Mapping cheatgrass in the Great Basin using 250-meter eMODIS NDVI

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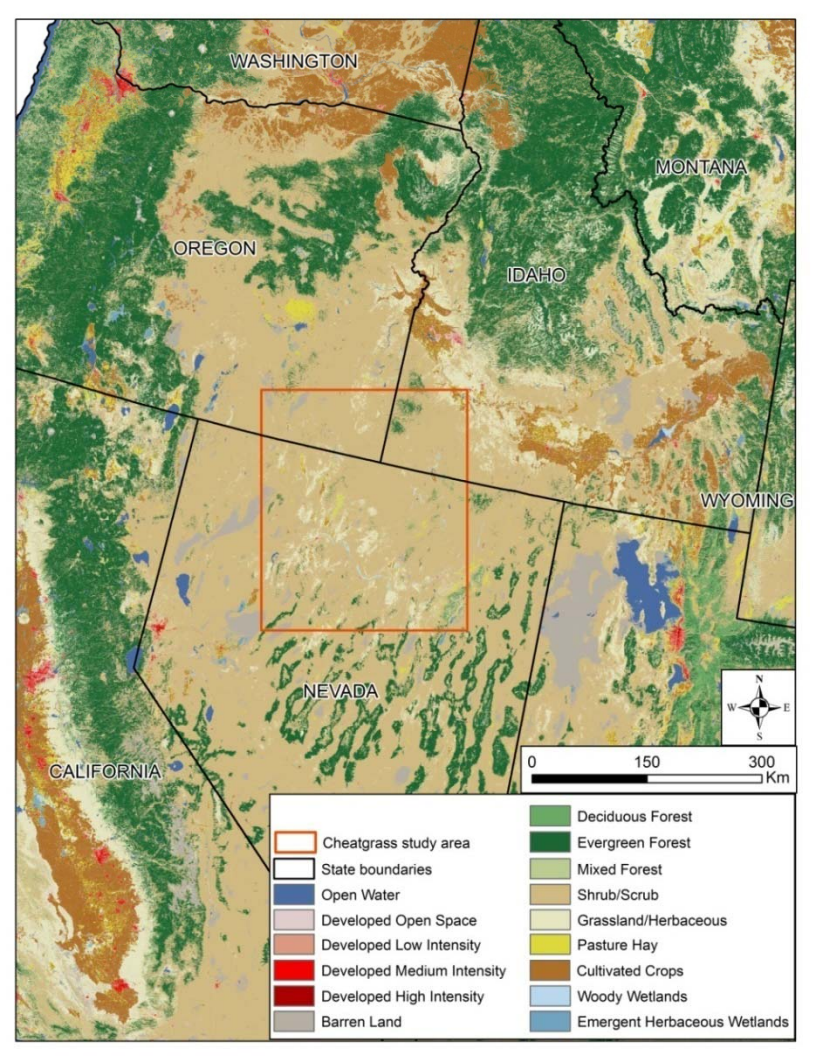
[3]Bureau of Land Management-Great Basin Restoration Initiative.

U.S. Department of the Interior
U.S. Geological Survey

Objective

Track cheatgrass (*Bromus tectorum)* abundance and extents spatially and temporally (2000 to 2010) to identify areas of increasing or decreasing cheatgrass dominance.



2001 NLCD

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The Conundrum

Cheatgrass is an invasive non-native grass that greatly increases fire frequency, severity, and extent. However, cheatgrass die off can leave behind barren land and lead to soil erosion.

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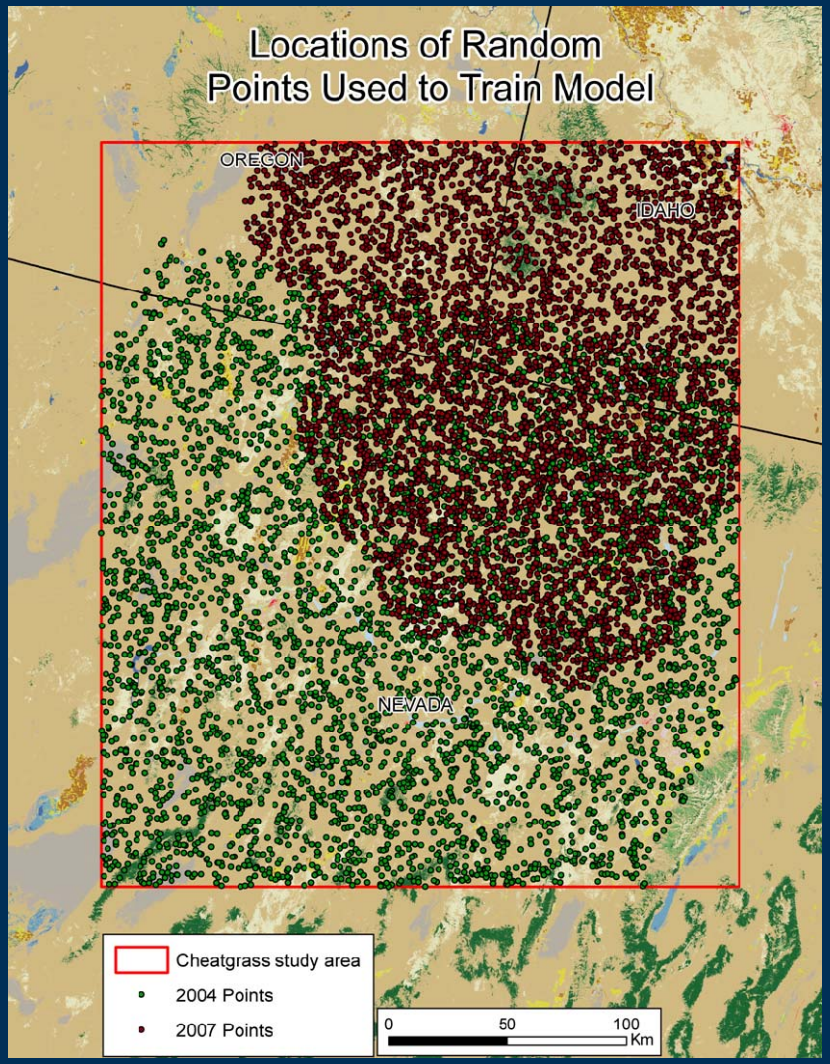
Model Development

About 9,000 points were randomly generated and used to train a regression-tree model. We gathered points from overlap areas between our study area and Peterson's 2004 cheatgrass map and 2007 annual grass index map in the Owyhee Uplands.



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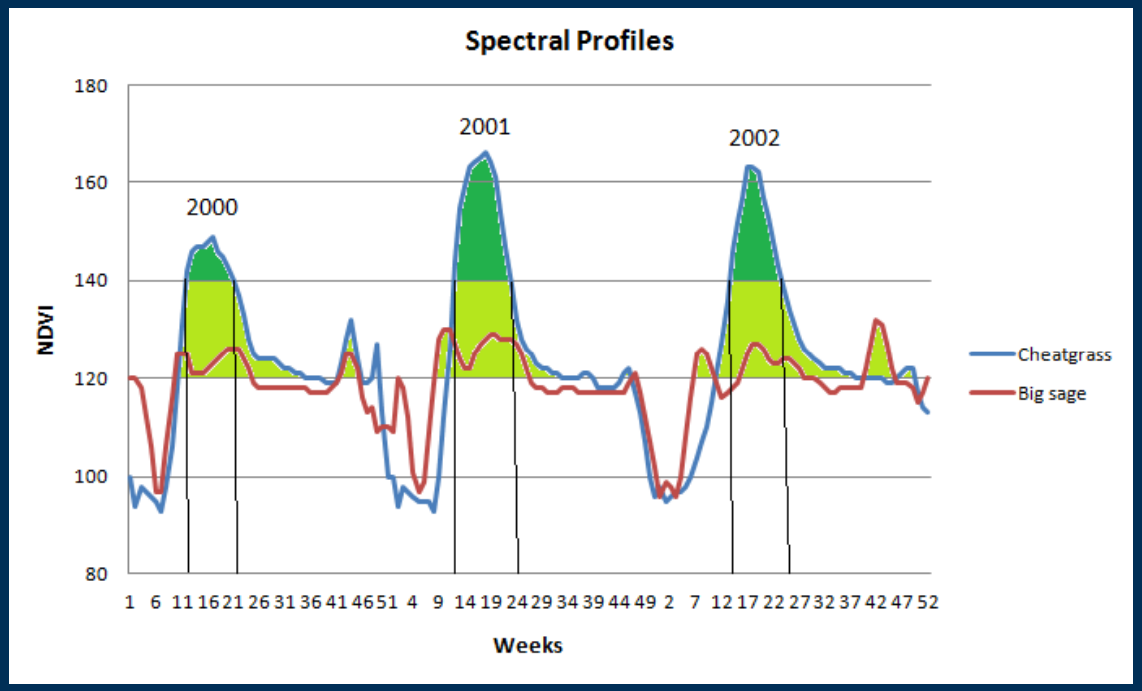
eMODIS NDVI Profiles

Early spring phenology of cheatgrass produces a spectral profile distinguishable from other vegetation types.



Two pixels in close proximity show distinctly different profiles during early spring.

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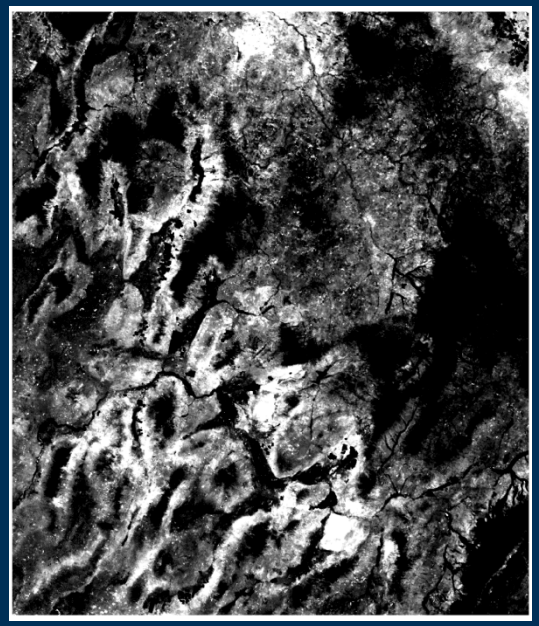
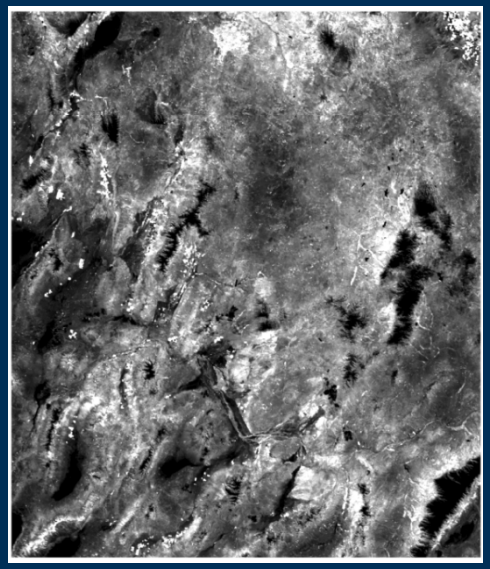
Time periods & index

We selected cheatgrass growing season period for spring and a period for cheatgrass senesce. We created an index to contrast spring and summer spectral differences.

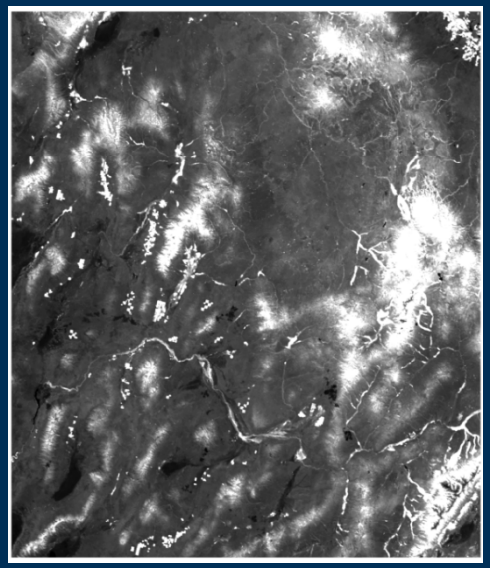
Index (Spring – Summer)
/ (Spring + Summer)



Spring period image



Summer period image



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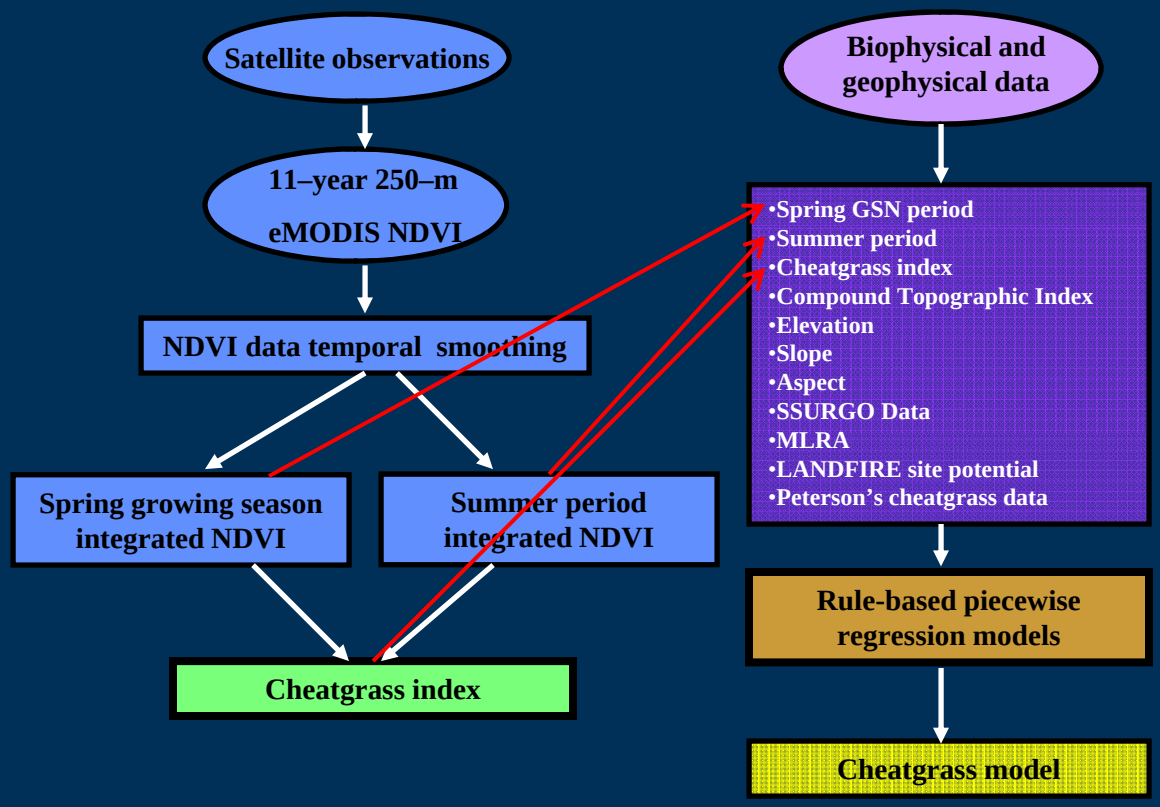
Cheatgrass model



Model details

Evaluation on training data (8933 cases):

Average |error|	2.7
Relative |error|	0.37
Correlation coefficient	0.87
R^2	0.76

Attribute usage:

Conds	Model	
83%	74%	spring
80%	83%	dem
79%	54%	index
61%	66%	summer
46%		mlra
38%	63%	cti
24%	30%	awc
20%		LF
5%	19%	nslp
3%	11%	sslp

Evaluation on test data (1011 cases):

Average |error|	2.8
Relative |error|	0.38
Correlation coefficient	0.85
R^2	0.72

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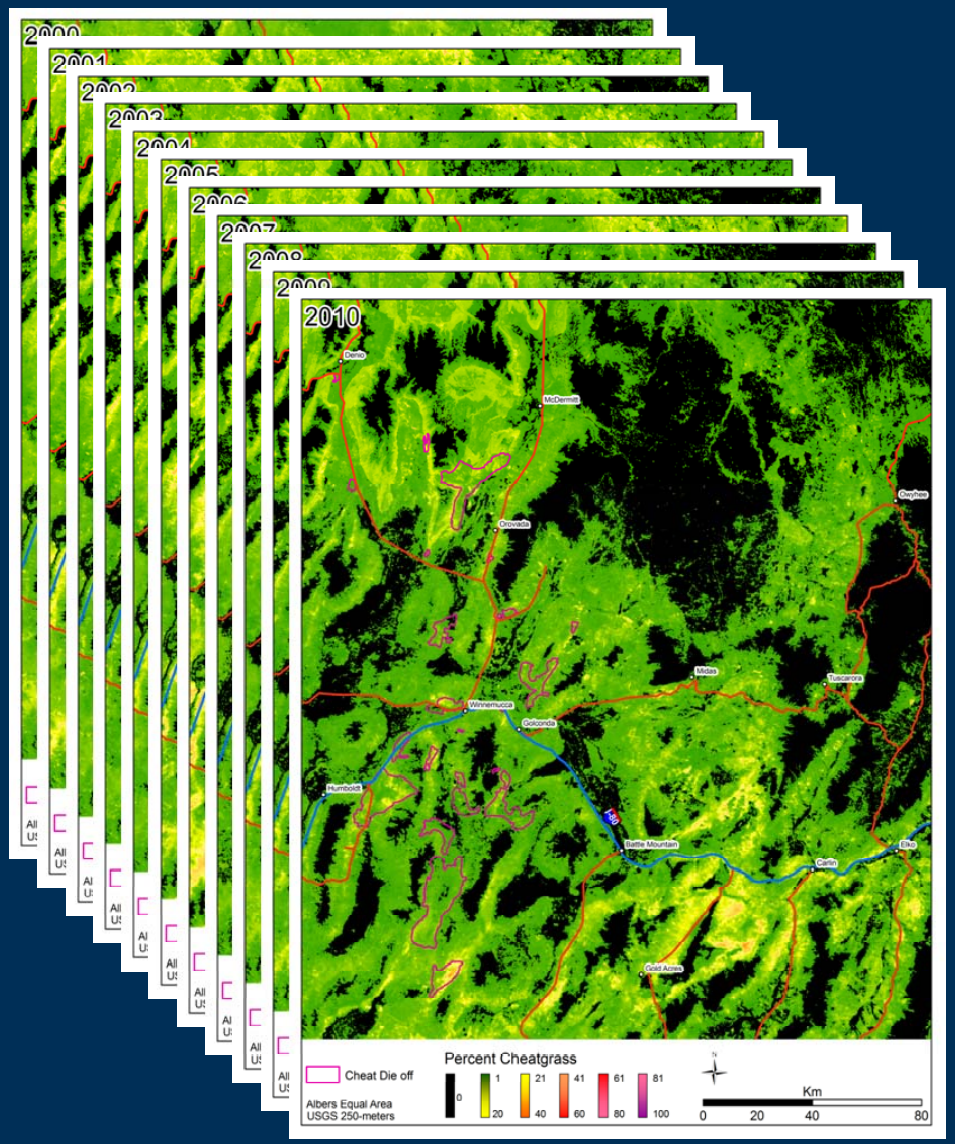
Cheatgrass maps

Maps have been developed for 2000 to 2010 using the cheatgrass model, geophysical data, and Peterson's cheatgrass data.



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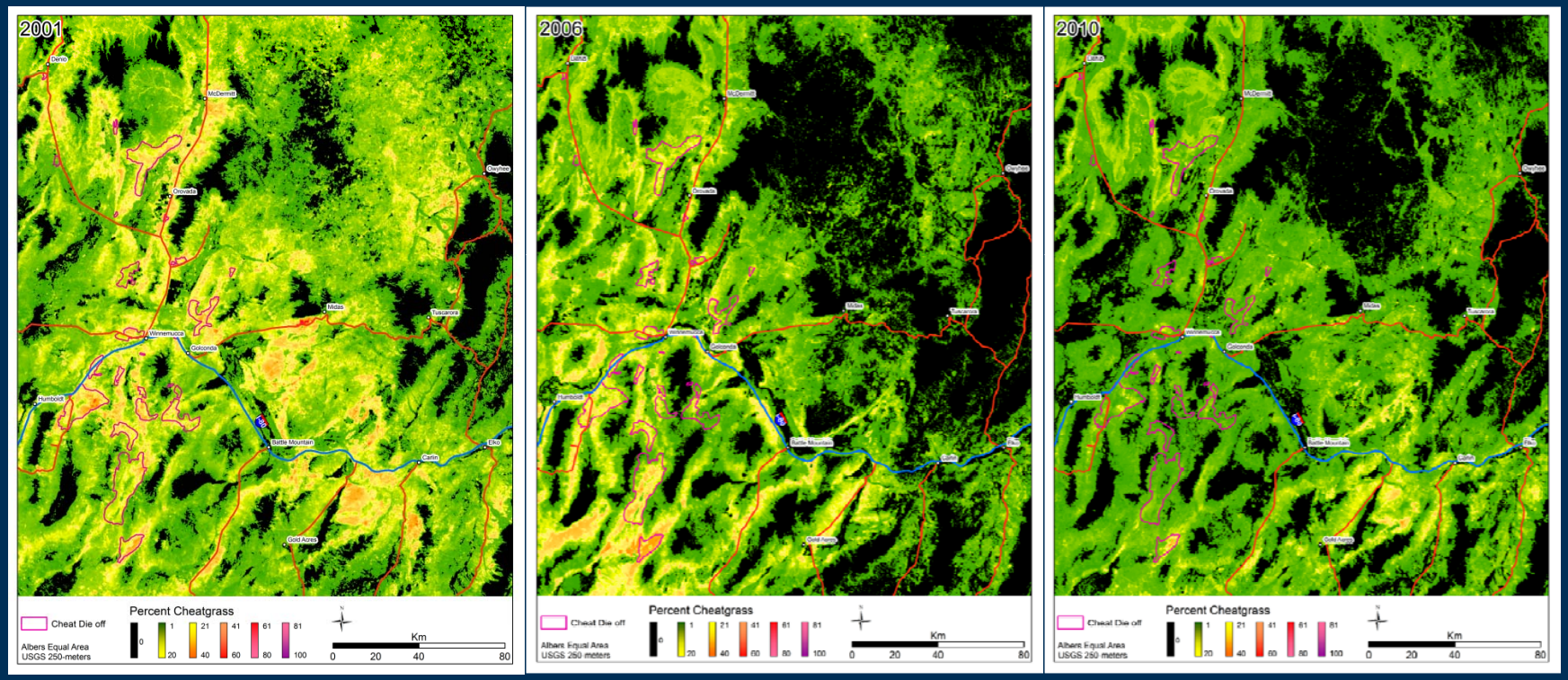
Comparing pre die-off with die-off areas



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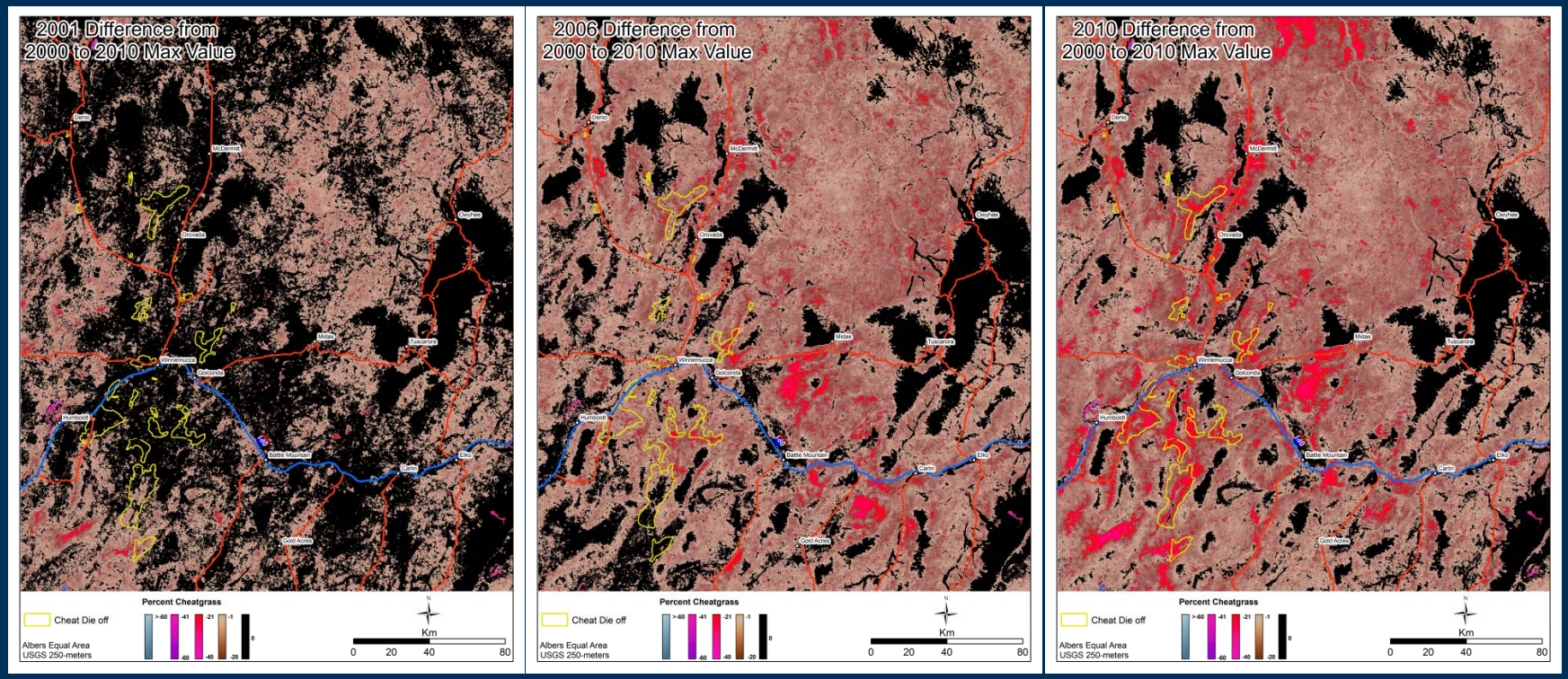
Difference Maps



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Future plans

- Model ecosystem performance anomalies by separating weather influences from influences of management activities and disturbances
- Estimate future cheatgrass productivity using future climate projections
- Estimate future cheatgrass extents using future climate projections

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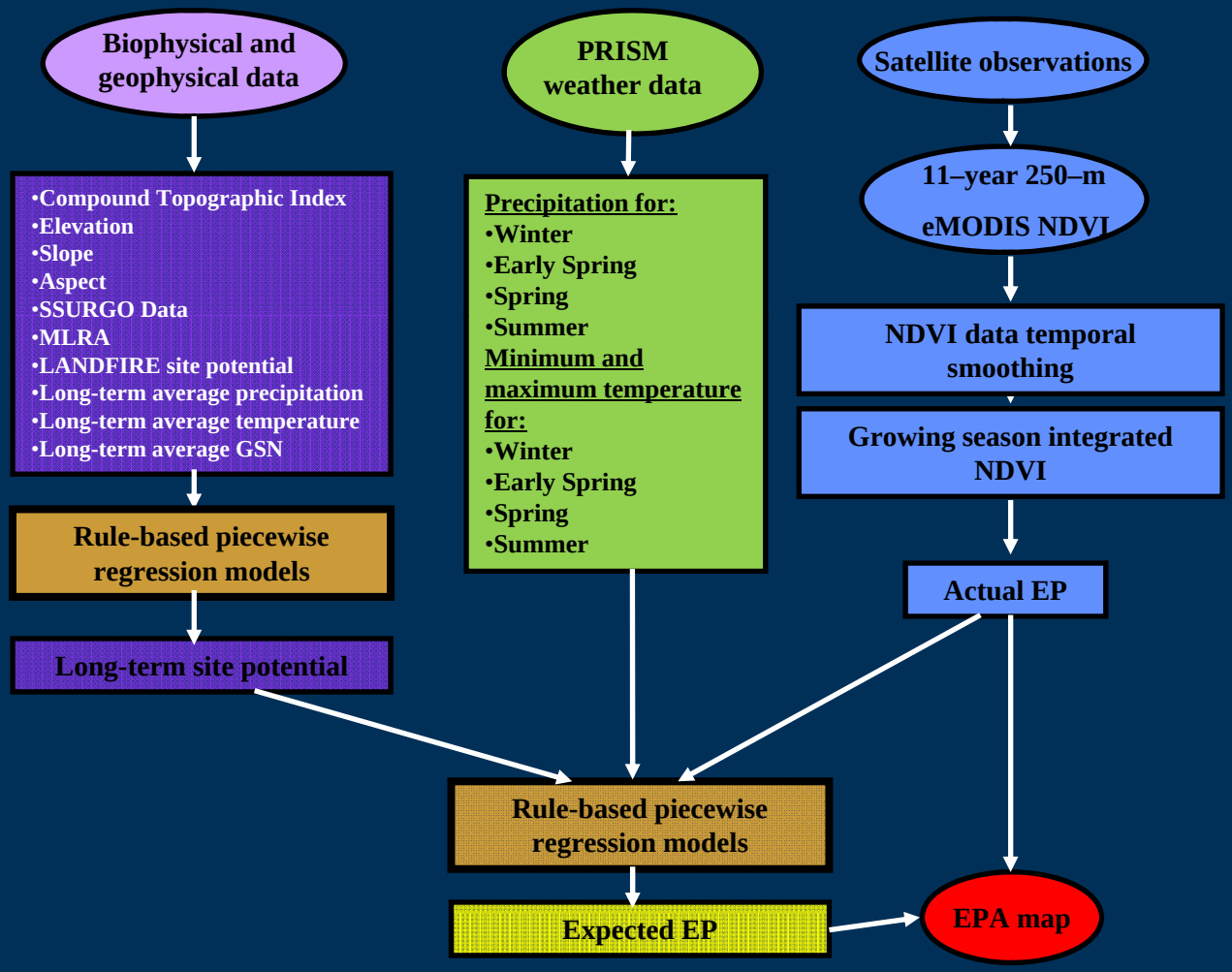
Ecosystem performance anomalies

Data inputs, processes, and outputs

We separate an ecosystems' response to weather from its response to management activities and disturbances. We identify areas of under and overperformance by comparing expected ecosystem performance with actual ecosystem performance.



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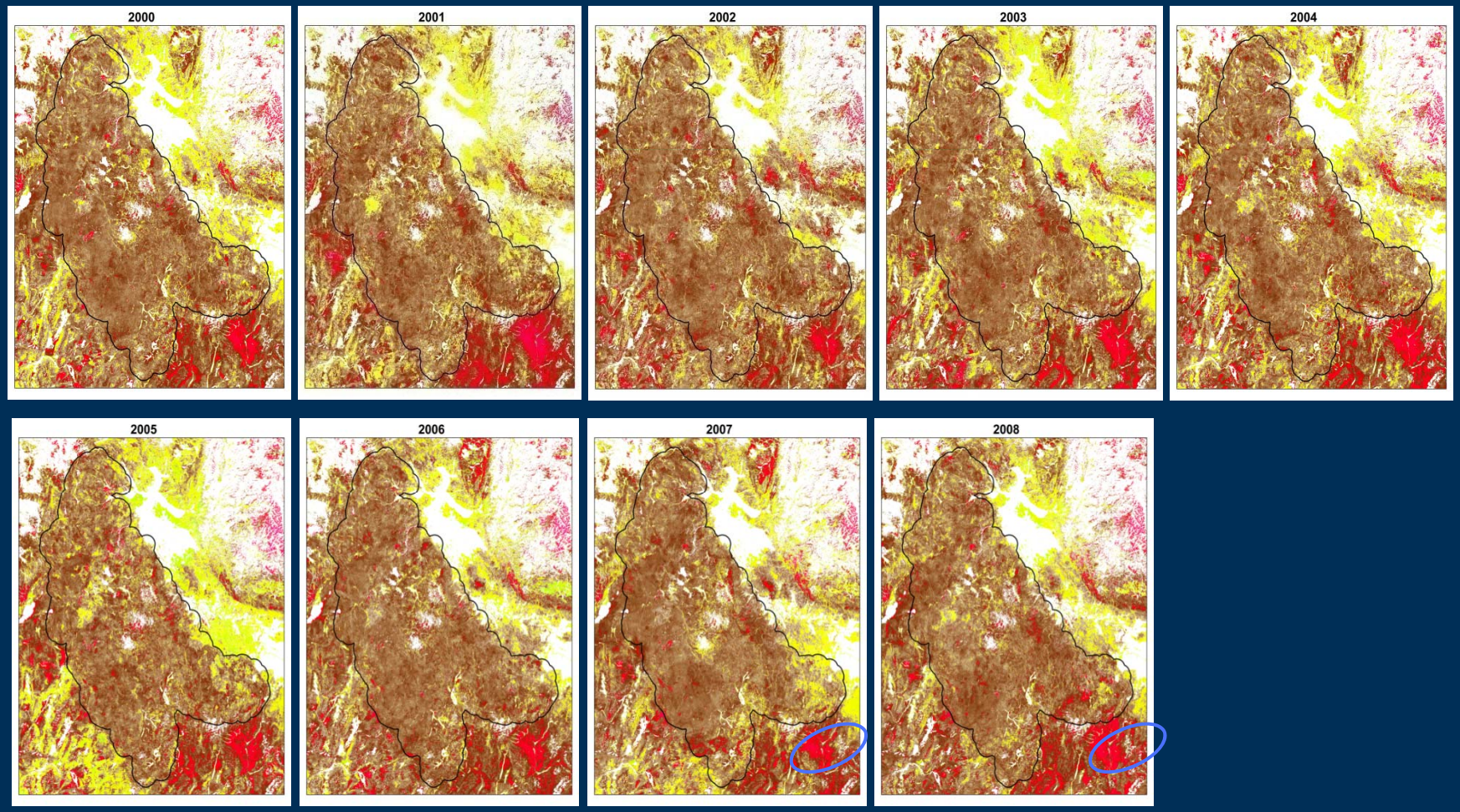
Performance anomaly time series



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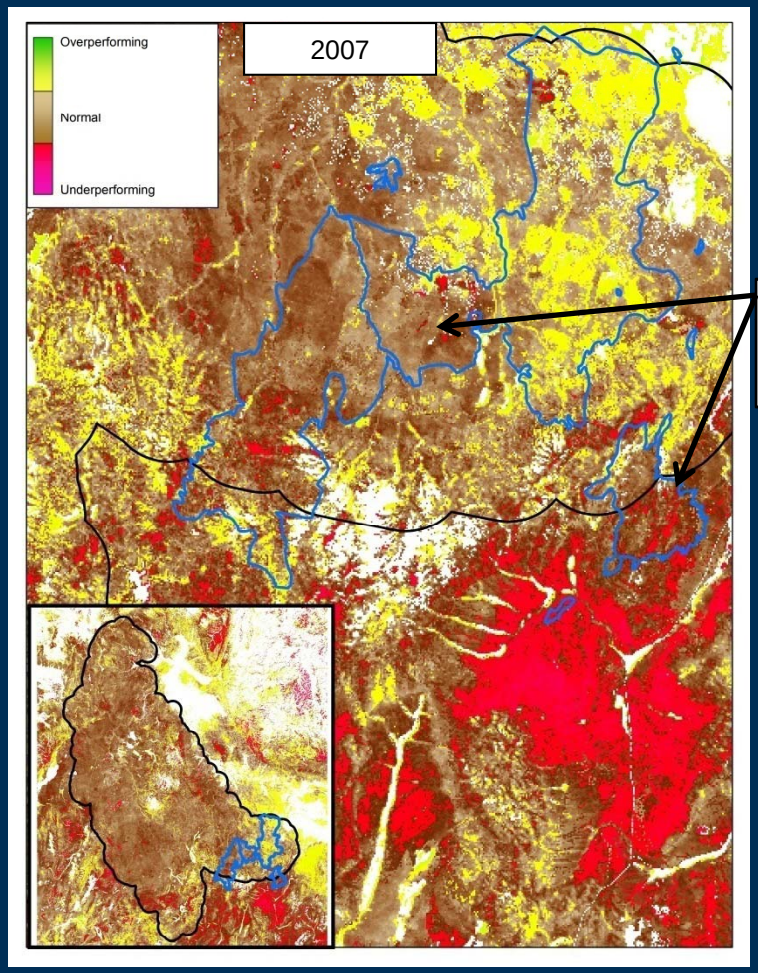
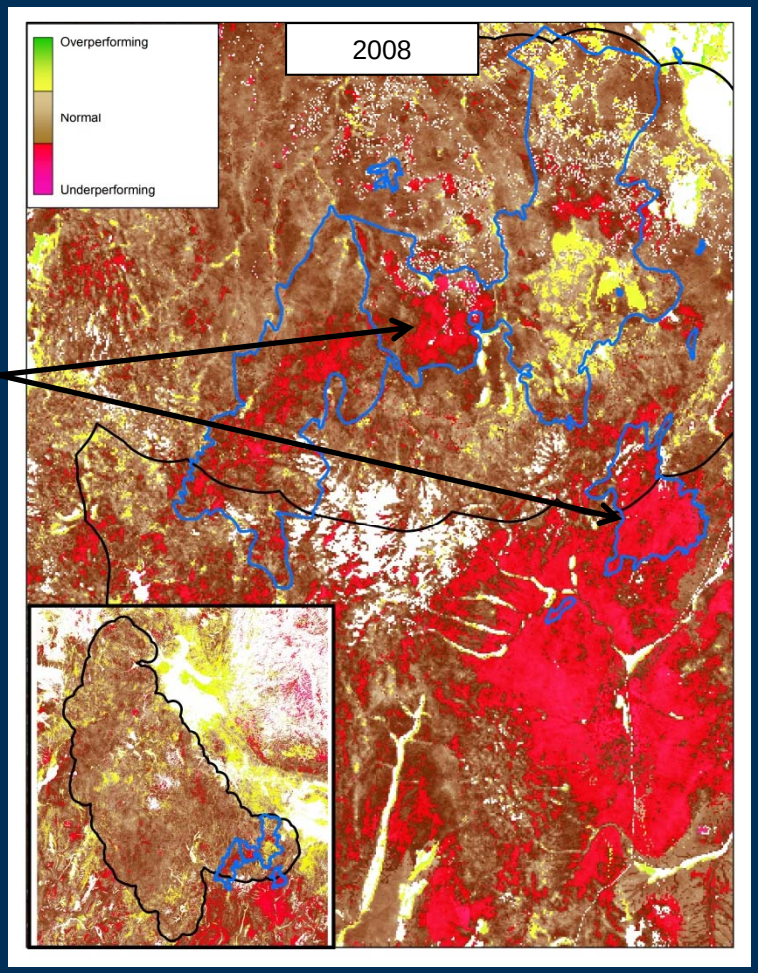
Fire disturbance reflected in performance anomaly



Significant performance changes



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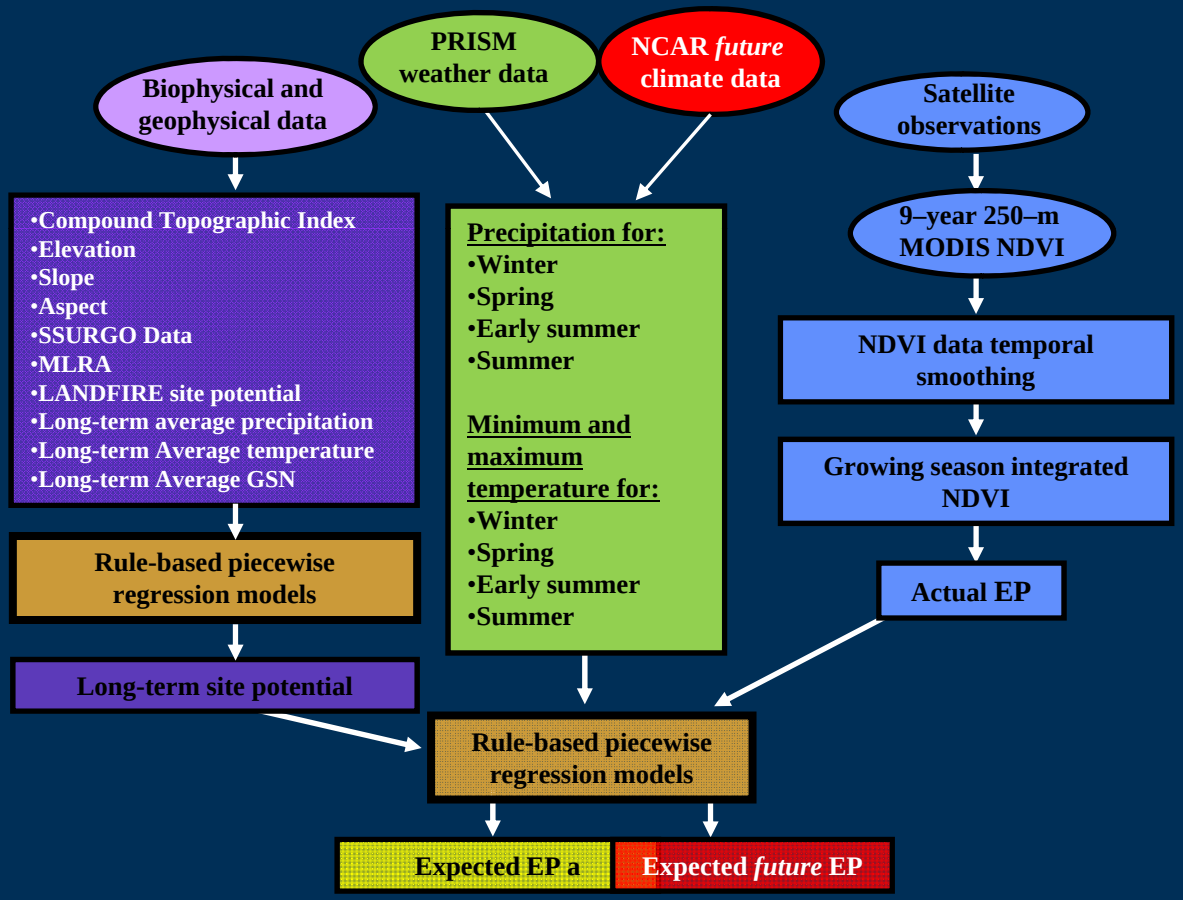
Past, present, and future land cover productivity and extents

We input historical and modern weather data and future climate data into our model to track big sagebrush productivity and extents through time. Understanding where big sagebrush is projected to be most productive and contract or expand can help inform management plans.

Data inputs, processes, and outputs



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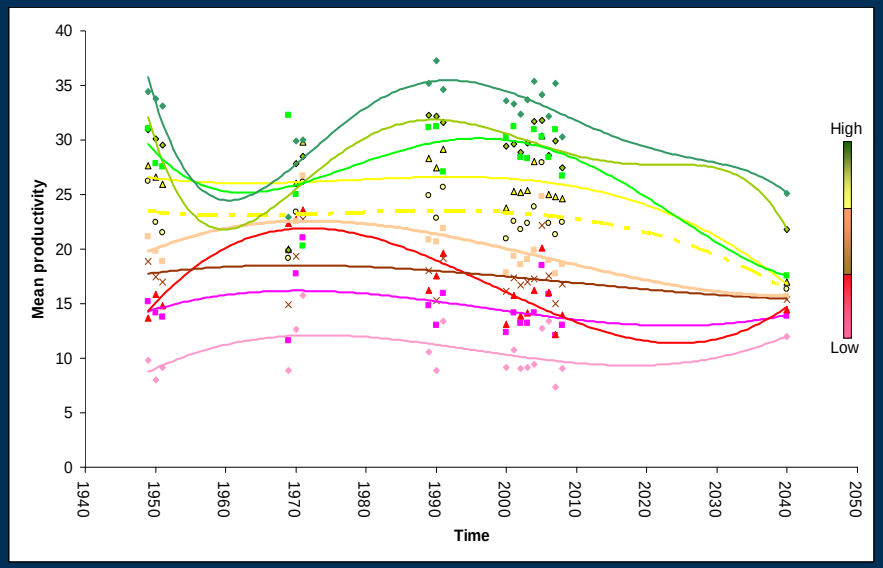
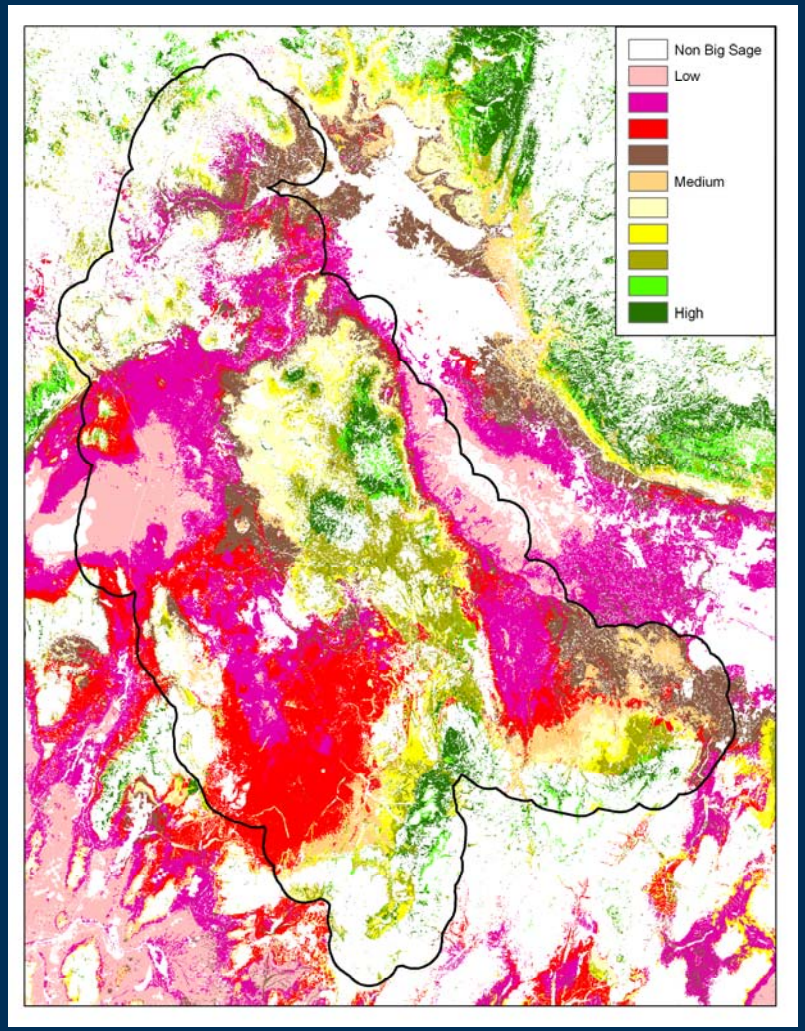
A time-series of big sagebrush productivity





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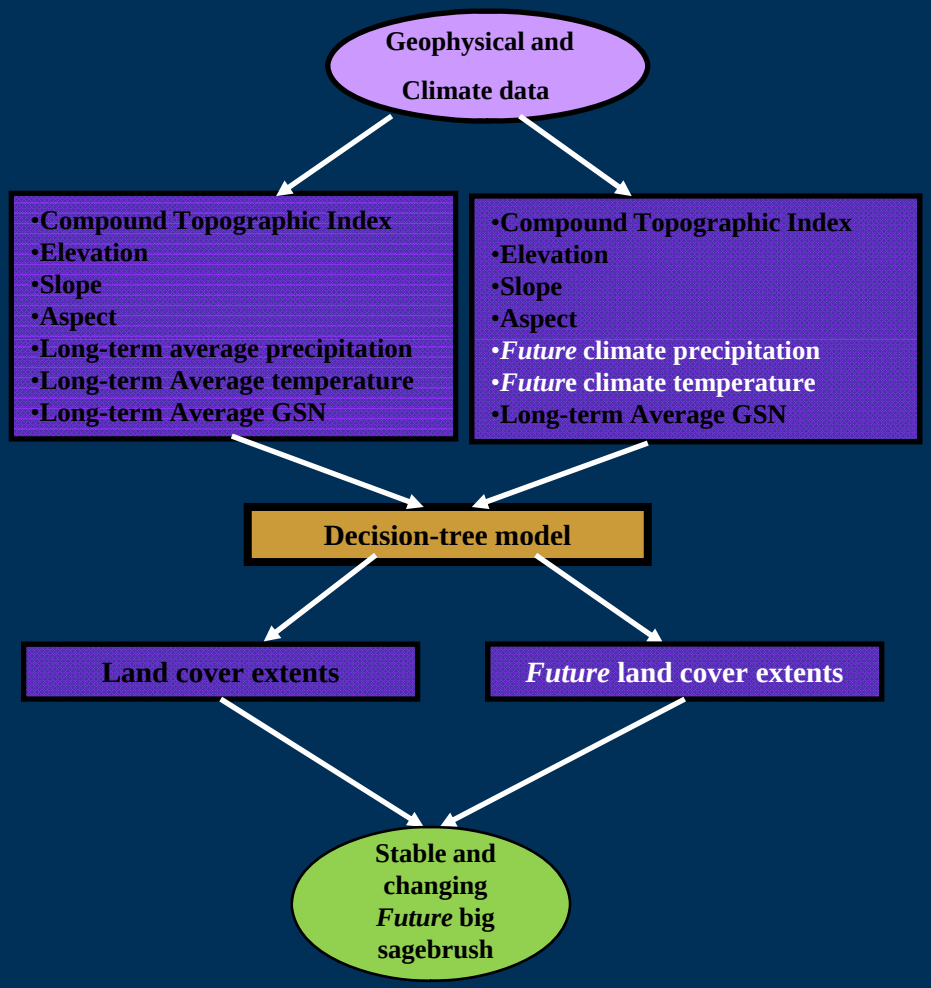
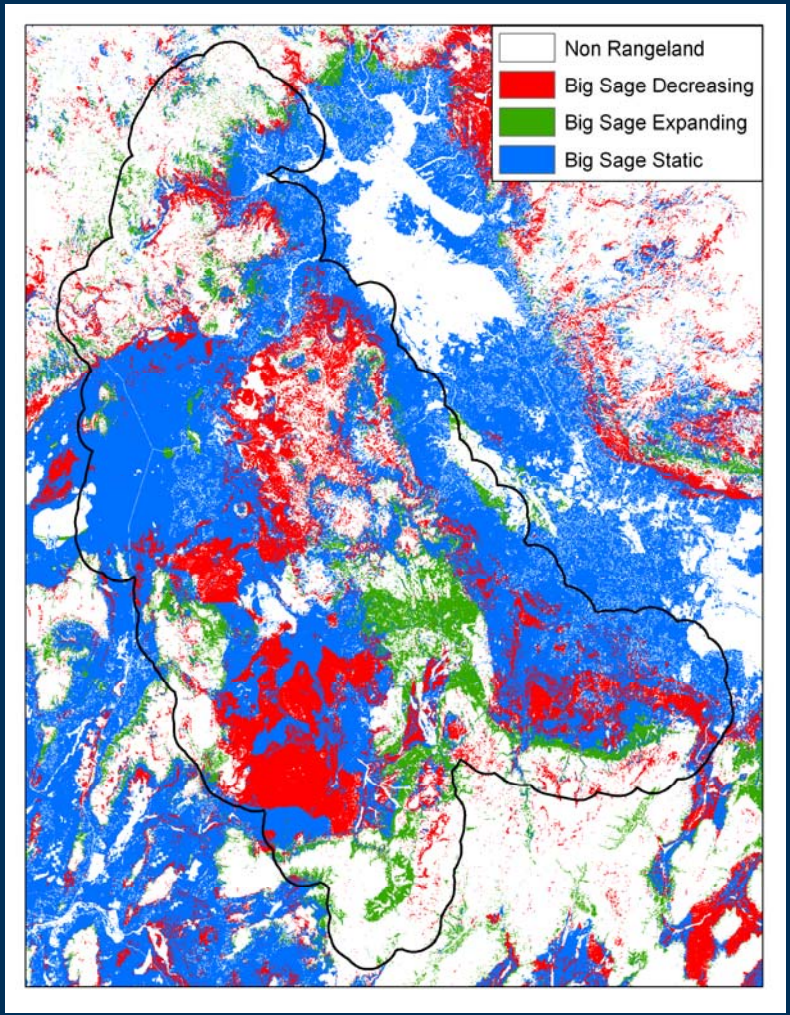
Estimating future big sagebrush extents





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Summary/Acknowledgements

The presence and abundance of cheatgrass varies spatially over time, and we can capture the variances using remote sensing technologies.

Ecosystem performance anomaly modeling separates weather effects from effects of disturbance and management activities.

Future land cover extents and productivity can be estimated using future climate projections as inputs into regression-tree software.

We seek to integrate our work with others, and we hope to expand the study area to include more of the northern Great Basin region.

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