Sage Grouse Winter Habitat Selection and Energy Development

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The recent surge in energy development has resulted in rapid and large-scale changes to western sage-steppe ecosystems without a complete understanding of its potential impacts to wildlife populations. As part of a larger study investigating the impacts of coal-bed natural gas (CBNG) development on greater sage grouse (*Centrocercus urophasianus*), we modeled female winter habitat use in the Powder River Basin (PRB) of Wyoming and Montana to 1) identify landscape features that influence sage-grouse habitat selection, 2) assess the appropriate scales at which selection occurs, 3) spatially depict winter habitat quality in a geographic information system to aid in conservation planning and 4) assess the effect of CBNG development on winter habitat selection. Our findings highlight the need for landscape scale research to gain further insight into sage-grouse ecology. The strength of habitat selection between sage grouse and sagebrush was strongest at a 1000-m scale showing that the abundance of sagebrush over a landscape scale is an important predictor of use by sage grouse in winter. We generated a new index of topography "roughness index" which drastically out-competed all other topographic variables (wi ~1). Sage grouse avoided coniferous habitats and rugged landscapes at a 400-m scale. Our winter habitat model based on vegetation and topographic was validated by an independent data set of sage grouse winter locations (R^2 = 0.95). After controlling for vegetation and topography, the addition of a variable quantifying the extent of CBNG development within 1 km indicated that sage grouse in otherwise suitable winter habitat avoid CBNG development. This demonstrates that current strategies to mitigate impacts of CBNG on wintering sage grouse populations are insufficient. Our spatially explicit habitat prioritization tools, when coupled with knowledge of bird movements and active lek locations provide a biological basis for decision-makers to formulate an effective conservation strategy for sage grouse in areas undergoing energy development.