ECOLOGICAL SUMMARY AND NARRATIVE for the Kamloops Future Forest Strategy

MSxk

Short- term Vulnerability = HIGH
Long-term Vulnerability = HIGH

Ecological Narrative for the MSxk through to 2080:

2008 to 2050

The influence of climate change

This subzone is an example of how a single forest health agent can change the timber profile and stand structure over a very short period. The subzone was dominated by stands of lodgepole pine, now either logged or dead. Future forest composition will likely be dominated by lodgepole pine, which is the focus of the present reforestation strategy.

As time progresses with warmer conditions, lodgepole pine will likely move outside of its broad range of ecological tolerance. This will affect vigour and lead to a high risk of future forest health impacts from a range of agents, one of which may be the mountain pine beetle.

Fire is a concern in the current unsalvaged dead pine stands for the next number of years. Once these stands have either been salvaged or they move beyond the most susceptible stages, the threat of fire will be reduced due to the low level of fuels in the newly regenerated forests. This lower fire risk may change soon after 2050.

Estimated future forest condition of stands currently mature

All the lodgepole pine older than 20 years old is either dead or soon to be so. This subzone was dominated by lodgepole pine with only minor amounts of Douglas-fir, spruce, subalpine fir, and aspen (possibly cottonwood on wet sites).

Where it is currently found, Douglas-fir and spruce released by lodgepole pine mortality will increase in size and vigour but will soon show signs of moisture stress on all but the wettest sites. Growth of subalpine fir will stagnate and its role as a future overstory species will be doubtful. The result by 2050 will be a very patchy mosaic of scattered fragments of mature or old timber likely dominated by Douglas-fir, and very small patches of aspen over a landscape mostly covered by young lodgepole pine.

Much of the dead pine has been harvested, yet some will not be salvaged and will remain as a short term fire hazard, especially if lightening storm frequency and intensity increases. As time moves on the risk of large fires diminishes as the hazard declines due to the dominance of young stands.

Estimated future forest condition of young stands

Most of the subzone is located on mesic sites on the Thompson Plateau resulting in similar growing sites and conditions. Young stands are composed primarily of lodgepole pine, with a minor component of spruce, subalpine fir and Douglas-fir. Lodgepole pine was the regeneration species of choice due to its frost tolerance and ability to deal with the cold winters and moderately short, hot summers. Lodgepole pine was planted, or naturally regenerated, where seed was available, over the past 20 years and continues at present.

Up to 2050 it is projected that at least half to the entire subzone will have a climate that it is hotter and drier than the normal range of lodgepole pine, more like the IDFxh where it is not found. Thus, a large proportion of lodgepole pine plantations will be growing in a climate that is not favourable to lodgepole pine. The increase in drought stress will result in lower vigour and increased mortality from a range of potential forest health agents, one of which could be a resurgence of mountain pine beetle.

Conditions will be conducive to increased incidence of tussock moth, potentially impacting young Douglas-fir. Increased spring moisture conditions may offset hotter, drier summers and maintain conditions conducive to comandra and stalactiform rusts. Western gall rust, needlecast, terminal weevil and dwarf mistletoe will likely increase with the overall warmer climate.

Lodgepole pine established on wetter, cooler aspects will have a higher likelihood of prolonged survival. Douglas-fir and ponderosa pine, once established, should be well adapted up to 2050, as will spruce on wetter sites. Subalpine fir will not be well adapted to the future in this subzone. A key element in establishing Douglas-fir will be to avoid frost-induced mortality; trees established beneath overstories of dead pine may have better survival.

2050 to 2080

The influence of climate change

Beyond 2050 and up to 2080, the future within the present MSxk will be one where lodgepole pine is well outside of its ecological tolerances, with much hotter, drier summers, approaching that found in the BGxh.

By 2080 surviving lodgepole pine stands, significantly weakened by drought stress, will be at high risk of mortality, possibly in combination with bark beetles and other forest health agents. The resulting mortality may increase the likelihood of severe fires.

Estimated future forest condition of stands currently mature

At 2080 there will be few old stands, as the subzone will be dominated by 70-90 year old pine. In draws and moisture receiving sites, older Douglas-fir and spruce will be surviving with some difficulty. There will be an increase in open stand conditions on these sites. There will also be concerns regarding control of invasive plants where disturbance from grazing, fire and other activities has occurred.

The dominating pine stands, regenerated after the mountain pine beetle outbreak of the early 2000s, will be declining rapidly and likely experiencing high levels of mortality, in the absence of harvesting or other interventions.

Estimated future forest condition of young stands

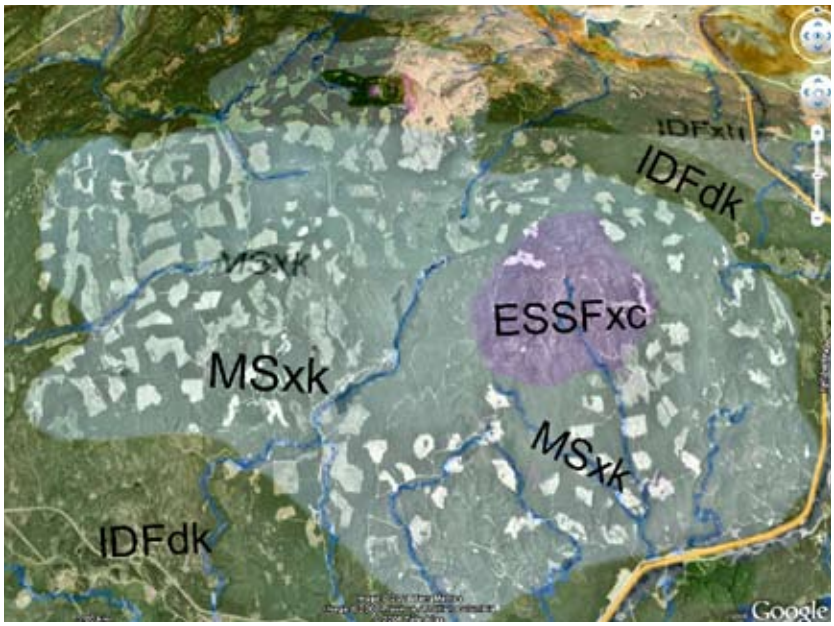
Beyond 2050 to 2080, a number of key parameters for species survival will be impacted. Ponderosa pine will be the lone conifer adapted to drier sites. Douglas-fir will be limited to mesic or moister areas and will require shade for establishment. Lodgepole pine will not be an option as it will be outside of its ecological tolerances.

Vulnerability summary

This subzone will experience a trend away from a lodgepole pine dominated subzone to one suited to ponderosa pine, limited Douglas-fir and an increased proportion of grassland.

CURRENT CONDITIONS

5% of the TSA
11% of the THLB



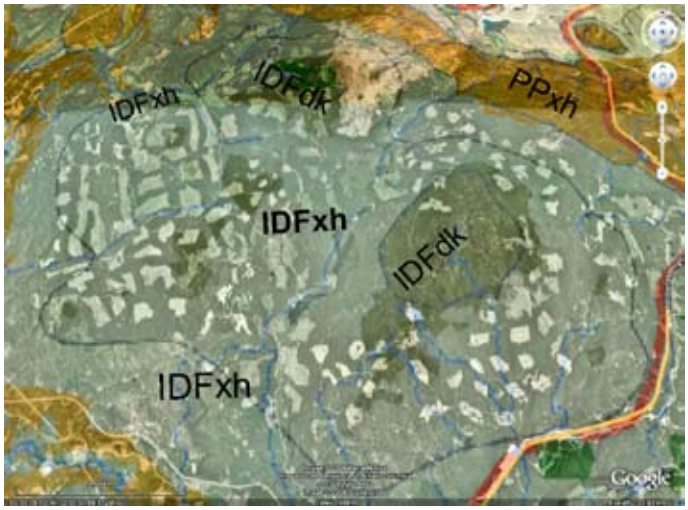
Logan Lk.

Sites Naturally Associated with MSxk	Plant Communities Associated with Current Subzone
Zonal site association	Closed stands of Pl & Sxw (Bl) with At, Pl & Fd in seral stages; moderate shrub cover of soopalallie, utah honeysuckle, spirea, grouseberry; moderate herb layer of pinegrass, arnica, twinflower; dense feathermoss, heron's bill moss and pelt lichens
Dry site association	Moderately open stands of Fd and Pl; open shrub cover of juniper, spirea, grouseberry, and soopalallie; sparse herb layer of pinegrass and kinnikinnick; sparse cover of feathermoss, heron's bill moss and lichens
Cold Air/ Soils association	Closed stands of Sxw on moist sites, and Pl on mesic sites; abundant shrub cover of Trapper's tea, falsebox, grouseberry, huckleberry; moderate herb layer of bunchberry, arnica, bramble; dense feathermosses, heron's bill moss and pelt lichens
Wet site association	Dense stands of Sxw, Pl (Bl, Act) (At in seral stages); rich shrub cover of gooseberry, twinberry, huckleberry, grouseberry, dogwood; moderate herb layer of bunchberry, arnica, twisted stalk, meadowrue; abundant feathermosses, leafy mosses & glow moss

Age Classes	Leading Stand Species	% of MSxk
<20	Pli 85% (Sx, Fd)	14
20-60	Pli 90% (Sx)	7
60-120	Pli 85% (Sx, Fd)	22
120+	Pli 72% Sx 14% Fd 13%	57

Climate Scenarios

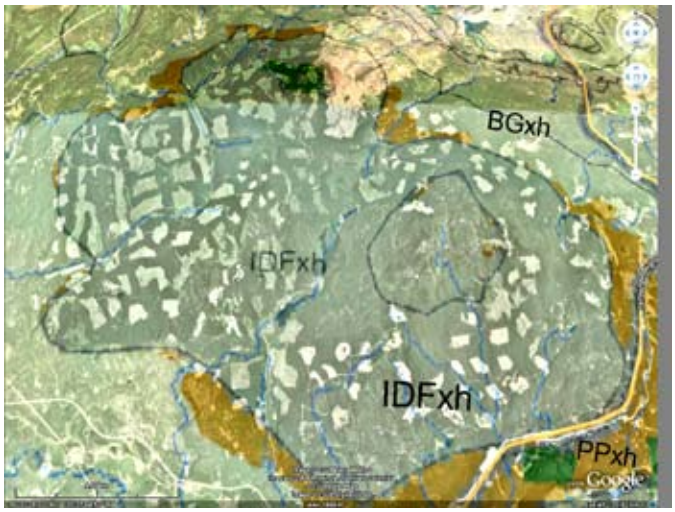
PCM-B1 2050 (least change)



Relative Elevations	Predicted Subzone Climate	% MSxk
Upper	MSxk	2
Mid	IDFdk	52
Valley and upper boundary areas may have slightly moister conditions		
Lower	IDFxh	46
Upper boundary areas may have slightly moister conditions		

Annual Climate Variables	Now	2050	Change
mean annual temp. (°C)	2.5	3.5	1.0
mean summer temp. (°C)	12.1	13.4	1.3
mean temp warmest month (°C)	13.2	14.8	1.6
frost free period (days)	73	92	26%
number of frost free days	147	163	11%
mean annual precipitation (mm)	479	499	4%
mean summer precipitation (Jun-Aug) (mm)	224	223	-1%
precipitation as snow (mm)	193	188	-3%
annual heat:moisture index	27	28	4%
mean summer heat:moisture index (May-Sept)	60	68	13%

HAD-A1F1 2050 (most change)



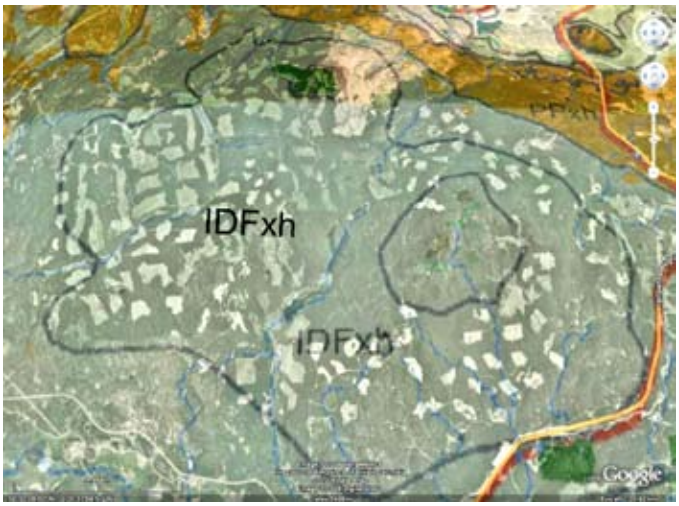
Relative Elevations	Predicted Subzone Climate	% of MSxk
Upper	IDFdk	3
Hills and lower boundary areas may have slightly drier conditions		
Mid	IDFxh	93
Hills and lower boundary areas may have slightly drier conditions		
Lower	BGxh	4

Annual Climate Variables	Now	2050	Change
mean annual temp. (°C)	2.5	5.9	3.4
mean summer temp. (°C)	12.1	17.0	4.9
mean temp warmest month (°C)	13.2	19.3	6.1
frost free period (days)	73	113	55%
number of frost free days	147	194	32%
mean annual precipitation	479	491	3%
mean summer precipitation (Jun-Aug)	224	199	-12%
precipitation as snow (mm)	193	155	-20%
annual heat:moisture index	27	33	24%
mean summer heat:moisture index (May-Sept)	60	100	66%

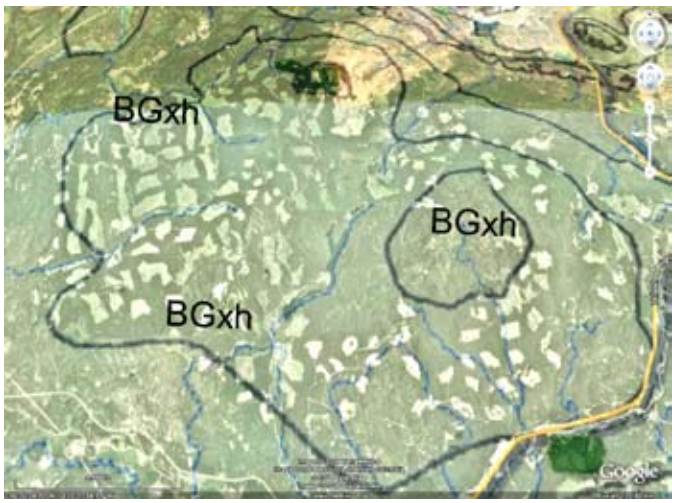
Normal summer heat:moisture index comparisons:
ICHvk – 28; ICHmw – 42; IDFxh – 90; BGxh – 139

Looking Even Farther Ahead:

PCM-B1 2080 (least change)



HAD-A1F1 2080 (most change)



Overview of Changing Climate focussing on 2050:

General Description

For the least-change PCM scenario this subzone will be tending toward the IDF, with temperatures slightly closer to the IDFdk than the MSdm (which is also relatively close but slightly cooler in the summer). With the most-change HAD scenario this subzone definitely crosses the line into the IDF climate with temperatures closer to the PP, and moisture similar to the IDFdk in summer but considerably higher in the fall, winter and spring.

Summary of Ecological Vulnerabilities and Opportunities

ROOT DISEASE - Small, fragmented pockets of *Armillaria* continue to exist here but can be delineated and therefore more easily managed. It may become more active here but it is doubtful that increased spread will be a huge problem as this subzone will continue to be dry.

INSECTS - Tussock Moth will increasingly become problematic. Regenerated pine stands may be once again vulnerable to mountain pine beetle in future.

MISTLETOE – It is expected that as the changing climate stresses pine, mistletoe will have significant effects.

RUSTS – Attropellis, western gall and commandra may all increase with the increased moisture forecasted for spring.

FIRE.- As ~90% of the current MSxk is mesic on the plateau, there will soon be much loss of pine due to mountain pine beetle. In the short term there will be significant fire hazard due to the quantity of fines present in pine crowns. Hazard may be high again in fifty years or so when the hotter and drier climate may make subsequent pine stands vulnerable again to pests. At the same time, unsalvaged MPB-killed stems from the current outbreak will be on the ground and present additional fire hazard, although this has not been well quantified.

Regeneration Vulnerabilities and Opportunities

MESIC SITES:

- About half of the beetle-killed stands due to the current outbreak will naturally regenerate to lodgepole pine, especially if salvaged. Pine regeneration will be highly to very highly vulnerable to mortality from a variety of agents as the climate tends toward the IDFxh (lower elevations with PCM or the whole area in HAD). Once it is 40 years old it will likely persist but be stressed.
- With the ongoing loss of pine overwood, there is less chance of natural spruce regeneration. Advanced spruce and subalpine fir regeneration will likely persist, albeit with a struggle.
- The introduction of some ponderosa pine should be attempted on lower slopes (not flats) to avoid frost damage. The susceptibility of ponderosa pine to frost and cold air within this subzone first needs to be determined.
- It is not clear how well western larch would do nor how to best approach it. Low elevation slopes with northern (and perhaps easterly) exposures should provide more moisture, a less harsh climate and a refuge from cold air pooling but this needs to be verified.
- It will be challenging (and risky/potentially costly) to introduce Douglas-fir into this subzone that will soon be dominated by younger pine stands interspersed with minor spruce stands (and a component of dead pine) and where the climate is seen as moving more toward IDFxh. Consider underplanting Douglas-fir into currently fully stocked pine stands that are tall enough to provide some shelter from growing season frosts.

GENERAL STATEMENTS OR CONCERNS FOR REGENERATION:

- Consider western larch (again look out for frost), and ponderosa pine (plant on south slopes).
- Subalpine fir is a poor choice here. Grand fir may have some chance later (beyond 2040 as it warms).
- Aspen should be encouraged in moister sites (as it occurs in the IDFxh) for habitat values and to reduce fire risk.

Maturing / Mature Stand Vulnerabilities

- Management in this subzone will revolve around 40-60 year old pine at 2050 from stands regenerating now after mountain pine beetle. We will have to start logging earlier than normal to start balancing age classes and avoid another catastrophic salvage situation.