Connectivity

Greater sage-grouse are a landscape-scale species, requiring large expanses of sagebrush to meet all seasonal habitat requirements. The loss of habitat from fragmentation and conversion decreases the connectivity between seasonal habitats potentially resulting in the loss of the population (Doherty *et al*. 2008, p. 194). Loss of connectivity also can increase population isolation (Knick and Hanser in press, p. 4, and references therein) and, therefore, the probability of loss of genetic diversity and extirpation from stochastic events.

Analyses of connectivity of greater sage-grouse across the sagebrush landscape were conducted by Knick and Hanser (in press, entire). Knick and Hanser (in press, p. 29) found that the average movement between population centers (leks) of sage-grouse rangewide was 16.6 km (10.3 mi), with a standard deviation of 7.3 km (4.5 mi). Leks within 18 km (11.2 mi) of each other had common features when compared to leks further than this distance (Knick and Hanser in press, p. 17). Therefore, they used a distance of 18 km (11.2 mi) between leks to assess connectivity (movement between populations), but cautioned that this distance may not accurately reflect genetic flow, or lack thereof, between populations (Knick and Hanser in press, p. 28). Genetic evidence suggests that exchange of individual birds has not been restricted, although there is a gradation of allelic frequencies across the species' range (Oyler-McCance and Quinn, in press, p. 14). This result suggests that widespread movements (e.g., across several States) are not occurring.

Population linkages primarily occurred within MZs, and connectivity between MZs was

limited, with the exception of MZs I (Great Plains) and II (Wyoming Basin). Within MZs, the Wyoming Basin (MZ II) had the highest levels of connectivity, followed by MZ IV (Snake River Plain) and MZ I (Great Plains) (Knick and Hanser in press, p. 18). The MZ VI (Columbia Basin) and VII (Colorado Plateau) had the least internal connectivity, suggesting there was limited dispersal between leks and an existing relatively high degree of isolation (Knick and Hanser in press, p. 18). Areas along the edges of the sage-grouse range (e.g., Columbia Basin, Bi-State area) are currently isolated from other sage-grouse populations (Knick and Hanser in press, p. 28).

Connectivity between sage-grouse MZs and the populations within them declined across all three analysis periods examined: 1965–1974, 1980–1989, and 1998–2007. The decline in connectivity was due to the loss of leks and reduced population size (Knick and Hanser in press, p. 29). Historic leks with low connectivity also were lost (Knick and Hanser in press, p. 20), suggesting that current isolation of leks by distance (including habitat fragmentation) will likely result in their future loss (Knick and Hanser in press, p. 28). Small decreases in lek connectivity resulted in large increases in probability of lek abandonment (Knick and Hanser, in press, p. 29). Therefore, maintaining habitat connectivity and sage-grouse population numbers are essential for sage-grouse persistence.

Sagebrush distribution was the most important factor in maintaining connectivity (Knick and Hanser in press, p. 32). This result suggests that any activities that remove or fragment sagebrush habitats will contribute to loss of connectivity and population isolation. This conclusion is consistent with research from both Aldridge *et al*. (2008, p. 988) and Wisdom *et al*.

(in press, p. 13), which independently identified the proximity of sagebrush patches and area in sagebrush cover as the best predictors for sage-grouse presence.