

TEMPERATE NATIVE GRASSLANDS: POLITICS, PREJUDICE, PRESERVATION AND PRIDE

A.W. Bailey

Department of Agriculture, Food and Nutritional Science, University of Alberta, Edmonton, Alberta T6G 2P5, CANADA.

ABSTRACT

The temperate native grasslands of North America are sustainable ecosystems that have endured millions of years of evolutionary history whereas some planted exotic grass species have been demonstrated to deteriorate soil quality, revealing their long-term non-sustainability. This paper reviews the role of exploitation, preservation and conservation of the temperate native grassland ecosystems and examines some of the assumptions and biases displayed by scientists within and among disciplines. Only a fraction of these grasslands remain following their pillaging by crop agriculture and suburban developers. Agronomy and crop agriculture are gradually recognizing that these grasslands are not wastelands. Many urban-based preservationists are eager to lock up more native grasslands so they can be left untouched and unmanaged thus promoting their deterioration in biodiversity, alien species invasion or severe overgrazing. There is also a moderate group of conservationists who encourage the effective utilization of this valuable resource primarily for livestock grazing and wildlife habitat, but also for recreation, watershed and aesthetics. As the human population continues to increase, policy changes need to be made requiring the planning and management of all temperate native grassland ecosystems.

KEYWORDS

ecosystem conservation, exploitation, grazing management, fire, herbivory, assumptions, biases

ORIGINS

The native grasslands of North America originated from early forested floras described by Dix (1964) as the Arctotertiary Flora, which was composed of C₃ plants, and the Neotropical Tertiary Flora, which was composed of C₄ plants. Drought assumed a major role in determining which organisms would survive and adapt to the drier conditions endured during the Tertiary Period. As the Rocky Mountains arose starting about 35 million years BP, a rainshadow was created on the plains to the east. Over a period of about 20 million years, the flora and fauna adapted to these new conditions to the extent that there were grasslands established 15 million years ago with diverse herds of adapted herbivory grazing them (Nikiforuk, 1994). It is assumed that the grasslands and semi-deserts in the cordilleran region of western North America stretching from the Yukon southwards originated in a similar manner.

In the northern half of North America, mountain and continental glaciers of fairly recent geological time interrupted the long period of grassland domination. Once the ice began to recede, tundra was established (Pielou, 1991). Later, the grassland organisms that had survived in mountain refugia and to the south of the glaciers dispersed across the plains and interior valleys of western North America. It remains unknown what proportion of the flora and fauna was lost due to glaciation. Moss (1955) indicated that there were about one-third fewer vascular native plant species in the fescue prairie association of the central plains as compared to the southwestern Alberta foothills. My recent research revealed that probable refugia areas of southwestern Alberta had 2 or 3 times more vascular plant species in the native fescue grassland communities than the equivalent communities in central Saskatchewan. In the Great Plains, the four most common temperate native grasslands are the Fescue, Mixed Grass, Tall Grass and Short Grass Prairie Associations.

The native temperate grasslands of North America have evolved and been influenced primarily by climate, herbivory and fire (Wright and Bailey, 1982). In the Great Plains, extreme winter cold and moderate summer temperatures are the norm. Cycles of drought and non-drought have been very significant to the evolution of an adapted flora and fauna. Herbivory have always been on the plains (Nikiforuk, 1994) and the vegetation is adapted to it. In more recent geological time periods, bison and grasshoppers have been the principle herbivores. West of the Rocky Mountains, there was frequently lower populations of herbivory and the grasslands are not as well adapted to grazing (Tisdale, 1982). Thus, there is evidence that the temperate native grasslands of North America have had a long period of evolutionary history with only a few temporary periods of cold temperatures interrupting the northern sector with glaciation, tundra and forest vegetation (Dix, 1964; Pielou, 1991; Nikiforuk, 1994). These grasslands have evolved for sustainability without the expense of cultural inputs such as energy and agricultural fertilizers.

RECENT HISTORY

The European explorers found the grassland communities difficult to understand, explore and exploit. Nomadic plains tribesmen defended their territory with vigor and cunning, preventing European penetration for decades. Nevertheless, in the winter of 1792-93, the surveyor Peter Fidler travelled and lived with the Peigan Indians on the Alberta grasslands (Fidler, 1792-93). He was impressed with the aboriginal survival skills and their extensive use of fire to burn the grasslands. Similarly, the Palliser expedition of 1857-1860 also observed the extensive use of fire by aboriginal man the temperate grasslands (Spry, 1963, 1968). James Hector, a member of the Palliser expedition described the high quality of forage provided by the native *Festuca hallii* grasslands for wintering horses in central Alberta (Spry, 1968). In contrast, John Macoun, a professor from Ontario, and a member of a Geological Survey of Canada expedition, was anxious to plant "improved" European hay and pasture species, thus replacing what he considered the inferior native species of the plains grasslands (Macoun, 1882). Macoun looked forward to the day when the Canadian prairie "wasteland" would be civilized by European settlement, annual and perennial crop farming.

PREJUDICE AND EXPLOITATION

Since Roman times, European agricultural man has fought against nature and has often been successful in humid temperate climates where drought is rare. There, man has often successfully manipulated plant and animal genetic material and fertilized the soil to raise the productivity and economic value of the agricultural products required by an "advanced civilization". Such an approach and philosophy would not tolerate the fierce plains Indian tribes nor the bison, grizzly bears, wolves and prairie fire that dominated the most extensive North American temperate native grasslands, the Great Plains. All of this "nature in the raw" was "uncivilized" and had to be subjugated just as the Romans did in Western Europe 2000 years ago (Reid, 1954; Rackham, 1990; Bailey and Bailey, 1994). In the United States, the federal government used the old Roman solution by sending out the cavalry to sort out and solve the problem of the fierce tribesmen on the Great Plains. In Canada, the solution was just as devastating. The tribesmen fell victim to the diseases of European man (Spry, 1968).

North American temperate native grasslands were mismanaged from

the beginning of European colonization. These rangelands have suffered from policy maker and settler assumptions and cultural biases (Bailey and Bailey, 1994). These included the assumption that their culture and concepts brought from the humid north temperate climates of Europe, eastern Canada or the eastern United States were superior and applicable to the temperate grasslands of the plains and intermountain regions of the West. They assumed the West was “uncivilized” and they desired to “civilize and Europeanize” it. They also assumed that native grasslands were wastelands and that the land must be cultivated and intensively managed for it to be valuable. To this day in Canada “improved” land refers to cultivated land and “unimproved” land suggests wasteland, including native rangeland. Another assumption was that native grasslands and native herbivores were inferior to introduced “improved” cultivars or breeds (eg. Macoun, 1882).

In spite of the warnings of the Palliser Expedition of the 1850’s regarding the high frequency of droughts on the Great Plains, the eastern Canadian attitude displayed by federal policy makers was typically European-biased and followed the recommendations of Macoun (1882); the native temperate North American grasslands had to be destroyed so that “civilization and modern progress” could occur. The land management policies applied to the settlement of the native temperate grasslands of the Great Plains and the intermountain regions of the West were designed by easterners and Europeans who had their own vested interests. The European agricultural model was applied to these plains grasslands which had a north temperate continental climate of cold winters, cycles of drought and non-drought, high population cycles of bison followed by cycles of low bison populations, vegetation recovery following overgrazing, and prairie fire when dry fine fuels became abundant and lightning or man were the ignition source. The negative repercussions of many of these ill-advised decisions continues to affect the remnant temperate native grasslands to this day.

The new country of Canada devised peculiar natural resource legislation contrary to established British colonial policy (Martin, 1973). These “made in Ontario and Quebec” concepts enabled the federal government to retain legislative authority over natural resources in the western prairies from 1870-1930. This policy precipitated two insurrections amongst the Metis and Indian people of Manitoba who had been left out of the negotiation process when Rupert’s Land was surrendered by the Hudson Bay Company to the new Canadian federal government. The Canadian government retained legislative control of the Great Plains, then designated as the Northwest Territories, not for the purpose of settling the land according to its best use, but for creating a consuming public and supply market for Ontario and Quebec manufacturers, to encourage the building of the Canadian Pacific Railroad (CPR), and to discourage the territorial ambitions of the United States (Wood, 1951). The Canadian government’s Dominion Lands Act of 1872 was a modified version of the 1862 Homestead Act in the United States (Martin, 1973). From 1870 to 1930, the administration of public lands in the Canadian West was the most important administrative activity of the Canadian federal government. They ignored the advice of the scientifically well balanced Palliser Expedition and established policies that forced settlers to plow the native grasslands in order to produce grain for export. This achieved two goals: 1. the farmers paid for the CPR and 2. Ontario and Quebec manufacturers had a captive market for their manufactured goods. All of this required that much of the native temperate grasslands of the Great Plains be destroyed by the plow following the subjection of the aboriginals, the bison and prairie fire.

In order to obtain a free 160 acres (1/4 section) of land in the Canadian west, the homesteader must abide by policies planned in the federal capital of Ottawa. To prevent land speculation, the homesteader must reside on the land and within 4 years had to plow at least 1/4 and plant a crop. What a novel European and Eastern North American concept! The native vegetation was not acceptable in the eyes of Ottawa bureaucrats. Only in recent decades has serious research been supported enabling the development of a greater understanding of the sustainability, productivity, forage quality and biodiversity of temperate native grasslands.

The remnant temperate native grasslands of western North America are important now to the range livestock industry, as habitat for all wildlife and as space for the grassland itself, for watersheds and for recreational opportunities. Traditionally, over the last 40 years its replacement by *Agropyron cristatum* (L.) Gaertn. and *Elymus junceus* Fisch. and other European grasses was considered an improvement (Dormaar et al., 1995). Research has demonstrated that these monocultures reduce soil quality due to a shift in carbon partitioning from below ground to above ground, to increased nutrient export, reduced energy flow and decreased organic matter input. Forage breeding has eradicated the sustainability characteristics of these grasses. Dormaar et al. (1995) recognized the value of these planted alien monocultures to the livestock industry but recommended that there be limits placed on acreages since soil sustainability is more important than short-term forage production.

Today, about 30-60% of the temperate native grasslands remain uncultivated in the drier ecosystems while as little as 5-15% remain in most higher moisture native grassland areas. However, Harrison et al. (1997) have found that on the most productive soils derived from grasslands in Saskatchewan, as little as 0.01% remains in the native grassland state.

PARKS AND PRESERVATION

The preservation movement is currently very popular in the western world and the proponents refer to themselves as “environmentalists”. Parks Canada, the United States Parks Service, provincial, state and municipal parks agencies, the Nature Conservancy and others have a common goal of preserving a large portion of the remnant temperate native grasslands as well as other native ecosystems of North America. The goal of preserving representative examples of native ecosystems is a noble concept. These urban based, and urban funded, preservation movements generally have an attitude of superiority towards the current resource managers, whether range managers, wildlife managers, foresters or agronomists, and tend to lump them in with the “agricultural and forestry exploiters” and the high profit motivated suburban land developers.

Preservationists who honestly believe they are “environmentalists and conservationists” continue pressing for the imprisonment of more examples of ecosystems. Hummel (1995) argued that “—We have a once-only opportunity to ensure that significant parts of our country remain in a wild, natural state, changing only at the hands of nature, and serving as benchmarks for measuring the changes we are making to so much of the rest of our lands and waters—”. Preservationists tend to ignore the current exploitation of many “conservation areas” that are no longer in a wild, natural state. In Alberta, Elk Island, Jasper and Banff National Parks reveal frequent wild ungulate overgrazing and overbrowsing which has predisposed certain temperate native grasslands to reduced biomass productivity, reduced biodiversity, reduced fuel load, reduced fire frequency, increased alien weed infestations, increased domination by European grasses, and/or increased soil erosion. This is particularly the case where herd

animals such as bison, wapiti and big horn sheep graze excessively in the growing season. In spite of predation in the mountain parks by high wolf and cougar populations as well as by black and grizzly bears, the populations of these wild ungulates is often not within the carrying capacity of the native grassland rangelands. Vegetation and soil deterioration will not stabilize until management limits wild ungulates to the carrying capacity of the ecosystem. It is apparent that preservation without management is no longer a choice because man has interfered with too many natural ecological processes. Simulation of some ecological processes is required even in parks. Some problems in Canadian national parks were discussed at a conference held 29 years ago (Nelson, 1969). These problems have magnified today with the greater tourist traffic and few solutions have been found.

The preservationists rarely recognize that the temperate native grasslands evolved under specific ecological and environmental conditions that were always dynamic, and never static. These grasslands were not only adapted to cycles of drought and non-drought for about 35 million years, they also came and went after various glaciations, occupation by tundra and forest during cold cycles (Pielou, 1991) and also endured low and high population cycles of mammalian, insect and rodent herbivory, as well as prairie fire. It wasn't all lightning-caused wildfire either, aboriginal man manipulated fire for his own purposes and the vegetation adapted to it over thousands of years (Hart et al., 1996). It appears that when the preservation movement succeeds in obtaining examples of temperate native grassland and placing them under their own management, they rarely have the depth of ecological knowledge, the funding, or the management skills, to emulate the natural environment under which the temperate native grassland ecosystems evolved. The existing national parks rarely have sufficient safeguards to prevent temperate native grasslands from continuous overgrazing in the growing season by wild ungulate herbivory. Ecosystem preservation without adequate implementation of rangeland resource management policies should not be an option.

PRIDE, CONSERVATION AND STEWARDSHIP

Between the two extremes of exploitation by agronomists and cropland farmers on the one hand and urban-based preservationists on the other lies a more moderate, less vocal group of conservationists. This group recognizes the innate right of the temperate native grasslands to exist and it also recognizes the practical reality of the necessity of these ecosystems to produce some kind of goods and services. This recognition is both ecologically based and practically oriented. It is recognized that herbivory and fire was a part of the natural grassland ecosystem and that man must be a wise and responsible steward of the land. On the other hand, the land must be managed in manner that is within the ecological amplitude of that ecosystem. The concern continues for these grassland ecosystems to be wisely used without either destroying them by cultivation, or exploiting them by overgrazing, or by locking them up in parks where other kinds of mismanagement are rampant. This group considers themselves to be responsible rangeland managers and they represent both the private and the public sector. Some ranchers, public rangeland administrators, scientists, educators and members of the general public consider themselves to be such practical and dedicated conservationists.

Throughout the 100 to 150 year occupation of temperate native grasslands by European man, there have been a few who placed great value on these grasslands. One of the first was Dr James Hector of the Palliser expedition who observed in 1858 that the lush native *Festuca hallii* grasslands of present day central Alberta were of

exceptional forage quality for providing sustenance to the expedition's horses throughout the 5 to 6 month winter period (Spry, 1968). Similarly, some conservationists are outraged by the callous disregard many crop farmers and agronomists hold towards temperate native grassland ecosystems. In his 1919 will, Saskatchewan rancher James B. Henson directed his executors to sell his property “—and with the monies thus procured to create a fund, to be ultimately used for the extermination of that class of vermin commonly known as farmers— I leave to each and every Mossback my perpetual curse, as some reward to them for their labors in destroying the open range by means of that most pernicious instrument, the plow” (Anonymous, 1994).

Today, there are an increasing number of conservationists, particularly those associated with the range management movement, who have become extremely impatient and frustrated with both the callous disregard of agronomists and crop agriculture, and the idealistic ignorance of the urban-based preservationists, towards temperate native grasslands. Neither group are willing to accept or recognize the very effective management and utilization of temperate native grasslands by the many responsible and dedicated conservation-minded ranchers and public range administrators who continue to be responsible stewards of the temperate native grasslands under their management. The urban based media delights in listening to the extravagant claims of the preservationist about the occasional mismanagement of the rangeland. Ironically, periodic overpopulation of bison on the plains in previous centuries probably contributed towards the biological resilience and biodiversity of today's native grassland flora that is able to preserve the soil on overgrazed rangeland more effectively than under most minimum tillage cropping practices.

THE FUTURE OF TEMPERATE NATIVE GRASSLANDS

The urban studies professor Frank Popper of Rutgers University advocated that the Great Plains be allowed to revert to their natural “prewhite” condition by destocking the crop farmers and replanting short grass and restocking buffalo (Harrison, 1990). Popper believes that the Great Plains will become almost totally depopulated as a result of “— the largest, longest-running agricultural and environmental miscalculation in American history—”. This is nothing but speculation but one point is correct. The non-sustainable aspects of crop agriculture must be dealt with quickly and effectively before the soils deteriorate further.

Fehrenbach (1986) observed that it is necessary to separate those areas on the plains in Texas that receive sufficient rainfall from those that do not. He observed that conventional European crop farming is possible where there is adequate moisture but no satisfactory strategy has evolved for the more arid areas. This principle applies throughout the temperate native grasslands of North America. However, there is little legislation or government policy in place to prevent private land owners from cultivating and destroying temperate native grasslands. Furthermore, sufficient research has not been done aimed at demonstrating the economic and ecological value of these sustainable native grasslands. For example, it is insufficiently recognized that the *Festuca* association of the Northern Great Plains and intermountain valleys provides forage quality to wintering livestock and wildlife superior to the common tame grasses. Similarly, this association is very resistant to overgrazing during the dormant season. The extent of destruction of native grasslands during oil and gas exploration, pipeline, utility corridor, road and dam construction continues unabated. The level of reclamation back to native species required by legislation and policy following such disturbance is inadequate. Future generations will look back with wonder at the

extremely low level of recognition given by this generation to the remnant temperate native grasslands.

Private preservationist groups continue to buy native grasslands and the urban public generally favours more parks in these grasslands. Normally, accompanying such acquisitions is the absence of an effective management plan to simulate the environmental forces required to maintain these ecosystems. Although temperate native grasslands are at the top of the list for many preservation activists, these same activists have little knowledge of, or appreciation for current grazing management successes on private and public temperate native grasslands.

In future, more attention needs to be placed upon overgrazing of temperate native grasslands by both livestock and wildlife. This causes dramatic declines in forage productivity with recovery requiring at least 20 years; it increases the proportion of shallow-rooted species that are less productive but more resistant to grazing pressure and there is an accompanying decline in soil organic matter (Dormaer and Willms, 1990). Overgrazing causes reductions in litter, reduced water infiltration, higher soil temperatures (Naeth et al., 1991), and thus artificial drought. Overgrazing during the growing season has more serious effects on grasslands than do similar grazing pressures during the dormant season.

Biodiversity is recognized as being important (West, 1993) by both preservationists and conservationists alike, and even among some agronomists. However, research over about 50 years in a Wisconsin prairie fragment revealed an 8 to 60% reduction in the number of species in the unmanaged tall grass prairie fragments (Leach and Givinish, 1996). Although preservationists wish to promote high species biodiversity, some of their actions have the opposite effect. The locking up of pristine native grasslands may not lead to their successful conservation. These grasslands are not as fragile as some well meaning preservationists think, and moderate grazing use and burning may conserve their diversity more effectively than either non-use or extreme overgrazing.

A small portion of the temperate native grasslands is composed of both active and stabilized sand dunes. Most of these dunes remain on public land. These are fragile ecosystems that more readily respond to changes in their environment than do adjacent lands of more favourable soil texture. Although there has been limited study of sand dune vegetation, incidental knowledge indicates that the total area of active blowing dunes in the Great Plains is diminishing. This contraction in total active dune area is likely indicative of an environment more favourable to grasslands than in the recent past. The trampling and grazing pressures of huge herds of bison and periodic summer lightning fires would favour more dune activity. It seems probable that there is a more conservative management of most temperate native grasslands in place now than several hundred years ago. Range managers are restricting overgrazing, fires and other natural and cyclical disturbance factors. A proactive approach is needed in the management of sand dunes found on temperate native grasslands. The management of these lands requires sufficient periodic overgrazing, trampling and summer fires to ensure the sand dune ecosystems continue to have a portion of their area as active dune complexes, thus conserving a part of our natural heritage.

West of the Rocky Mountains, the temperate native grasslands and sagebrush-grass ecosystems in the lower elevation mountain valleys are gradually surrendering more area to residential and industrial development, to vineyards, orchards and various types of "suburban horse slum" style acreage development. The back to nature movement

is in full swing among those who can afford it. Most people have little or no understanding of the natural role of fire in managing fuels in this environment. Periodically, when fuels have accumulated, fire becomes the great leveller and races out of control in spite of man's most modern and sophisticated fire suppression equipment. Recreationists on off road vehicles such as dirt bikes and 4 x4's are causing serious ecological damage as the thrill seekers pit their skills against the rugged terrain. Governments need to manage such activities and the off-road members of the public need to be educated regarding the consequences of their actions and be prepared to pay the costs of reclaiming native grasslands that they damage.

Public rangeland administrators normally limit livestock to the carrying capacity of the range whereas fewer restrictions are consistently enforced on wild ungulates of the national parks or livestock on some poorly managed private land. Recent natural droughts and man-induced droughts caused by overgrazing have caused Alberta rangeland administrators to revisit policy related to carrying capacity (Turnbull et al., 1994). The recent increases in cow size and earlier calving do influence the quantity of forage removed and thus necessitate a revision of stocking rates to remain within carrying capacity.

Preservationists generally tend to lobby big government to legislate protection as represented by the Endangered Species Act in the United States and similar legislation soon to be enacted in Canada. As West (1997) indicated "The Endangered Species Act is another of the top-down, command and control approaches to conservation that came largely from Washington D.C. Such legislation and the bureaucratic attitudes they generate could be foisted off on public land states in the West, whether the locals liked it or not." It is much harder to do where there are vast tracts of private land, as on the Great Plains.

In "conservation areas", policies and management decisions that have caused a deterioration of temperate native grasslands needs to be revised to accommodate the requirements of entire ecosystems rather than the over emphasis of a few large herbivore or predator species, of tourism business interests, or of cultural biases of the country's human population. There is an urgent need to re-educate national parks policy makers, managers and support groups in basic range management principles in order for them to understand the urgency of effective conservation of temperate native grasslands.

Rangeland resource policy is undergoing major change throughout the temperate grasslands of North America. Historically, public rangeland administrators have recognized livestock grazing and mineral extraction as the primary users of temperate native grasslands on public lands. As the human population has become accustomed to having more leisure time, and has become aware of their environment, recreational experiences have become more important in society, the public has demanded more access to, and influence in, the administration of public grasslands. Currently, access to public land, riparian management and the integration of livestock grazing with wildlife habitat management and forestry are major policy issues (Turnbull et al., 1994; Wikeem and Lester, 1994).

In British Columbia, a complex questionnaire was sent to 19 client groups; it addressed the research, policy and extension needs for British Columbia rangelands (Horton 1995). Those surveyed represented commercial user groups, diverse non-commercial groups, government rangeland managers, and academics. The questionnaire revealed a substantial diversity in priority amongst client groups regarding most issues. The highest priority issue for research was integrated resource management and related issues. Respondents

favoring more research in that area were commercial groups, government field staff and research scientists whereas the non-commercial groups rate other areas more highly. This illustrated a basic difference in viewpoints among users. Those utilizing rangelands daily were aware of the wide diversity in rangeland users and generally recognized that more integration of the uses of rangelands and their products was essential, whereas the more urban based interest groups, who normally utilized rangelands less frequently, tended to focus on single issues. Every group wanted a clarification of the objectives and goals for British Columbia rangeland. These client groups wanted the politicians to clarify current policies regarding the use of public rangelands. Decisions unpopular with some client groups would need to be taken if the results of the questionnaire were to be implemented.

The developed world is experiencing an incredibly rapid rate of change in technology which affects all facets of human life. Many people are reacting in anger and frustration as they find themselves victims of changing times. Recently, there has been great upheaval for users of temperate native grasslands. As a result of the declining population of commercial rangeland users, such as ranchers, residing in rural areas, more and more influence is being felt by government decision-makers from urban-based lobby groups whose personal livelihoods are not directly affected by the changes for which they lobby. Nevertheless, new information and new societal priorities will precipitate changes in both legislation and policies regarding the use of temperate native grasslands.

SCIENTISTS AND THE "SEARCH FOR THE TRUTH"

Scientists generally confine their search for new knowledge and for "the truth" to a relatively narrowly defined discipline. Normally, this is the discipline in which they have received their postgraduate education. As a result, the scientist is often poorly prepared to become involved in interdisciplinary research. Similarly, they are not prepared to conduct intensive personal scrutiny into the assumptions and biases within their discipline.

Few scientists are aware of their personal biases. Most feel that because they have been trained in a discipline, and have used the scientific method in their research endeavours, that they are consistently tolerant of other points of view. This attitude is often in error. Scientists must face the reality that each individual comes with our own baggage of upbringing, unique cultural orientation, biases and unwarranted assumptions. Specialists in one discipline frequently misunderstand another specialist's point of view because each has failed to identify and communicate their assumptions. For example, most agronomists assume that new cultivars will consistently produce more forage and have no negative effects on the soil and other parts of the ecosystem. Thus, this justifies their position that it was correct for crop agriculture to destroy most of the temperate native grasslands and perhaps it is acceptable to plow the remainder. However, Dormaar et al. (1995) have demonstrated that some of the most widely used grass monocultures reduce soil quality. Similarly, most preservationists assume that temperate native grasslands can be locked up for decades in the absence of appropriate herbivory and fire management regimes without losing biodiversity. Leach and Givinish (1996) have demonstrated otherwise. Preservationists, particularly the zoologists, seem to see nothing wrong with encouraging the overpopulation of their favorite mammalian herbivory, such as bison, wapiti and big horn sheep, to excessively graze in national parks to the extent of the elimination of dominant native grasses, the invasion of alien weeds and subsequent high levels of erosion. In North America, agronomists, preservationists and most conservationists alike seem to be petrified regarding the natural role

of fire in the temperate native grassland ecosystems. They are taking no leadership role whatsoever in encouraging the development of suitable legislation, policy and the municipal infrastructure that is necessary to enable the safe and effective reintroduction of prescribed fire into the temperate native grasslands.

Most scientists are undoubtedly genuine in their feelings that they are contributing to their disciplines. Undoubtedly they are, but this does not negate the likelihood that many are working towards goals that will negatively affect the temperate native grassland ecosystems.

CONCLUSIONS

In North America, there was a conspiracy by policy makers based on eastern American and Canadian self-interest and greed that resulted in the demise of a much larger proportion of the temperate native grasslands than was economically and ecologically warranted. The settlers who farmed the Great Plains and intermountain valleys did need to plant some crops to earn a livelihood and to provide winter fodder for livestock but the attitudes expressed so bluntly by Macoun (1882), the Ontario agronomy professor, were biased and based upon assumptions that caused difficulties for every European colonial power around the world.

The tide is turning from the agrarian disdain towards temperate native grasslands to an acceptance of these ecosystems. Many well meaning, urban-based preservations are eager to lock up more native grasslands, so they can be left untouched, and thus allowed to deteriorate. There is also a more moderate group who are concerned about both conservation and wise utilization of this valuable resource. Greater interest is being displayed towards the utilization of native plant species in further reestablishment of temperate native grasslands. However, as the human population continues to increase, policy changes should be made to require the planning and management of all temperate native grassland ecosystems regardless of ownership. Whether it be 'pristine wilderness', parks, public rangeland or private land, all require long-term range management planning. It needs to be acknowledged that fire and herbivory are the primary ecological tools available for the sustainable management of all native grassland ecosystems. The most sensitive and difficult policy issues for managers on both private and public rangelands is related to the coordination of the diverse interest groups demanding access to, and influence on, the management of these resources.

REFERENCES

- Anonymous.** 1994. Cranky cowboy cursed from grave at farmers who spoiled prairie. *Edmonton Journal*, January 7, 1994.
- Bailey, A.W. and P.G. Bailey.** 1994. The traditions of our ancestors influence rangeland management. *Rangelands* **16**: 29-32.
- Dix, R.L.** 1964. A history of biotic and climatic changes within the North American grassland. p. 71-89. *In* D.J. Crisp (ed.) *Grazing in terrestrial and marine environments*. Blackwell Sci. Publ., Oxford.
- Dormaar, J.F., M.A. Naeth, W.D. Willms, and D.S. Chanasyk.** 1995. Effect of native prairie, crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.) and Russian wildrye (*Elymus junceus* Fisch.) on soil chemical properties. *J. Range Manage.* **48**:258-263.
- Dormaar, J.F. and W.D. Willms.** 1990. Sustainable production from the rough fescue prairie. *J. Soil and Water Conservation* **45**: 137-140.
- Fehrenbach, T.R.** 1986. Historical influence of grasslands on American and Texas cultures. *Proc. 10th North American Prairie Conference of Texas Woman's University, Native Prairie Association of Texas, Dallas*, 4p.
- Fidler, P.** 1793. Journal of a journey over land from Buckingham House to the Rocky Mountains in 1792 & 93. *In* Haig, B. (ed.) 1991.

A southern Alberta bicentennial: a look at Peter Fidler's journal, 1792-93. Historic Trails West Ltd., Lethbridge.

Harrison, E. 1990. Return Great Plains to nature, prof urges. *Chicago Sun-Times*, July 1, 1990.

Harrison, T., Greig Reimer and N. Lynn. 1997. An assessment of prairie remnants in highly cultivated ecoregions of Saskatchewan, p.76. *In* Abstracts, 50th Annual Meeting, Society For Range Management, Rapid City, South Dakota, February 16-21, 1997.

Hart, R.H., W.D. Willms, and M.R. George. 1996. Cool-season grasses in rangelands. p. 357-381. *In* L.E. Moser, D.R. Buxton, and M.D. Casler (ed.) Cool-season forage grasses. Agron. Mono. 34. Publ. Amer.Soc. Agron., Crop Sci. Soc. Amer., and Soil Sci. Soc. Amer. Madison.

Horton, P.R. 1995. British Columbia crown range research and extension review project. B.C. Min. For., Research Branch, Kamloops.

Hummel, M. (ed.) 1995. Protecting Canada's endangered spaces. Key Porter Books, Toronto.

Leach, M.K. and T.J. Givnish. 1996. Ecological determinants of species loss in remnant prairies. *Science* **273**: 1555-1558.

Macoun, John. 1882. Manitoba and the Great North-west: field for investment; the home of the emigrant, being a full and complete history of the country. World Pub. Co. 687p.

Martin, Chester. 1973. "Dominion Lands" policy. Carlton Library No. 69., McClelland and Stewart, Toronto. 259p.

Moss, E.H. 1955. The vegetation of Alberta. *Bot.Rev.* **21**: 493-567.

Naeth, M.A., D.S. Chanasyk, R.L. Rothwell and A.W. Bailey. 1991. Grazing impacts on soil water in mixed prairie and fescue grassland ecosystems of Alberta. *Can. J. Soil Sci.* **71**: 313-325.

Nelson, J.G. (ed.) 1969. Canadian parks in perspective. Harvest House, Montreal. 343p.

Nikiforuk, A. (ed.) 1994. The land before us: a geological history of Alberta. Tyrell Museum of Paleontology. Red Deer College Press, Red Deer.

Pielou, 1991. After the ice age. University of Chicago Press, Chicago.

Rackham, O. 1990. Trees and woodland in the British landscape. Dent, London.

Reed, J.L. 1954. Forests of France. Faber, London.

Spry, I.M. 1963. The Palliser expedition. MacMillan, Toronto. 310p.

Spry, I. M. (ed.) 1968. The papers of the Palliser expedition 1857-1860. The Champlain Society. Toronto. 694p.

Turnbull, M. G., B.W. Adams, M.L. Anderson and L. Cole. 1994. Alberta rangeland resources, p. 31-37. *In* Taha, F., Z. Abouguendia, and P.R. Horton (ed.). Proc. 1st Interprovincial Range Conf. in western Canada. Regina. 345p.

Tisdale, E.W. 1982. Grasslands of western North America: the Pacific Northwest bunchgrass, p. 223-245. *In* A.C. Nicholson, A. McLean and T.E. Baker. Grassland ecology and classification, Symposium Proceedings. B.C. Min For.Pub. No.R28-82060.

West, N.E. 1997. Book review of F.B. Samson and F.L. Knopf. (ed.) Prairie conservation: preserving North America's most endangered ecosystems. Island Press. *J. Range Manage.* **50**: 110.

West, N.E. 1993. Biodiversity of rangelands. *J. Range Manage.* **46**: 2-13.

Wikeem, B. and T. Lester. 1994. Range management in British Columbia, p. 42-53. *In* Taha, F., Z. Abouguendia, and P.R. Horton (ed.). Proc. 1st Interprovincial Range Conf. in western Canada. Regina. 345p.

Wood, V.A. 1951. Alberta's public land policy, past and present. *J. Farm Economics* **33(4)**: 735-749.

Wright, H. A. and A.W. Bailey. 1982. Fire ecology of the United States and southern Canada. Wiley, New York.