

Rare Plants and Rare Plant Communities in Alberta Face an Uncertain Future:

A Case Study of a Prescribed Burn near Saskatchewan River Crossing, Alberta



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In 2007, I conducted a study (Timoney 2007) of montane and subalpine vegetation in the upper North Saskatchewan River area between Whirlpool Point and Saskatchewan River Crossing, Alberta. The report was submitted to the provincial government and Parks Canada and recommended that a prescribed burn planned for the area be postponed. According to the Alberta government and Parks Canada, the primary objectives of the prescribed burn were to reduce the number of pine stands susceptible to mountain pine beetle, to create a fuel break, and to create vegetation types typical of the historical fire regime. The government's objectives were not grounded in evidence-based science and are discussed in detail in the Timoney report.

The recommendation to postpone the burn was based upon the facts that there was insufficient knowledge to predict the response of rare landscape elements to fire, that the burn would have probable negative effects upon rare plants and rare plant communities, and that the prescribed burn plan was flawed. The report was suppressed. A prescribed burn of roughly 7,900 ha was conducted in 2009 (Figure 1). Following the burn, I conducted further studies of the area in 2009 and 2011. This article presents a summary of that study's findings (Timoney 2012).

Observations Within Plots

Results documented a significant number of rare vascular plants, lichens, and bryophytes and rare plant communities associated with limber pine, whitebark pine, and montane grassland. Significantly, about 251 rare taxa were

found in the study plots. About 73 percent of the rare taxa were non-vascular plants. A composite burn index scored to indicate fire severity was the strongest environmental factor that explained variations in vegetation composition two years after fire. Total vegetation change (assessed through ordination) was strongly correlated with fire intensity. Fire caused declines in species richness of rare lichens, rare bryophytes, rare vascular plants, and of lichen species richness in general. At moderate to high fire severity, about three to seven rare species were lost per plot at two years post-fire. Relative to the average of 17 rare species per plot, the loss of three to seven species resulted in an average reduction in richness of rare species of 18 to 41 percent.

Percent cryptogam crust post-fire was negatively correlated with fire intensity, indicating that sites that burned severely had either a lower cover of cryptogam crust before fire, or that fire destroyed cryptogam crust. Seven species indicators of severe fire were identified, five of which were bryophytes and two of which were vascular plants. Of the 444 taxa that were found in the 22 plots sampled in 2007 and 2011, some were present in only one of the years. Both ecological and non-ecological factors account for the differences in presence-absence. Statistical tests revealed that the lichen, bryophyte, and vascular plant species matrices were significantly correlated, indicating that these plant groups comprise integrated communities. Across years and within vegetation groups, the strongest correlation was between the vascular plant matrices, which suggests that the vascular plant assemblages were more resistant to post-fire change

than were the bryophyte and lichen assemblages.

More study should be conducted to better understand the ecology of the rare species and communities and, in particular, their responses to fire. Observations should be expanded to alvar and cliff communities to better understand these landscape elements. Similarly, study of cryptogam crusts would further understanding of their response to fire.

Observations Outside of Plots

Some of the most-affected areas lay outside the vegetation plots that were established before the fire. Despite low fuel loads, some undescribed cliff and alvar communities were strongly degraded in the fire (Figure 2). Trees in open limber pine savannahs were sensitive to low intensity fire. A major impact of the prescribed burn was the loss of many formerly healthy rare limber pine and whitebark pine vegetation communities. The barren bedrock created by intense heat presents an inhospitable environment for plant propagules. Recovery from site degradation in such communities may take decades. The area lying between Highway 11 and plot PSP11 was subjected to high intensity fire; there was near total mortality of trees. Water erosion and wind deflation of exposed soils were noted. Slope angles of ≥ 20 degrees appeared to be more prone to erosion than did less steep areas.

Spread of *Ribes* species after the fire is of conservation concern due to their role as the intermediate host for white pine blister rust. Extensive walking between plots indicates that *Ribes* plants have

increased in frequency since the fire. The loss of cryptogam crusts, if widespread, could have long-term effects on soil stability, site quality, ecological integrity, and species richness. The weed response detected to date has been moderate. Among the exotics, *Taraxacum officinale*, *Tragopogon dubius*, *Poa pratensis*, and *Vicia cracca* have appeared in the flora within or outside of the plots.

In areas where fire caused stand replacement, there was loss of limber pine forest and savannah associations, whitebark pine woodlands, montane, subalpine, and riparian old-growth forests, and scientifically important old limber pine trees. In the short-term, the rare limber pine and whitebark pine communities have been made rarer.

In the long-term, the impacts to the limber pine and whitebark pine populations will depend on whether both species can successfully regenerate. Regeneration is not a certain prospect given a rapidly changing climate, white pine blister rust, an expanding mountain pine beetle population, and the uncertain future of the Clark's nutcracker, the critical seed dispersal agent for both pine species.

Management and the Future

It was irresponsible for government to have proceeded with the prescribed burn in the absence of sufficient knowledge as to how the fire would affect rare plants and rare communities. Use of aggressive and degradative land management techniques was not justified by the situation. The use of repeated aerial ignitions to "clean up" (i.e. burn) high elevation forests with a documented naturally long fire return interval was counter to the normal ecological processes and conditions that shape the landscape.

The primary objectives of the burn: "Reduce the number of pine stands with high susceptibility to mountain pine beetle... Create a strategic fuel break... [and] Restoration of an area in the Upper North Saskatchewan River valley to vegetation types reflecting historic fire regime..." are discussed in the report (Timoney 2012) and shown to be based on outdated policy and a poor understanding of science. The government's use of misleading information is documented.

At last communication with the government, plans were to continue to use prescribed burns in the area, including burning the riparian zone of the North Saskatchewan River south of Highway 11. The Alberta government and Parks Canada need to do a better job of incorporating science into their decision-making; they need to change policy that has proven ineffective, outdated, or detrimental.

Plans to burn other parts of the upper North Saskatchewan area should be postponed. Prior to any future prescribed burns, monitoring the effects of the 2009 burn should continue over the next decade in order to determine if the burn is achieving ecologically defensible objectives. If it is not, then prescribed burns should cease.

Policies and objectives of the Alberta Environment and Sustainable Resource Development and Parks Canada prescribed burn programs should be reviewed in light of changing

environmental conditions, especially in regard to conservation of rare plants, rare vegetation communities, and critical or rare habitats. The forest environments of Alberta are different from what they were in past decades. Climate change is leading to regional desiccation. Glaciers are retreating and stream flows in many areas are in decline. Species ranges are in flux. The mountain pine beetle has effectively escaped containment in Alberta in spite of aggressive efforts to contain the beetle's spread.

In the rush to battle a perceived mountain pine beetle threat, significant components of the ecosystem are being ignored and, in the case of this burn, degraded or destroyed. The North Saskatchewan prescribed burn was not supported by science. Hopefully, the results presented here will help to focus future monitoring efforts and to engender a more cautious approach to the management of such valuable ecosystems. Government can and should do better. ♣

References

- :ASRD (Alberta Sustainable Resource Development). 2011. Appendix 1 – Maps of study area (burn severity) [accompanies Caners 2011]. Alberta Sustainable Resource Development, Edmonton, Alberta.
- :Caners, R. 2011. Effects of recent prescribed fire on bryophytes and vascular plants of the Upper North Saskatchewan River, Alberta. Alberta Sustainable Resource Development, Edmonton, Alberta.
- :Timoney, K. P. 2007. A Study of Rare Plants and Rare Plant Communities, with Observations and Recommendations Regarding a Prescribed Burn, in the North Saskatchewan Unit. Alberta Sustainable Resource Development, Parks Canada, and Alberta Natural Heritage Information Centre, Edmonton, Alberta.
- :Timoney, K. P. 2012. Response of Rare Plants and Communities to a Prescribed Burn near Saskatchewan River Crossing, Alberta. Available by email from: treeline@treeline-ecological.ca.

Note: The study to which this article refers was conducted in the public interest without remuneration. All costs were borne by the project participants. A copy of the full report (Timoney 2012) is available upon request to: treeline@treeline-ecological.ca.

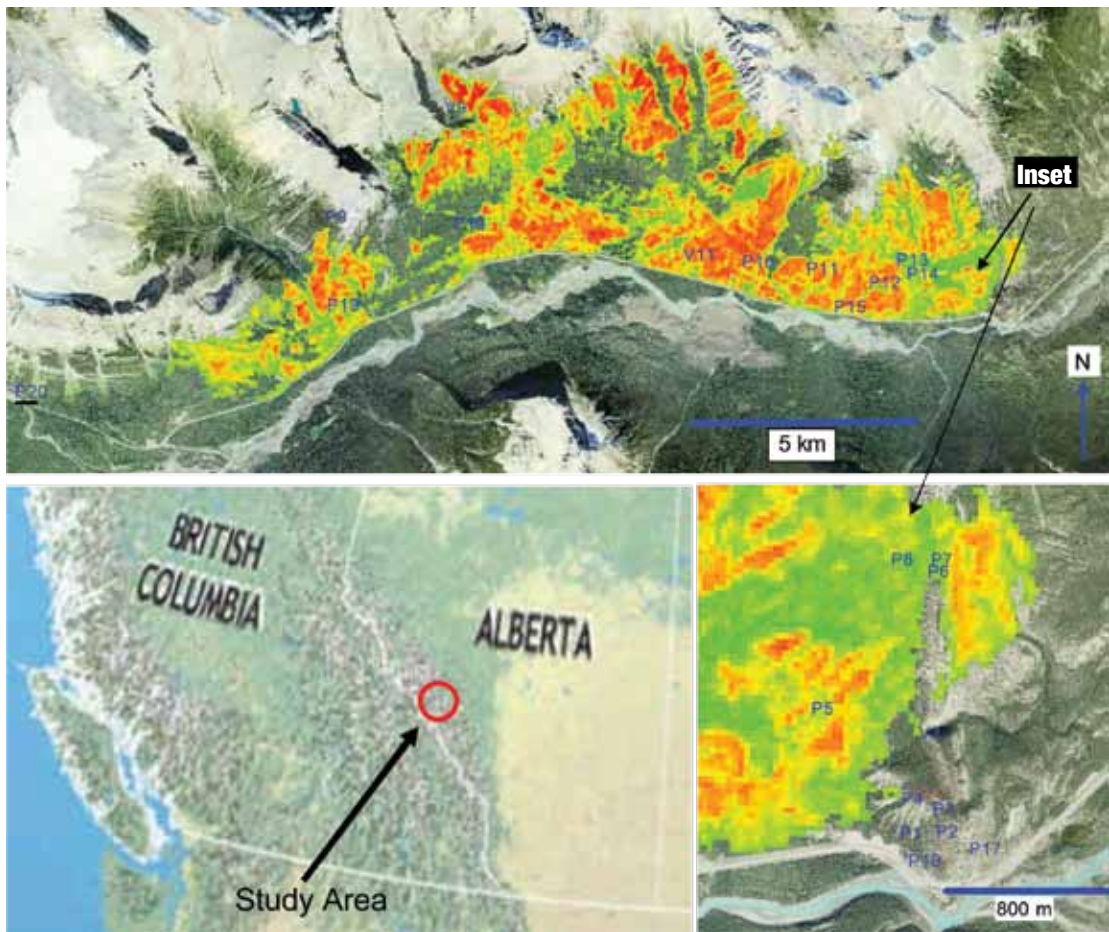


Figure 1. Locations of rare plant study sites that were sampled in 2007, and again in 2010 and/or 2011, in relation to a 2009 prescribed burn severity index (from ASRD 2011). Maximum burn severity is bright red; minimum burn severity is green. The colors are coded to a unitless normalized burn ratio based on differences in Landsat TM/ETM bands that are sensitive to fire. Maximum and minimum values in this image were +1353 and -186. Unburned areas are reportedly indicated by values of about -100 to +100, whereas burned areas range from about +100 to +1300. See ASRD (2011) and Caners (2011) for details. Maximum burn severity is correlated with increased charring, consumption of fuels, exposure of mineral soil and ash, scorched or blackened vegetation and with decreased moisture content and aboveground biomass and cover (Caners 2011).



Figure 2. Bedrock in this intensely burned alvar (limestone pavement) community suffered exfoliation. The whitish areas are bedrock depressions that contained a thin layer of plants and organic soil before the burn. The dark gray areas are burned saxicolous cryptogam communities. Regeneration of such sites may take decades and the future plant assemblages that will occupy such sites are unknown. 6 September 2009.