

# INVASION OF THE CANADIAN PRAIRIES BY AN EXOTIC PERENNIAL

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## Introduction

Since settlement of the Canadian Prairies the grasslands have been influenced by a variety of agricultural practices.<sup>18</sup> These practices and their impact, such as tillage and growing annual crops, have completely obliterated the grasslands. Another activity that has generated much interest and has modified the prairie is imprudent grazing management. While these activities have drawn considerable attention from conservationists, an equally important event

which has received less attention has been the purposeful introduction of exotic plants such as Alfalfa (*Medicago sativa*), Crested Wheatgrass (*Agropyron cristatum*), Russian Wild Rye (*Psathyrostachys juncea*) and Smooth Brome (*Bromus inermis*) into the prairie ecosystem, primarily for the purpose of forage production.

To the uninformed or unconcerned the introduction of exotic species into the prairie ecosystem is a threat to the ecological integrity of the prairie ecosystem.



Old school north of Maryfield, Saskatchewan. Abandoned building sites often vegetated with Smooth Brome, which moves outwards from these sites.

B. de Vries

ms is viewed as harmless unless they pose a threat to crops. However, to conservationists these introductions should signal the potential for further destruction of native flora and, they also signal an unknown threat to the ecosystem. Unfortunately many students of the natural prairie have been concerned with the larger and more obvious issues, cultivation and grazing, not to grassland disappearance because of seeding and the competitive expansion of exotic species.

How long and in what ways these exotic plants express their potential and impact on the ecosystem over their new range is not elucidated by short-term evaluations. Their dispersal, establishment, and domination of native flora can be an insidious process that for all practical purposes permanently transforms native vegetation into plant communities dominated by exotics. In particular, many vegetation complexes are becoming dominated by Smooth Brome.

### **The introduction and use of Smooth Brome**

The exact date when Smooth Brome was introduced to Canada is not known, but it appeared sometime between 1875 and 1888.<sup>1-5</sup> Immigrants from Europe may have brought some of the grass with them, which there will be no record. Regardless of the date of introduction and its origin, by 1896 scientists with the Dominion Department of Agriculture recognized Smooth Brome as a useful grass for revegetating native grasslands that had become "exhausted;" by 1930 its superior adaptability and performance was recognized.<sup>7</sup> It became widely used for hay and pasture, frequently escaping cultivation to form a common grass cover on roadsides, railway rights-of-way, abandoned lands, and other disturbed areas.<sup>10</sup> Since its introduction in the late 1800s Smooth Brome has been widely distributed throughout Canada.

This long-lived perennial is adapted to a variety of soils, growing best on those that are fertile and well-drained.<sup>16</sup> Smooth Brome is valued for grazing and hay and it is the most important introduced forage in the central and northern parts of the Prairie Provinces.<sup>11</sup> This distribution corresponds with the Aspen Parkland and the southern edge of the Boreal Forest. In the Mixed Prairie Smooth Brome is best adapted to sites that are cooler and moister than the general environment. It is also grown under irrigation.

### **Ecological relations of Smooth Brome with native flora and fauna**

Once Smooth Brome establishes, it effectively suppresses the growth of other species. Research on a protected Fescue Prairie in Saskatchewan identified that the richness of native species declined to a point where native species were almost non-existent on sites where Smooth Brome had invaded (Grilz, unpubl. data). Where exotic species were dominant in Mixed Prairie in Manitoba, the cover and diversity of native species was reduced.<sup>22</sup> Wilson concluded that introduced species can competitively exclude native grasses, with Smooth Brome being one of the most dominating introductions.<sup>23</sup> Looman also noted a decline in floristic composition on sites where Smooth Brome had invaded.<sup>11</sup>

Not only is this demise and domination of native species occurring, but the adulteration of native germplasm is also a concern. There is evidence that Smooth Brome is crossing and intergrading with Northern Awnless Brome (*Bromus pumpehianus*), a native perennial (V. Harms, pers. comm.). What long-term impact this will have is unknown.

Associated with the increases in Smooth Brome in native prairie is a decline in use of the grassland by many species of wildlife (Driver, unpubl. data). At Last Mountain Lake Wildlife Refuge Driver found that as the age of Smooth

Brome-dominated grasslands increased the use by birds declined from eight to ten species to primarily two species — Savannah Sparrow and Clay-colored Sparrow. Wilson and Belcher concluded that exotic vegetation influences bird communities by causing a change in the species composition with some bird species increasing while others decline.<sup>22</sup>

### Dispersal Ecology of Smooth Brome

The most obvious threat by Smooth Brome to native grassland ecosystems is the cultivation and seeding of this exotic on prairie that has been degraded by improper grazing. Other threats are subtle, but perhaps more important is the spatial distribution of this species.

In the early evaluations of this grass, Fletcher stated that Smooth Brome had one disadvantage — “a habit of growing like quackgrass” (presumably *Agropyron repens*).<sup>5</sup> We can only speculate exactly what was meant by this statement, but it is assumed he meant that Smooth Brome possessed an aggressive and spreading habit. Smooth Brome is one of the best grasses for erosion control, thus it is often seeded on sites disturbed in road construction, and oil, gas and mineral development.<sup>21</sup> These many seedings act as small foci that can collectively occupy nearby areas faster than one large introduction such as seeded pastures.<sup>6-9</sup> Hume and Archibold’s data show that seeds of Smooth Brome were transported at least 7 m from the edges of seeded pastures.<sup>9</sup> Provided a suitable habitat is present in adjacent vegetation, many sites are subject to invasion because of prolific seed production. Once established Smooth Brome spreads rapidly by rhizomes and seeds. Thus, the well-intentioned effort of stabilizing sites by revegetating them with Smooth Brome is actually accelerating the spread of this species.

The major issue that must be reckoned with is the planting of Smooth Brome in the vicinity of grasslands that are suscep-

tible to invasion. How it moves into through the prairie does not appear related to a specific vector, but rather a host of dispersal mechanisms.

Looman concluded that Smooth Brome does well in the Fescue grassland of Canada, invading sites that are grazed or otherwise disturbed.<sup>11</sup> However, Fescue Prairie which is protected from grazing by domestic livestock is not exempt from invasion by Smooth Brome. Data from a relict Fescue Prairie near Saskatoon shows that Smooth Brome was the most common of 16 graminoids. Similarly, Blood reported that Smooth Brome was the fifth highest producing graminoid in Fescue Prairie in Riding Mountain National Park.<sup>2</sup> In relative terms both of the tracts of Fescue Prairie were undisturbed. We have also observed brome invasion of many relict areas of Fescue Prairie.

The grasslands of the Mixed Prairie region in southern portions of the Prairie Provinces appear resistant to invasion by Smooth Brome. However sites with better soil and moisture conditions, including riparian zones and wooded draws, are being invaded by brome.

Native grasslands that are protected and viewed by many naturalists as being undisturbed, however, this attitude is tempered by the definition of disturbance and its scale. Large accumulations of dead plant material tend to reduce the vigour and density of the grasses, creating sites amenable to establishment of other species. Ways of preventing this accumulation include its removal by grazing or mowing and the use of prescribed burning.<sup>4</sup> Hulbert concluded that where fire is used regularly Smooth Brome is not common in native grassland except where native grasses have been weakened or are absent following disturbance.<sup>8</sup>

Protected native grasslands may also harbour high populations of mammals and their activities such as burrowing and

herbivory can create significant disturbance on a localized scale that is not obvious. Larger disturbances are also caused by burrowing animals such as Red Fox and Badger. We have observed Thirteen-lined Ground Squirrels caching inflorescences of Smooth Brome near their burrows. This caching, combined with the disturbance of burrowing creates a potential site for establishment.

We have a poor understanding of the importance of this species in the diets of birds. For a similar species, Cheatgrass brome (*Bromus tectorum*), a small percentage of the seeds ingested can pass unharmed through the digestive tract of birds.<sup>19</sup> Perhaps another important means of dispersal is the fact that often this grass is mowed after seeds have been formed. When this hay is consumed by domestic livestock and native ungulates some seeds may pass through the digestive tract in a germinable condition and be dispersed over the landscape.

Smooth Brome has a prolonged period of seed dispersal, with seeds being dispersed from maturation in mid-summer throughout the winter (V. Harms, W.P. Herbarium, University of Saskatchewan). Since seedheads are often elevated above the snow, seeds may be blown from established plants across snow pack, lodging at other sites in the snow. It is a matter of chance as to whether the site of seed deposition provides a suitable safe site for its germination and establishment.

Smooth Brome is often planted along streams because of the high potential for forage production on these sites. Since seeds and seedlings of Smooth Brome can tolerate prolonged periods of flooding the seeds can be transported downstream and deposited over a wide area.<sup>14</sup> The movement of seeds by water in these situations is extremely important to its long distance dispersal along riparian zones, although the other

transport mechanisms are probably also operating.

### **Why is Smooth Brome successful?**

This question can not be answered with certainty, but from a theoretical standpoint the following arguments can be put forth. This grass has been selected by forage breeders for superior establishment, growth, persistence, and prolific seed production over a wide range of conditions. The germination and the growth of seedlings are also far superior to many native species.<sup>20</sup> When established brome forms a dense root system in the upper soil profile.<sup>13</sup> The purposeful selection for the prevailing environmental conditions of the Canadian Prairies and natural selection processes have produced an extremely well-adapted species that has become naturalized. These characteristics, combined with the fact that there are few if any natural predators, are enabling the grass to spread unchecked.

### **What does the future hold?**

Through the history of settlement on the Canadian Prairies there has been an attitude of attempting to remedy the symptoms of poor land management rather than addressing the cause(s). One of these ill-founded solutions has been the introduction of exotic plants. Smooth Brome was examined as a potential forage because production of native grasses was apparently declining.<sup>7</sup> Little or no attempt was made to determine why it was declining. This attitude was, and still is, bolstered by the thought that technology or new technologies will permanently solve resource management problems.<sup>3</sup>

Conservationists have the opportunity to learn from the mistakes made by treating symptoms of poor resource management rather than identifying and treating the cause of the problems. The invasion and domination by Smooth Brome of natural ecosystems, a serious resource management problem, must be ad-

dressed and solved before the natural heritage of the Canadian Prairies is lost. This issue will continue to worsen because of natural selection pressures and the release of new and improved varieties.

Today we do not know for certain what the longterm consequences of introducing Smooth Brome might be. Only time will elucidate the implications of introducing this species to native plant communities. However, by examining the impacts of this plant on a local scale we feel confident of some predictions.

It is our opinion that a passive or hands-off approach to managing natural areas will eventually result in invasion by this exotic. Vegetation types that appear most prone to invasion by Smooth Brome are Boreal Forest, Aspen Parkland, Fescue Prairie and specialized habitats occupied by woody species in the Mixed Prairie. These vegetation types provide habitats that are similar to the "steppe meadows," shrubbery and openings that Smooth Brome occupies in Eurasia.<sup>12</sup> Conservation management plans must be developed that place managers in a proactive position rather than one in which they react to invasions. The consequences of invasions by Smooth Brome will become more severe the longer the development of plans is delayed.

## Conclusions

The future of many native plant communities on the Canadian Prairies is bleak because of the combined influence of ploughing native grasslands and the introduction of Smooth Brome. As more land comes under cultivation and the native grasslands become more fragmented, the ratio of the disturbed land to undisturbed prairie increases. This increase in the relative amount of disturbed land will accelerate the rate of spread of exotic species.

Conservationists are now faced with an enormous task if they wish to preserve the integrity of native flora. Our native grassland ecosystems are threatened by current land use philosophy and a species was introduced without considering its long-term impact on the ecosystem. Should we accept Smooth Brome as a part of the native flora and let this species take its natural course? How much and what is this species acceptable? These questions can be answered only after landscape management goals are established.

We should prevent invasions wherever invasions have already occurred. In the earliest stages of development. In other words, strategies should be developed to protect the unaffected or least affected grasslands first. Until this is completed we must direct our management activities toward eliminating satellite populations. This will require that we expand our understanding of ecological relationships of Smooth Brome in native communities.

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<sup>2</sup> BLOOD, D.A. 1966. The *Festuca scabrella* Association in Riding Mountain National Park, Manitoba. *Can. Field-Naturalist* 80:24-32.

<sup>3</sup> CROSSON, P.R. and N.J. ROSENBERG. 1989. Strategies for agriculture. *Science* 145:261:128-135.

<sup>4</sup> DRIVER, E.A. 1987. Fire in grasslands — friend or foe? *Blue Grasslands* 45:217-225.

<sup>5</sup> FLETCHER, J. 1893. A valuable European grass. Canada House of Commons Report of the Select Standing Committee on agriculture and colonization 32.

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#### EDITOR'S NOTE:

The problem with Smooth Brome is that its natural insect, nematode, and fungous pests haven't come over with it from Europe. And this raises a taxonomic question in my mind: If *Bromus inermis* is akin enough to *B. pumpellianus* to cross with it, why can't the parasites and predators which *B. pumpellianus*, as a native species, undoubtedly bears as a burden, attack *B. inermis*? I haven't observed any such disease or insect attack in nature; therefore my guess is that the two species are distinct, contrary to the views given by some authors. — J.H. Hudson