

Restoring Mixed Grass Prairie in Southeastern Alberta, Canada

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On the Ground

- Between 2008 and 2010 a cultivated field of 57 ha within the mixed grass prairie of southeastern Alberta was restored with native grasses and silver sagebrush plugs.
- Wildlife occupying the site increased from being dominated by horned larks to 13 species using the land within 3 years. Two of these species Sprague's pipit and chestnut-collared longspur are native grassland specialists considered "Threatened" under Canada's Species at Risk Act.
- Litter values on the reseed in year 3 were approaching normal values that would be expected on a loamy site within a healthy mixed grass prairie.

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Native grasslands have evolved over thousands of years and comprise a variety of grass, forb, and shrub species, each of which plays a role in community composition. However, over the last 90 years we have lost roughly 80% of our native grasslands in Canada and 70% of our grasslands across the Northern Great Plains of North America.^{1,2} Native grass restoration efforts are occurring throughout North America and the rest of the world as a means to increase biodiversity and natural landscapes.³ Conversion of abandoned cropland to native grass is a key area for restoration, with several efforts and successes throughout North America resulting from sowing seeds.^{4,5} The diversity in structure and plant composition with native grasslands is important to the nesting, rearing, and foraging of wildlife, including species at risk such as Sprague's pipit (*Anthus spragueii*) and chestnut-collared longspur (*Calcarius*

ornatus).^{6,7} "Species at risk" is a term referring to all species listed as "endangered," "threatened," or "species of special concern" under Canada's Species at Risk Act.

Native grasslands and many of the associated wildlife species have declined significantly across the Northern Great Plains.^{8,9} In Alberta only 43% of the driest portion of the mixed grass prairie remain, and these remaining areas are subjected to ongoing fragmentation and human development.^{9,10} Loss of native grasslands, whether large or small scale, have direct negative impacts on wildlife with specialist needs provided by grassland systems. These cultivated areas within large contiguous grassland blocks are areas largely devoid of wildlife specialists and provide a foothold for invasive plant species to establish and spread to adjacent native grassland and modify habitat that has taken thousands of years to evolve. Efforts to restore these "gaps" with grass, forb, and shrub species found in the local native plant community can help reverse this degradation, improving their value to wildlife, including species at risk, and at the same time also be effective in providing additional grazing opportunities for landowners. These restoration efforts can be expensive even using low diversity mixtures (\$243–\$720/ha; all dollar amounts in this paper given in Canadian dollars), which solidifies the need to maintain our existing native grasslands.³

The Right Mix

Restoration efforts have changed over the decades. Early approaches focused on establishing perennial cover. These were predominantly tame pasture or hay lands comprising agronomic species or a mix of native and non-native grass. Where these initiatives provided habitat for some common grassland bird species (generalists) they provided little benefit to habitat specialists, many of which are now listed as species at risk.^{11,12,13} Planted grasslands comprised of nonindigenous species including bluegrass (*Poa* spp.), brome (*Bromus* spp.), and alfalfa (*Medicago sativa*) were found to be sink habitat for specialized avian fauna such as Sprague's pipit.¹³ More recently, the approach of using native species to reclaim the land to a state that mimics that site's natural community is occurring. This switch to restoration of native grasses is im-

portant, but even in these cases the correct native grass mixture for a specific ecological range site are not usually chosen, as limited resources favors selection of cheaper varieties, which negates the efforts to restore species that are dominant in the native reference plant community.

In 2008 MULTISAR, a project managed by Alberta Conservation Association (ACA), Alberta Environment and Sustainable Resource Development (ESRD), and the Prairie Conservation Forum (PCF), collaborated with a private landowner to restore 57 ha of native grasslands, using a seed mixture matching the local native plant community that would be expected to occur on that target site. We evaluated two aspects of the restoration from before seeding to 3 years after 1) change in the vegetation composition found on the site and 2) change in the wildlife species richness on the site.

Understanding What Was Once There

The 57-ha restoration project is located near Manyberries in southeastern Alberta within the dry-mixedgrass (mixed grass prairie) natural subregion. The site is a “U”-shaped parcel of land surrounded by native grassland and occurs on the edge of a large parcel of native grassland to the south, and a mixture of cropland and grassland to the north. Loamy soils are found on the site, which was previously used as cropland that switched between chemical fallow and crop every other year since 2003.

Plant communities on loamy soils identified in the “Range Plant Communities and Range Health Assessment Guidelines for the Dry Mixedgrass Natural Subregion of Alberta” include needle and thread (*Hesperostipa comata*), blue grama grass (*Bouteloua gracilis*), June grass (*Koeleria macrantha*), northern and western wheatgrass (*Elymus lanceolatus* and *Pascopyrum smithii*), low sedge (*Carex duriuscula*), sandberg bluegrass (*Poa secunda ssp. secunda*), silver sagebrush (*Artemisia cana*), pasture sagewort (*Artemisia frigida*), and scarlet mallow (*Sphaeralcea coccinea*).¹⁰ Species at risk observed in these native plant communities include Sprague’s pipit, chestnut-collared longspur, and long-billed curlew (*Numenius americanus*). Total precipitation for the area is 353 mm with the majority of precipitation (209 mm) occurring between May and September.

A range inventory was completed in the adjacent native grassland in 2007 prior to restoration to identify the plant community and its species composition. A 50-m transect was defined at a representative site within the community and a Daubenmire frame was placed at 5-m intervals to record the percentage foliar cover of each species. Each species was averaged over the 10 frames of each transect to determine species composition.¹⁴

Starting the Process

In 2008 the site was prepared for seeding by completing a preburn using glyphosate. This was done in early May to help remove unwanted weeds and grass and to ensure a clean bed in which to broadcast the seed mixture (Fig. 1). A transect



Figure 1. Year 2: following glyphosate application.

was completed in the adjacent native grassland that contained similar range sites (i.e., loamy) as the reseeded site. Based on that inventory a species mixture comprising 27% northern wheatgrass, 20% western wheatgrass, 20% blue grama grass, 17% needle and thread, and 16% June grass was chosen (based on weight). Needle and thread made up 30% of the species composition in the native communities. Unfortunately, due to the high cost for the needle and thread seed (\$110–\$154/kg), resulting from increased processing costs associated with debarbing, it was reduced to 17% in the seed mixture but still accounted for 50% of the final seed cost. Final cost for the seed mixture was \$405/ha, similar to what was identified in Europe for a low-diversity seed mixture.³

Broadcast seeding was selected over direct seeding due to potential clogging of the hoses on the seed drill, wet conditions that favored broadcast seeding, increased survivorship, and the desire to create heterogenic habitat.^{4,5} Native grass seed was broadcast at 10 kg/ha using a broadcast seeder behind a tractor and followed up with a light harrow to ensure good soil to seed contact. A fence was installed around the property to prevent disturbance and to let the grass establish. In August 2008, the site was mowed and baled to reduce Russian thistle (*Salsola kali*) and kochia (*Kochia scoparia*), which had established during the summer. We assessed the site in summer 2008 to determine if the seeded grass was establishing on the site.

Target broadleaf herbicide was sprayed in spring 2009 to combat Russian thistle and kochia (Fig. 2). One hundred and fifty silver sagebrush plugs were planted in low-lying areas 2 weeks after spraying to add a natural shrub component to the newly established community. Sagebrush plugs were 7.5 cm tall with an additional 10 cm of root mass. Plugs were inserted into the ground by hand using a metal pole to create the hole, placing the plugs in the ground, and compacting the soil around them. Detailed range transects and range health assessments were conducted in 2010. We completed range health assessments to measure ecological integrity, litter,



Figure 2. Year 1: thistle and kochia on the site.

structure, weeds, and bare soil.¹⁵ Ecological integrity looked at how well the community resembles a reference community that would normally be found on the site. Litter values that measure the past year's growth were determined by raking one plot frame (0.25 m²) and estimating the amount of litter (kg/ha). Structure was assessed to determine if all four layers were present: 1) low shrubs, 2) tall graminoids and forbs, 3) medium graminoids and forbs, and 4) ground cover.¹⁵ Weeds and bare ground looked at the number and density of invasive plants and how much of the bare ground was human caused.¹⁵ Range health scores were determined by adding up each of the five factors.

We conducted point counts for wildlife at four sites within the reseeded area and one control site in the adjacent native grassland in June 2007, 2009, and 2010. We recorded all birds, mammals, and herptiles seen or heard within a 100 m radius over a 5-minute period at each site in each year.

Creating Habitat Requires Patience and Precipitation

Precipitation amounts in 2008, totaling 209 mm between May and September, matched the long-term average for the area. Site evaluation in September 2008 (first growing season) revealed the presence of all five planted grass species on the site. Native wheatgrasses made up 9.6% of the vegetative composition, followed by blue grama (4%), June grass (0.5%), and needle and thread (trace). In 2009 precipitation amounts were lower than average (188 mm), and Russian thistle and kochia were decreasing in cover, providing opportunities for the native grass seedlings. In 2010 precipitation was above average (240 mm), and the establishing plant community contained 13.4% blue grama, 13% northern wheatgrass, 10.9% June grass, 6.7% western wheatgrass, 4.7% needle and thread grass, 2.8% green needle grass (*Nassella viridula*), 2.8% pasture sage (*Artemisia frigida*), and 26% bare soil (Fig. 3). Litter values ranged between 179 kg/h and 280 kg/ha with the average range health score being 69% (healthy with prob-

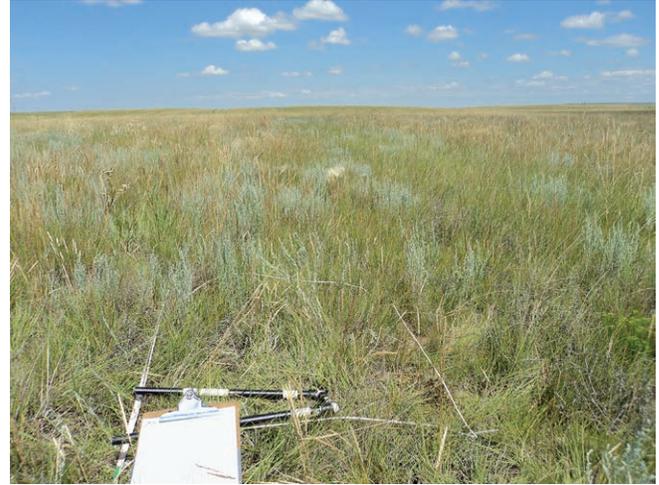


Figure 3. Year 3: establishing grassland.

lems). Litter amounts equaling or exceeding 291 kg/ha are considered excellent for the mixed grass prairie.¹⁴ All silver sagebrush plugs planted (100%) in 2009 had established, and the young shrubs were branching out and increasing in height in 2010.

A New Home

Wildlife surveys on the reseeded site conducted in June 2007 (preseeding) identified a landscape dominated by horned larks (*Eremophila alpestris*), with McCown's longspurs (*Calcarius mccownii*) heard on the periphery next to native grasslands. The native control site had eight species present in 2007 including chestnut-collared longspurs; however, no Sprague's pipits were heard. Wildlife point count surveys completed in June 2009 revealed seven species utilizing the reseeded area and nine species on the native control. Baird's sparrow (*Ammodramus bairdii*), western meadowlark (*Sturnella neglecta*), and vesper sparrow (*Pooecetes gramineus*) were all found on both the control and reseeded area. Chestnut-collared longspur was again found only on the native control site. In June 2010 wildlife point counts identified 13 species at point count stations using the reseeded site and 12 using the native site (Fig. 4). The increase in species as well as at the control site may be related to its proximity to the restoration site and the impact of filling in the "gap," thereby reducing fragmentation. Sprague's pipit and chestnut-collared longspurs were identified on both the reseeded and native control sites. Other species found on the reseeded site but not on the native control included sharp-tailed grouse (*Tympanuchus phasianellus*) and grasshopper sparrow (*Ammodramus savannarum*).

Why Native Grass Is Important for Wildlife

Native grasslands contain a high plant species diversity and heterogenic structure not found in most tame pastures, which are characterized as having a few species in a homogeneous structure. Plant species diversity and heterogeneity in vertical and horizontal structure are important characteristics

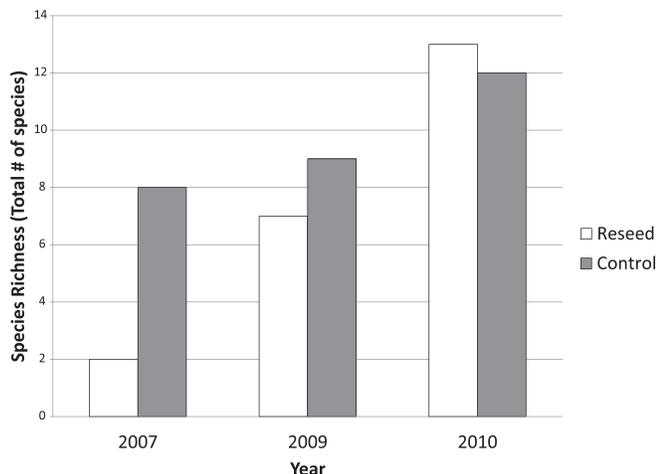


Figure 4. Change in species richness over time at reseeded and native control sites.

to consider when creating habitat for native wildlife species including several species at risk.

Native grassland restoration projects need to consider matching the species used in the seed mix with what would be expected in native habitats on similar soil types. This requires looking at the soils and plant communities in adjacent land and selecting a seed mixture based on what would be the dominant plant community for that soil type. In this project using this process, wildlife species richness (number of species) on the site was increased from two to 13 species in 3 years. Two species at risk were present on the site by year 3, providing evidence that native grass restoration efforts can create suitable habitat for these species.

The Next Phase

Only native grasses were seeded. This allowed for spraying for broadleaf weeds in year 2 without loss of seeded forbs due to chemical treatment of the site. Chemical treatment was used once in the spring as the majority of the site contained Russian thistle and kochia. This gave the native grasses a competitive edge, and they outcompeted the weeds. As with several plant communities in the mixed grass prairie, forbs make up a component of the community and should be considered in year 2 or 3 after broadleaf control has been completed. For this small study site, natural colonization of forbs was monitored. An influx of desirable forbs was observed including pasture sagewort (*Artemisia frigida*) and western yarrow (*Achillea millefolium*), which do well in more disturbed landscapes. Future restoration projects will include a forb component compatible with the surrounding native community in year 2 or 3. Sagebrush plugs planted on the site developed extremely well and should be used in future restoration efforts.

Limitations exist in relation to seed cost and availability, but using species that would normally dominate the plant community can help restore the native habitats. Success in restoration is dependent on precipitation and location but also on seed selection. It is therefore important to know the

characteristics of the site well ahead of time and select a compatible seed mixture.

Good for Cattle and Wildlife

Restoration activities using native grasses specifically suited to an area can be beneficial to a ranching operation by increasing grazing opportunities and at the same time create habitat for species at risk. Further research is needed at this site and others to compare seeded native grass versus naturally occurring native grasslands in relation to use by wildlife. Research should focus on breeding success of rare species of grassland birds such as Sprague's pipit and chestnut-collared longspur. Native grassland restoration efforts should focus on wildlife habitat creation for rare species and match plant communities based on ecological site characteristics and the needs of those species.

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