

Executive Summary: Workshop for Experts on the Genetics of the Greater Sage-Grouse

*Held at the USGS Fort Collins Science Center in Fort Collins, Colorado,
On October 22 and 23, 2014*

Prepared by the Workshop Planning Team

The greater sage-grouse (*Centrocercus urophasianus*) is one of the most intensively studied upland game bird in North America. Ongoing research continues to improve our understanding of genetic diversity across the species' range including the degree to which observed differences represent distinct or isolated populations. Techniques and metrics used to evaluate and describe genetic isolation, divergence, and diversity have also evolved and improved since previous genetic studies were published in 2005 and summarized in 2011 (Oyler-McCance *et al.* 2005; Oyler-McCance and Quinn 2011). Since then, new research on the genetics of sage-grouse has been completed while other studies are now in progress.

In 2010, the U.S. Fish and Wildlife Service (Service) determined the greater sage-grouse warranted protection under the Endangered Species Act (ESA or Act) but that listing was precluded by higher priorities. Habitat loss and fragmentation due to a variety of factors were cited as the primary threats to the species. Fragmenting habitats can isolate or reduce the size of populations, which may be more vulnerable to population declines, reduced genetic diversity, and potentially extinction. We used this workshop to better understand the latest science regarding sage-grouse genetics and any potential risks associated with isolation and small populations.

The Service is currently assessing the status of the greater sage-grouse and is gathering the best available scientific and commercial data to inform a status determination by September 30, 2015. While a rider to the Fiscal Year 2015 Omnibus Appropriations Bill will prevent the Service from writing or publishing a proposed rule, it does not relieve the Service from completing a status review to determine whether the species still warrants protection under the Act.

As the Service gathers the best available information on sage-grouse genetics, the Service partnered with the U.S. Geological Survey (USGS) to organize a workshop to elicit information from scientific experts about recent developments in the field of sage-grouse genetics. The workshop explored the characteristics of gene flow across the range, including potential impediments, or barriers, to gene flow and any implications of genetic divergence across the range of the greater sage-grouse. The workshop also explored potential interactions between threats and genetic processes, and provided an opportunity for scientific experts to discuss ongoing and upcoming research on sage-grouse genetics. The workshop was structured to elicit information from the scientific experts that could later help the Service identify genetic differentiation across the range, populations with low genetic diversity, or populations with unique genetic characteristics.

The following is a brief summary of the key issues identified by individual experts during the workshop. Group consensus was not asked for or provided during the workshop, so this summary reflects individual perspectives shared by experts:

- Currently, the published genetic data is not sufficient to determine the amount of landscape-level gene flow between large, eastern and western portions of the overall range, but upcoming research will investigate further. Some degree of gene flow likely occurs from east-to-west across the range.
- Natural and human-caused features that impede the movement of individual birds, such as mountains, large rivers, deserts, forests, large reservoirs, agricultural fields, electrical power lines, highways, and energy development, may generally act as barriers to gene flow for the greater sage-grouse.
- Available genetic data indicates that the bi-state, Columbia Basin, and Jackson Hole populations are isolated from other populations and have low levels of gene flow with other sage-grouse populations. The Columbia Basin and Jackson Hole populations are also small, isolated, and less genetically diverse than the bi-state population. The bi-state population has likely been isolated for thousands of years, but it is currently unclear how long the Columbia Basin and Jackson Hole populations have been isolated.
- The Missouri River Valley likely acts as a barrier to gene flow between populations located to the north and south.
- The Strawberry Valley population in Utah has low genetic diversity likely due to predation, but is still connected to other nearby populations.
- Small, isolated populations are more vulnerable to extirpation or extinction from demographic processes and stochastic events. Threats that fragment sagebrush habitats potentially increase the number and magnitude of barriers to gene flow and amplify the risks of small, isolated populations.
- Populations at the periphery of the range may have low genetic diversity as a result of low numbers or isolation, but may also be uniquely adapted to specific environmental conditions. These unique adaptations may increase the adaptive potential of sage-grouse so that the species has a higher probability of persistence during potential future changes to habitat or climate.
- Upcoming research, particularly a range-wide landscape connectivity study, will provide more information about the role that barriers play in moderating gene flow across the species' range.
- Available research has not evaluated the genetic makeup of all sage-grouse populations. Upcoming research may also identify additional isolated populations.

This workshop was one component of the Service's information gathering process for the status review. Information gathered during the workshop will be used by the Service in conjunction with other published literature or information submitted by interested parties, to evaluate the status of the species. The Service is committed to using the best available scientific and commercial information, and will incorporate new information as it becomes available.