

# Sagebrush Steppe Climate Change Vulnerability Assessment



## Brief for Resource Managers

### Effects of climate change on sagebrush regeneration at the leading and trailing edge of its distribution

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In the United States, the current distribution of big sagebrush ranges from Washington and California east to the Dakotas and Nebraska. In the future, areas where sagebrush will expand, the leading edge, are predicted to be on the northern edge of its current range—predominately northeast Montana. Conversely, areas where the current sagebrush distribution is predicted to contract, the trailing edge, reside at the southern edge of the current distribution, including the Great Basin. Both of these projected shifts are most likely in response to predicted increased minimum temperature and changes in precipitation amount and seasonality. Climate and hydrological factors have the potential to strongly affect sagebrush regeneration because sagebrush does not reproduce asexually and depends solely on germination rates and seedling survival. By exploring these relationships using an ecohydrologic simulation model, we found that sagebrush germination is not expected to be limiting at either the leading or trailing edge. However, seedling survival was expected to decrease at the trailing edge while increasing at the leading edge.

#### Management Implications

- Seed germination is unlikely to change at either the leading or trailing edge.
- Seedling survival is expected to decrease at the trailing edge while increasing at the leading edge.
- Actions to enhance seedling survival would be beneficial at both the leading and trailing edges.

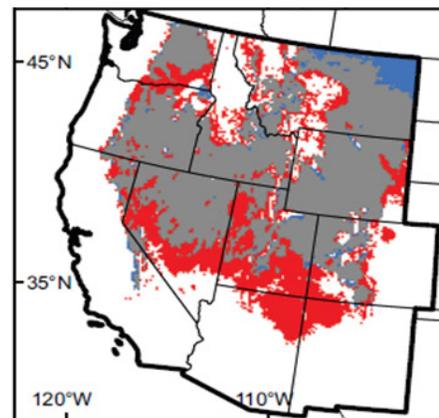


Figure 1. The future sagebrush distribution leading edge is represented in blue and the future trailing edge is represented in red. *Image from: Schlaepfer et al 2012.*

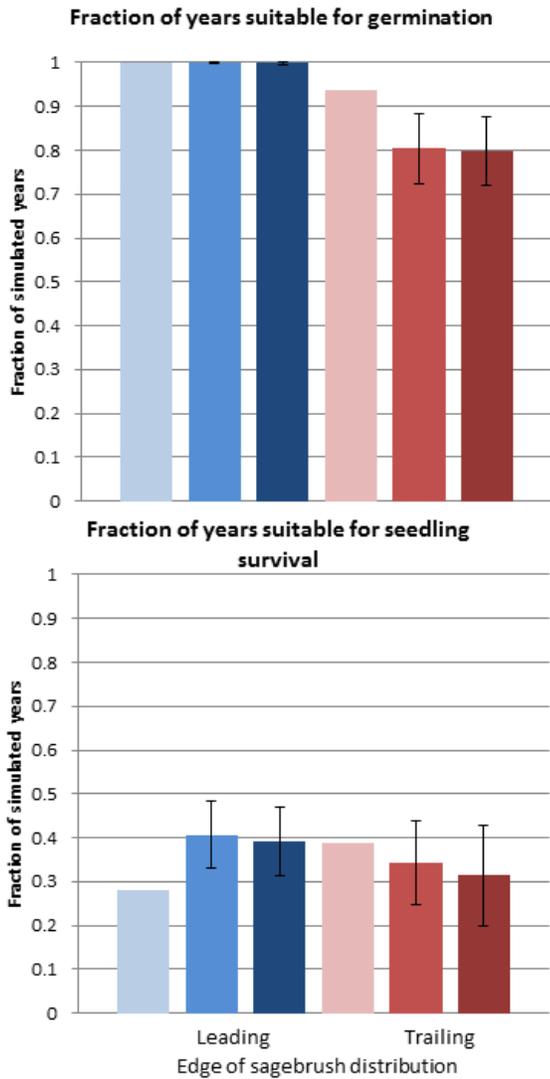


Figure 2. Mean fraction of simulated years suitable for sagebrush germination and seedling survival for the leading (blue) and trailing (red) edges under current climate (lightest shade), RCP4.5 (medium shade), and RCP8.5 (darkest shade) emission scenarios. Values are means among sites for current climate and for future scenarios values are means of 16 GCMs. Error bars are 1 SD.

**Most relevant references:**

Schlaepfer, DR, WK Lauenroth, and JB Bradford. 2012. Effects of ecohydrological variables on current and future ranges, local suitability patterns, and model accuracy in big sagebrush. *Ecohydrology* 35:374-384.

Schlaepfer, DR, WK Lauenroth, and JB Bradford. 2014. Modeling regeneration responses of big sagebrush (*Artemisia tridentata*) to abiotic conditions. *Ecological Modelling* 286:66-77.

Schlaepfer, D. R., W. K. Lauenroth, and J. B. Bradford. 2014. Regeneration processes in big sagebrush (*Artemisia tridentata*). *Rangeland Ecology & Management* 67:344-357.