Living Lab Program for Climate Change and Conservation - Final Report

Project title: Wildfire impacts on endemic Okanagan plants

Lead researcher(s): Susan Murch

Research findings

The start date of our project was delayed in 2022.

During the spring and summer of 2022, we conducted botanical surveys in the burn zone and adjacent areas of Skaha Provincial Park. We worked with elders from PIB to ensure that the collections met with indigenous priorities and protocols. Dr. Erland and 2 students collected a total of 139 Soil samples, 93 botanical vouchers and completed vegetation surveys in Spring Summer and Fall for 31 Sites. Vegetation surveys identified 160 species encompassing 122 genera and 42 different families, 81 % of identified species were native, with the remaining 19 % were invasive.

Samples are currently stored in the freezer and controlled environment chambers awaiting results of lab experiments. In the summer of 2023, we are planning to characterize the soil seedbank and to analyze the samples for karrikins to integrate with this data.

Preliminary analysis of vegetation survey data identified several interesting trends:

Trend 1: Native grasses are recovering best in less disturbed sites and which experienced low severity fire in 2020. Invasive grass species in comparison, are performing best in the control sites and do not show a significant difference with disturbance.

Native grass species included:

- 6 week fescue (*Vulpia octoflora*)
- Blue bunch wheatgrass (*Pseudoregeneria spicata*)
- Heller's rosetta grass (*Dichanthelium oligosanthes*)
- Pine grass (*Calamagrostis rubescens*)

Invasive grass species identified included:

- Cheat grass (*Bromus tectorum*)
- Orchard grass (*Dactylis glomerata*)
- Rye grass (*Lolium perenne*)

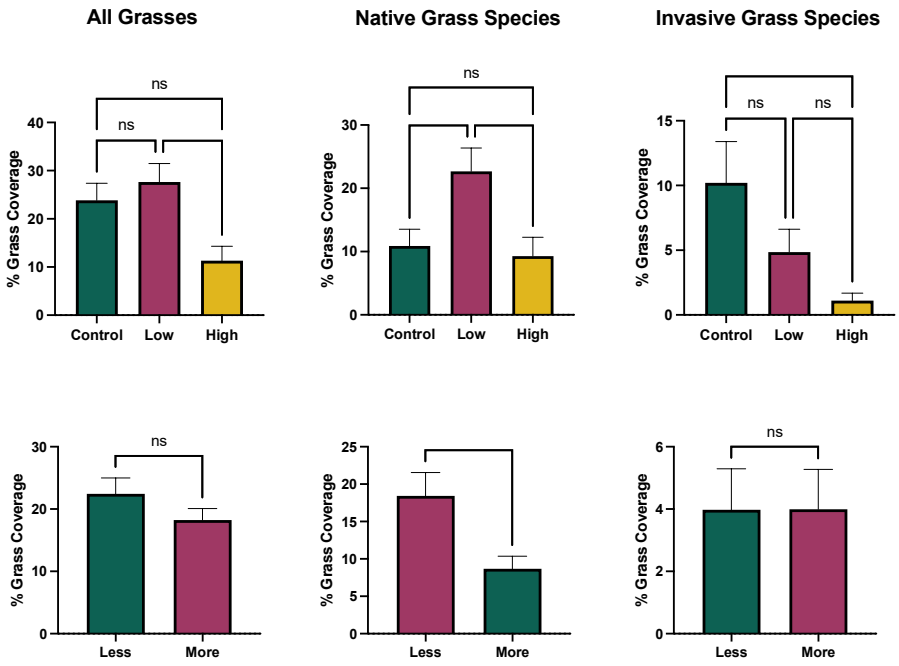

Figure 1. Percent total (left), native (centre) and invasive (right) grass coverage at sites classified by fire severity in 2020 (top) or disturbance (bottom). Stars indicate significant via Analysis of Variance (alpha = 0.05). Bars show mean percent coverage across sites, error bars represent standard error margin.

Trend 2: Species diversity did not vary significantly between site classifications.

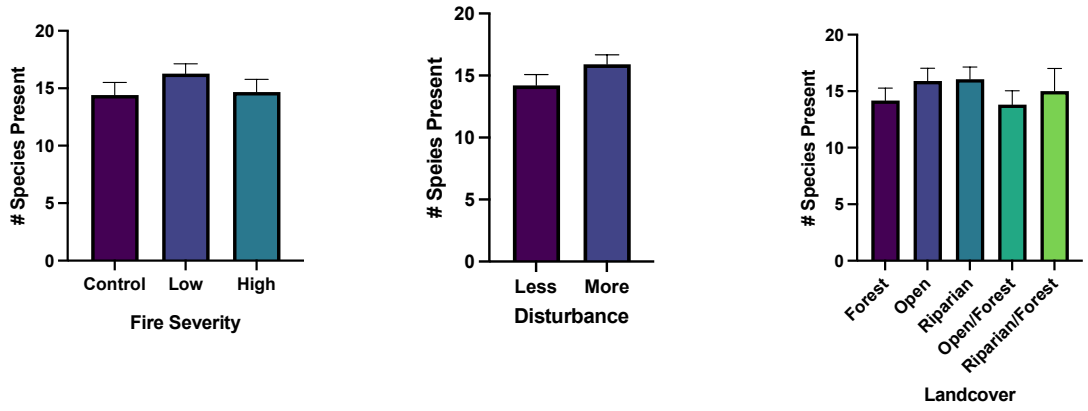

Figure 2. Total number of presence identified at sites grouped by fire severity (left), disturbance level (middle) and landcover type (right). Bars represent means and error bars the standard error margin

Trend 3: 23 species were found to have a significant correlation between species density and fire severity (Spearman's rank non-parametric test, two-tailed t-test, alpha = 0.05).

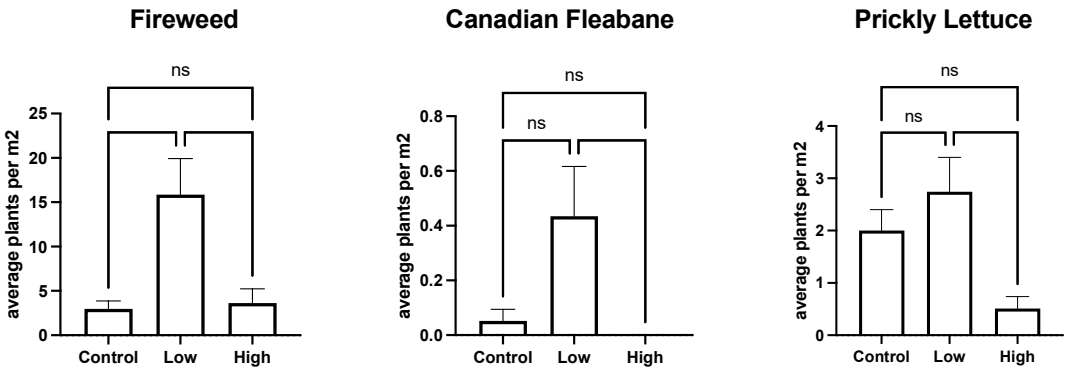

Figure 3. Species density (mean plant per meter squared) for the top three sepcies showing a correlation with fire severity: fireweed (Chamerion angustifolium, left), willowherb (Epilobium ciliatum, centre) and prickly lettuce (Lactuca serriola, right)

Table 1. Results of correlation analysis between species density at sites (plants per meter squared) and site fire severity. ~35 % of species showed a significant correlation with fire were invasive while the remaining.

SPECIES COMMON NAME	SPECIES	INVASIVE OR NATIVE	SPEARMAN R	P-VALUE
PRICKLY LETTUCE	*Lactuca serriola*	I	0.4678	<0.0001
FIREWEED	*Chamerion angustifolium*	N	0.3589	<0.0001
WILLOWHERB	*Epilobium ciliatum*	N	0.3097	<0.0001
CANADIAN FLEABANE	*Conyza canadensis*	N	0.3037	<0.0001
GREAT MULLEIN	*Verbascum thapsus*	I	0.2745	<0.0001
WILLOW	*Salix spp.*	N	0.26	<0.0001
GARDEN ROSE	*Rosa sp.*	I	0.2461	<0.0001
FIELD FILAGO	*Filago arvensis*	I	0.2387	0.0001
SPREADING DOGBANE	*Apocynum adrosaemifolium*	N	0.2301	0.0002
BLACK COTTONWOOD	*Populus trichocarpa*	N	0.215	0.0006
SNOWBRUSH	*Caenothus velutinus*	N	0.2056	0.001
BUFFALO BERRY	*Shepherdia canadensis*	N	0.1986	0.0015
DESERT PARSLEY, YELLOW	*Lomatium ambiguum*	N	0.1892	0.0025
BLACK MEDIC	*Medicago lupulina*	I	0.1889	0.0026
EUROPEAN RASPBERRY	*Rubus idaeus*	IN	0.181	0.0039
ASPEN, TREMBLING	*Populus tremuloides*	N	0.1726	0.0059
THIMBLEBERRY	*Rubus parvifolium*	N	0.1621	0.0098
BULL THISTLE	*Cirsium vulgare*	I	0.1615	0.0101
RED CLOVER	*Trifolium pretense*	I	0.1567	0.0126
CHOCOLATE LILY	*Fritillaria affinis*	N	0.153	0.0149
SUMAC	*Rhus glabra*	N	0.1396	0.0264
SNOWBERRY	*Symphoricarpos albus*	N	0.1323	0.0355
VETCH	*Vicia sativa*	I	0.1284	0.0413

Finding 4: Only very weak correlations were found between disturbance and species densities, in some cases, however, a significant difference between more and less disturbed sites was observed, especially for species already known to populated disturbed sites including fireweed.

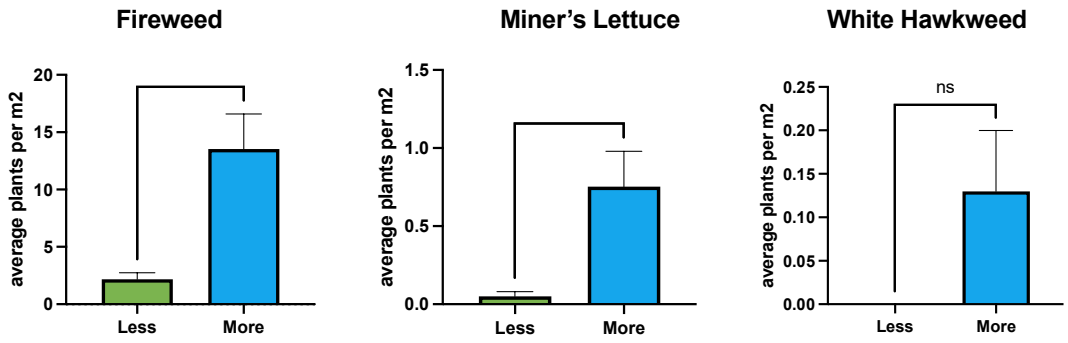

Figure 4. Species densities in more and less disturbed plots for fireweed (Chaemarion angustifolium, left), miner's lettuce (Claytonia perfoliata, centre) and white hawkweed (Hieracium albiflorum). Stars indicated significant difference (two tailed t-test, alpha = 0.05)

Methods summary

31 Sites sampled and monitored at Skaha Bluffs Provincial Park in 2022. Sites were classified by:

Ecosystem:

- Riparian
- Forest
- Open

Disturbance Level:

- 16 More (< 10 m from a path or trail)
- 15 Less (>10 m from a path or trail)

Burn severity (both from fire mapping and confirmed by visual assessment of sites):

- 9 Control (no burn)
- 12 Low severity
- 19 High severity

Vegetation Surveys conducted at three time points in Spring (May) Summer (July – August) and Fall (Sept) 2022:

- 0.5 m^2 grids and 10 m long transects at each site
- Both presence of species and density counts included

Soil samples collected from all sites in Spring 2022.

- 10 cm deep and 1 inch diameter soil cores collected at 1 m intervals along a 10 m transect
- For 12 sites, samples were collected individually for assessment of within site variability, for the remainder of site samples were pooled

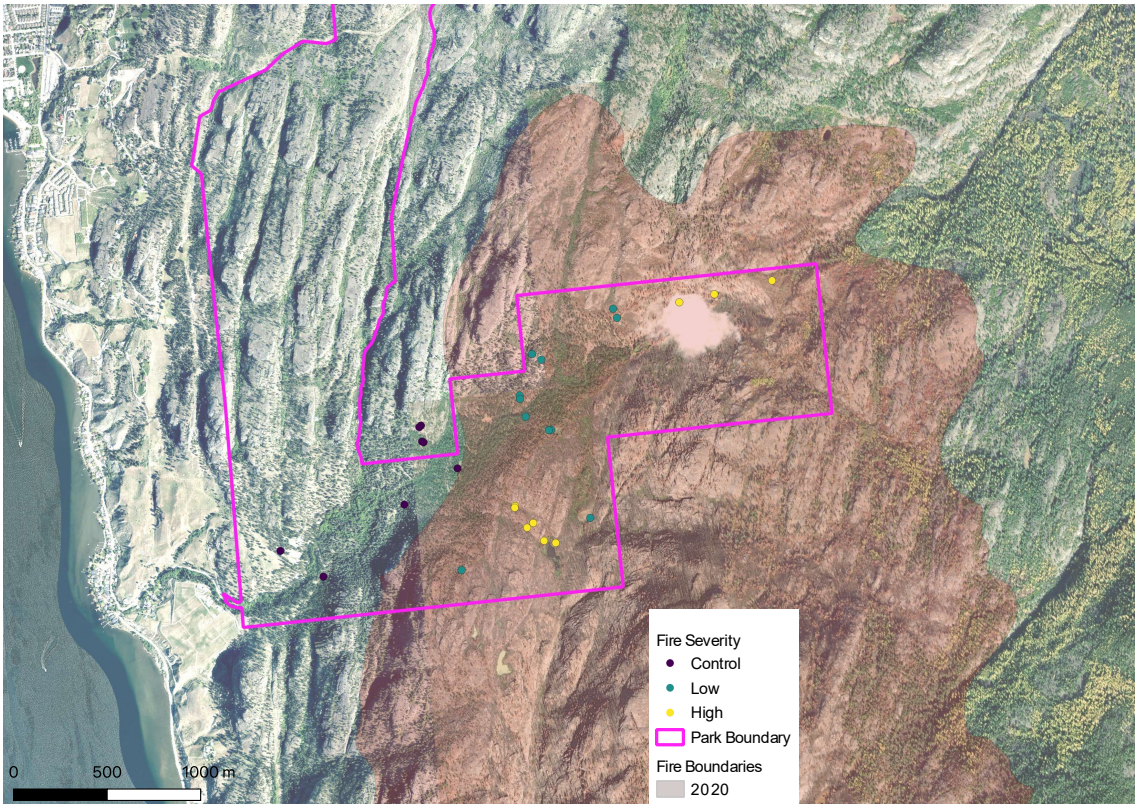

Figure 5 Map of sites surveyed in 2022

Key outcomes for BC Parks

- The results to date suggest that disturbance following the current re-entry period is not having a negative impact on re-vegetation after the fire.
- Vegetation surveys, particularly with respect to regrowth of native grasses supports the use of prescribed or cultural fires which would be most similar to the low severity fire condition for invasive plant suppression and promotion and maintenance of the bunch grass meadows for which Skaha Bluffs Provincial Park is known and which supports at-risk ungulate populations within the park. Use of prescribed burns may also reduce risk of higher severity burns which have had a negative impact on plant community composition and density.

Relevance to BC Parks management

- Low intensity, prescribed burns may be useful in promoting and maintaining health of the ecosystems within the park.

Project's challenges/opportunities

A major delay in the project was recruitment of undergraduate research assistants to participate in the project, due to delay in funding release of the project.

Soil seedbank characterization was projected for completion in 2023 to 2024 and is now in progress.

Soil karrikin analysis was projected for completion in late 2022 but has been delayed due to significant damage to the mass spectrometry system in the lab in Summer 2022 resulting from a

campus-wide power surge. These experiments are currently in progress. We anticipate that we will meet our final reporting deadline of March 2024. We look forward to integration and testing of targeted hypotheses generated in the vegetation surveys in our upcoming experiments.

Conclusions/next steps

While the vegetation survey is complete, work to characterize the soil seedbank and karrikin content of soils is in early stages. These results are anticipated to be completed in 2023 with final data analysis and integration of results across the three area of investigation will occur in early 2024. A final report will be provided at this time.