Introduction

Early settlers of the arid Great Basin homesteaded in the vicinity of lower elevation streams, springs, and river courses. These areas provided not only water, but climate and topography more tolerable than that of the surrounding mountains, and comparatively lush forage for livestock. In Nevada, although 86 percent of the land area is in public ownership, the lowland riparian areas are still predominantly in private ownership. Compiling figures from several land management agencies, we estimate that at least 85 percent of Nevada's lowland meadow habitat is privately owned.

Wildlife inventory and research on two ranches in northern and central Nevada between 1978 and 1985 revealed that the privately owned lands are of critical value to many wildlife species. The value of this region's privately owned land to wildlife is not a function of quantity (i.e., acreage), but rather of quality (i.e., type of land involved). Most of the information in this fact sheet has been taken from McAdoo et al. (1986). The purpose of this fact sheet is to emphasize the importance of private meadows as wildlife habitat, and set the stage for management suggestions (in upcoming fact sheets) which can both improve both economic productivity and wildlife habitat quality.

Study Areas

The Saval Ranch is located in northeastern Nevada, approximately 40 miles north of Elko. The ranch unit, including federal grazing lands, consists of 49,105 acres, of which 1,708 acres are privately owned irrigated meadows. These large lowland meadows, located along three perennial streams, are irrigated by natural stream flow, through diversion ditches with flood irrigation, and are cut for hay production. Meadow vegetation includes a variety of grasses, sedges, rushes, and forbs. Common species are bluegrass, Nebraska and Douglas sedge, and wiregrass (Baltic rush), as well as interspersed willow. Vegetation adjacent to lowland meadows consists of a big sagebrush/alkali sagebrush mosaic with a variety of grasses and forbs.
The Gund Research and Demonstration Ranch (owned by the University of Nevada, Reno) is located in north-central Nevada, 40 miles northeast of Austin. The ranch unit consists of 95,000 public and private acres, of which 700 acres are lowland meadow. In contrast to the Saval Ranch, meadows at the Gund Ranch are located near the edge of a playa, rather than along perennial streams. The wettest areas are dominated by wiregrass and saltgrass, with some extensive patches of basin wildrye. Native hay meadows are irrigated primarily by water from geothermal springs and, to a lesser extent, from intermittent mountain streams via diversion ditches. Vegetation on adjacent uplands consists of black greasewood and big sagebrush, with a variety of understory plants.

**Methods**

Relative abundance of birds was determined by using a sampling method described by Blondel et al. 1981. Rodent populations were sampled by live trapping, using mark/recapture methodology. Density estimates of rabbits and hares were determined through the use of 3-mile walking transect routes. These methods and sampling intensity are described in detail by McAdoo et al. (1986). In addition to quantitative data, field notes of animal sightings and signs (droppings, tracks, dens, etc.) were kept by both permanent and seasonal personnel. Emphasis was placed on compiling a complete species list of wildlife species and their habitat preferences.

**Results and Discussion**

**Birds**

Low-elevation meadows on both ranches supported diverse bird communities. Of the 80 species at the Saval Ranch and 75 species at the Gund Ranch that were associated with lowland meadows, 28 and 25 species, respectively, required this habitat. These species are referred to as "obligatory" meadow species (Table 1). An additional 10 species were considered "preferential" lowland meadow species. These birds nested in habitats including but not limited to the lowland meadows, but were more abundant in the lowland meadow habitat. Twenty-six bird species using lowland meadows were found as commonly in high-elevation riparian habitats as in the lowland meadows.

Total bird abundance (for all species combined) was typically greater in lowland meadows than in adjacent upland habitats. At the Gund Ranch, for example, twice as many birds used irrigated meadows as used greasewood/sagebrush habitat. Of the six most abundant meadow nesting species - savannah sparrow, red-winged blackbird, long-billed curlew, killdeer, Brewer's blackbird, and western meadowlark - only the latter two were observed on upland habitat transects.

Lowland meadow habitat was obviously of critical importance to the birds that required this habitat. Included among these species were several that were unique because of their esthetic value to the general public. A few greater sandhill cranes were nesting annually at the Saval Ranch in the large hay meadows that contained some patches of willow cover. In Nevada, sandhill cranes require lowland meadows with willows for successful nesting and rearing of young. Although the cranes nest in the herbaceous vegetation, willows are used for hiding cover. Most of this habitat in Nevada is in the northeastern part of the state (Elko County), where the Saval Ranch is located. This species occurred only as a migrant at the Gund Ranch, where no willow cover was available.

Long-billed curlews nested on both study areas. However, this species was more abundant at the Gund Ranch where the low growth-form saltgrass meadows were interspersed with irrigated hay meadows and greasewood habitat. According to the literature, this species prefers to nest in short grass areas such as provided by saltgrass meadows.
Nine waterfowl species were observed in the lowland meadow areas. Most of these were summer residents nesting in the vicinity of the perennial streams at the Saval Ranch and irrigation ditches on both ranches.

In addition to providing nesting habitat, the lowland meadows of both ranches also provided stop-over habitat for a number of migrating bird species, including the lark bunting, bobolink, snowy egret, American avocet, white-faced ibis, and white pelican. The importance of "wetlands" and riparian habitat for migrating birds has been well documented. Irrigated lands that are partially flooded to provide shallow water or muddy flats are particularly attractive to shorebirds.

Several birds of prey species (raptors) hunted in the lowland meadow areas of both ranches on a regular basis. These included the Swainson's hawk, red-tailed hawk, American kestrel, prairie falcon, and great-horned owl during summer, the rough-legged hawk during winter, and the golden eagle year-round.

The primary value of meadows to most predatory birds was the production of their prey species. However, northern harriers and short-eared owls also nested in these lowland meadow habitats at both ranches. Lowland meadow habitats, including wetlands, are essential for nesting populations of these two species.

Sage grouse used lowland meadows, especially from mid- to late summer. Meadow habitats in Nevada provide insects and succulent forbs which are important for young sage grouse (Klebenow 1972). Greatest use of low-elevation irrigated meadows occurs when vegetation in the surrounding upland habitat has dried out in the summer heat.

Riparian wetland habitat, including meadows, typically supports the most abundant and most diverse bird communities (Carothers et al. 1974). The added value of these meadow habitats increases at low elevations, where the contrast between the structure and productivity of surrounding upland habitat is greatest. Although meadows at higher elevations are important, generally the lower the elevation the larger the percentage of nesting birds.

**Mammals**

Lowland meadows were used by 18 mammal species at the Gund Ranch and 24 species at the Saval Ranch. Four of these species, the vagrant shrews, montane shrews, mountain voles, and muskrats, were only found in meadows. Although rodent populations (of all species combined) were variable from year to year, the highest populations were typically recorded in the lowland meadow type.

Deer mice were the most-abundant rodent species during five years of sampling at the Gund Ranch. They inhabited both irrigated basin wildrye meadows and adjacent greasewood/sagebrush lands. However, they were almost three times more abundant in the meadow habitat than in the upland habitat.

Mountain cottontails and black-tailed jackrabbits used lowland meadows at both ranches, but white-tailed jackrabbits were found only in the Saval Ranch meadows. Of the three, black-tailed jackrabbits were the most abundant on both study areas. Jackrabbits tend to feed in areas with high grass cover, often moving to these areas at night from adjacent upland habitat.

The relatively high populations of prey species in the lowland meadows made these areas attractive hunting locations for predators. Coyotes were frequently sighted in these meadows, and we also observed evidence of meadow use by badgers, bobcats, and short-tailed weasels. Rabbits and rodents comprise the bulk of coyote diets in the West. Badgers also rely heavily on rodents for food.
Use of lowland meadows by mule deer was observed at both ranches. Although summer deer populations were greatest in adjacent mountain ranges at each ranch, fall and spring use of lowland meadows on the way to and from winter ranges was heavy. Mule deer feed primarily on grasses in the spring and forbs in the summer. Hay meadows provide green succulent forage and may be important as spring range for mule deer (Kerr 1979). During the summer season, deer bedded among willows and other shrubs along low-elevation streams and in basin wildrye and other tall vegetation in irrigated meadows.

**Management Practices and Implications for Wildlife**

Since the vast majority of lowland meadows in the Great Basin are in private ownership, decisions on management and alteration of these meadows are made primarily on an economic basis. Resultant effects on wildlife are therefore mostly coincidental.

Almost any management action that alters meadow habitat can negatively impact some wildlife species but positively affect others. However, management practices that have the greatest potential to adversely affect wildlife populations in meadows include improper livestock grazing, cutting native hay, willow control, stream channelization, and habitat conversion through wetland drainage or planting crops. The adverse impacts of such practices can be minimized in some cases by proper planning. For example, livestock grazing intensity, timing, and duration can be controlled to minimize impacts and even benefit some wildlife species. Irrigation and development of stockponds or troughs can be largely beneficial to wildlife if done properly. Other practices, such as channelization and willow control eliminate more of an already reduced and limited habitat, and therefore are almost always detrimental to wildlife.

**Conclusions**

Although lowland meadows in northern Nevada comprise only a small portion of the region’s total land area, they provide critical wildlife habitat for many species. As with riparian habitat elsewhere in the country, lowland meadows maintain high species diversity of both plants and animals. Numerous species use these areas for short periods during migration or during dry periods when lush vegetation and water are not available in other habitats. Other species depend on meadows year-round. Meadows also produce high populations of prey species important to a variety of bird and mammal predators. The predominant private ownership of these meadows presents a unique challenge to wildlife managers in a region where most of the surrounding land is publicly owned. There is a critical need for better education of both public and private land managers about the importance of lowland meadows in ecosystems of the Great Basin.

A holistic approach to the management of complex natural systems is needed. As applied to this region, with its land-ownership patterns and historical livestock use, this approach would specifically include consideration of a given rancher’s entire land-use plan. Both the direct and indirect effects of public land grazing guidelines, as they might influence a rancher’s use of his private land, must be considered. For example, ranchers faced with depressed market prices, increased production costs, and a mortgage may respond to cutbacks in federal grazing permits or increased federal grazing costs by more intensive use of their private lands. Such intensive management (e.g., willow control, habitat conversion, etc.) could mean long-term negative impacts on many wildlife species.

Both public and private lands and wildlife benefit from management practices which keep water on the land longer, allowing it to soak in, recharge aquifers, grow vegetation, and not rush off with such speed that it washes soil with it. The benefits of good quality meadow vegetation resulting from wise management will payoff with better livestock forage and wildlife habitat.
According to Carother's (1977), "...we should not look back on land management practices of the past with too much remorse and certainly with no blame" - they merely reflect man's successful settlement, allowing current lifestyles. Rather, past management practices should be a "foundation for learning and understanding how to cautiously move forward in our interactions with the environment."

<table>
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<tr>
<th>Ranch</th>
<th>Habitat</th>
<th>No. of Species</th>
<th>Obligatory</th>
<th>Preferential</th>
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<td></td>
<td>Sagebrush</td>
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<td>6</td>
<td>5</td>
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<td>Lowland meadow</td>
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<tr>
<td></td>
<td>Greasewood/sagebrush</td>
<td>33</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

*aTotal number of species associated with a habitat; a complete list of species is available from the author.
*bSpecies nesting only and/or observed only in a specific habitat.
*cSpecies nesting in several habitats, but most abundant in one habitat.

References Cited


