Comment

"Silver Sagebrush Community Associations in Southeastern Alberta, Canada." *Rangeland Ecology & Management* 58:400–405

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Understanding the distribution and abundance of habitat and resources is an important issue in wildlife conservation and will advance understanding of wildlife habitat relationships (Morrison 2001). Jones et al. (2005) developed a vital habitat layer, describing the distribution of silver sagebrush (*Artemisia cana* Pursh) in southeastern Alberta, Canada, and identifying relationships between sagebrush characteristics and physiographic parameters. This paper adds greatly to our understanding of poorly-studied silver sagebrush communities and as Jones et al. (2005) point out, this is an important first step in developing management plans for sage-grouse (*Centrocercus* spp.) recovery. This product has recently been used to understand sage-grouse habitat relationships, linking habitat to the viability of the endangered Alberta greater sage-grouse (*Centrocercus urophasianus*) population (Aldridge 2005).

However, we have several concerns with the recommendations Jones et al. (2005) make regarding the management of sagebrush habitats for greater sage-grouse in Alberta. They indicate that "silver sagebrush is a quasi-riparian species, requiring mesic sites" (p. 404), and that lotic and overflow sites had "the best sagebrush characteristics (i.e., greater mean percentage of occupancy, denser, more even distribution and taller plants)" (p. 404). From this, they suggest that to recover greater sage-grouse populations in Alberta, conservation and management efforts should strive to maintain and enhance lotic and overflow sites. Contrary to these recommendations, we feel that any conservation efforts or dollars appropriated toward "enhancing" lotic and overflow sites would offer minimal benefits to sage-grouse recovery in Alberta. We discuss these problems below and highlight recent research that supports why management of lotic and overflow sites is not likely to have much influence on sage-grouse populations.

Current research indicates that poor productivity as a result of low nest success and low juvenile recruitment are the ultimate factors driving range-wide sage-grouse population declines (Schroeder et al. 1999; Johnson and Braun 1999; Aldridge 2001; Aldridge and Brigham 2002; Crawford et al. 2004; Aldridge 2005). As a result, management recommendations for most populations, including strategies outlined in the Canadian sage-grouse recovery strategy (Harris et al. 2001), indicate that conservation and management efforts should aim to enhance productivity (nest success and recruitment) if population declines are to be reversed (Johnson and Braun 1999; Schroeder et al. 1999; Connelly et al. 2000; Aldridge 2001; Aldridge et al. 2003). Thus, one would expect that by enhancing lotic and overflow sites, as suggested by Jones et al. (2005), nest success and chick survival and recruitment would be enhanced. Of course, this assumes that sage-grouse choose to place their nests and rear their young in sagebrush habitats associated with lotic and overflow sites.

Recent research, including some in silver sagebrush communities in southeastern Alberta (Aldridge and Brigham 2002; Watters et al. 2002; Aldridge and Brigham 2003; Aldridge 2005), indicates that sage-grouse select nest sites with moderate to high sagebrush cover and sagebrush density, with plants of intermediate to tall heights (Delong et al. 1995; Sveum et al. 1998b; Schroeder et al. 1999; Connelly et al. 2000). Although the thickest, most dense sagebrush may conceal nests from above and reduce potential avian predation (Connelly et al. 2000; Watters et al. 2002), the understory community (grass and forbs) may be compromised within dense shrub stands (Klebenow 1969; Aldridge and Brigham 2002), exposing nests at the ground level to terrestrial predators (Delong et al. 1995; Sveum et al. 1998b; Watters et al. 2002). If placed in the most dense shrub habitats, nests tend to fail (Delong et al. 1995; Schroeder et al. 1999; Connelly et al. 2000). Thus, sage-grouse select for tall dense sagebrush cover that still has suitable understory cover to provide both horizontal and vertical cover (Connelly et al. 2000; Watters et al. 2002; Crawford et al. 2004). Selection for more heterogeneous (patchy) sagebrush habitats occurs across life stages (Boyce 1981; Aldridge 2005), and fitness (nest success) is enhanced in patchy habitats (Aldridge 2005). While lotic and overflow sites contain dense sagebrush cover, these sites also have primarily continuous or uniform distribution of sagebrush plants (Jones et al. 2005), which may not be the best priority conservation habitats for sage-grouse.

Abundance and diversity of forbs in the understory, which are often lacking in dense thick sagebrush habitats, provides resources necessary to meet dietary limitations for chicks (Peterson 1970; Drut et al. 1994; Sveum et al. 1998a; Aldridge and Brigham 2002). As a result, lotic and overflow sites are not selected by hens for either nesting or rearing of chicks, and may be avoided, as has recently been shown in Alberta (Aldridge 2005). Hens move their broods from nest sites in upland habitats to lower mesic sites with a high forb component

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(Peterson 1970; Drut et al. 1994; Sveum et al. 1998a; Connelly et al. 2000), sometimes selecting for sagebrush when forb availability is low (Aldridge and Brigham 2002; Aldridge 2005). Thus, enhancing dense sagebrush in "riparian" or lotic overflow sites will not likely increase low productivity, the limiting demographic parameter for sage-grouse and the ultimate cause of population declines (Schroeder et al. 1999; Aldridge 2001; Aldridge and Brigham 2001; Crawford et al. 2004).

We caution managers about the incorrect assumptions drawn about the importance of these lotic, overflow, and shrubby "riparian" habitats for sage-grouse, even if they are dominated by dense sagebrush cover. Dense sagebrush cover is only one component of high-quality sage-grouse habitat (Aldridge and Brigham 2002, 2003; Aldridge 2005). These areas may be important winter habitat, because sage-grouse tend to move into low or windswept valleys during winter, where sagebrush is more abundant and exposed from snow, providing food and cover (Eng and Schadweiler 1972; Homer et al. 1993). However, because productivity and recruitment are the most limiting demographic parameters, habitat conservation dollars would be better directed at maintaining or enhancing nesting (upland patchy sagebrush habitat with a suitable understory of tall grass and forbs) and brood-rearing habitats (mesic areas with increased forb cover, intermixed with intermediate sagebrush cover, although not necessarily "riparian" sites). These habitats will have the greatest probability of increasing productivity and recruitment. Management strategies for sage-grouse should be undertaken within a framework of collaborative adaptive management (Aldridge et al. 2004), to increase knowledge and understanding of sage-grouse habitat requirements.

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