Knick, S.T., S.E. Hanser, R.F. Miller, D.A. Pyke, M.J. Wisdom, S.P. Finn, E.T. Rinkes, and C. J. Henny. 2010. Ecological influence and pathways of land use in sagebrush. Chapter 13, Studies in Avian Biology. No. 38.

Abstract: The authors described the dominant anthropogenic land uses in the Sage-Grouse Conservation Area (SGCA; the pre-settlement distribution of sage-grouse buffered by 50 km [Connelly et al. 2004, Schroeder et al. 2004]) and their influence on patterns and processes of sagebrush habitats and sage-grouse populations. They considered the primary land uses within the range-wide distribution of Greater Sage-Grouse, which encompasses >2,000,000 km^2 (Connelly et al. 2004). They conducted regional analyses based on seven sage-grouse management zones (Stiver et al. 2006). Sagebrush is the dominant land cover on 530,000 km^2 within the sage-grouse range. They organized land uses into broad categories of agriculture, urbanization and infrastructure, livestock grazing, energy development (nonrenewable and renewable), and military training. The offered the following descriptions regarding the effects of powerlines on sage-grouse and sagebrush habitat. Power lines covered a minimum of 1,089 km^2 and had an ecological influence on almost 50% of all sagebrush within the SGCA. They were not able to map or estimate the density of smaller distribution lines in rural areas. Similar to roads, power lines also followed major river valleys and crossed lower elevations. The Energy Policy Act of 2005 directed that corridors for transporting energy (oil, gas, hydrogen, electricity) be designated on federal land (United States Departments of Energy and the Interior 2008). New corridors, as currently proposed, would affect an additional 2% (12,000 km^2) of the sagebrush across the SGCA currently not influenced by a mapped power line. Amount of additional sagebrush habitat that would be affected by new corridors ranged from <0.2% in the Columbia Basin (13 km^2) and Great Plains (85 km^2), which already have a large proportion influenced by power lines and infrastructure, to >5% in the Northern Great Basin (3,552 km^2). An estimated 9,656 km of overhead power lines have been developed for coalbed methane natural gas production in Powder River Basin (Braun et al. 2002). Over 28,000 km of new roads, 33,000 km of pipelines, and 8,400 km of overhead power lines would be developed as part of the infrastructure to construct an additional 50,000 wells in this 32, 400 km^2 region (United States Department of the Interior 2003c). Similar increased development is planned for other oil and gas producing regions A minimum of 10,182 communications towers >62 m in height were present in the SGCA . The area potentially influenced included 4% of the current sagebrush distribution. They stated that power lines as part of potential cumulative effects of a connecting infrastructure of roads, motorized trails, railways, power lines, and communications corridors fragment or remove sagebrush land cover.

Regarding the potential individual effects of power line on sage-grouse, they stated the following: power line poles along transmission corridors provide nest and perching opportunities for Common Ravens (*Corvus corax*), American Crows (*C. americanus*), and raptors (Reinert 1984, Knight and Kawashima 1993, Steenhof et al. 1993, Lammers and Collopy 2007). Ravens are primary predators on sage-grouse and other prairie grouse nests (Coates et al. 2008, Manzer and Hannon 2005) and can travel >10 km from these locations (Boarman and Heinrich 1999). Collisions with power lines, in addition to increased predation risk, were a primary source of mortality for lowland populations of sage-grouse in Idaho (Beck et al. 2006).

Regarding the effects of wind or geothermal energy they stated the following: the effects of these developments on sagebrush or sage-grouse are largely unknown because development has been too recent to identify immediate or lag effects. Specific environmental concerns of wind turbines were noise produced by the rotor blades, aesthetic (visual), and mortality to bats and birds flying into rotors (United States Government Accounting Office 2005). These considerations may be reduced through advanced technology, but the greater influence on ecosystems is likely to result from roads that are necessary to construct and maintain sites used for wind energy, and power lines that transfer electricity to users (Kuvlesky et al. 2007). Sage-grouse also may avoid areas with turbines because of the visual obstruction (no citation provided). They concluded the energy development physically removes habitat to construct well pads, roads, power lines, and pipelines; indirect effects include habitat fragmentation, soil disturbance, and facilitation of exotic plant and animal spread. More recent development of alternative energy, such as wind and geothermal, creates infrastructure in new regions of the sage-grouse distribution. Land use will continue to be a dominant stressor on sagebrush systems; its individual and cumulative effects will challenge long-term conservation of sage-grouse populations. They author did not cite any specific studies documenting the specific effects of power lines on sage-grouse other than Beck et al. 2006. In this study the authors reported that 2 radio-collared birds were killed by collisions with a power line.