

Doherty, K.E. 2008. Sage-Grouse and Energy Development: Integrating Science with Conservation Planning to Reduce Impacts. Dissertation, The University of Montana, Missoula, MT.

Effective conservation planning in the face of rapid land use change requires knowledge of which habitats are selected at landscape scales, where those habitats are located, and how species ultimately respond to anthropogenic disturbance. I assessed sage-grouse (*Centrocercus urophasianus*) large scale habitat ecology and response to energy development in the winter and nesting seasons using radio-marked individuals in the Powder River Basin, Montana and Wyoming, USA. Landscape scale percent sagebrush (*Artemisia spp.*) cover at 4-km² was the strongest predictor of use by sage-grouse in winter. After controlling for vegetation and topography, the addition the density of coal-bed natural gas wells within 4 km² improved model fit (AIC -6.66, $w_i = 0.965$) and indicated that sage-grouse avoided energy development. Nesting analyses showed that landscape context must be considered in addition to local scale habitat features ($w_i = 0.96$). Findings provide managers a hierarchical filter in which to manage breeding habitats. Twice the amount of nesting habitat at 3, 5 and 10-km scales surrounded active leks versus random locations. Spatially explicit nesting and wintering models predicted independent sage-grouse locations (validation $R^2 \geq 0.98$). I incorporated knowledge of energy impacts into a study design that tested for threshold responses at regional scales analyzing 1,344 leks in Wyoming from 1997-2007. Potential impacts were indiscernible at 1-12 wells within 32.2 km² of a lek (~1 well / 640 ac). At higher wells densities a time-lag showed higher rates of lek inactivity and steeper declines in bird abundance 4 years after than immediately following development. I spatially prioritized core areas for breeding sage-grouse across Wyoming, Montana, Colorado, Utah and the Dakotas and assessed risk of future energy development. Findings showed that bird abundance varies by state, core areas contain a disproportionately large segment of the breeding population and that risk of development within core areas varies regionally. My analyses document behavioral and demographic responses to energy development, offer new insights into large scale ecology of greater sage-grouse and provide resource managers with practical tools to guide conservation.