Nutrients
pH
Soil texture
Freezing temps, heat
Length of growing season
Etc.

What is "process-based" thinking?



- **Understanding that what we see is created by the functional capacity of ecological processes**
  - **Energy**
  - **Nutrients**
  - **Water**



Regions with similar climate, land use

Geographic areas with similar soils

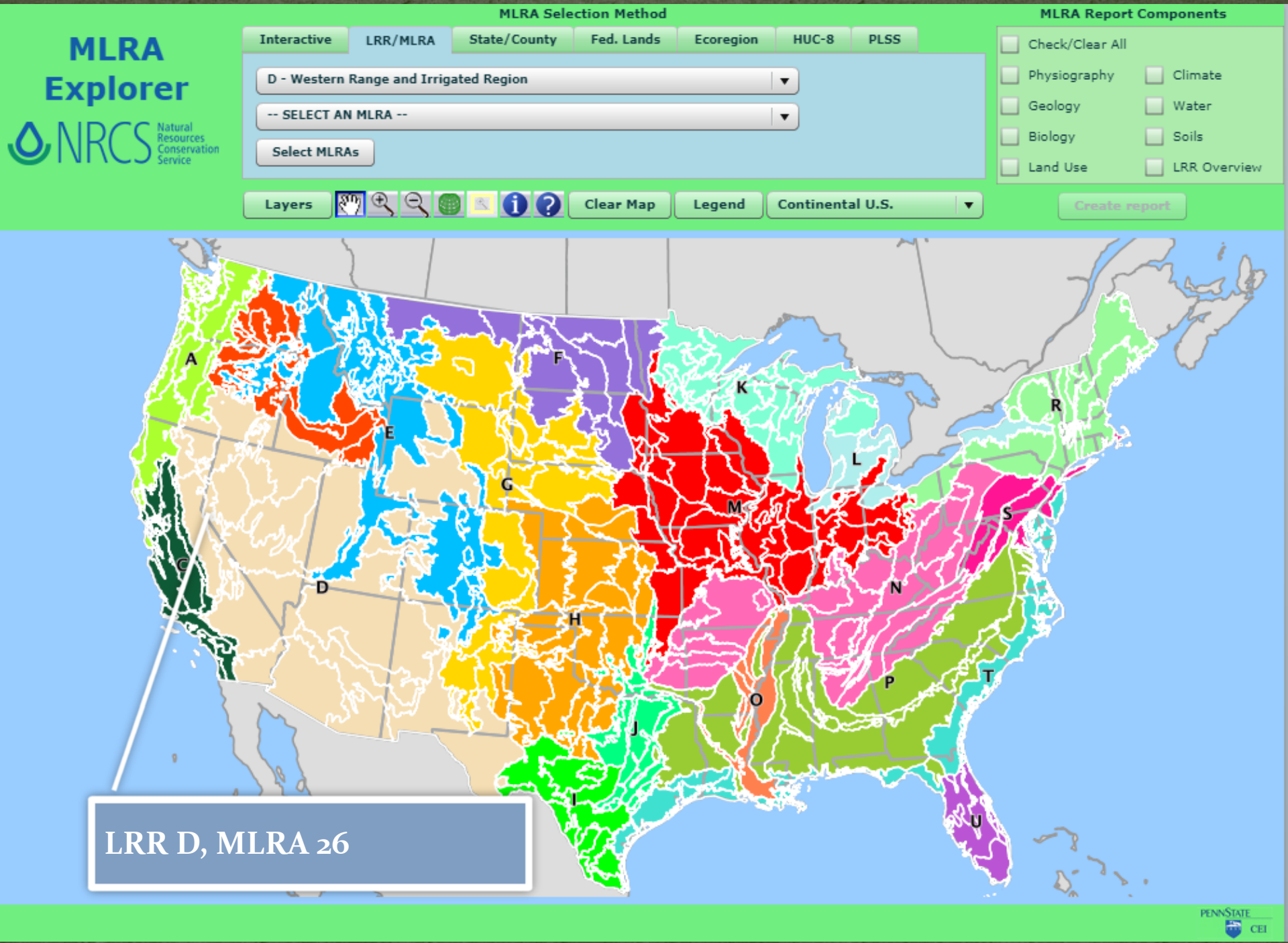
Similar landscape patterns

Groups of Ecological Sites – share landscapes

Intermingled ecological sites or a single site

One individual representative of the site

An observation of plant-soil relationships


MLRA Explorer
NRCS Natural Resources Conservation Service
MLRA Selection Method
Interactive
LRR/MLRA
State/County
Fed. Lands
Ecoregion
HUC-8
PLSS
D - Western Range and Irrigated Region
-- SELECT AN MLRA --
Select MLRAs
MLRA Report Components
Check/Clear All
Physiography
Climate
Geology
Water
Biology
Soils
Land Use
LRR Overview
Layers
Clear Map
Legend
Continental U.S.
Create report
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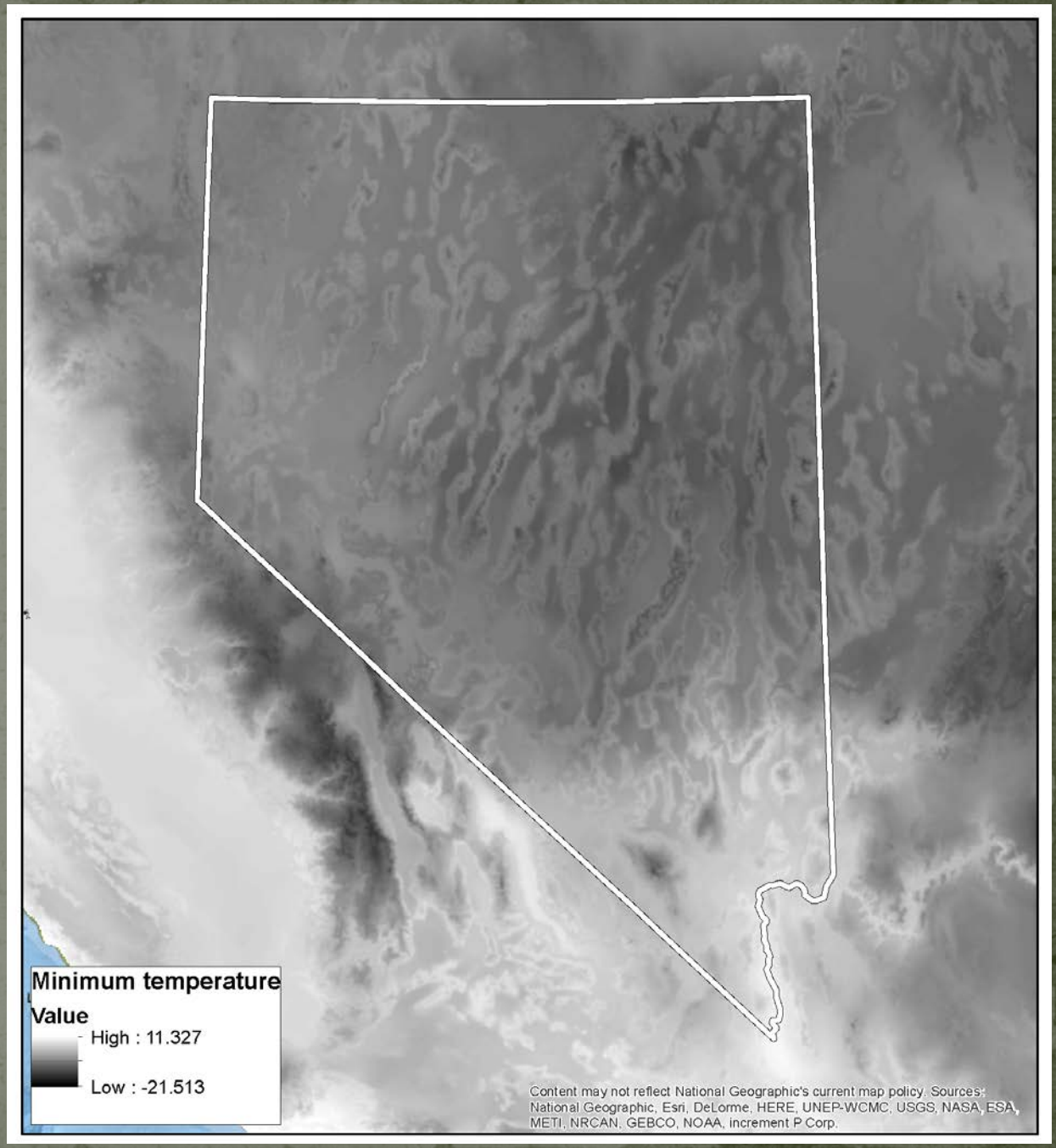
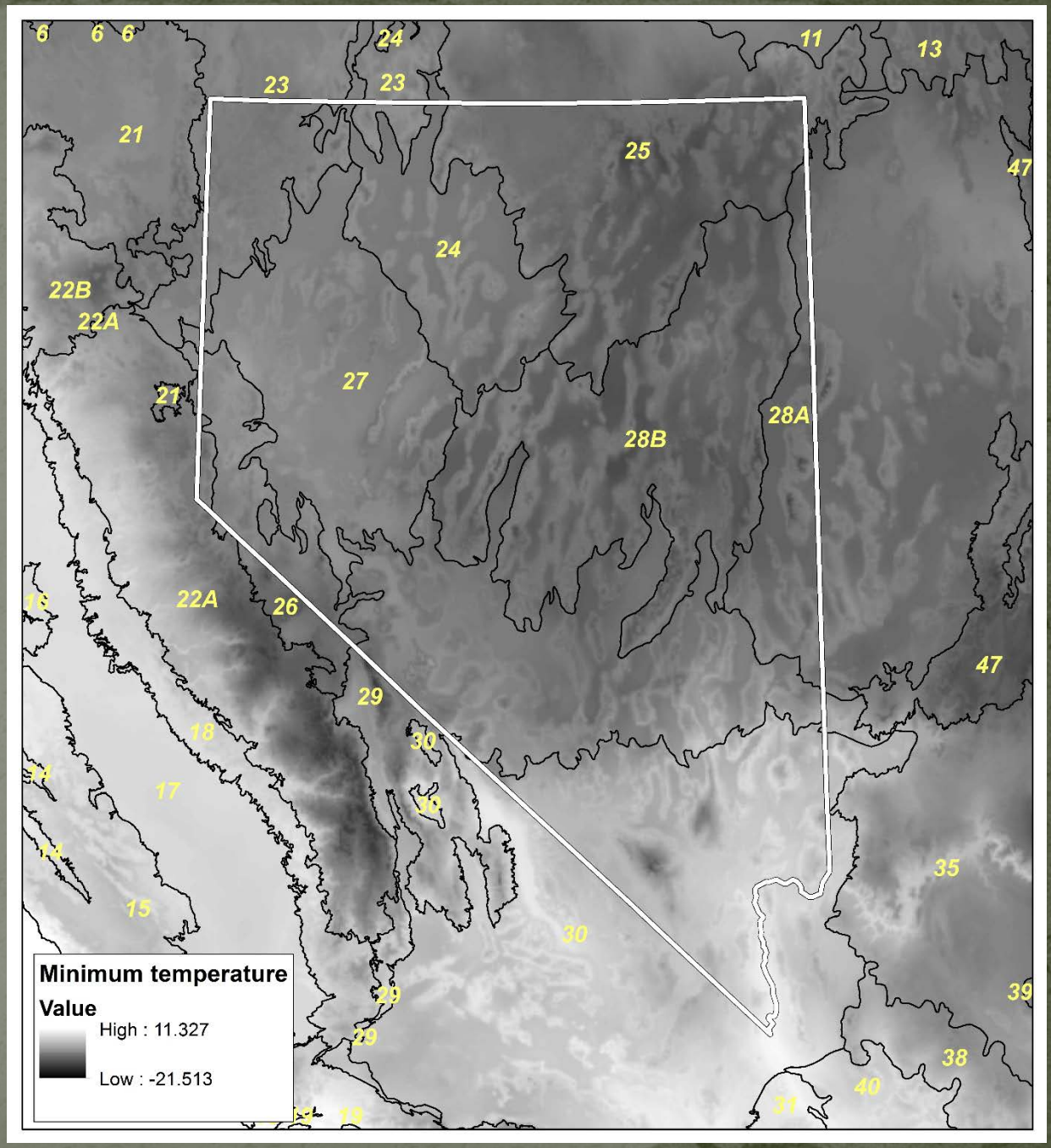
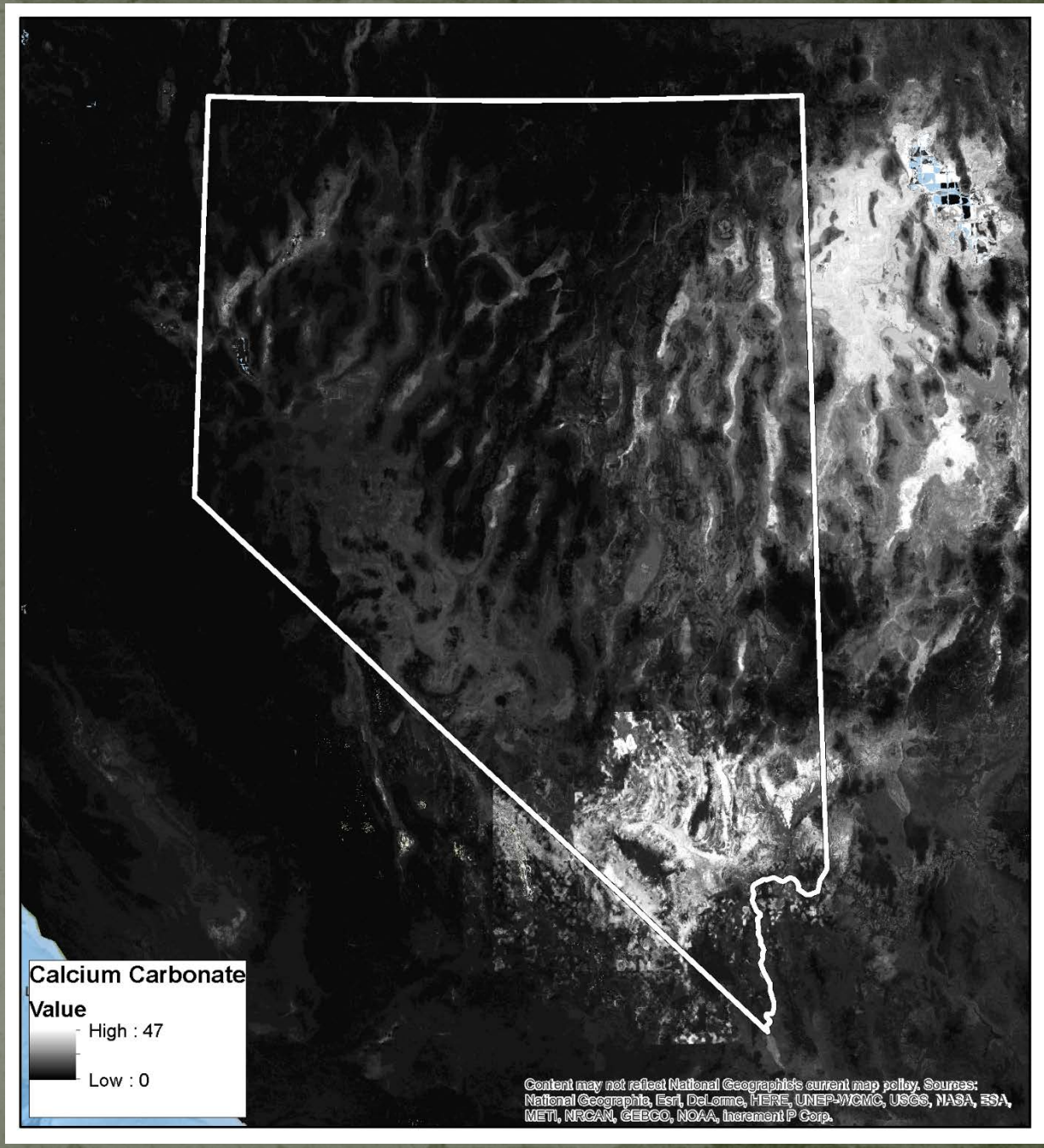
Minimum temperature



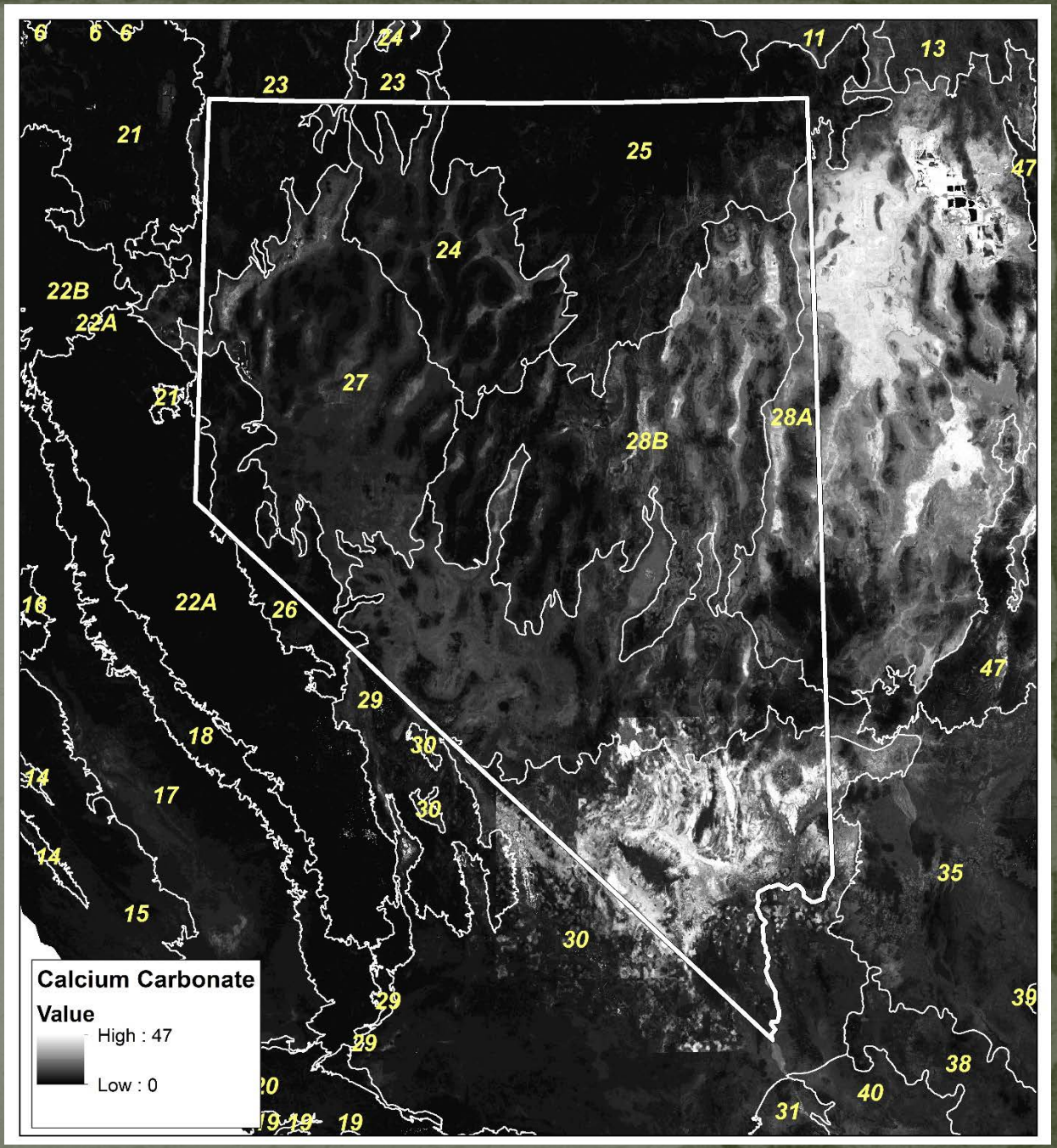
Minimum temperature



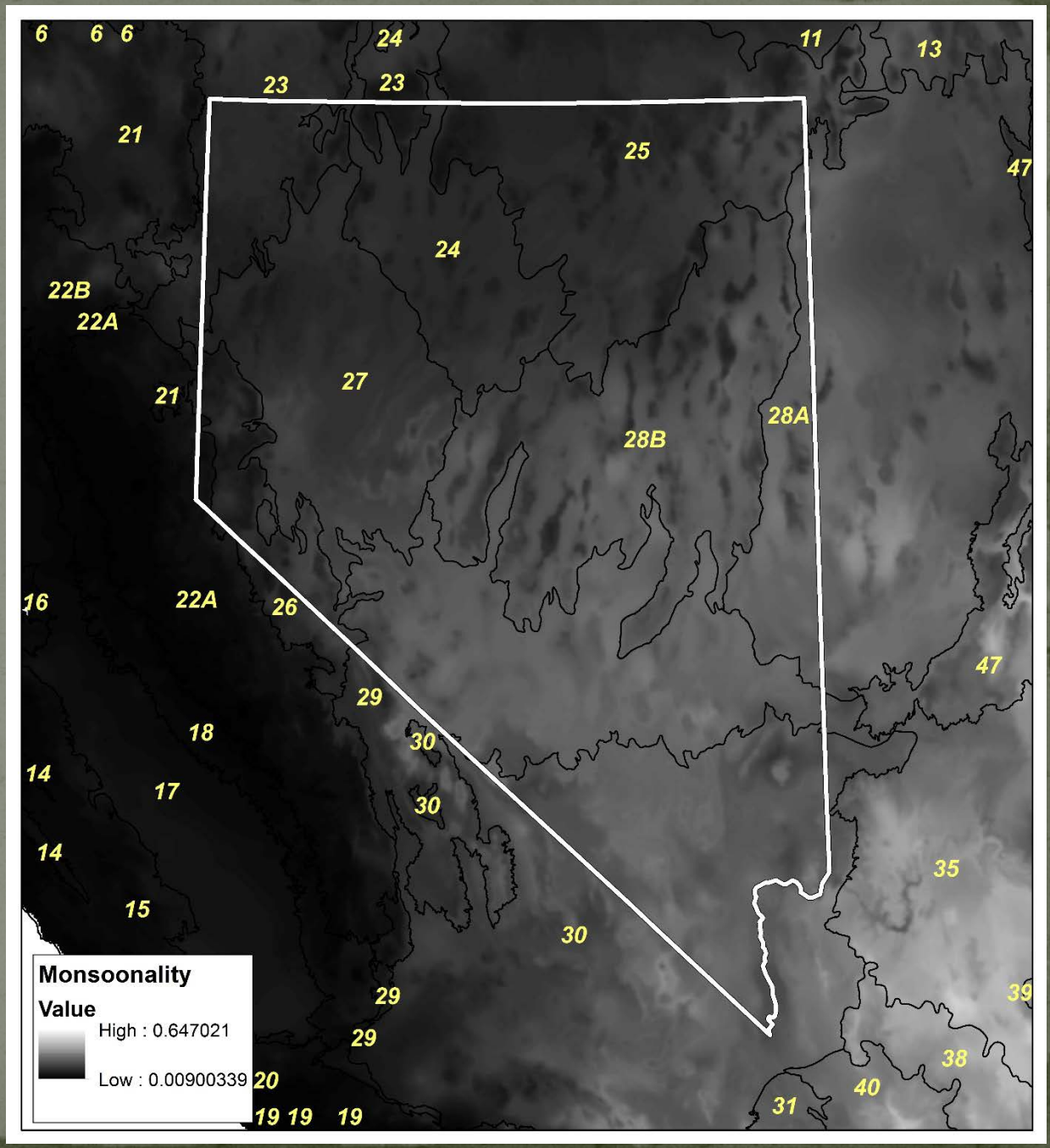
Calcium carbonate



Calcium carbonate



Monsoonality: Summer rain



Basic Model Precipitation, Temperature, and Vegetation (MLRA 28b)

Cryic = 8,200-1300 ft, 18-28" mean annual ppt
Xeric and Xeric-Aridic,
fir, spruce, bristlecone

Frigid = 6,000-8,200 ft, 12-20"
Xeric-Aridic and Xeric,
black sage, low sage, mountain sage, pinyon

Mesic = 4,000-6,500 ft, 5-12"
Aridic and Aridic-Xeric ,
shadscale, black sagebrush

Western Range and Irrigated Region

Xeric = moisture during winter, summers are dry
Aridic = very little moisture during any season

Basic Model
Precipitation, Temperature, and Vegetation (MLRA 25)

Cryic = 6,500-9,500+ ft, 16-20+" mean annual ppt
Xeric bordering aridic or udic
aspen, snowberry, mtn brome

Frigid = 5,500-9,500 ft, 12-18" mean annual precip
xeric or aridic bordering xeric
low sagebrush, mountain big sagebrush, bitterbrush, Idaho fescue

Mesic = 4,200-8500 ft, 8-14" MAP
aridic bordering xeric
Wyoming big sagebrush, low sagebrush, bluebunch wheatgrass, Thurber's needlegrass

Owyhee High Plateau

Ecological sites

Sites that have similar climate and soils that produce similar kinds and amounts of vegetation

Ecological sites

- Why divide landscapes into basic units?
  - Recognize and communicate important and repeatable differences in
    - Vegetation
    - Soils
    - Ecological processes
    - Disturbance response
- Ecological sites assure that our goals and expectations for land should not be the same everywhere

Ecological Site Groupings for Mgmt

- Disturbance Response Groups
  - Consolidate similar ecological sites in a way that is important for management
- Example, MLRA 25:

Group 2: low sagebrush, 12-14" precip 4 sites	Claypan 12-16	025XY017NV
	Claypan 16+	025XY032NV
	Gravelly Claypan 12-16	025XY023NV
	Clayey 12-14	025XY054NV
Group 6: mountain big sagebrush, 12-16" precip 7 sites	Loamy Slope 12-16	025XY012NV
	Loamy 12-14	025XY027NV
	Gravelly Loam 12-16	025XY007NV
	South Slope 14-18	025XY016NV
	Shallow Loam 14-16	025XY042NV
	Loamy 14-16	025XY056NV
	Fractured Stony Loam 14+	025XY046NV

Example of Grouping

Loamy 10-12” – May ‘16

Granitic Slope 10-12” - May ‘16

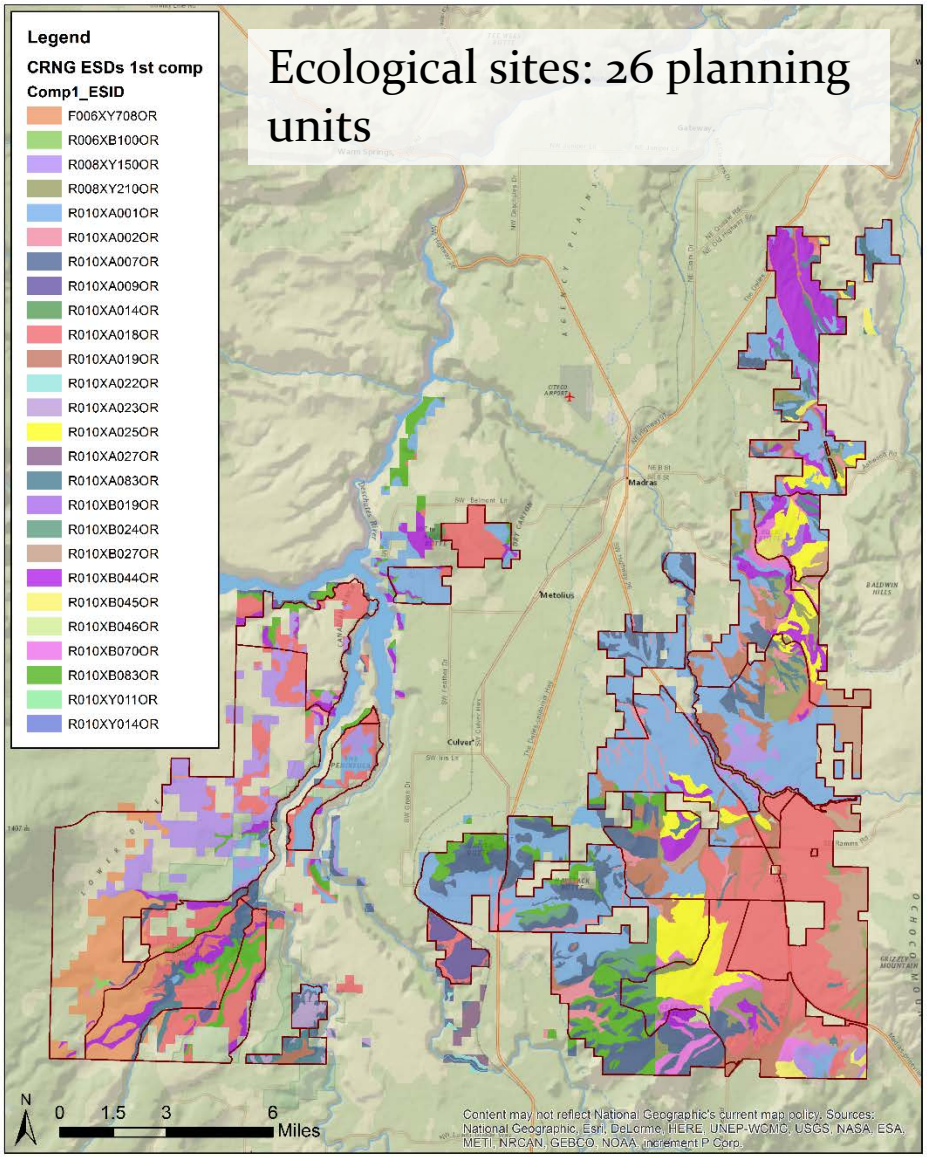
Shallow Loam 10-12” – April ‘16

MLRA 26, group 9

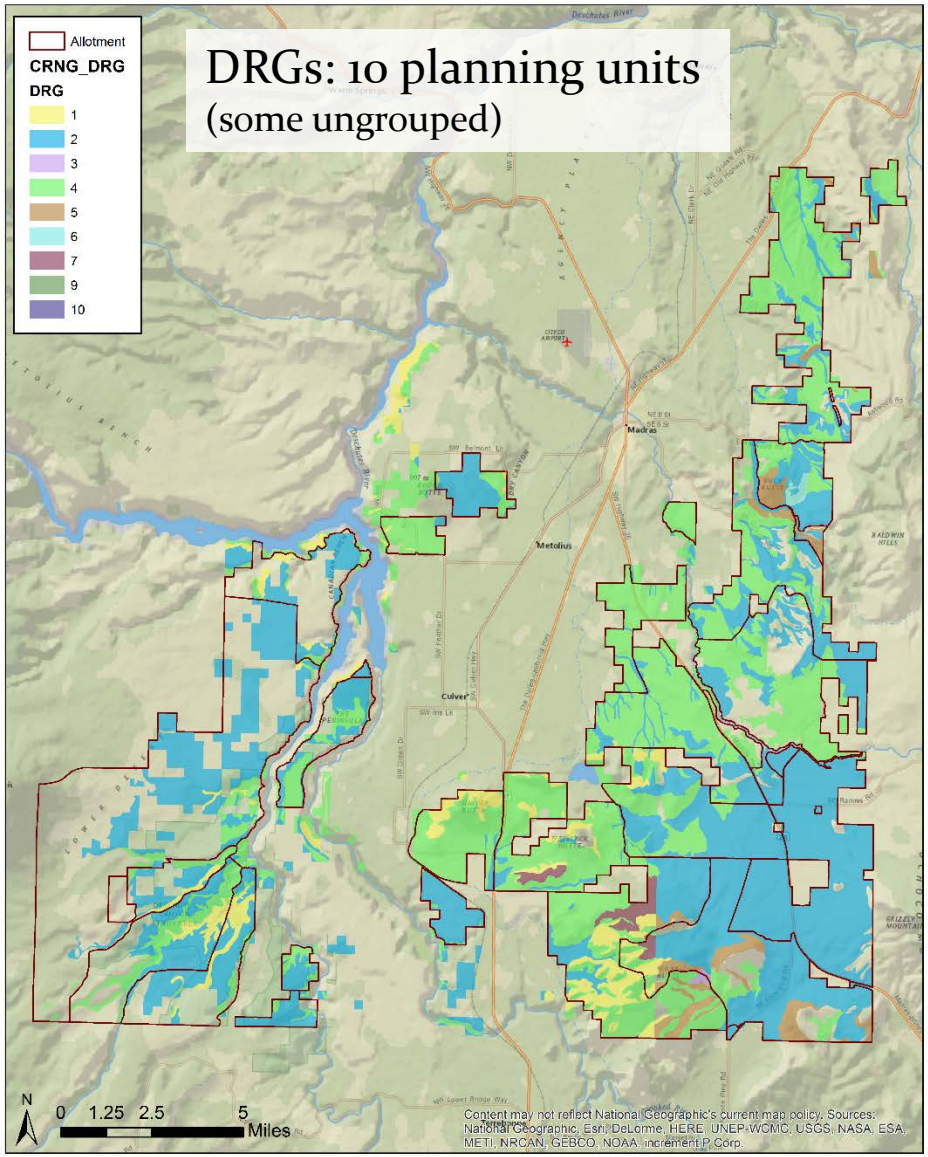
- Range of big sagebrush (Wyoming, basin, and mountain) and Antelope bitterbrush
- Thurber’s needlegrass and desert needlegrass
- Precipitation 10-12”
- Soils: Mollic epipedon
- Model has annual state and tree state

Crooked River National Grasslands

Crooked River National Grasslands Soil Map

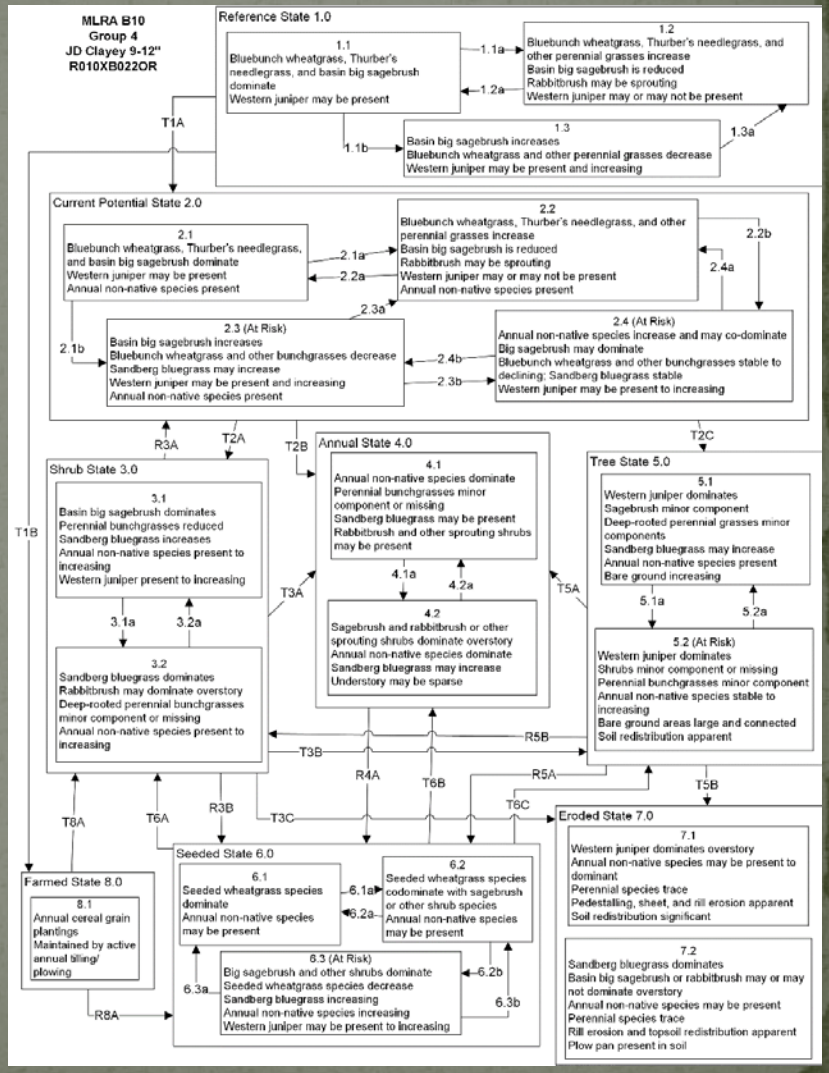


Crooked River National Grasslands DRG Map



State and Transition models (STM)

- NRCS has accepted the STM as the format for describing ecological dynamics for the nation's rangelands
- Captures knowledge
  - Historical events, use
  - Recent management
  - Observations after disturbances
  - Scientific literature
  - Resilience and resistance
- Stringham lab since 2007 (OR, NV, CA)



ESD handbook

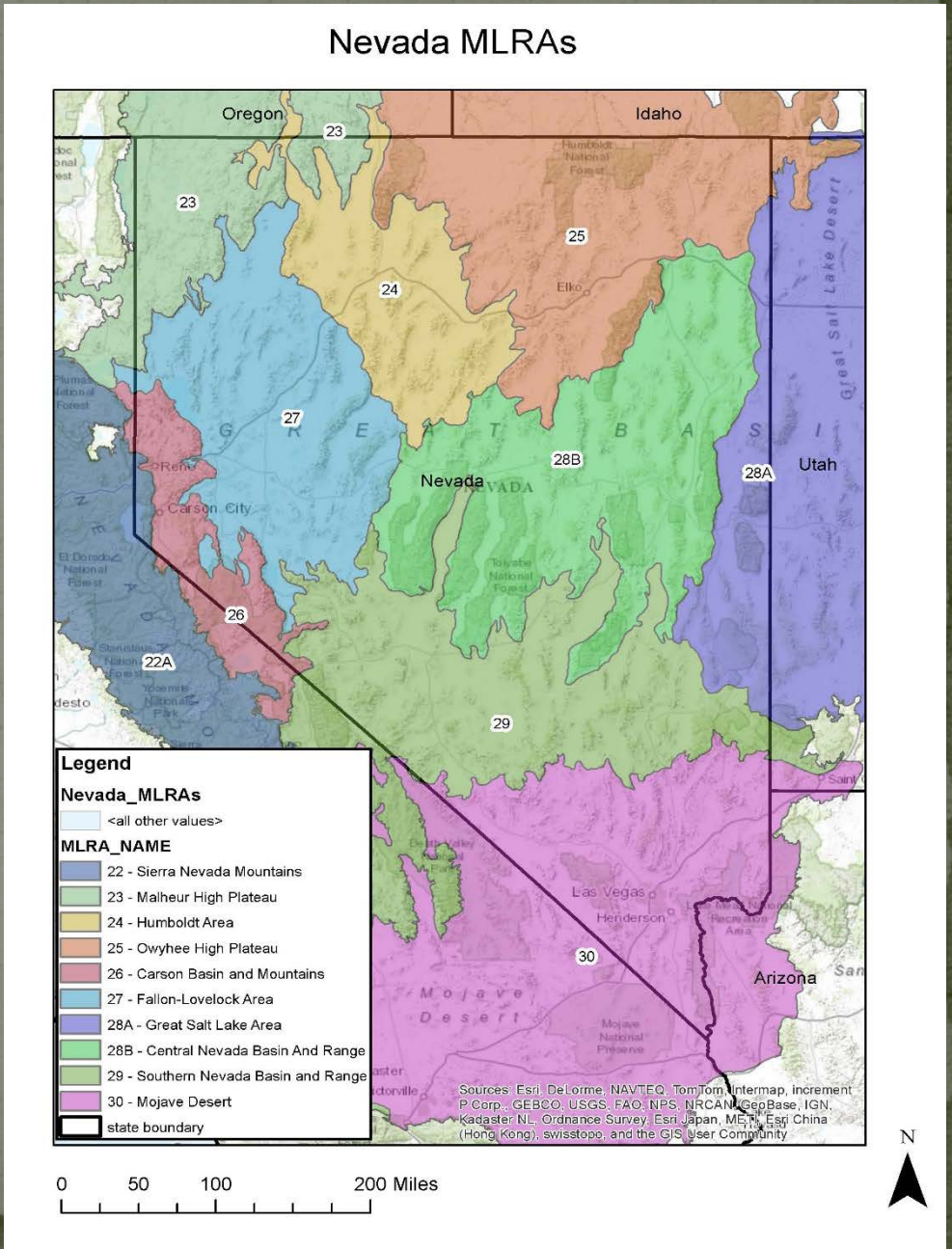
STM development

- By MLRA
- Built by an interdisciplinary team
- DRGs to expedite model-building
- Office meetings
- Field visits:
  - Full soil description
  - Species lists
  - Grass density
  - Annual production

Nevada - Major Land Resource Areas

- MLRA 28A & 28B
  - 310 Field notes / 190 ES*
- MLRA 26
  - 154 Field notes / 104 ES
  - 91 NV sites, 13 CA sites
- MLRA 25
  - 115 Field notes / 69 ES
- MLRA 24
  - 79 Field notes / 54 ES
- MLRA 23
  - 174 Field notes / 84 ES

*ES = ecological site



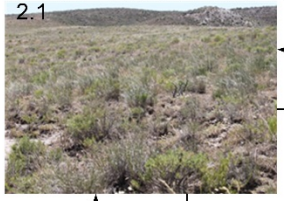
MLRA 25 Wyoming big sagebrush group

Reference State 1.0: pristine, no non-native species

T1A: weed introduction

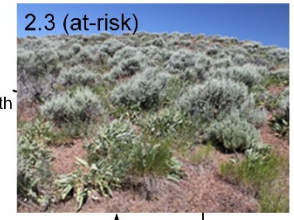
Current Potential State 2.0

2.1



2.2

2.3 (at-risk)



2.1a: Fire

2.2a: Time, grazing mgmt

2.3a: Fire, moth

2.1b: Time, grazing mgmt

2.3b: Fire

T2B: Fire, inappropriate grazing mgmt

T3A: Fire or Soil disturbance

T2A: Inappropriate grazing mgmt or soil disturbance

R3A: Brush management, native seeding

Annual State 4.0

4.1

4.2

4.1a: Time, Grazing mgmt

4.2a: Fire

Shrub State 3.0

3.1

3.2

3.1a: Fire or brush treatment or Aroga moth

3.2a: Time, grazing mgmt

T5A: Fire

R4A: Herbicide and seeding with appropriate grazing management

T6A: Fire or inappropriate tree removal practices

T3B: Time

Seeded State 5.0

5.1

5.2

5.3 (at-risk)

5.1a: Time, grazing mgmt

5.2a: Fire, brush mgmt, moth

5.3a: Fire, brush mgmt, moth

5.2b: Inappropriate grazing mgmt

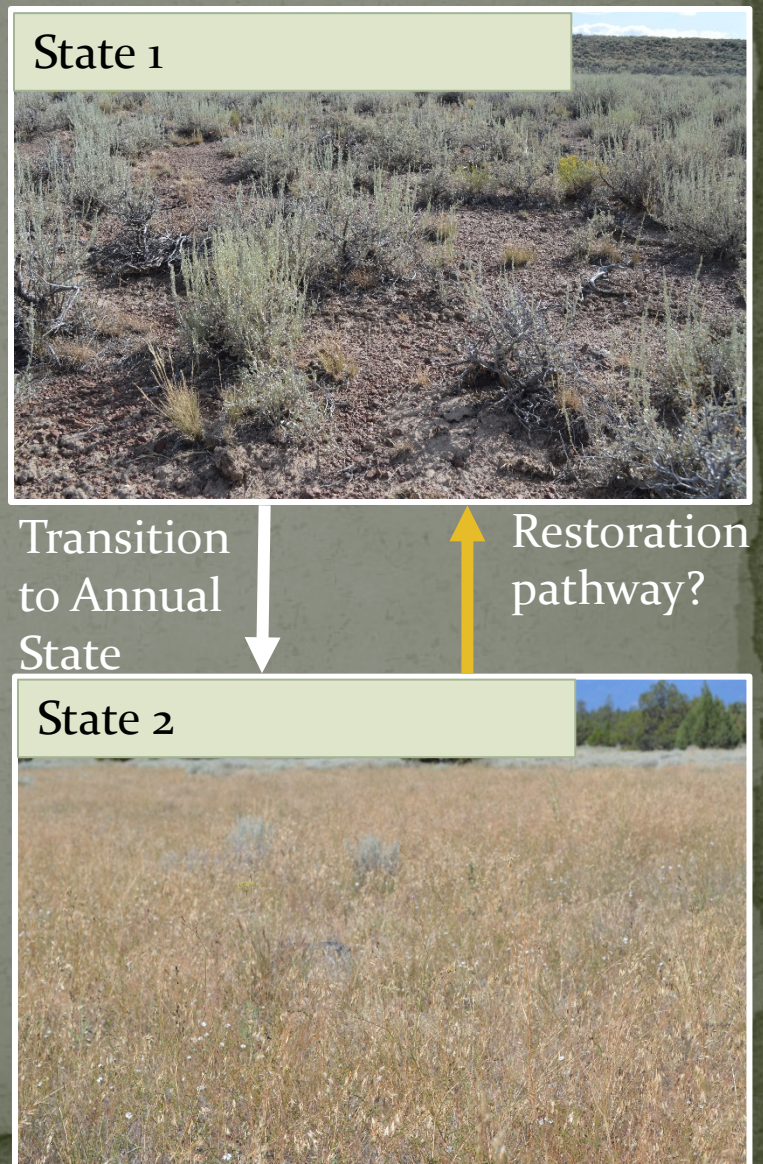
Tree State 6.0

6.1 (6.2 not pictured)

T5B: Time

State and Transition models

- **Tool for thinking about system ecology by MLRA**
- Describe ecological dynamics
- Restoration pathways
- Living documents
- Designed for land managers

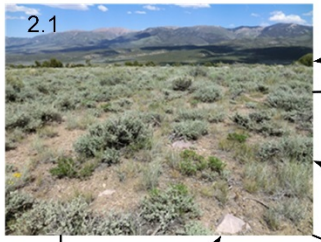


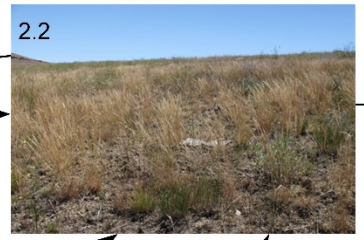
MLRA 25
Low sagebrush 12"+ group

Reference State 1.0: pristine, no non-native species

T1A: Introduction of non-native species

Current Potential State 2.0





2.2a: Time

2.1a: Fire

2.4a: Wet winter, dry spring

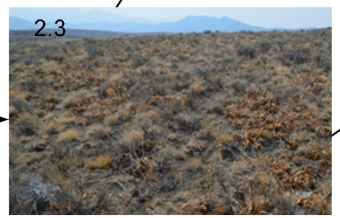
2.2b: Heavy spring precipitation

2.4b: Wet winter, dry spring

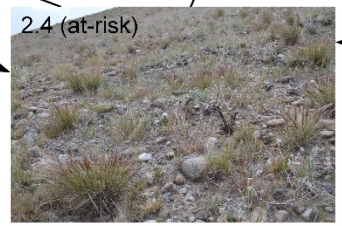
2.3a: Fire, brush treatment, Inappropriate grazing mgmt

2.1c: Heavy spring precip

2.1b: Time, inappropriate grazing mgmt



2.3b: Fire



T2A: Inappropriate grazing mgmt

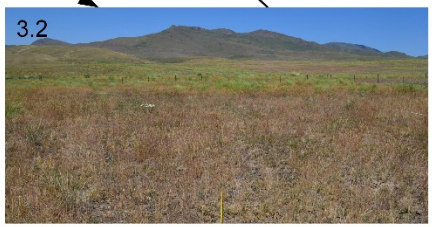
T2B: Concentrated disturbance

R4A: Herbicide and seeding with appropriate grazing mgmt

Shrub State 3.0

3.1a: Fire

3.2a: Time



T2C: Fire, soil disturbance

Forb State 4.0

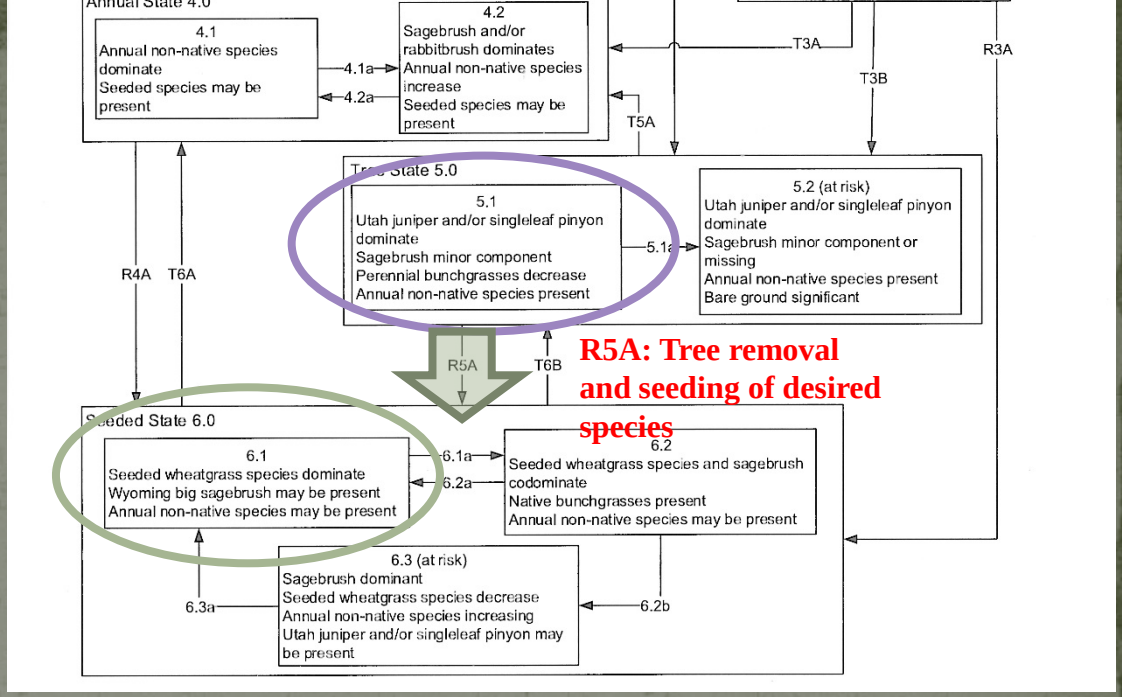
T3A: Inappropriate grazing mgmt, fire

Annual State 5.0

T3B: Fire, variation in annual precipitation

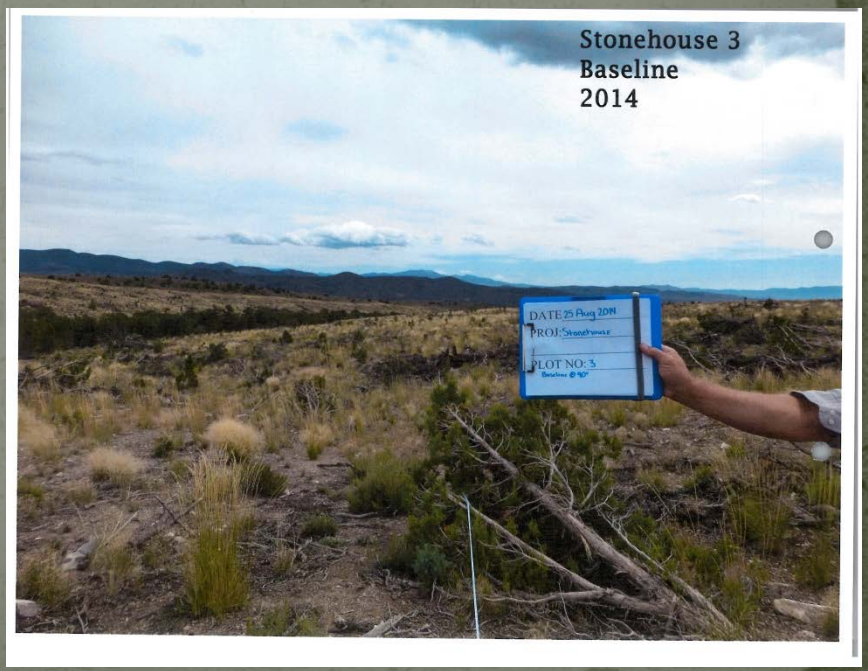
STMs in Use

- Ely BLM fuels treatments
  - Wyoming big sagebrush / indian ricegrass group



Before Treatment 2009

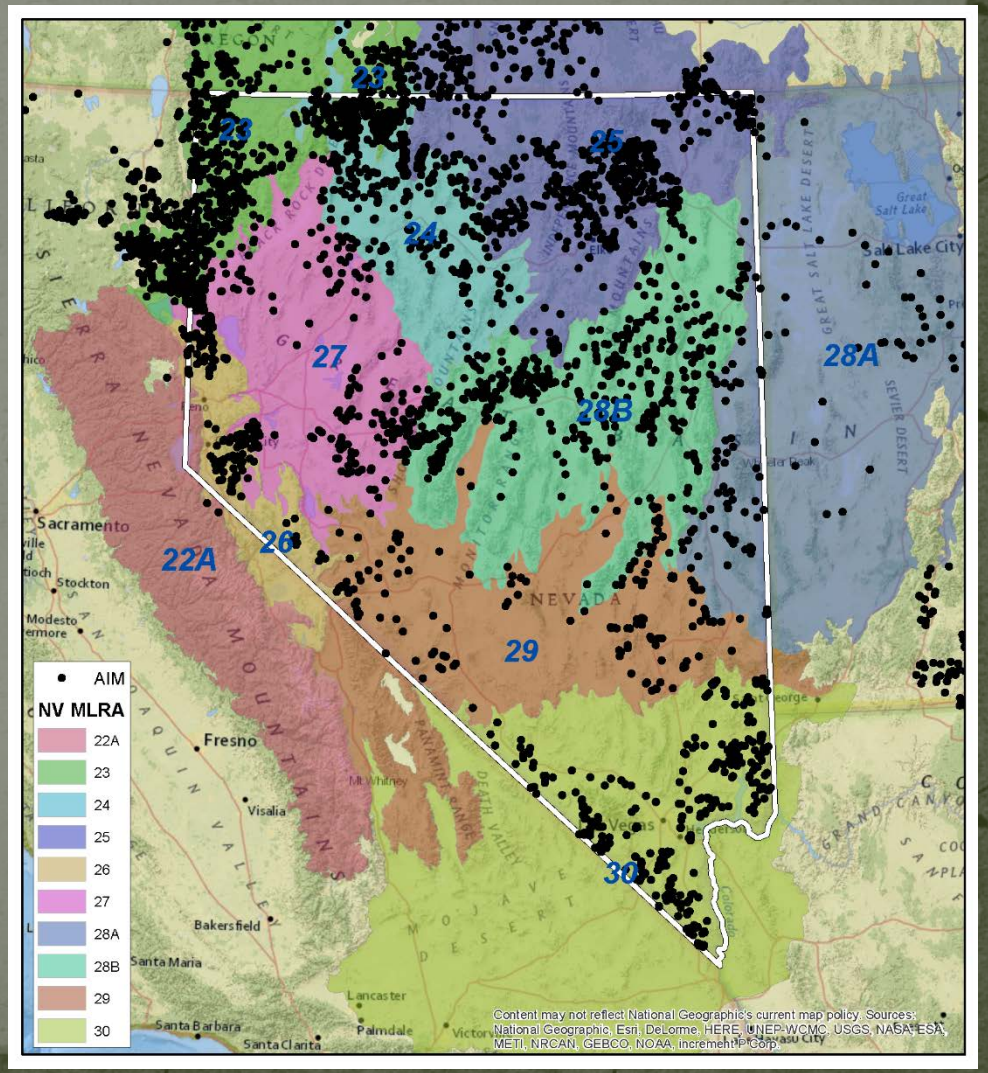
R5A



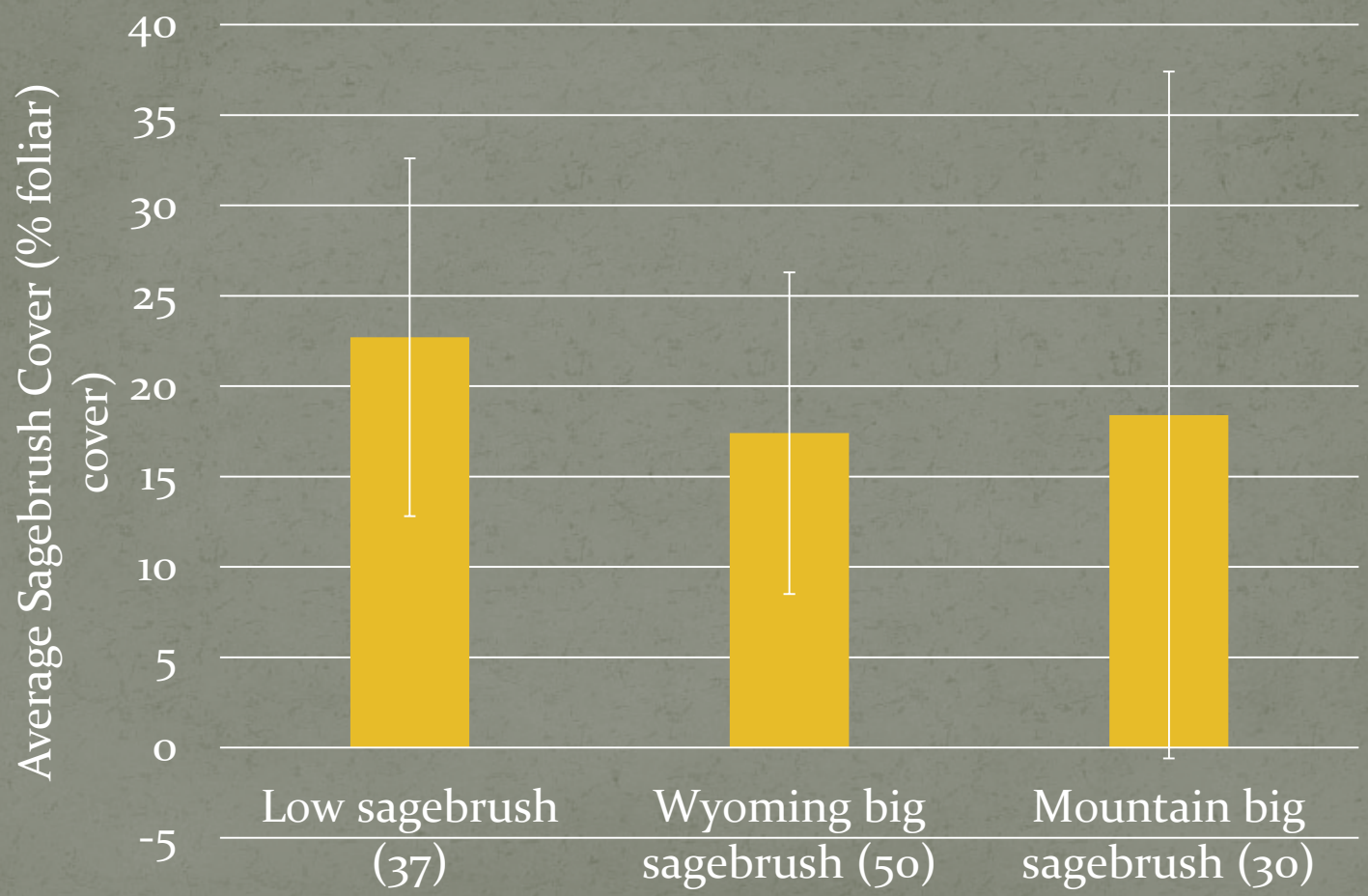
After Treatment 2014

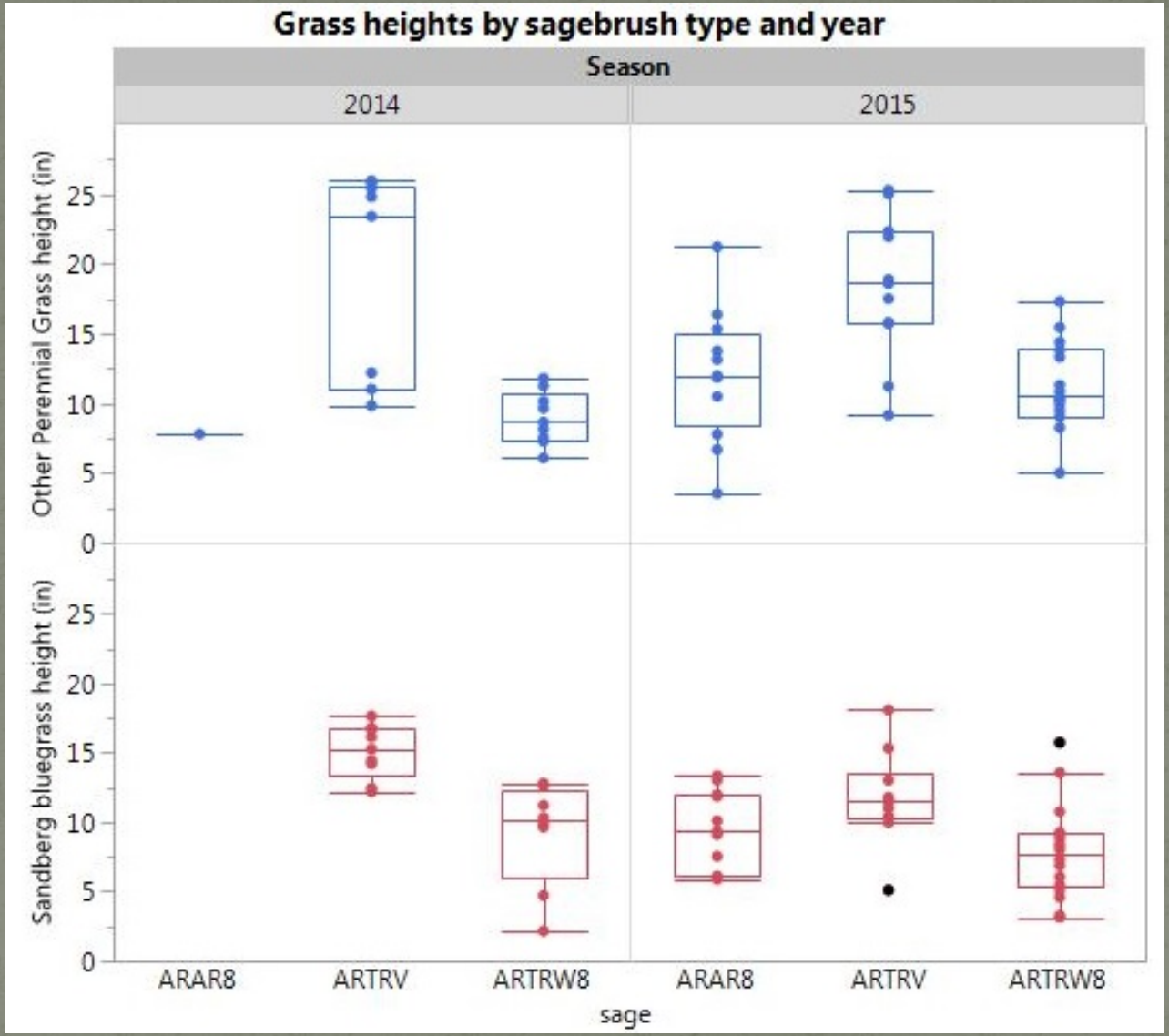
Using AIM data with STMs/DRGs

- AIM sampling already stratified by ecological sites or DRGs
- Data analyzed from 2011 to 2015

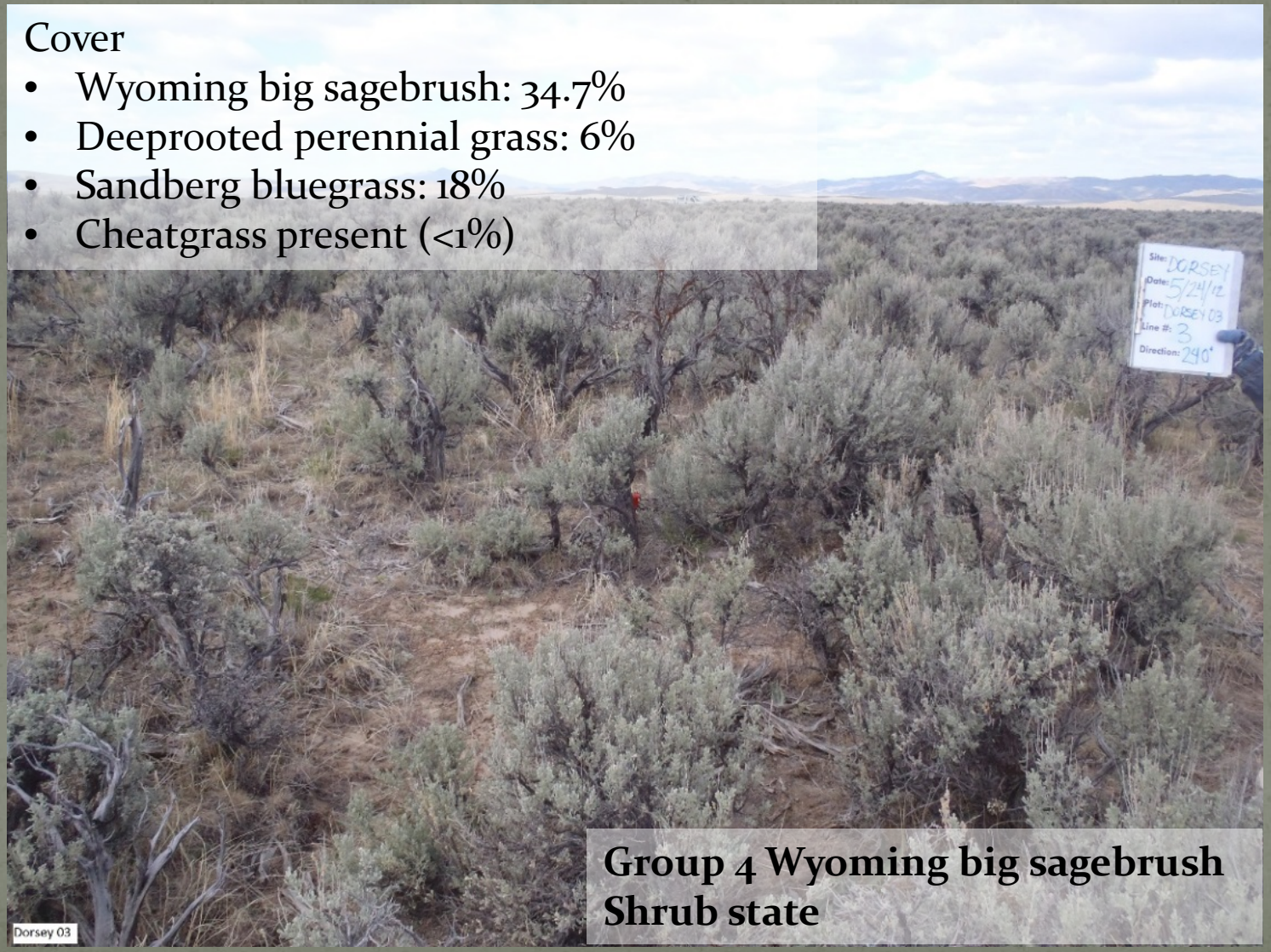


Sagebrush cover by species




Grass heights by sagebrush type and year
Season
2014
2015
Other Perennial Grass height (in)
Sandberg bluegrass height (in)
0
5
10
15
20
25
ARAR8
ARTRV
ARTRW8
sage

Examples from AIM data



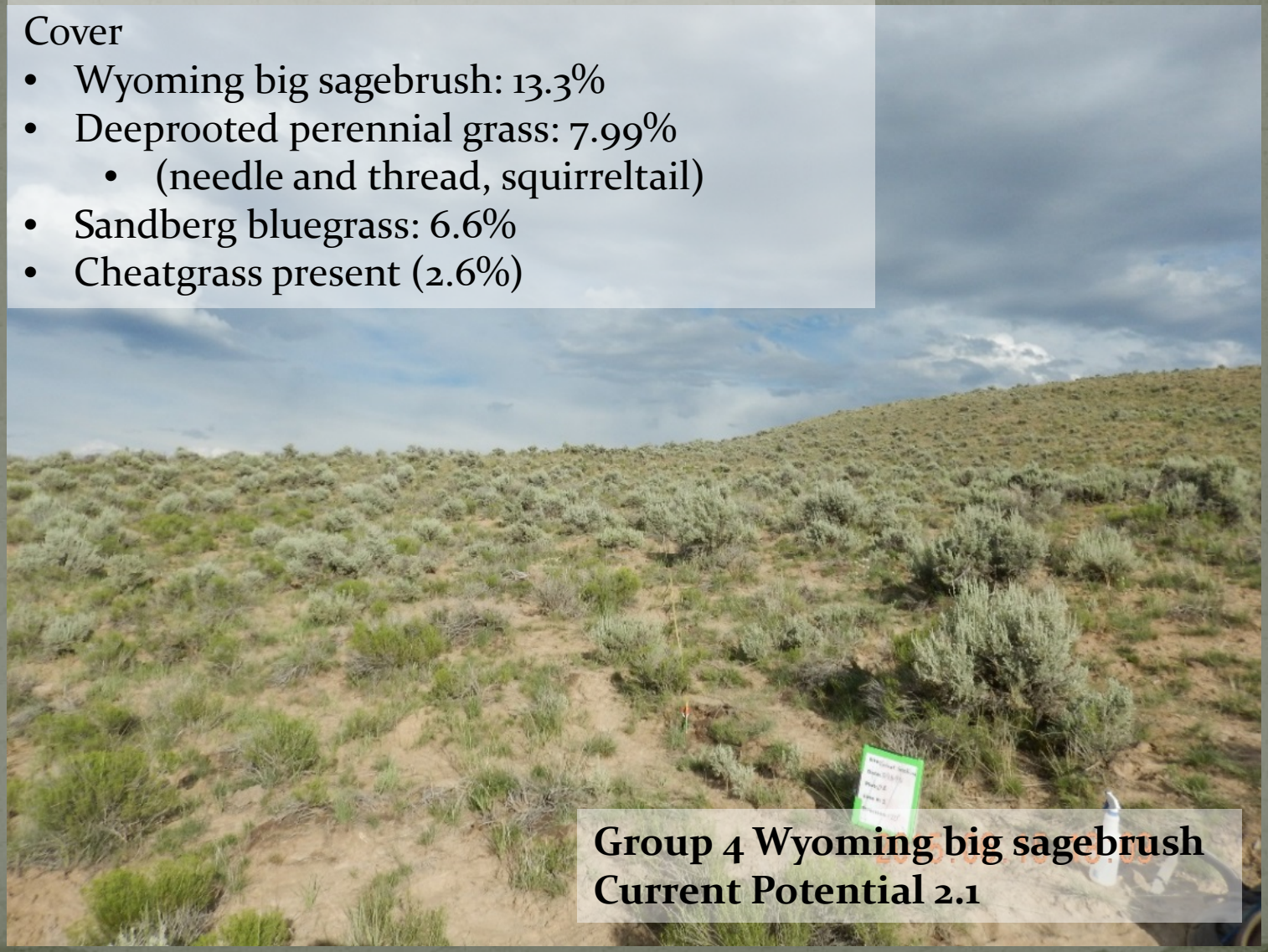
Cover

- Wyoming big sagebrush: 34.7%
- Deeprooted perennial grass: 6%
- Sandberg bluegrass: 18%
- Cheatgrass present (<1%)

Group 4 Wyoming big sagebrush Shrub state

Examples from AIM data

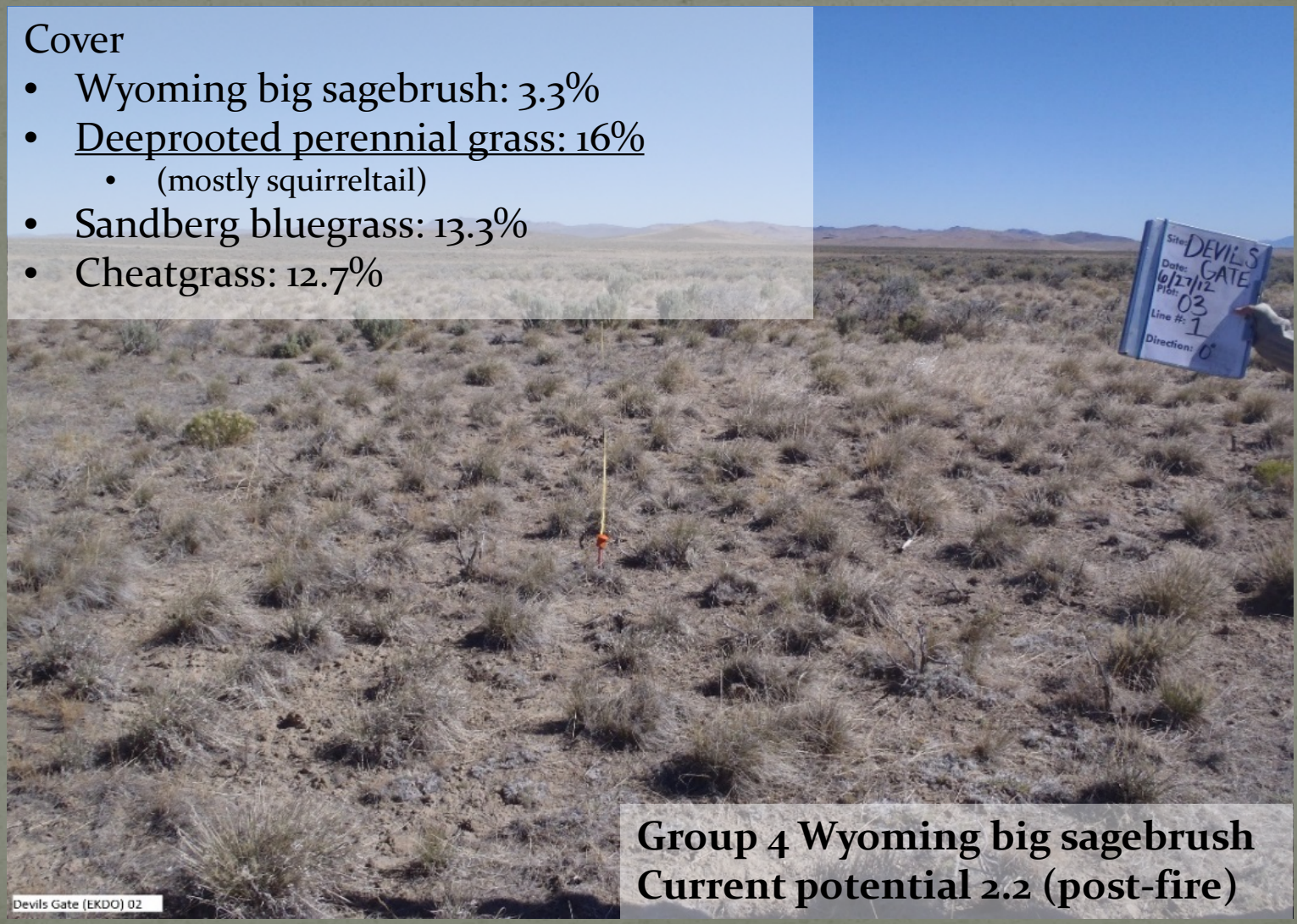
Cover
- Wyoming big sagebrush: 13.3%
- Deeprooted perennial grass: 7.99%
  - (needle and thread, squirreltail)
- Sandberg bluegrass: 6.6%
- Cheatgrass present (2.6%)



Group 4 Wyoming big sagebrush
Current Potential 2.1

Examples from AIM data

Cover
- Wyoming big sagebrush: 3.3%
- Deeprooted perennial grass: 16%
  - (mostly squirreltail)
- Sandberg bluegrass: 13.3%
- Cheatgrass: 12.7%

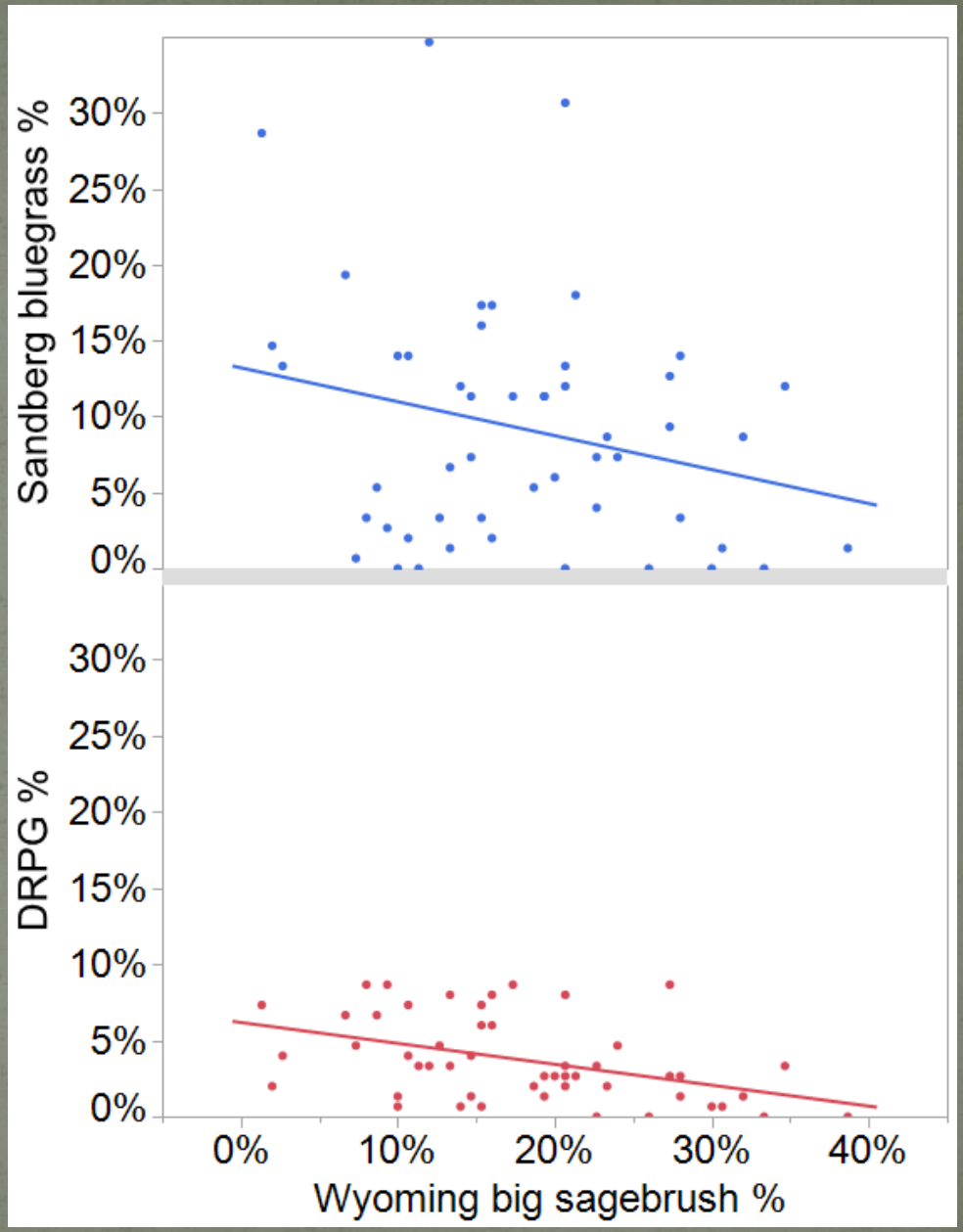


Group 4 Wyoming big sagebrush
Current potential 2.2 (post-fire)

16%: highest cover of grass in the Wyoming big sagebrush group in MLRA 25 (50 plots)

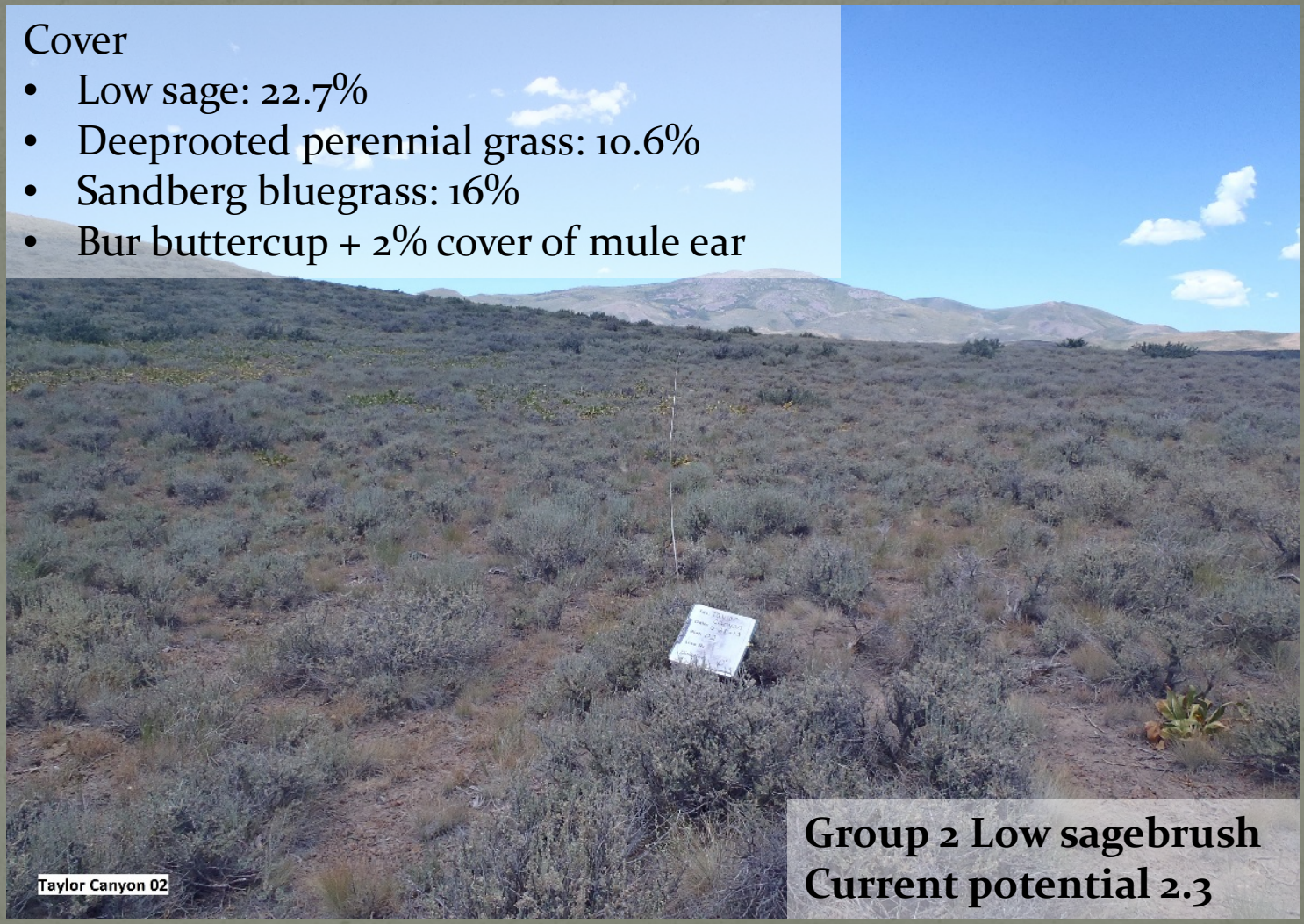
Grass functional groups vs. Wyoming big sagebrush cover

- 50 plots in MLRA 25
- Deep rooted perennial grass never higher than 10%
  - Slight relationship to shrub cover



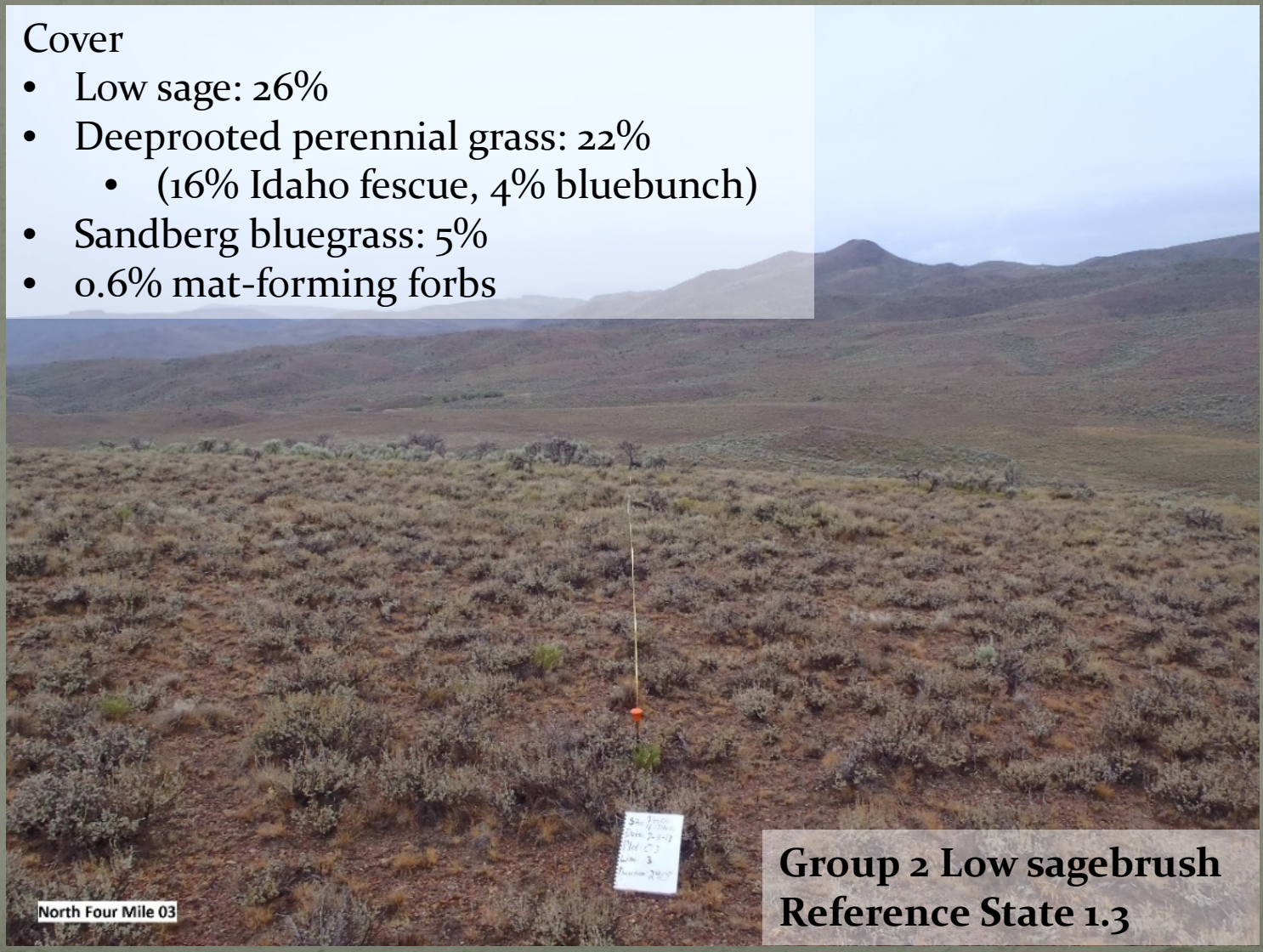
Examples from AIM data

Examples from AIM data



Examples from AIM data

Cover
- Low sage: 26%
- Deeprooted perennial grass: 22%
  - (16% Idaho fescue, 4% bluebunch)
- Sandberg bluegrass: 5%
- 0.6% mat-forming forbs

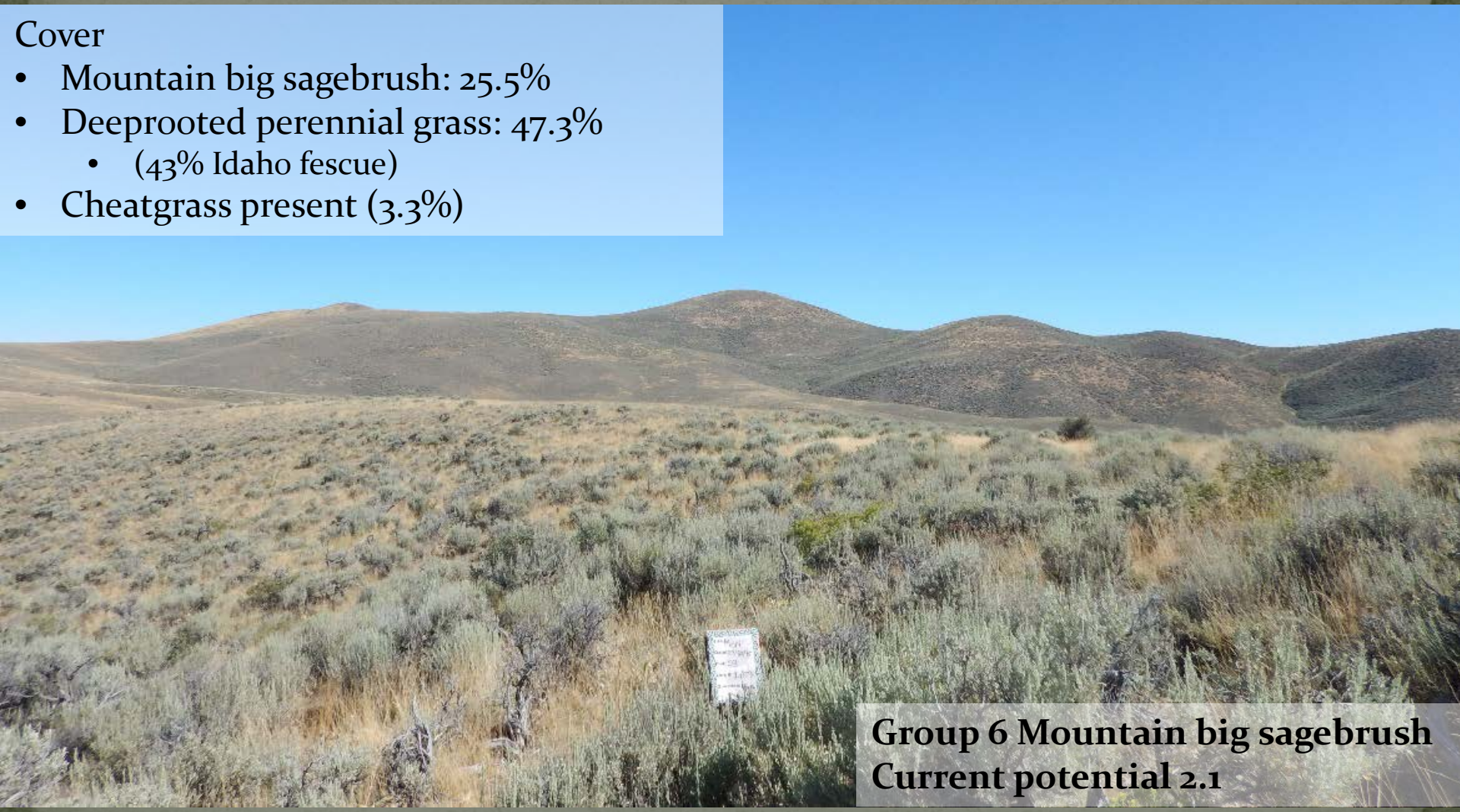


Group 2 Low sagebrush
Reference State 1.3

Examples from AIM data

Examples from AIM data

Cover
- Mountain big sagebrush: 25.5%
- Deeprooted perennial grass: 47.3%
  - (43% Idaho fescue)
- Cheatgrass present (3.3%)



Group 6 Mountain big sagebrush
Current potential 2.1

Highest cover of grass of all plots analyzed in MLRA 25 (117 plots)

Takeaway

- Shrub cover is highest in the shrub state
  - Reduced resiliency
- Grass cover is highest in Reference or Current Potential, post-disturbance
- Need more biome-level surveys like Davies et al. (2006)
  - More specific than AIM data
  - What does sagebrush cover, by DRG, look like in MLRA 25?

Current Evolutions

- ESDs historically focused on production data
- Habitat issues often cover focused
- Scale = landscape
- AIM data & other cover data sources
  - Relate shrub cover to understory characteristics
- Modeling
  - Improve mapping

http://www.cabnr.unr.edu/resources/MLRA.aspx

Recommendations

- Use existing soil maps
  - Know the quality of your soil survey
- Ecological site descriptions
- Any available point data: AIM, LMF, NDOW data
  - To verify ecological site remotely, if possible
- Use state and transition models to guide management decisions, after verifying Site and State on the ground
- Do not assume measurements are useful across regional boundaries
  - Sagebrush cover in the Bodie Hills ≠ Sonoma Range ≠ Desatoyas

How?

- Training
- Wider availability of ecological site descriptions
- Stratify sagegrouse habitat requirements by MLRA
- How do STM States work for your management objectives?

Current state and transition models for Nevada and Oregon B10:
http://naes.unr.edu/resources/mlra.aspx