

SageCast

Dynamic spatiotemporal modeling of sagebrush cover under
climate change to support management of sage-grouse in
Wyoming, USA

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Motivation

Goal of the core area strategy:

"...to minimize future disturbance by co-locating proposed disturbances within area already disturbed or naturally unsuitable."

State of Wyoming 2015

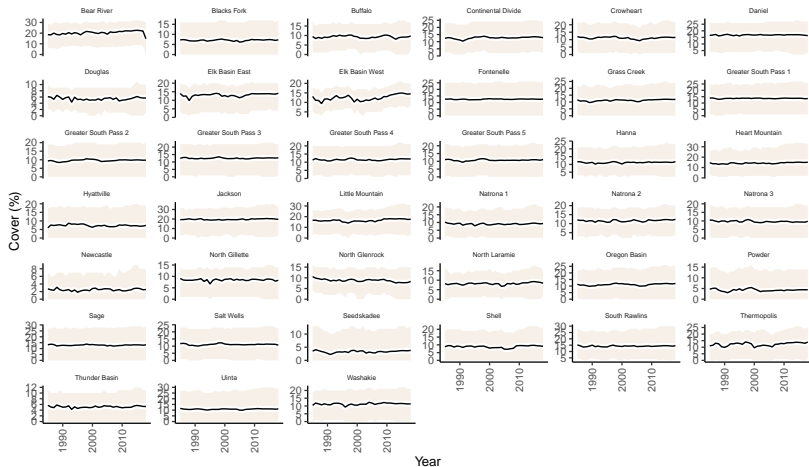
Motivation

Climate change might switch habitat from being “naturally” suitable to unsuitable, or vice versa.

Approach

1. Fit a dynamic time series model to the Back-In-Time sagebrush data set to quantify the influence of weather/climate on sagebrush cover change.
2. Use the fitted model to project changes into the future, driven by global circulation model projections.

Data: BIT Time Series



Model: dynamic additive spatiotemporal model

$y_{i,t}$ = observed percent cover of cell i in year t

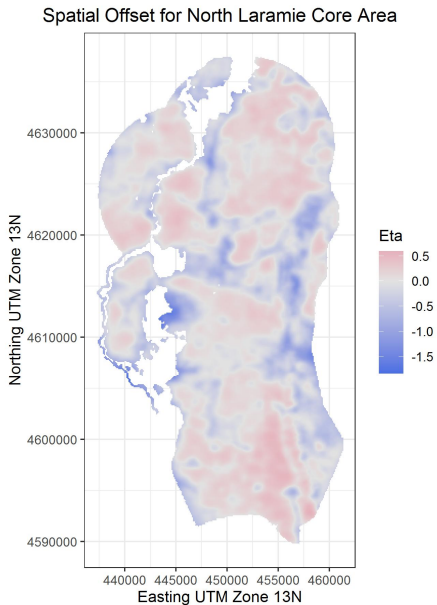
$x_{i,t}$ = log cover in year $t-1$ and observed climate covariates in cell i in year t

w_i = observed deviation of cell i from the mean percent cover

$$y_{i,t} \sim \text{Poisson}(\exp(\mu_{i,t})) \quad (1)$$

$$\mu_{i,t} = \beta x'_{i,t} + \gamma_t + w_i \quad (2)$$

Spatial offset (w_i)

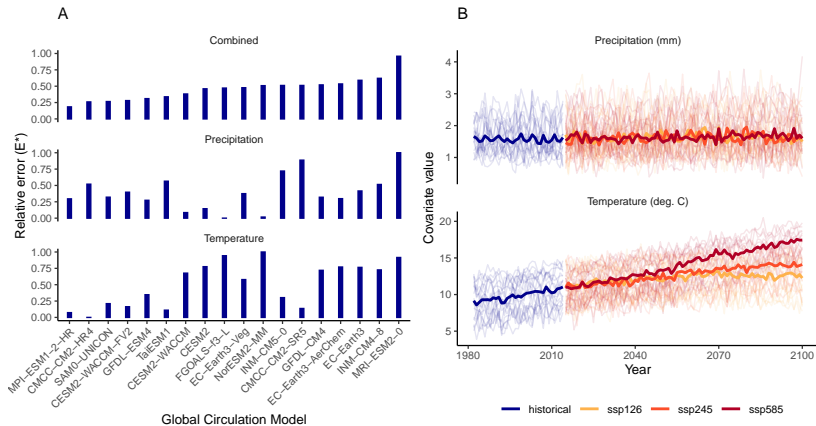


Climate covariates

- ▶ Average spring-through-summer* precipitation
- ▶ Average spring-through-summer temperature

* March 1 through August 31 for each year t

Climate change projections

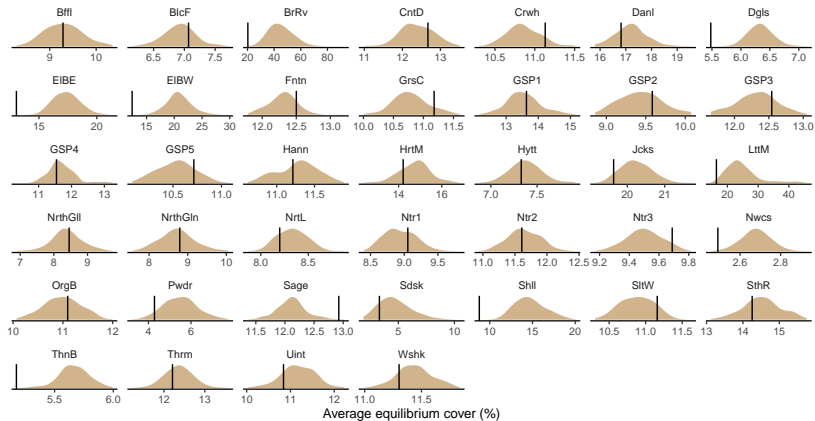


Sagebrush cover targets

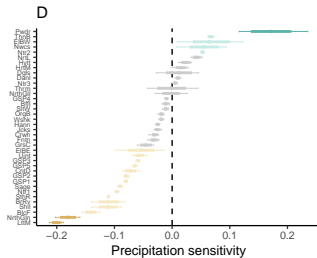
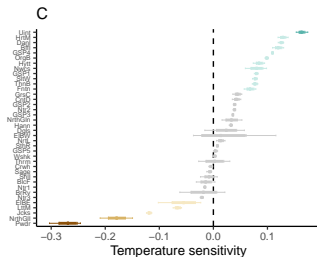
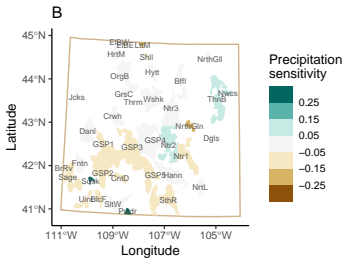
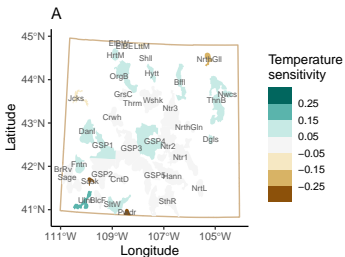
Average cover across all active nesting and summer habitat at 100m resolution

Region	NestingTarget	SummerTarget
Central Region	13.32%	12.29%
Northeast Region	9.04%	10.36%
Southwest Region	15.43%	16.71%

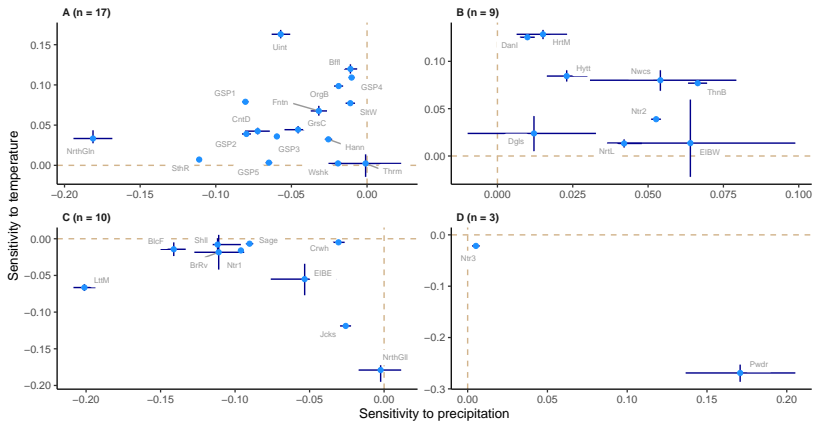
Results: equilibrium cover



Results: Climate sensitivity

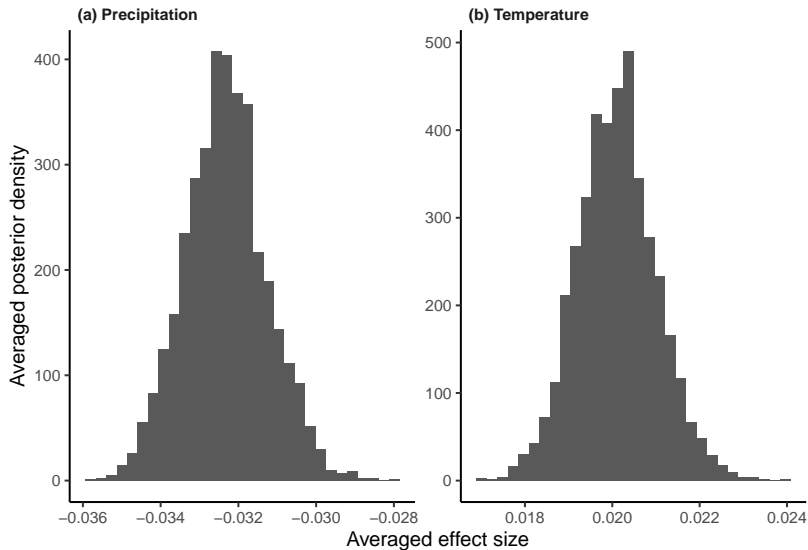


Results: Climate sensitivities

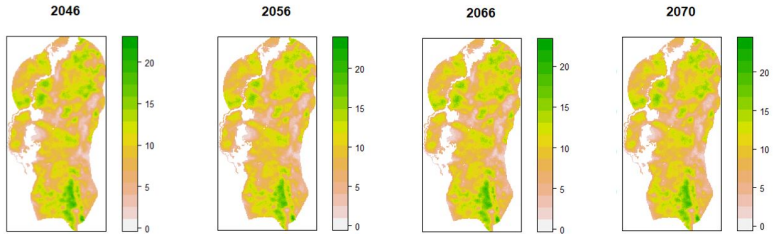


Average posterior effects

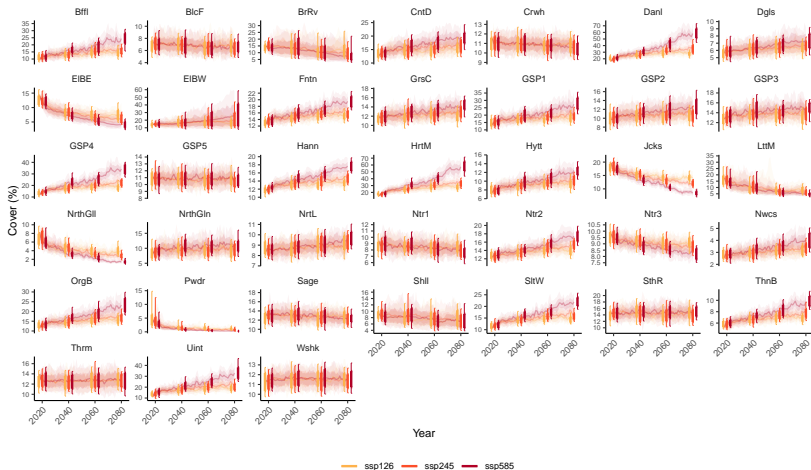
*Removed Seedskadee



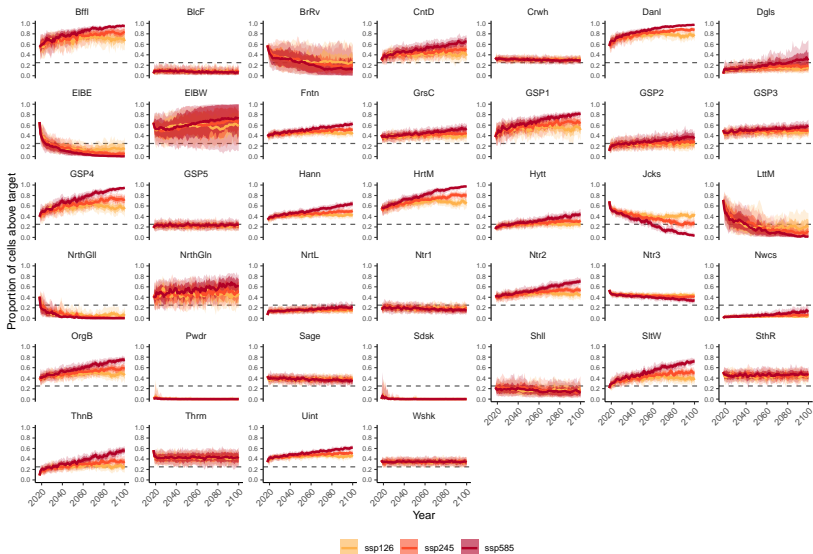
Projections of sagebrush cover



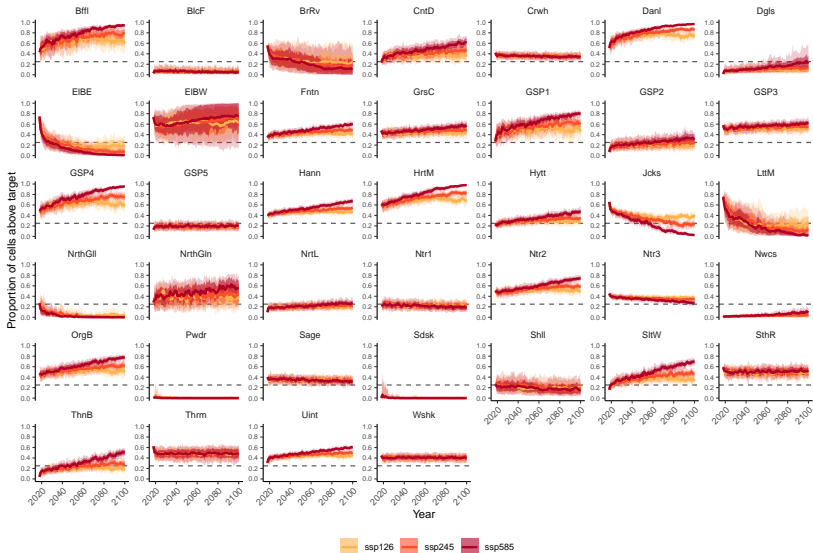
Projections of sagebrush cover



Projections of sagebrush cover: nesting targets



Projections of sagebrush cover: summer targets



Conclusions

- ▶ Climate change is likely to benefit more than hurt sagebrush ecosystems in Wyoming
 - ▶ Positive effect of temperature and temperature increasing
 - ▶ Negative effect of precipitation, but precipitation projected to remain the same
- ▶ Few, if any, “lost causes”
- ▶ Sage-grouse core area strategy still viable under climate change