Grasslands at the Northwest Edge

by Sybille Haeussler, Bulkley Valley Research Centre, Smithers, BC.

Imagine for a moment, the grasslands of British Columbia. Chances are, the last place that will come to mind is the Skeena Region of northwest B.C. This, after all, is the land of salmon, totem poles, mist-shrouded forests and mountains. Native grasslands form little or no part of this picture –even for those who live here. But precisely because of their rarity, remoteness, and a general lack of awareness, the Skeena Region includes some of the best-protected and most endangered grasslands in our province.

Northwest B.C. has two significant low elevation grassland landscapes, located in the Stikine River valley and at the western edge of the Nechako Plateau, with small pockets of grassland scattered in the Bulkley and mid-Skeena valleys, and north to the Yukon border (Figure 1).

Two obvious features distinguish these northwestern grasslands from the more familiar grasslands of the southern B.C. interior. First, slender wheatgrass (*Elymus trachycaulus*) replaces bluebunch wheatgrass (*Pseudoregnaria spicata*) as the dominant, late seral bunchgrass. Secondly, big sagebrush (*Artemisia tridentata*) is replaced by smaller sages such as pasture sage (*Artemisia frigida*), northern wormwood (*Artemisia campestris*) and Michaux's mugwort (*Artemisia michauxiana*).

Other characteristic native plants are stiff needlegrass (*Agnatherum occidentalis*), spreading needlegrass (*Agnatherum richardsonii*), glaucus bluegrass (*Poa glauca*), june grass (*Koeleria macrantha*), timber oatgrass (*Danthonia intermedia*), Rocky Mountain fescue (*Festuca saximontana*), purple reedgrass (*Calamagrostis purpurascens*), purple peavine (*Lathyrus nevadensis*), northern bedstraw (*Galium boreale*) nodding onion (*Allium cernuum*) and yarrow (*Achillea millefolium*).

Saskatoon (*Amelanchier alnifolia*), snowberry (*Symphoricarpus albus*), prickly rose (*Rosa acicularis*) and wild cherries (*Prunus virginiana, P. pensylvanica*) are typical shrubs.

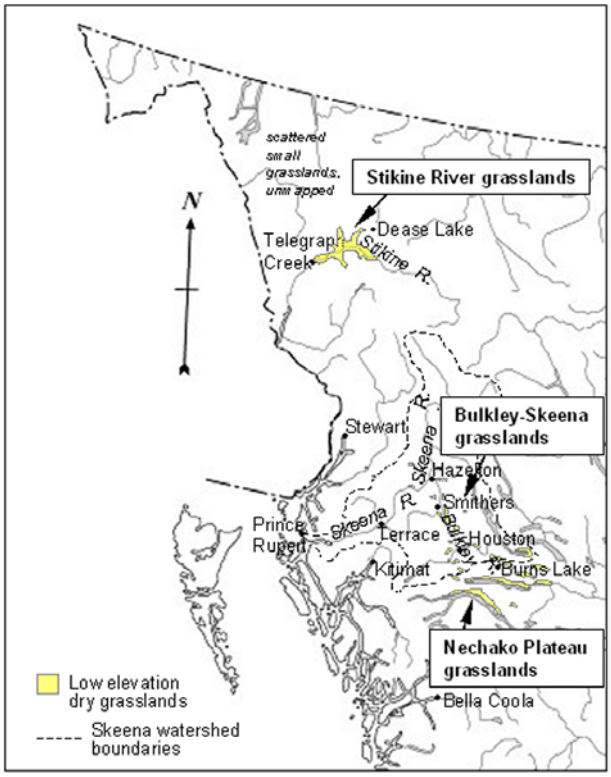


Figure 1. *Grasslands of northwest B.C.*

With their high insolation and low snowpacks, these grasslands provide critical habitat for many wildlife species, notably mule deer and western garter snakes, and support xerophytic plants and insects not found elsewhere in the landscape.

They are also a magnet for invasive species from warmer and drier climates and agricultural environments. Non-native plants that are widely naturalized include dandelion (*Taraxacum officinale*), Kentucky bluegrass (*Poa pratensis*) and timothy (*Phleum pratense*). So far, cheatgrass (*Bromus tectorum*) and knapweeds (*Centaurea* spp.) are absent.

Stikine Region Grasslands

The Stikine River in far northwest B.C. steepens into a narrow canyon east of the Coast Range at Telegraph Creek. Like the canyons of the Fraser and Thompson Rivers to the south, the Grand Canyon of the Stikine creates an unusually warm and dry rainshadow microclimate which, combined

with sedimentary bedrock and volcanic ash deposits from nearby Mt. Edziza, results in one of BC's most spectacular and pristine low elevation grassland landscapes (Figure 2).

Figure 2. *Stikine Canyon grasslands near Tanzilla junction.* *(B.C. Forest Service photos)*

These boreal grasslands line the steep banks of the Stikine River and tributary rivers such as the Klastline, Tahltan, Tuya, and Tanzilla. Once threatened by hydroelectric dam proposals, the grasslands adjacent to the Stikine River are now largely protected within Stikine River Provincial Park. With little agriculture, urban or industrial development in this remote region, the Stikine grasslands may be the least damaged and best-protected grasslands in B.C. However, the recent surge in oil, gas and mineral exploration activities in the region has increased road construction, infrastructure development and air and off-road traffic, creating a variety of potential threats including invasive species and changes in seasonal movements and behaviour of wildlife populations.

In the Stikine region, warm, dry, low elevation scrub-steppe (a mosaic of dry grasses, sedges, sages and other forbs interspersed with patches of woody scrub) occupies south-facing riverbanks, escarpments and terraces. These dry grasslands merge with the more expansive grassy tundra and subalpine scrub on the uplands of the Stikine Plateau, but their growing season is much longer, and their biota and soils are more typical of southern grasslands.

Characteristic features include large monospecific patches of creeping juniper (*Juniperus horizontalis*) or dogbane (*Apocynum androsaemifolium*) that lend colour to the hillsides and are reminiscent of the dry grasslands of the Rocky Mountain trench and Peace River escarpments.

The Stikine grasslands contain an interesting blend of plant and animal species from the Peace River and Great Plains region, the Beringian steppes of Yukon and Alaska, and the Cordilleran region of southern B.C. and the western United States. Unusual, disjunct plants include Rocky Mountain juniper (*Juniperus scopulorum*), which hybridizes with creeping juniper, Indian rice grass (*Acnatherum hymenoides*), western snowberry (*Symphoricarpos occidentalis*) and wood rose (*Rosa woodsii*).

These grasslands support a regionally important population of mule deer and a remarkable band of canyon mountain goats featured in the documentary film *Life on the Vertical*.

Nechako Plateau Grasslands

This Nechako Plateau grassland landscape encompasses the shorelines of the large linear lakes that form the western margins of the Fraser River Basin. There are over 300 lakes in the region surrounding the town of Burns Lake, known locally as 'The Lakes District'. All of the large lakes (Ootsa, Francois, Cheslatta, Tcheskinkut, Burns, Decker) and many of the smaller ones at one time had fairly extensive native grassland along their northern (south-facing) shorelines.

Most original grassland is now converted to hayfields, pasture and front lawns, or was inundated during flooding of the Nechako Reservoir in the 1950s. What remains is heavily encroached upon by trembling aspen, snowberry, prickly rose and various agricultural grasses and often badly eroded by livestock and machine traffic, but are there still gems to be found on steeper and less accessible slopes (Figure 3).

Figure 3. *The spectacular Colleymount grassland overlooking Francois Lake.*(*S. Haeussler photo*)

Newly designated protected areas such as Uncha Mountain - Red Hills Park on Francois Lake (Figure 4) offer the promise of a more enlightened future.

Figure 4. *Saskatoon – slender wheatgrass scrub-steppes in Uncha Mountain – Red Hills Provincial Park are surrounded by beetle-killed pine forests.* (*Adrian de Groot photo*)

Pine forests surrounding the Nechako Plateau grasslands have been massively affected by the current mountain pine beetle outbreak. It is unclear whether this development represents bad news or good news for grassland ecosystems.

Bulkley, Babine and Skeena Valley Grasslands

The Skeena River drainage basin is wetter than either the Stikine or the Nechako Plateau and generally lacks the calcium- and base-rich soils needed for good grassland development. Most low-elevation herbaceous plant communities in the Skeena watershed are not true grasslands, but moist, rich meadows dominated by cow-parsnip (*Heracleum maxiumum*), fireweed (*Epilobium angustifolium*), asters (*Aster conspicuus*, *A. modestus*), meadow rue (*Thalictrum occidentale*), peavine (Lathyrus nevadensis) or bracken fern (*Pteridium aquilinum*).

Figure 5. *The largest "natural grassland" in the Bulkley Valley. Cattle grazing has transformed the lower slopes from cow parsnip to a diverse mix of tame grasses and wild forbs. Upper slopes are dry grassland.* (*Joanna Smith photo*)

Along the Bulkley River and its tributaries, grasslands were appropriated long ago for agricultural fields and pasture. Small, scattered dry grasslands, scrub-steppe and Rocky mountain juniper savanna-steppe can still be found on sun-exposed, rapidly drained soils on steep southwest-facing slopes, river escarpments and isolated river terraces but are under heavy threat from rural property development. The northeast shoreline of Babine Lake, by contrast, has expanses of shrub-steppe and savanna-steppe in relatively pristine condition.

The Role of Disturbance

The exceptional biological diversity found on northwest B.C. grasslands results from a complex and highly active disturbance regime operating at many scales of time and space.

Herbivores ranging in size from ants to large ungulates and grizzly bears play a key role in retarding tree and shrub encroachment onto grassland. They also maintain grassland diversity by grazing, browsing, redistributing seeds and exposing mineral soil.

Fires also profoundly affect ecosystem diversity. On many northwest B.C. grasslands, fires occur more frequently and are more variable in size, seasonality and severity than in the surrounding forests or wetlands. Spring burning in late March or April, before leaf-flush, was used extensively by aboriginal communities and later by European settlers for land clearing and habitat manipulation, and is still in frequent use in some areas –particularly on Indian reserves. Later in the year, accidental and lightning-caused fires are also important.

Today's mosaic of scrub, grasses and tree thickets is the result of millennia of recurring, patchy fires of variable intensity. Short- and longer-term changes in climate affect fire behaviour, as well as rates of tree encroachment and herbivore abundance.

Like the antelope brush ecosystems of the southern Okanagan and the Garry Oak woodlands of Vancouver Island, Skeena Region grasslands are subject to many environmental threats including habitat fragmentation and loss from urban and industrial development, insensitive grazing practices and recreational abuse.

Paradoxically, it is their very dynamic nature that makes northwest grassland ecosystems particularly vulnerable to degradation from invasive plant and animal species and to subtle changes in their disturbance regime, such as fire suppression or overuse, soil exposure and erosion, or changes in herbivore abundance.

A. Lessons from the Fire Line

In 2001, six grassland benchmark sites were established between Hazelton and Francois Lake to monitor rangeland condition and test restoration options. Although the intent was to conduct controlled burns at each location, six years later, only two sites have been successfully burned. A third site failed to ignite, and a reburn at the first site also failed, both due to insufficient fuels.

Spring burning has traditionally been a simple, inexpensive method for maintaining rangelands, but northwest B.C. grassland enthusiasts have learned that it is no panacea for restoring ecosystems in the modern age. There are many barriers to successful burning, including health and safety concerns that make it nearly impossible to conduct burns during a 1- to 2-week burning window. Tree and shrub encroachment on most test sites has reduced grassy fuels to the point where a spring burn either will not carry effectively or has minimal impact on resprouting vegetation. Moreover, at some sites, burning enhances the spread of undesirable species.

With help from B.C. Parks, we recently began testing the use of brush saws and aspen girdling as a restoration technique on several test sites. These labour- intensive techniques are too expensive for widespread, repeated use, but our hope is that several years of cutting will invigorate herbaceous layers enough to carry a prescribed burn.

The lessons we are learning in the Northwest will sound familiar to anyone who has attempted grassland restoration elsewhere in B.C. or North America. It seems everyone needs to experience the mistakes first-hand. On the positive side, our existing network of benchmark sites, located right at the climatic margin for viable grasslands, is ideally situated to serve as a canary-in-the-coalmine for monitoring the effects of climate change on vulnerable ecosystems.

Predicting Effects of Climate Change

Changes in climate take place across a huge range of spatial and temporal scales (sidebar B). While changes in temperature and precipitation do affect grasslands directly, more often they have an indirect or cascading effect on patterns of disturbance, grassland foodwebs, and human behaviour. Any prediction of the effect of global warming on northwest B.C. grasslands is thus likely to be wrong, and guaranteed to be a vast oversimplification.

That said, I predict that some northwest B.C. grasslands will expand as result of global warming, while others will shrink. All will experience some displacement of their current biota by both native and non-native species. The rate of invasion will accelerate with human activity and habitat fragmentation in the surrounding landscape. However, even remote grasslands will undergo invasion, for example by native rhizomatous shrubs, airborne insects, fungi, and flowering plant seeds, and as a result of ungulate use. Larger, contiguous grasslands, such as those in the Stikine, will be less

affected by climate change than scattered pocket grasslands, like those in Bulkley and Skeena. This will happen even if the climate changes more rapidly in the Stikine than further south.

Biological diversity will increase in some areas and for some biotic groups and will decrease for others. Grassland plants and animals with greater plasticity, including the ability to be physiologically active in the early spring and late fall, multiple reproductive modes and broad ecological tolerances, will out-compete species with narrow, rigid niche preferences.

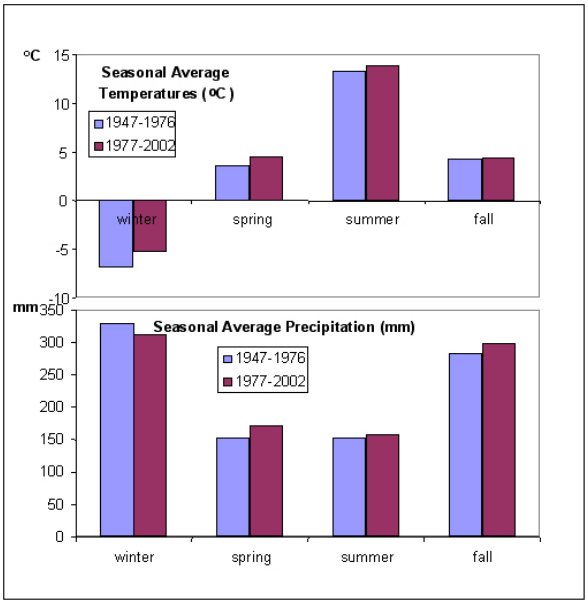
On the whole, cool season, rhizomatous grasses are likely to benefit at the expensive of summer-active, bunchgrasses. Earthworm invasions will disrupt cryptogamic soil crusts. Some ephemeral species, such as spring flowering annuals or certain insects that are currently rare, will explode in abundance, while others will disappear.

In some cases, indigenous species will coexist happily alongside new arrivals while elsewhere they will be completely overrun. In general, we should expect an overall loss in beta diversity —that is, in the degree to which individual grasslands differ from neighbouring grasslands and from grasslands in more urbanized areas to the south.

These predictions are drawn from my field observations of changes in northwest B.C. grassland ecosystems over the past 30 years, bolstered by a small amount of local grassland research (sidebar A) and plenty of published research from other geographic regions and ecosystems. One thing ecologists know for certain is that there will be some surprises, as no two ecosystems respond alike and the future never entirely replicates the past.

B. Warmer and Wetter?

In recent decades, the climate in northwest BC has been warmer, especially during the winter, and wetter, at least during spring and summer (Figure 6). Anecdotally, this has resulted in smaller grasslands with higher shrub cover, because moister conditions reduce summer fires and encourage tree and shrub growth.



Until more research is done, it is difficult to attribute these changes to global warming since annual and decadal climatic variability can also have long-lasting effects on grassland ecology. For example, ungulate populations, which have a huge effect on tree and shrub encroachment, can take years to recover from a single winter with unusually heavy snow. Likewise, an exceptional white spruce seed year followed by warm, wet summer weather can establish a cohort of trees that permanently influences grassland dynamics.

Figure 6. *Differences in average temperature and precipitation in the Bulkley Valley before and after the 1977 PDO regime shift.*

Lately, many important ecological phenomena in B.C. have been linked to the Pacific Decadal Oscillation (PDO), which flipped from a dominantly negative mode from 1947 to 1976 to a dominantly positive mode since 1976. Some are suggesting that the return to more extreme 1970's style weather since 2003 could be the result of another PDO regime shift. Interactions between global warming and cyclical phenomena like the PDO are likely to have a major effect on grassland viability.

Endangered Grasslands and the Pizza Test

How much change can a grassland ecosystem threatened by climate change, invasive species, altered disturbance regimes, urban and industrial development and other indignities of the 21st Century undergo before losing its essential character or integrity?

This question is often asked, not only of B.C. grasslands, but about any unique entity threatened with extinction from globalization, including indigenous cultures and languages. There may be some lessons to be learned through analogy.

Those involved in native land claims and the cultural survival of indigenous peoples, have observed a recurring phenomenon, now ironically referred to as "the pizza test". The pizza test famously reared its head during the landmark Delgaamukw vs. British Columbia land claims trial of the Gitksan and Wet'suwet'en peoples of northwest B.C. According to the original Delgaamukw ruling handed down by B.C. Chief Justice Alan McEachern in 1990, the Gitksan and Wet'suwet'en relinquished their aboriginal identity and cultural integrity because they participated in the European wage economy and adopted modern foods such as hamburgers and pizza. In other words, they failed the pizza test.

The pizza test perpetuates a static view of culture and has been thoroughly discredited in the academic literature, as well as receiving a level of repudiation in the courts. It is not insignificant that the Gitksan and Wet'suwet'en were successful in having Justice McEachern's ruling overturned in the Supreme Court of Canada.

How does the pizza test apply to northwest B.C. grasslands threatened by global change? Ecosystems, like cultures and languages, continually adapt to new circumstances. Holding on to a static view of ecosystems, is every bit as specious as perpetuating a static view of culture and language. Ecologists and conservationists in western North America, myself included, notoriously cling to idealized conceptions of pristine, pre-European natural ecosystems. The accelerating pace of global change and events such as B.C.'s extraordinary mountain pine beetle outbreak challenge us to adopt a more realistic view of grasslands and other ecosystems as dynamic, adaptive entities.

Yet it is undeniable that whether it's pizza, Kentucky bluegrass or Lumbricid earthworms, these global invasives can serve as early indicators of an avalanche of change that may result in the disintegration of a culture or ecosystem. We need more substantive indicators of health and resilience than the pizza test to predict whether an adapting social or ecological entity maintains its distinctiveness or becomes an undifferentiated part of the global stew.

For grasslands at the Northwest edge, this could mean shrinking to the point of being completely engulfed by the surrounding forest. Alternatively, these ecosystems could remain open and grassy but increasingly indistinguishable from a local soccer field or a vacant lot downtown.

The message of the pizza test is that not all changes are important or necessarily a bad thing. The challenge for those of us who love B.C. grasslands will be to figure out what the really important threats associated with climate change are and how we can work most effectively to ensure the future health and resilience of these very special ecosystems.

Further Information

Life on the Vertical. An award-winning documentary film about the Grand Canyon of the Stikine and its mountain goats. Available at: http://www.stikine.net/rec/shop.html

ClimateBCv3.1: A program to generate climatic data for climate change & genecology studies in B.C.. Available at: http://genetics.forestry.ubc.ca/cfgc/res_climate-models/ClimateBC_v31_Instructions.pdf

Sybille Haeussler is a Smithers-based research scientist and professional forester whose work and hobby time includes conservation and restoration of northwest B.C. grasslands and other endangered ecosystems. She is a post-doctoral research fellow at the University of B.C. Portions of this article appear in the Spring 2007 edition of BC Grasslands newsletter, published by the BC Grasslands Conservation Council.