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Publication Brief for Resource Managers

Release Date:	Contact:	Phone:	Email:
June 17, 2008	Cameron Aldridge	970-226-9433	aldridgec@usgs.gov
	Zachary Bowen	970-226-9218	bowenz@usgs.gov

U.S. Geological Survey, Fort Collins Science Center, 2150 Centre Ave. Bldg. C, Fort Collins, CO 80526-8118

Range-wide patterns of greater sage-grouse persistence[1]

Greater sage-grouse (*Centrocercus urophasianus*) once occupied 1.2 million km^2 of the North American shrub-steppe-dominated habitats of the western United States and southwestern Canada. Today, sage-grouse exist in just over half of their historical range, with populations declining by 2 percent per year since 1965. Although numerous studies have documented local population declines, none have examined how broad-scale, long-term trends have affected range contraction.

Investigators used a digital range map depicting the current and estimated pre-settlement distribution for sage-grouse to determine whether common landscape factors can be used to predict range-wide patterns of sage-grouse extirpation. They developed a persistence model for greater sage-grouse based on landscape conditions among currently occupied (extant) and previously occupied (extinct) ranges.

Range-wide extirpations were explained by distribution of remaining sagebrush habitat, cultivated cropland, human population density in 1950, prevalence of severe droughts, and historic range periphery. The authors estimated that extirpation was more likely in areas having at least 4 persons/km^2 in 1950, a minimum of 25 percent cultivated cropland (ca. 2002), and severe droughts on average of 3 years per decade. In contrast, greater sage-grouse were more likely to persist in areas further than 30 km from historic range periphery and in landscapes with a minimum of 25 percent sagebrush cover within a large area (2,979 km^2).

Although the authors highlight populations that may be at risk based on past patterns of extirpation, future range loss may relate less to historical mechanisms of decline and more to recent changes in land use and habitat condition, including energy developments, non-native species invasions, and spread of new invasive disease such as West Nile virus. This paper discusses implications of future landscape change on the persistence of current populations and provides insights into greater sage-grouse conservation efforts.

If sage-grouse are protected under the U.S. Endangered Species Act, retrospective assessments of sage-grouse range and population performance will be critical to understanding relationships between anthropogenic drivers of landscape change and sage-grouse population persistence.

[1] Scientific references and the full report forthcoming in *Diversity and Distributions*, Blackwell Publishing.

FULL REPORT:

Cameron L. Aldridge,[1*] Scott E. Nielsen,[2,6] Hawthorne L. Beyer,[2,7] Mark S. Boyce,[2] John W. Connelly,[3] Steven T. Knick,[4] And Michael A. Schroeder, 2008, Range-wide patterns of greater sage-grouse persistence:* Diversity and Distributions, *(Blackwell). In press.
[1]*Natural Resource Ecology Laboratory, Colorado State University and U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO. Corresponding author: tel. 970-226-9433; email aldridgec@usgs.gov*
[2]*Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada, boyce@ualberta.ca*
[3]*Idaho Fish and Game, Department of Biological Sciences, Idaho State University, Pocatello, ID, JCsagegrouse@aol.com*
[4]*USGS Forest and Rangeland Ecosystem Science Center, Snake River Field Station, steve_knick@usgs.gov*
[5]*Washington Department of Fish and Wildlife, schromas@dfw.wa.gov*
[6]*Formerly, ASRC Management Services at USGS Fort Collins Science Center, Fort Collins, CO; currently, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada, scottn@ualberta.ca*
[7]*Graham Kerr Building, Division of Environmental & Evolutionary Biology, University of Glasgow, Scotland, UK, hawthorne@spatialecology.com*

MANAGEMENT IMPLICATIONS

Sage-grouse populations are affected by precipitation and drought. Drought conditions result in decreased nest success and/or reduced chick survival. This analysis found that the number of severe droughts from 1950–2003 had a weak negative effect on patterns of sage-grouse persistence. However, droughts may have a greater influence on future sage-grouse populations, since projected temperature increases over the next 50 years could result in drier conditions that reduce sagebrush habitat quality. Drier conditions in turn could influence impacts from livestock grazing, invasions of non-native species, and fire frequency. Although temperature and seasonal precipitation patterns cannot be changed, livestock grazing practices could be altered in dry years to reduce the removal of herbaceous vegetation.

Management strategies that reduce fire frequency could be effective, because fire has been shown to reduce the quality of sagebrush habitats, resulting in sage-grouse population declines. And, climate change has been demonstrated to dramatically alter fire frequencies.

Management actions that increase and enhance the number, quality, and connectivity of sagebrush habitats, while limiting fragmentation from anthropogenic sources, will be particularly important for maintaining viable sage-grouse populations, given uncertainties associated with the impact of climate change on sagebrush habitats, as well as increased energy extraction activities in sagebrush ecosystems.

Model predictions could be used as an initial conservation tool. While misclassification of sage-grouse persistence could be due to inaccuracies in the current range maps or other environmental and anthropogenic factors not considered, model outputs can be used to spatially identify two conservation practices: (1) mitigation of negative effects in areas where populations are most at risk; and (2) identification of areas best suited for possible recolonization. Areas currently occupied by sage-grouse but predicted as extirpated (i.e., false-negative predictions) can be used to rank populations most at risk of future extirpation and subsequently identify sites for immediate conservation efforts. Conversely, extirpated range most similar to habitats currently occupied by sage-grouse (i.e., false-positive predictions) can be used to identify areas most suitable for recolonization. Establishing connectivity to core populations or increasing patch size through restoration efforts, together with possible reintroduction programs, may provide a strategy for reversing historic sage-grouse population declines.

Conservation of remaining sage-grouse range will likely require prioritization of populations. Maps predicting probability of sage-grouse persistence could be used in conjunction with local measures of population performance and known threats to prioritize or “triage” sites for management and protection. Study results suggest conservation efforts that maintain large expanses of sagebrush habitat and enhance the quality and connectivity of those patches would support persistence of sage-grouse populations.