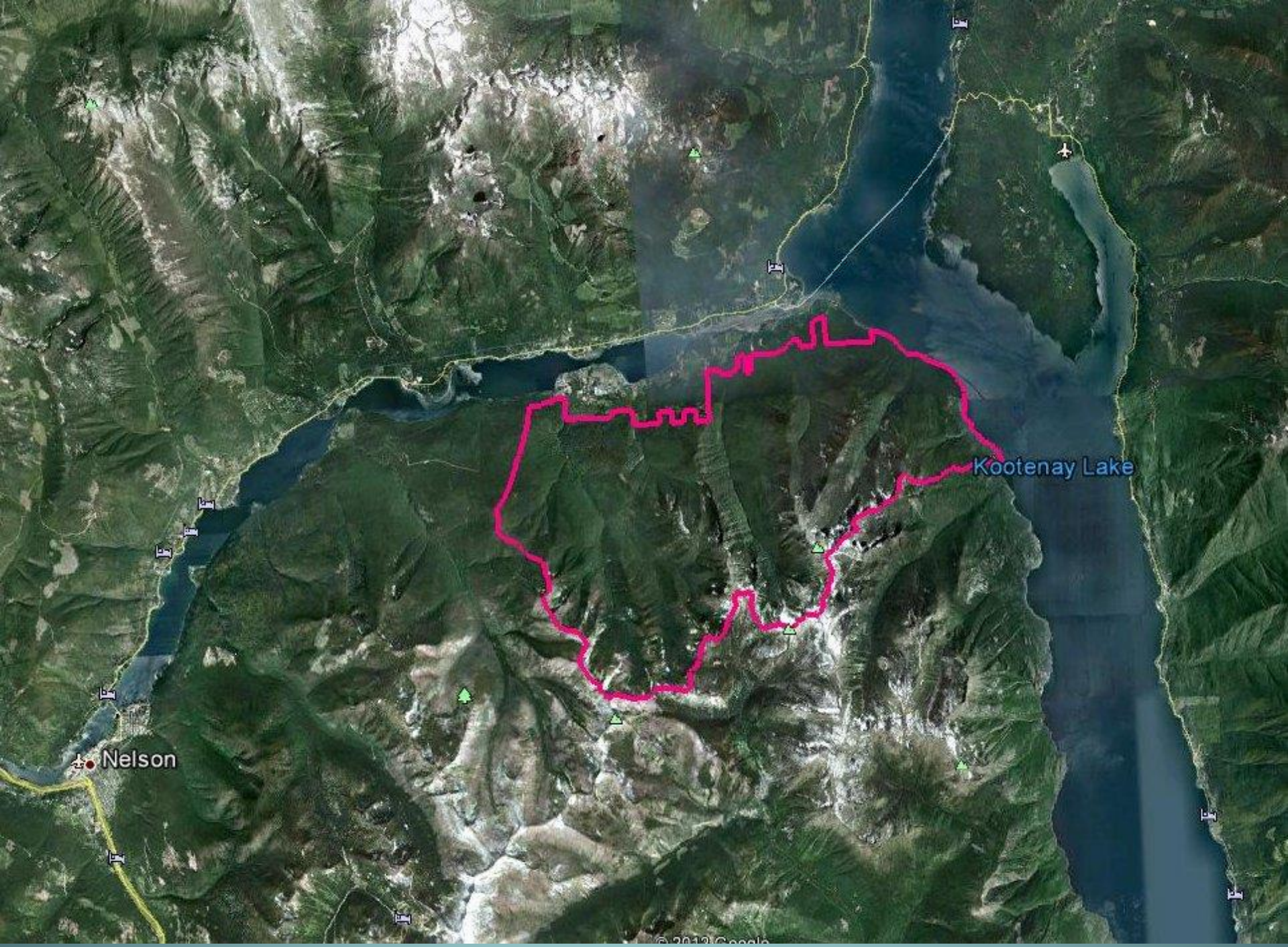
Climate change adaptation in the Harrop – Procter Community Forest

BCCFA Conference
October 22, 2021

Erik Leslie, RPF
Forest Manager, Harrop-Procter Community Co-op

HPCC
Harrop Procter Community Co-Op

Columbia Basin trust


Kootenay Lake
Nelson

Harrop-Procter Community Forest

- 11,300 hectares
- 600 m to 2300 m elevation
- Whole watersheds
- 110-year old mixed coniferous stands


2017 wildfire
2003 wildfire

Harrop-Procter Community Co-op

- Community Forest since 1999
- Not-for-profit co-op, 200+ members
- Objectives:
  - Ecosystem-based forestry, water protection
  - Local employment
  - *Community wildfire protection (since 2003)*
  - *Climate change adaptation (since 2010)*

WHY THIS PROJECT?
Lots of talk, not enough action

Disconnect between climate change adaptation theory and management actions on the ground

Need real-world management examples

Pilot study with outreach

Project advisory committee (1)

Deb MacKillop, RPF—FLNRORD Regional Ecologist, Kootenay-Boundary Region

Ian Wiles, RPF—FLNRORD District Stewardship Officer, Selkirk Resource District

Randy Waterous, RFT—Forestry and Land Use Superintendent, Interfor Grand Forks

Craig Stemmler, RPF—Woodlands Manager, Atco Wood Products, Fruitvale

Stephan Martineau, Manager—Slocan Integral Forestry Cooperative, Winlaw

Project advisory committee (2)

Rachel Holt, PhD, RPBio—Veridian Ecological Consulting, Nelson

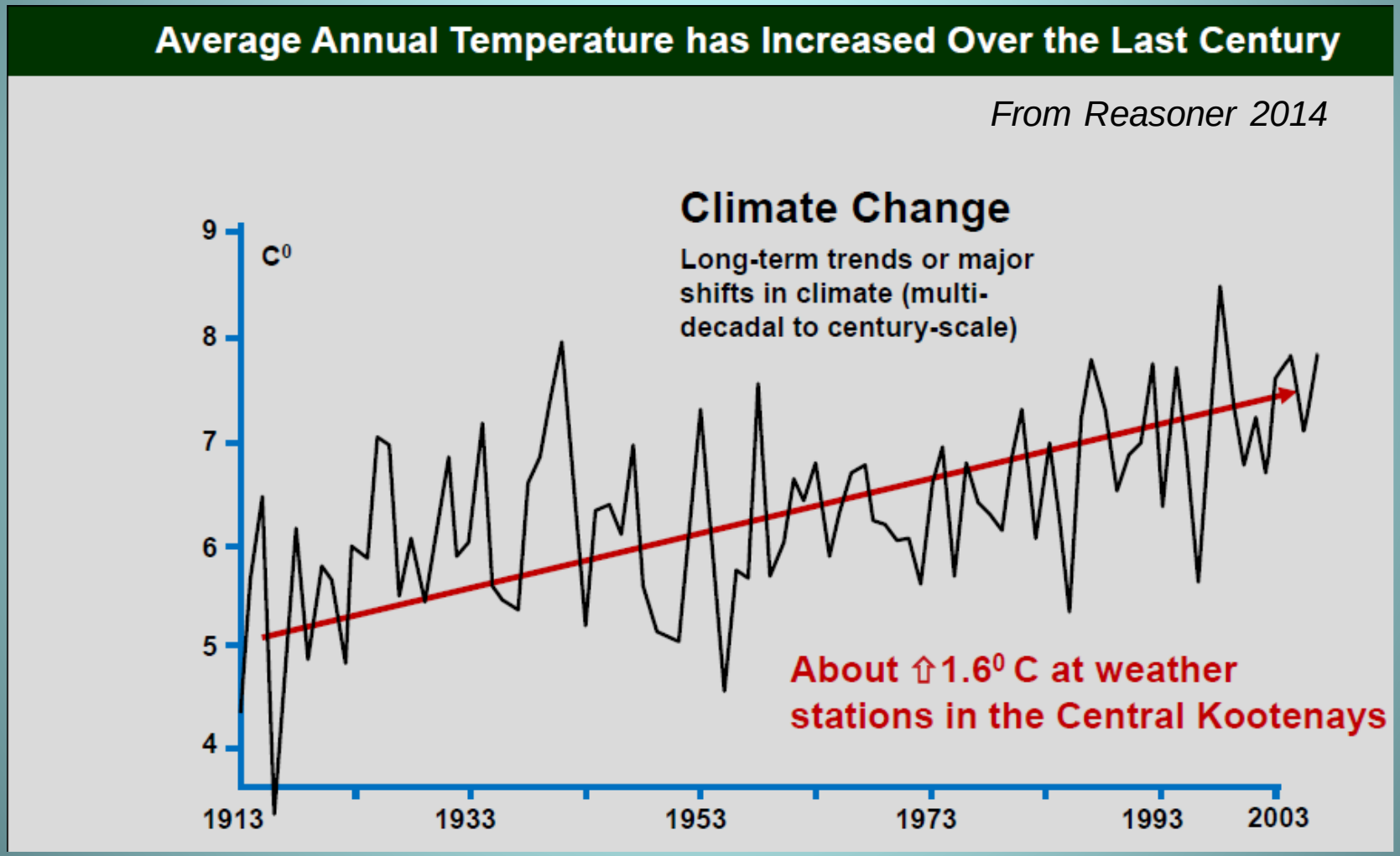
Cindy Pearce, RPF—Mountain Labyrinths Consulting, Revelstoke

Brendan Wilson, PhD, RPBio—Chair, School of Environment & Geomatics, Selkirk College

Mike Drinkwater, RPF—Vice President, Harrop-Procter Community Cooperative, Procter

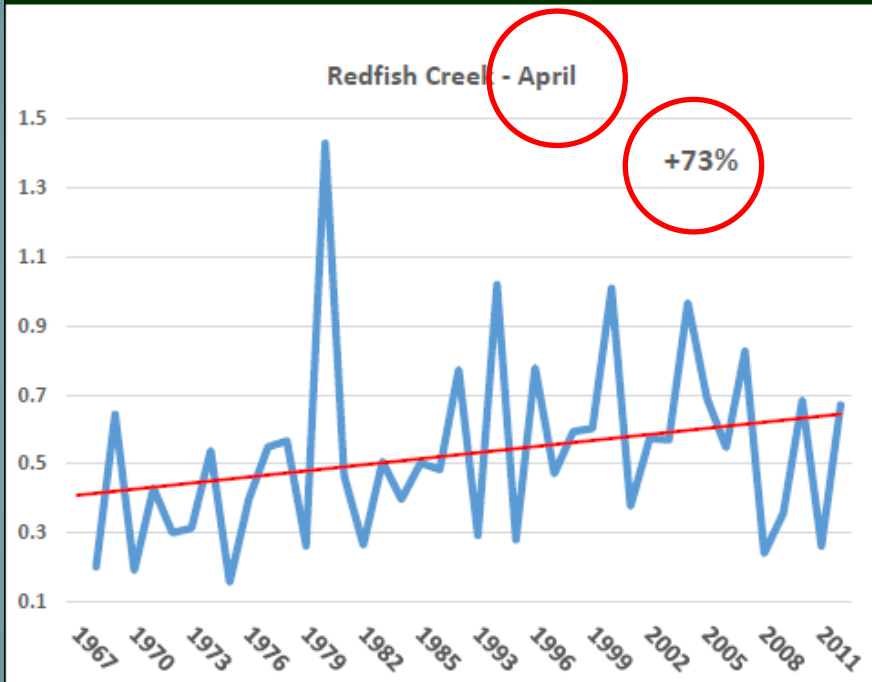
Tim Hicks/ Brianna Burley—CBT Manager, Water and Environment, Castlegar

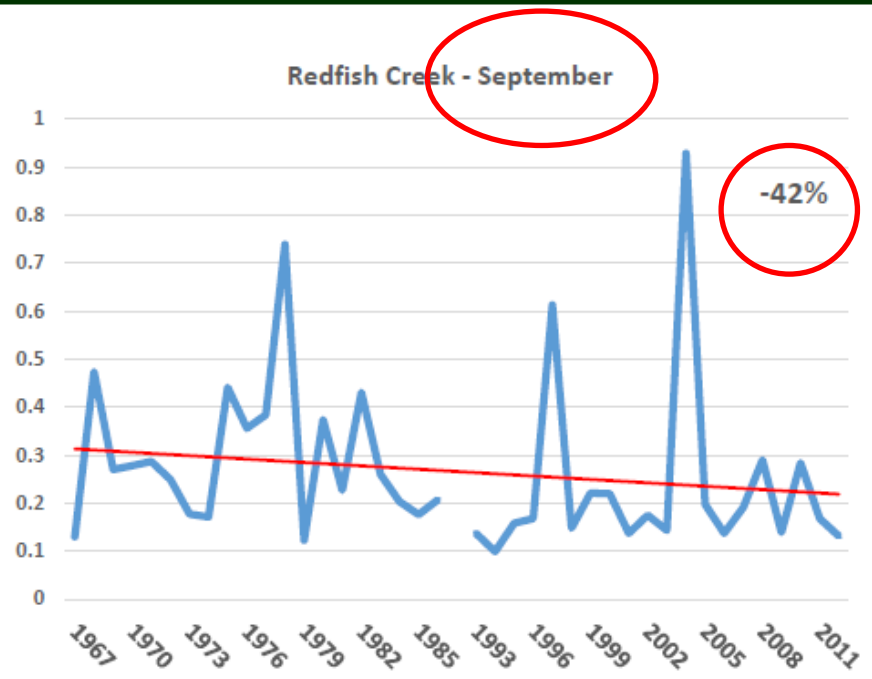
Premise 1: sufficient science to act



Significant changes over past 40 years

Climate Change Impacts Streamflows and Snowpack





Trend Analysis (Zhang, 1999)
Mann Kendall p = 3.8E-2

Trend Analysis (Zhang, 1999)
Mann Kendall p = 3.7E-2

Monthly Mean Discharge (m^3/s)

Columbia Basin trust

Climate models: simplified summary

Over the next 30 to 60 years:

- ***Fall/ winter/ spring* 2 - 5° warmer and 10 - 25% wetter**
- ***Summer* 3 - 7° warmer and up to 30% drier**
- **~5 to 15+ times more average annual area burned**
- **Increased frequency and magnitude of extreme precipitation events**

Good enough to get started…

Premise 2: we have enough high-level direction

Climate Change Strategy (2013 – 2018)
Ministry of Forests, Lands and Natural Resource Operations

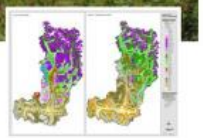
September 10, 2013

Adapting Forest Management in the Kamloops TSA to Address Climate Change

The Kamloops Future Forest Strategy

FINAL REPORT

By the KFFS TSA Team



BCTS
BC Timber Sales

Provincial Climate Change Action Plan

Managing Risk and Seeking Opportunity in a Changing Climate

February 3, 2015

BC Ministry of Forests Lands and Natural Resource Operations

Forest Stewardship Action Plan
for
Climate Change Adaptation

Seminar
March 1, 2012

Kathy Hopkins - Technical Advisor – Climate Change

BRITISH COLUMBIA

1

Adapting forest and range management to climate change in the Kootenay Boundary Region:

Considerations for practitioners and Government staff

2016

1. About this Series

There is strong scientific evidence that climate change will significantly affect British Columbia's forests and rangelands.[1] Therefore, adapting forest and range management to climate change is necessary to foster resilient[2] ecosystems that continue to provide the services, products and benefits society relies on.

This extension note is part of a series that uses current climate change research[3] to summarize, for each region, projected climate changes, impacts to ecosystems, and potential adaptation strategies. Where regional information is limited, information is drawn from provincial-scope research.

The intent of this extension note is to inform adaptation of forest and range practices to climate change by providing **best available information**[4] to resource professionals, licensees, and Government staff engaged in: operational planning under the *Forest and Range Practices Act;* monitoring effectiveness of

Adaptation: generalities → specifics

- ‘Promote resilient species’
- ‘Enhance landscape diversity’
- ‘Partial cut dry sites’
- ‘Account for timber losses’
- ‘Update stocking standards’

- Which species? Where?
- Species and age targets?
- Where? How?
- How much?
- To what? Density? Provenances?

Premise 3: Consistent community values

- Protect domestic water
- Create sustainable jobs in the community
- Maintain/ enhance biodiversity
- Protect community from wildfire

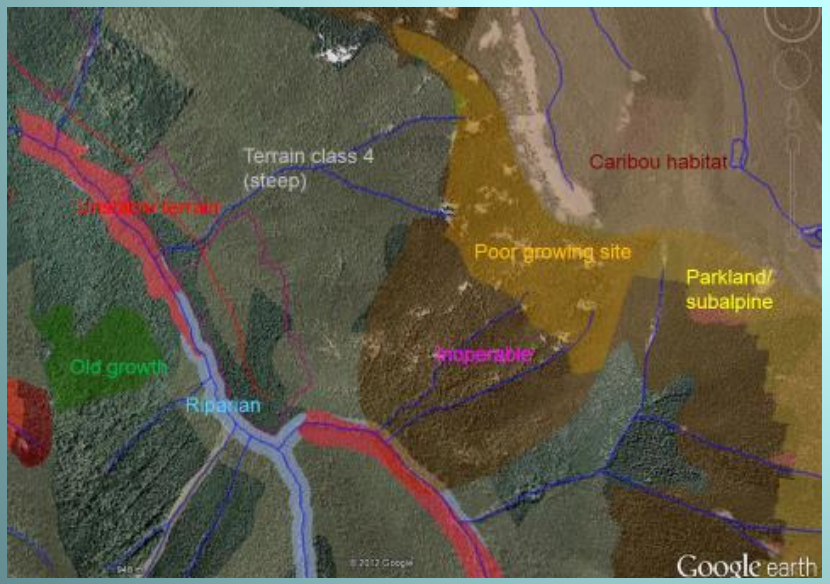


Overview of project

Risk assessment—*Where* do we prioritize management actions?

Operations strategy—*How* do we manage differently?

Management Plan & AAC—*How fast* do we adapt?



Risk Assessment

Objective: Prioritize areas for adaptive actions

- *Focus on next 20 to 40 years*

RISK = Probability X Consequence

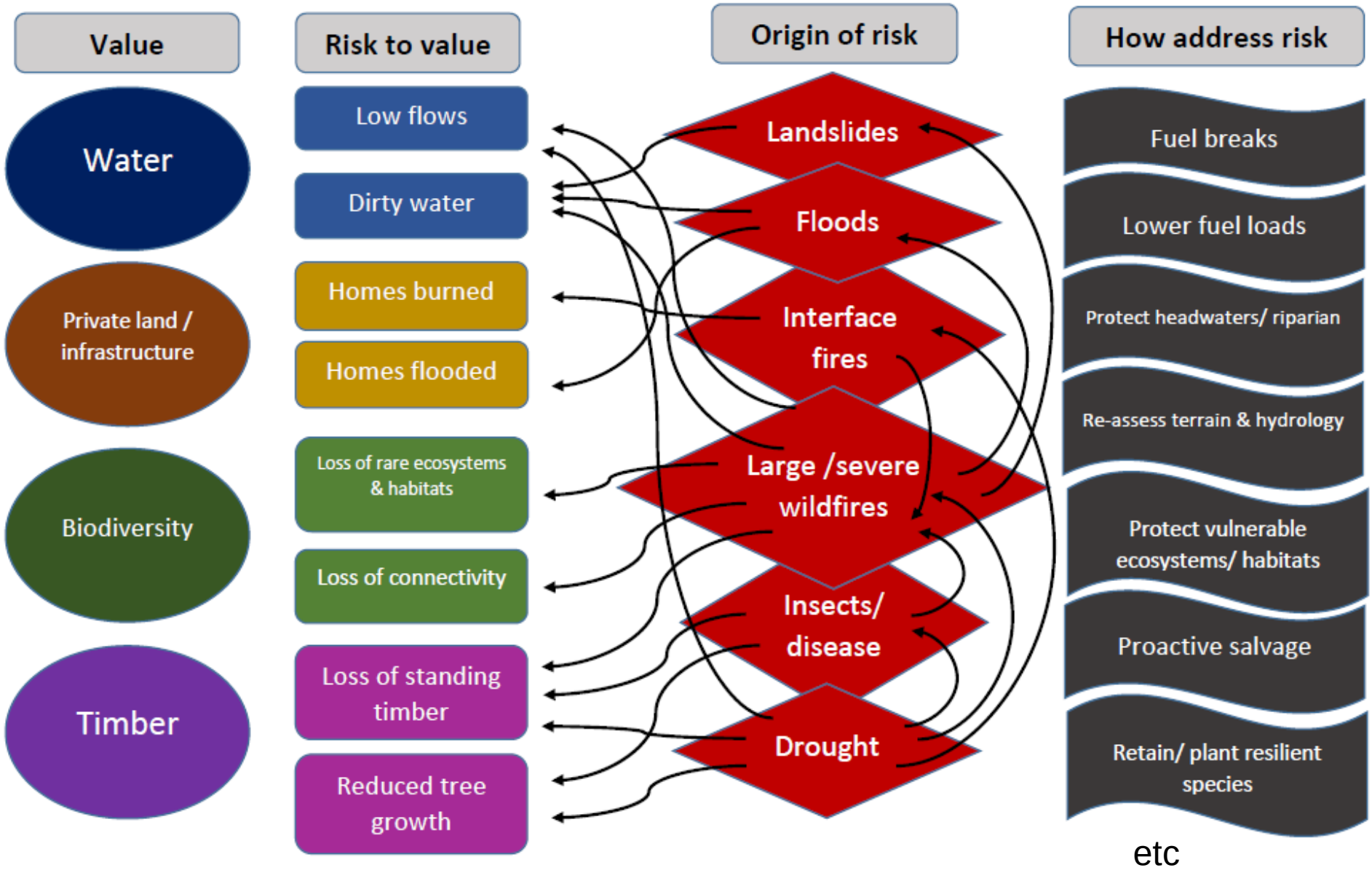
Probability of:

- Fire
- Drought
- Altered stream flows

Consequence to:

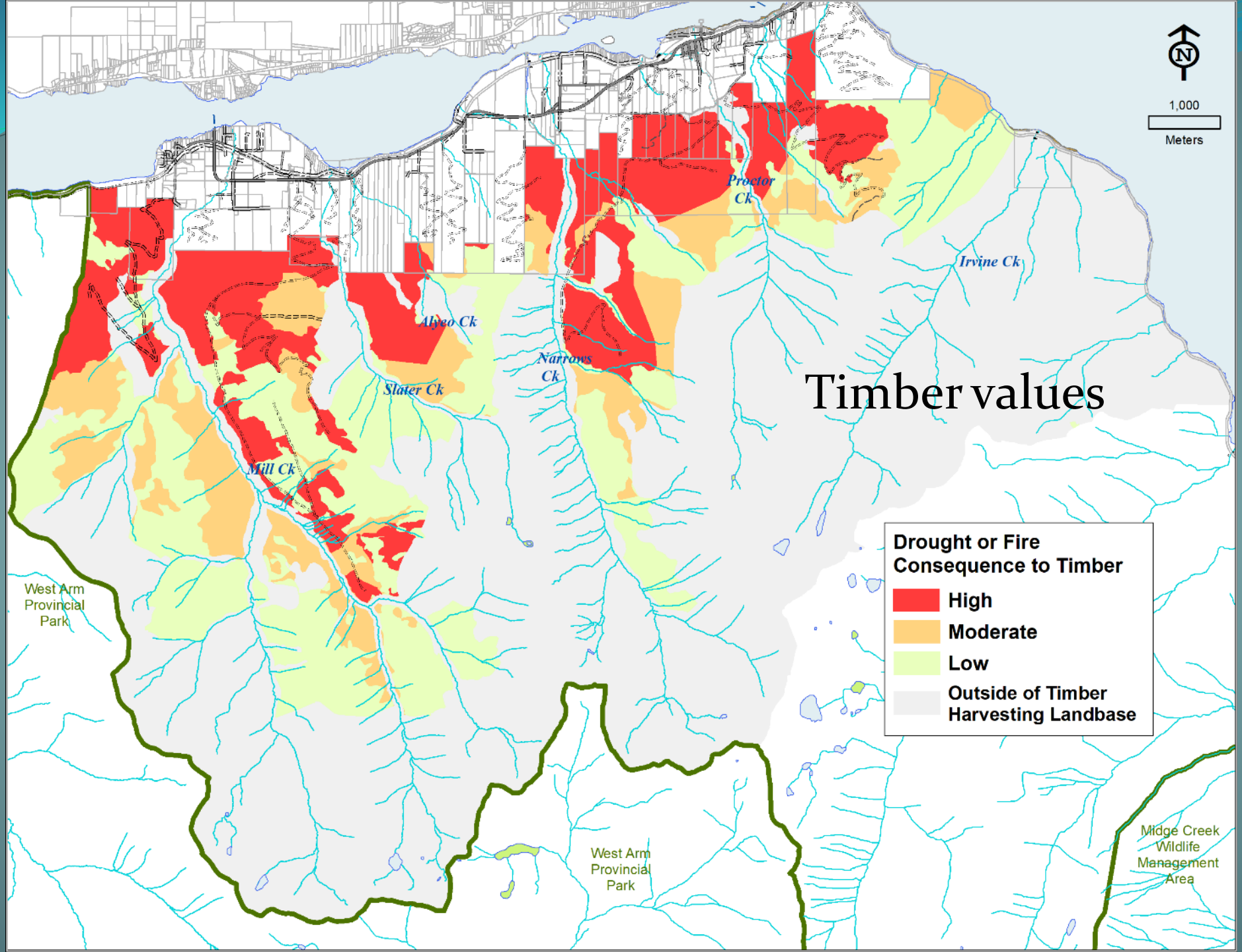
- Homes
- Water
- Biodiversity
- Timber

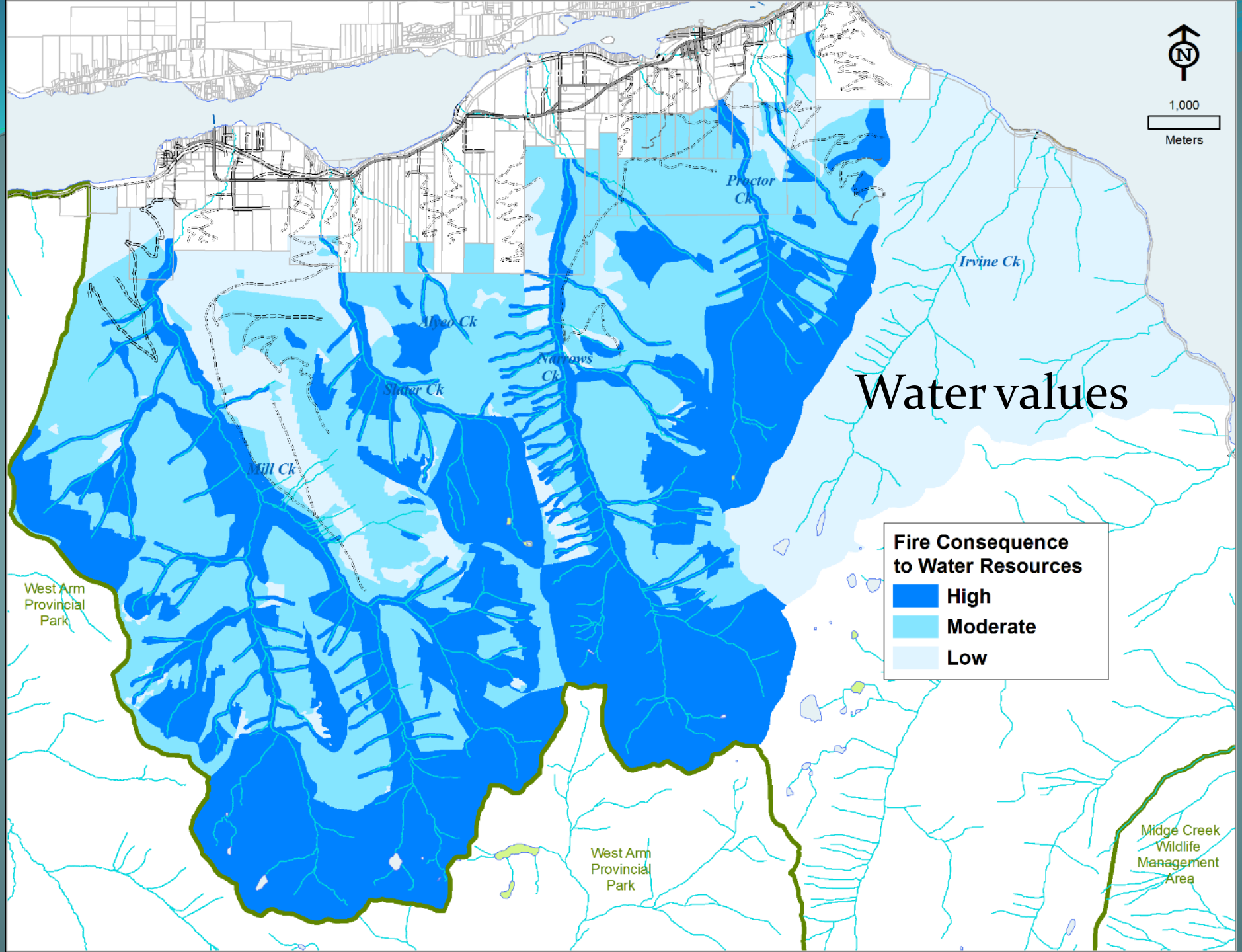
RISK MATRIX					
		Fire Consequence			
		High	Moderate	Low	Very_low
Fire Probability	Extreme	Extreme	High	High	Low
	High	High	High	Moderate	Low
	Moderate	High	Moderate	Moderate	Low
	Low	Moderate	Moderate	Low	Low
	Very Low	Moderate	Low	Low	Low


Value
Risk to value
Origin of risk
How address risk
Water
Private land / infrastructure
Biodiversity
Timber
Low flows
Dirty water
Homes burned
Homes flooded
Loss of rare ecosystems & habitats
Loss of connectivity
Loss of standing timber
Reduced tree growth
Landslides
Floods
Interface fires
Large /severe wildfires
Insects/ disease
Drought
Fuel breaks
Lower fuel loads
Protect headwaters/ riparian
Re-assess terrain & hydrology
Protect vulnerable ecosystems/ habitats
Proactive salvage
Retain/ plant resilient species
etc

Consequence mapping: Values

- Homes
- Water
- Biodiversity
- Timber


Timber values
Proctor Ck
Irvine Ck
Alyeo Ck
Narrows Ck
Slater Ck
Mill Ck
West Arm Provincial Park
West Arm Provincial Park
Midge Creek Wildlife Management Area
1,000
Meters
Drought or Fire Consequence to Timber
High
Moderate
Low
Outside of Timber Harvesting Landbase


Water values
Fire Consequence to Water Resources
High
Moderate
Low
1,000
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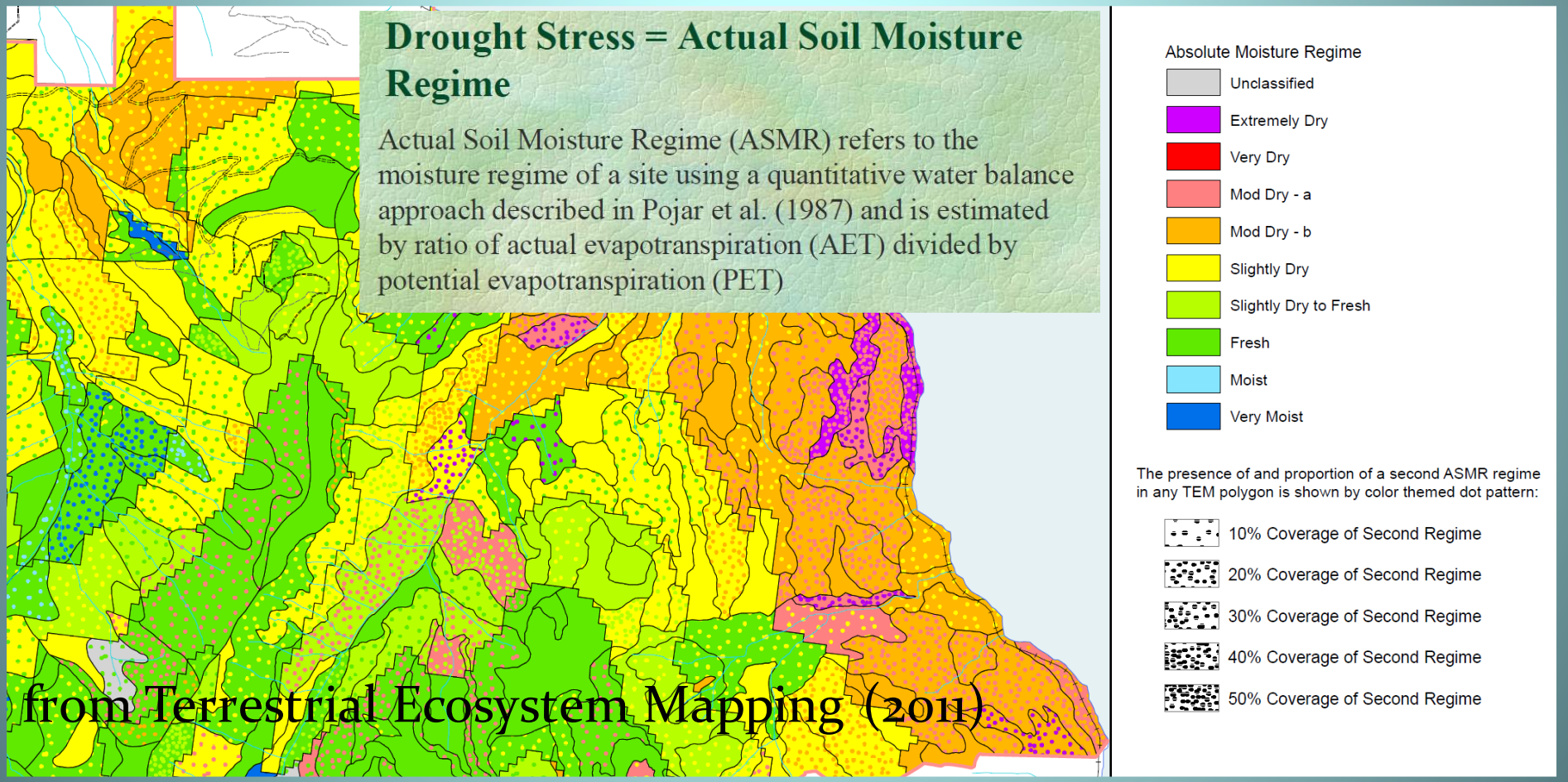
Proctor Ck
Irvine Ck
Myer Ck
Narrows Ck
Slater Ck
Mill Ck
West Arm Provincial Park
West Arm Provincial Park
Midge Creek Wildlife Management Area

Probability of fire and drought: *Actual Soil Moisture Regime (ASMR)*

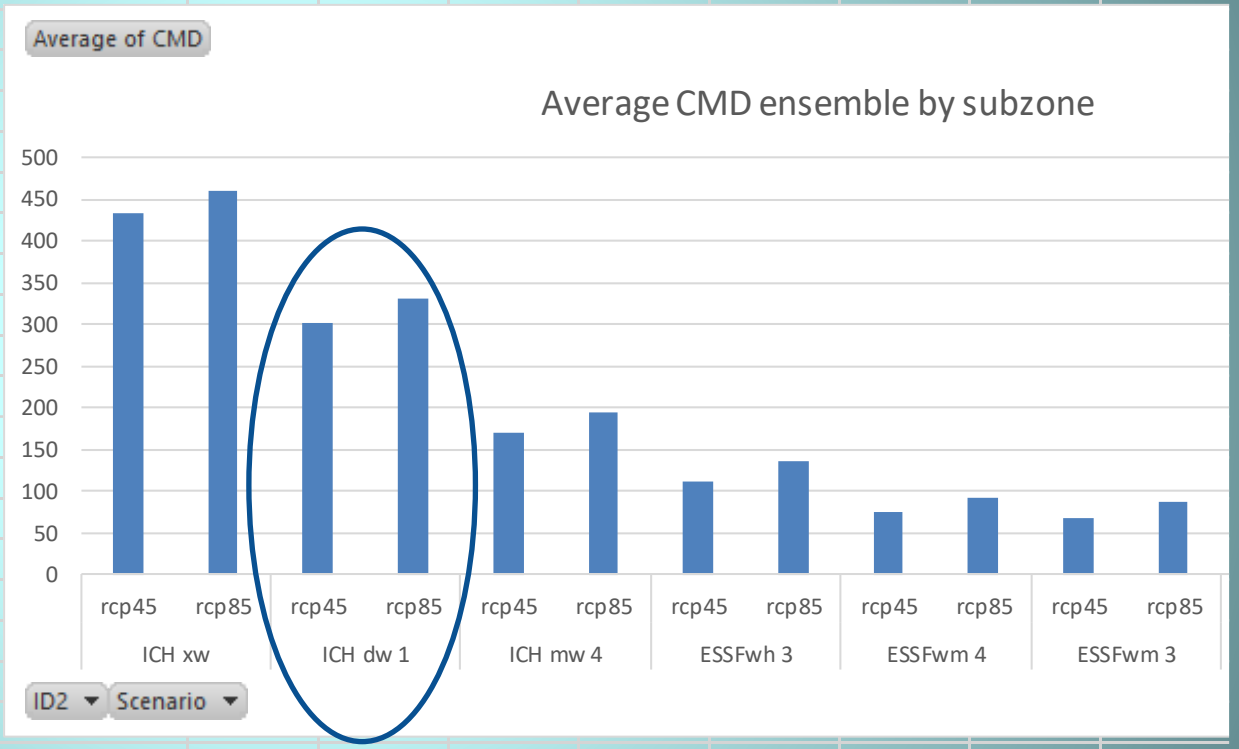


from Terrestrial Ecosystem Mapping (2011)

Cumulative moisture deficits

Average CMD ensemble all decades and scenarios

ID2	Scenario	Average of CMD
ICH xw	rcp45	433
ICH xw	rcp85	462
ICH dw 1	rcp45	302
ICH dw 1	rcp85	330
ICH mw 4	rcp45	169
ICH mw 4	rcp85	196
ESSFwh 3	rcp45	113
ESSFwh 3	rcp85	136
ESSFwm 4	rcp45	75
ESSFwm 4	rcp85	92
ESSFwm 3	rcp45	69
ESSFwm 3	rcp85	88
ESSFwmw	rcp45	50
ESSFwmw	rcp85	67
ESSFwmp	rcp45	36
ESSFwmp	rcp85	51

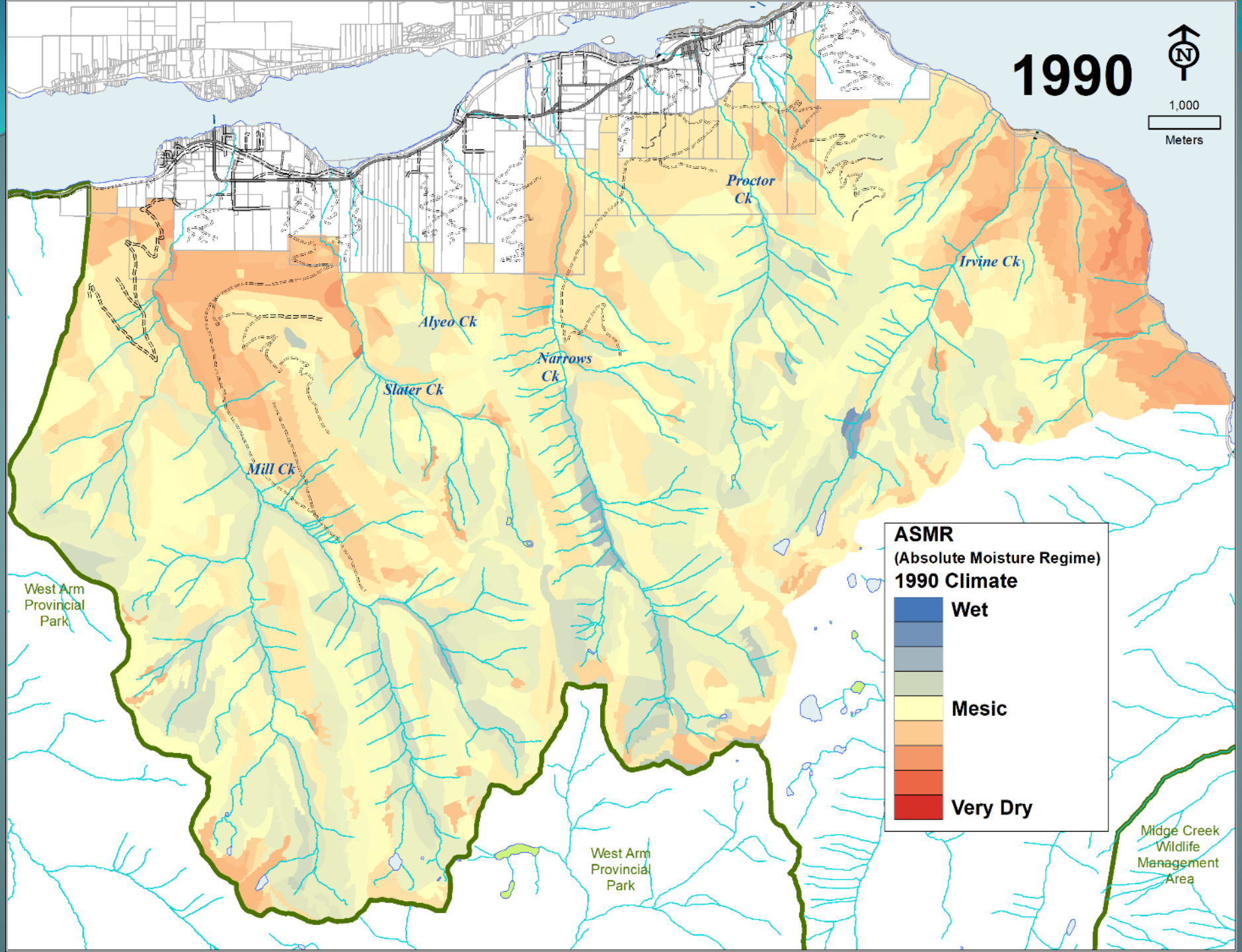


Will MacKenzie R.P. Bio.
Provincial Research Ecologist

Future Period	rSMR / BGC	SMR0	SMR1	SMR2	SMR 3	SMR4	SMR5	SMR6	SMR7
1961-1990	ICH dw 1	1.5	2	2.5	3	4	5.5	6.5	7.5
2085	ICH dw 1	0	1	1.5	2	2.5	4.5	5.5	7.5
1961-1990	ICH mw 4	2.5	2.5	3.5	4	5	6	7	8
2085	ICH mw 4	1.5	2	2.5	3	4	5.5	6.5	7.5

	rSMR	SMR0	SMR1	SMR2	SMR 3	SMR4	SMR5	SMR6	SMR7
1961-1990	ESSFwh 3	2.5	3.5	4	4.5	5	6	7.5	8
2085	ESSFwh 3	2	2.5	2.5	3.5	4	6	6.5	8
1961-1990	ESSFwm 3	3	4	4.5	5	5	6	7.5	8
2085	ESSFwm 3	2.5	2.5	3.5	4	5	6	7	8

From Will MacKenzie and Deb MacKillop, FLNRORD


1990
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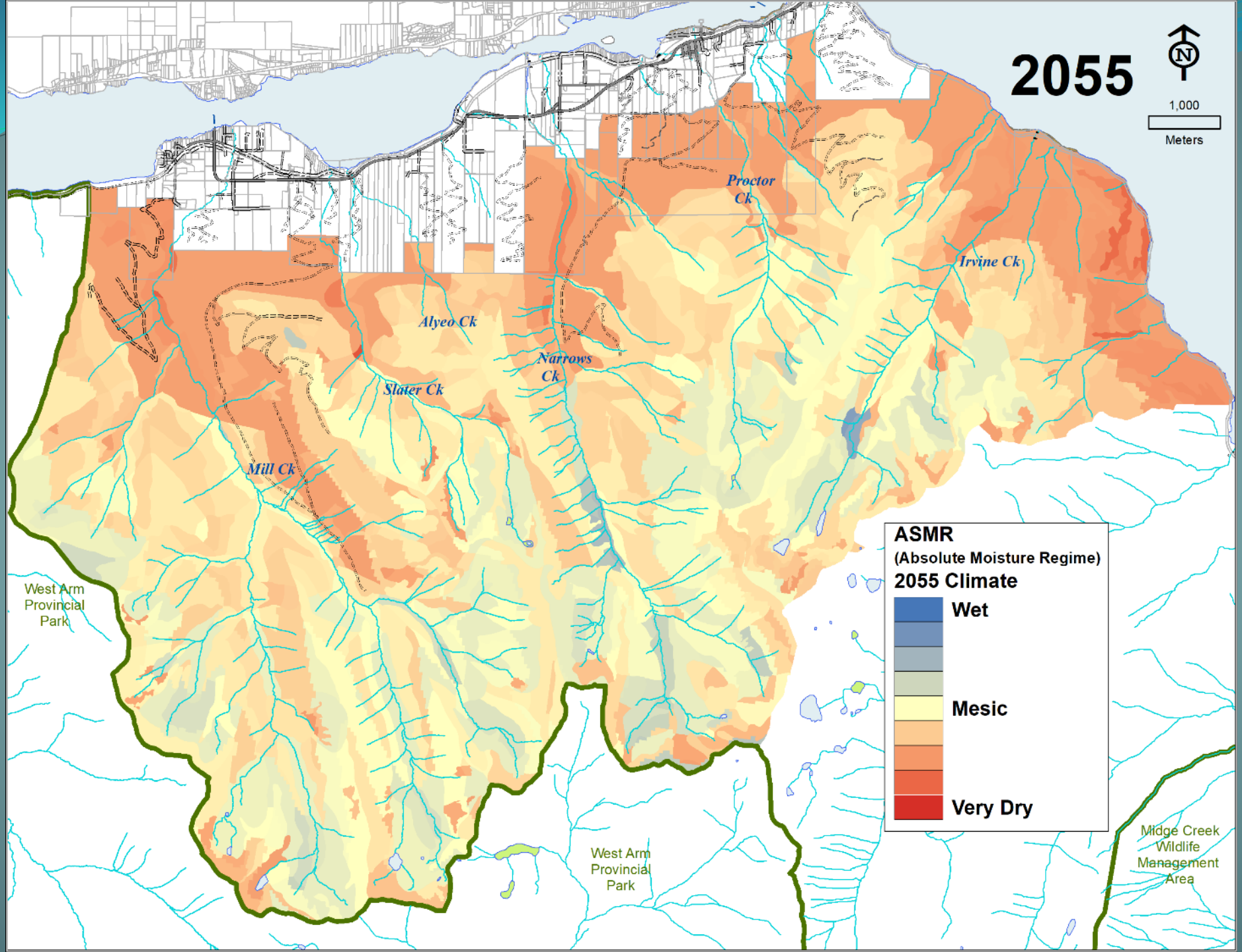
Meters
Proctor Ck
Irvine Ck
Alyeo Ck
Narrows Ck
Slater Ck
Mill Ck
West Arm Provincial Park
West Arm Provincial Park
Midge Creek Wildlife Management Area
ASMR
(Absolute Moisture Regime)
1990 Climate
Wet
Mesic
Very Dry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Alyeo Ck
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Slater Ck
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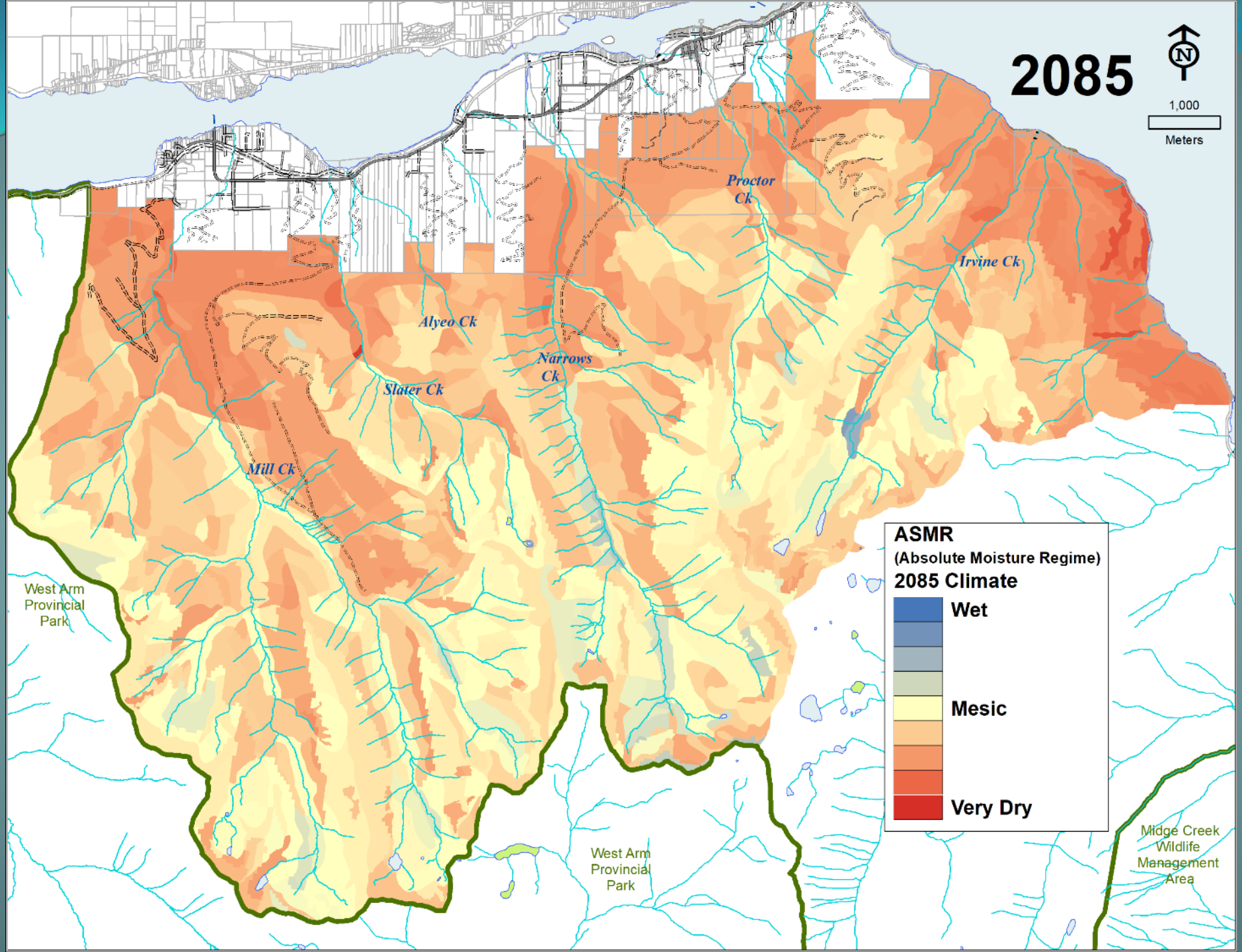
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ASMR
(Absolute Moisture Regime)
2085 Climate
Wet
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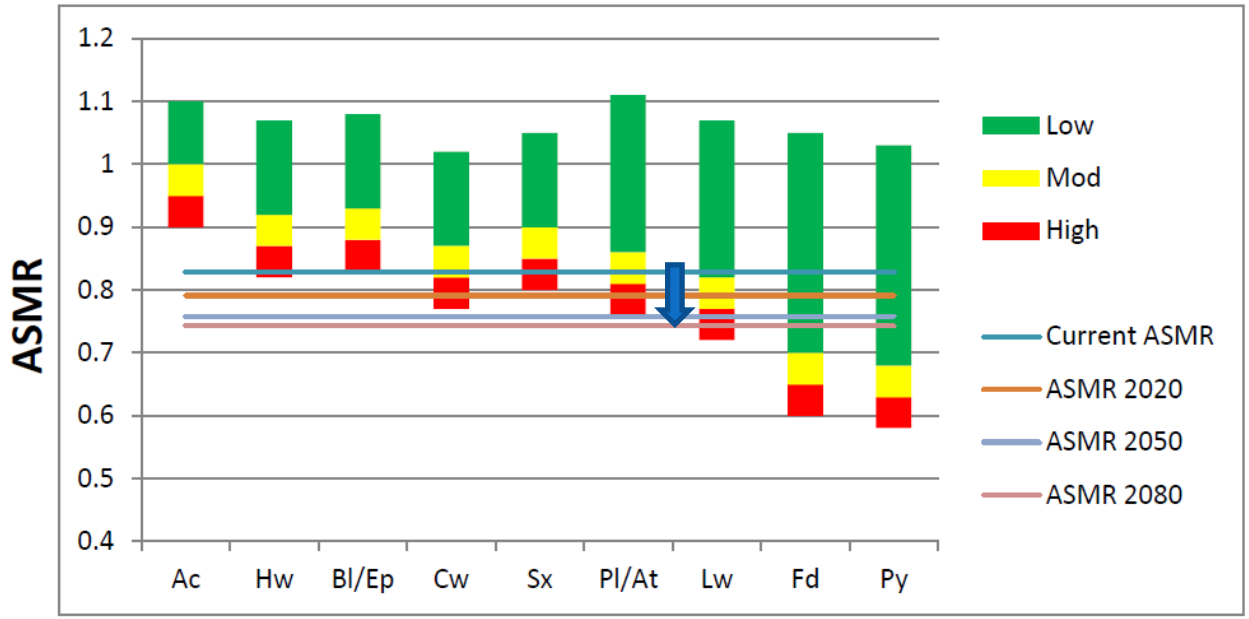
Very Dry

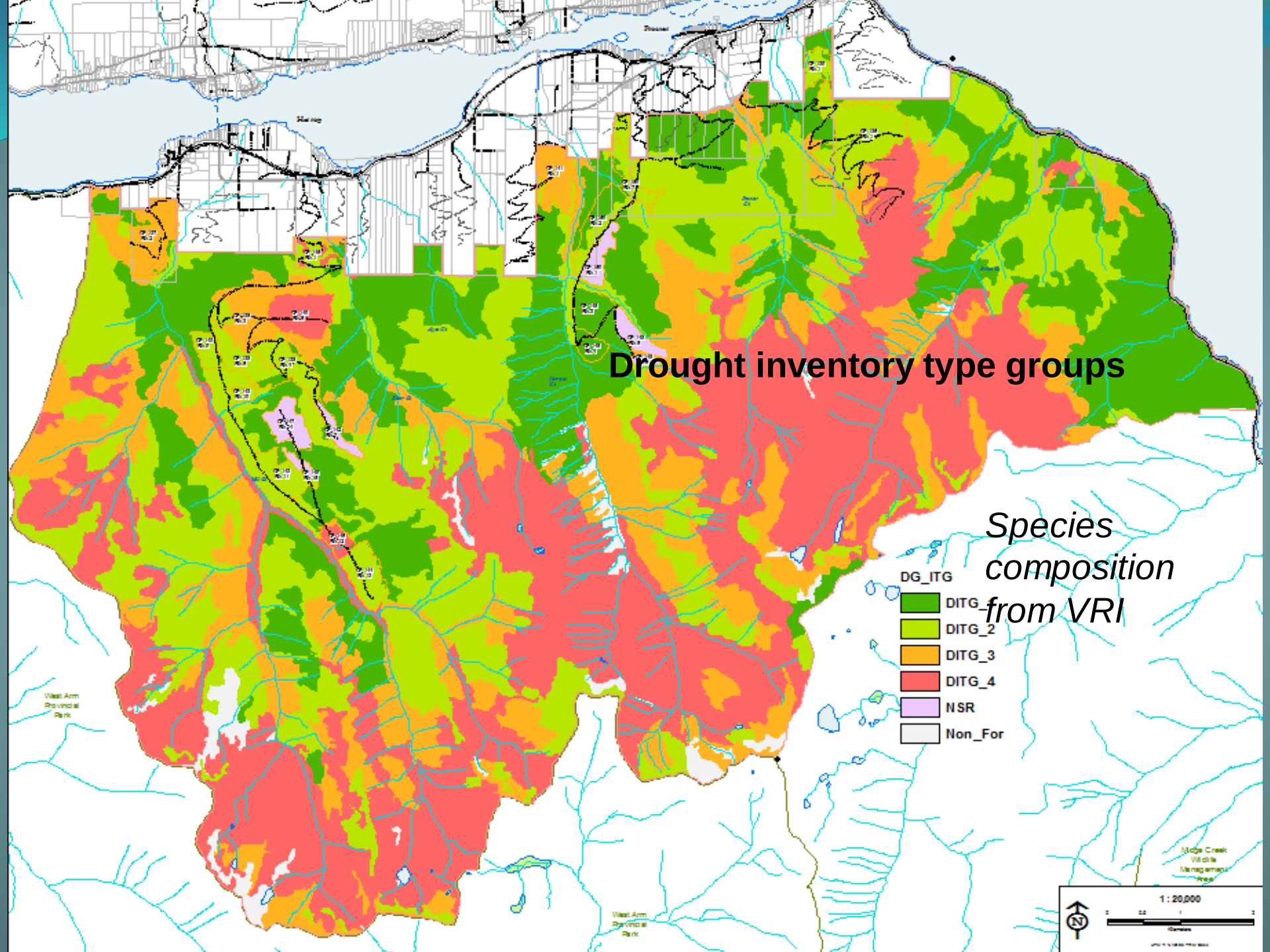
Drought probability: Tree species

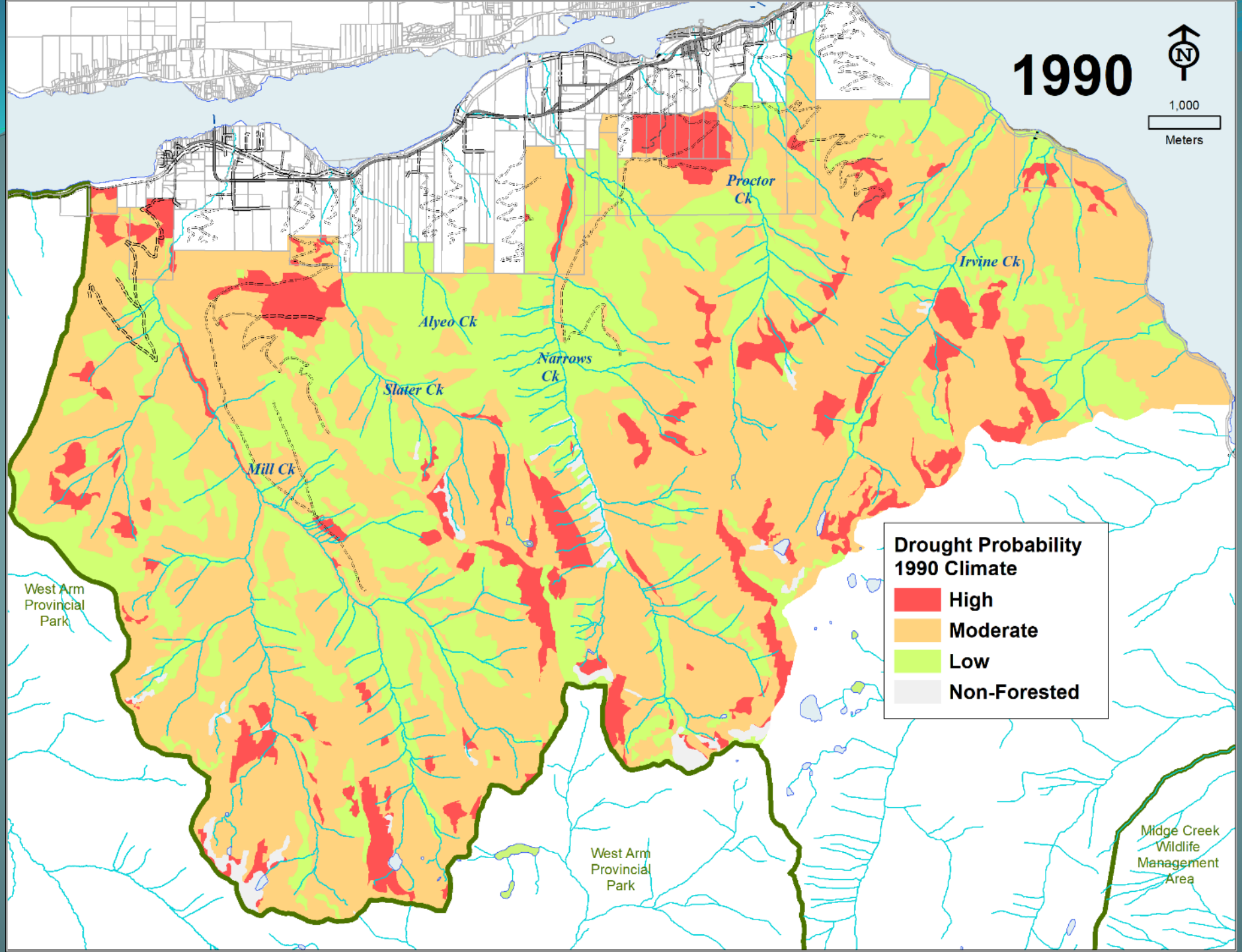
BEC	ICH dw 1	Bigeoclimatic Unit
RSMR	4	Relative Soil Moisture Regime
		Actual Soil Moisture Regime

Values			
Current ASMR	**ASMR 2020**	**ASMR 2050**	**ASMR 2080**
0.83	0.79	0.76	0.74



From Delong 2012


Drought inventory type groups
Species composition from VRI
DG_ITG
DITG_1
DITG_2
DITG_3
DITG_4
NSR
Non_For
1 : 20,000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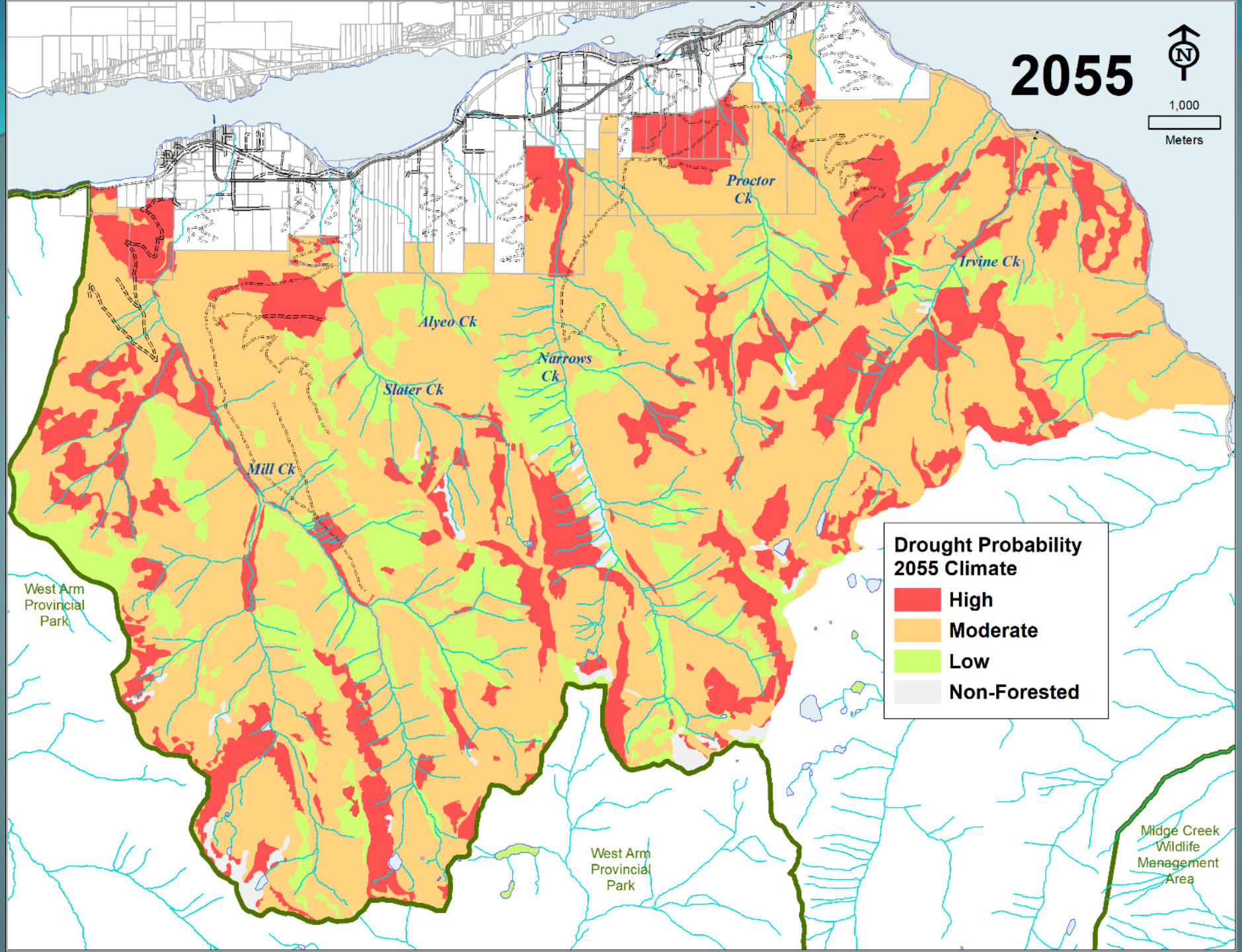
Narrows Ck
Slater Ck
Mill Ck
West Arm Provincial Park
West Arm Provincial Park
Midge Creek Wildlife Management Area
Drought Probability 1990 Climate
High
Moderate
Low
Non-Forested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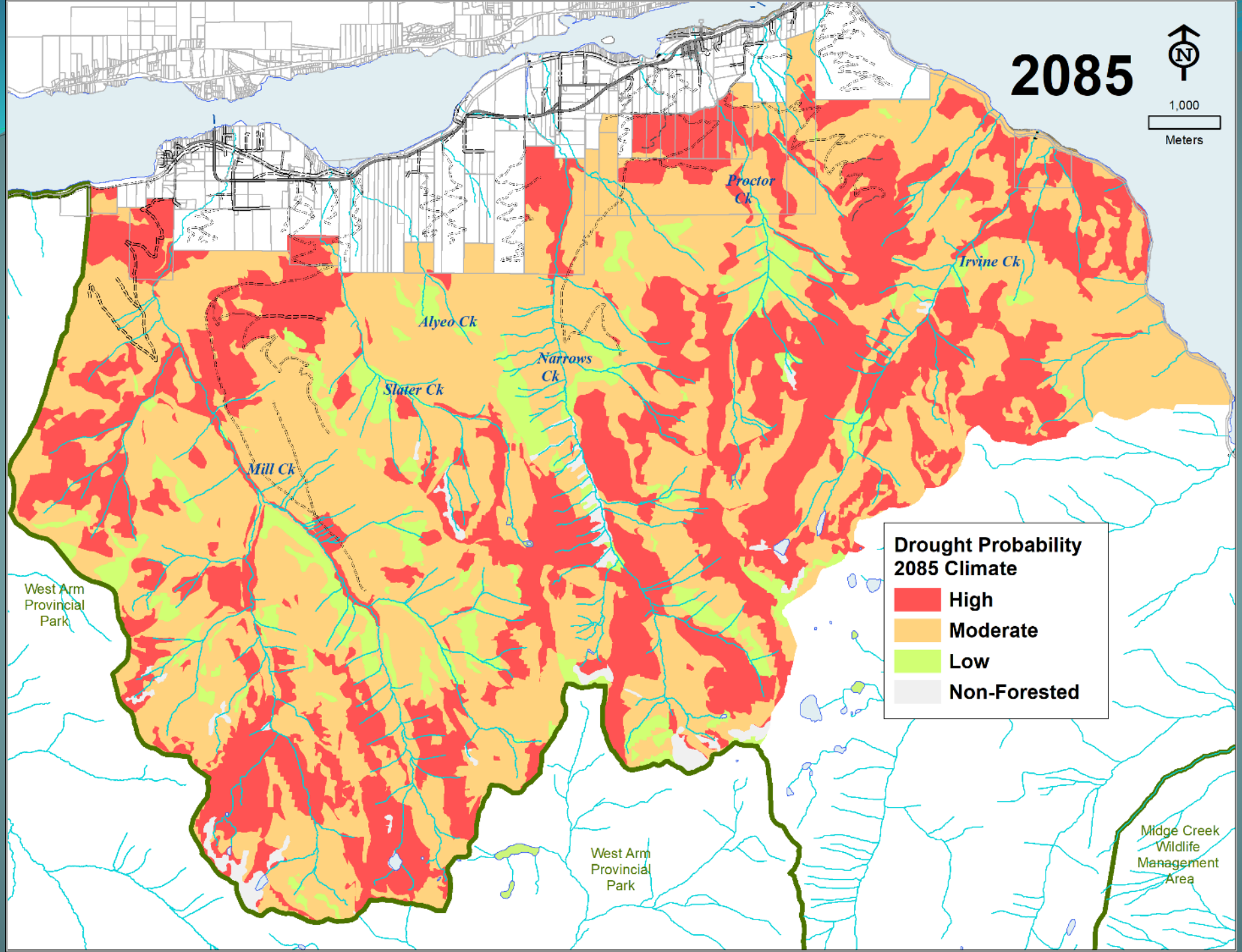
Drought Probability 2055 Climate
High
Moderate
Low
Non-Forested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Midge Creek Wildlife Management Area
Drought Probability 2085 Climate
High
Moderate
Low
Non-Forested

Fire probability

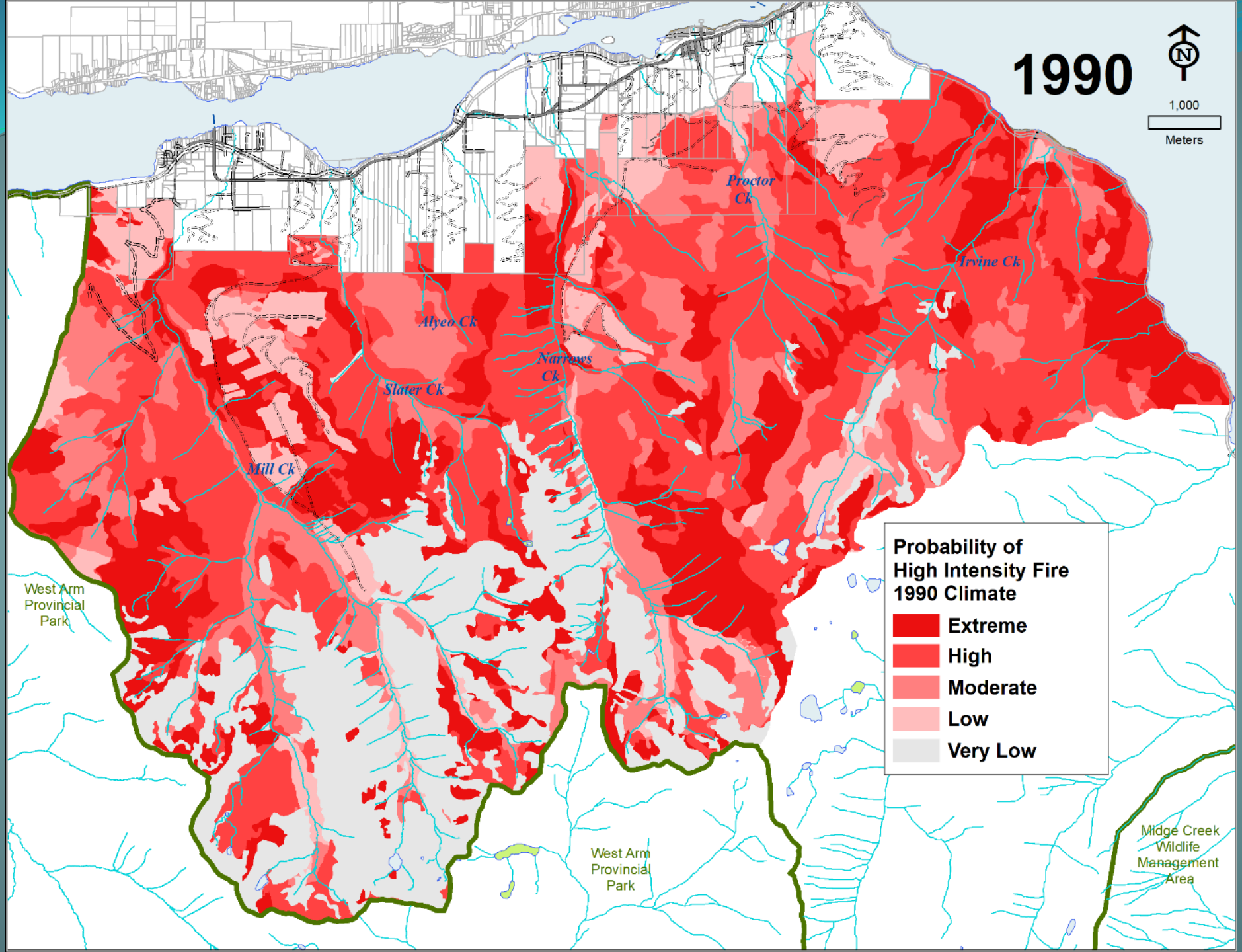
Fire probability: likelihood of high severity fire

Did <u>not</u> use PSTA algorithm

Fuel_Load	ASMR			
	A_DRY	B_MOD	C_MOIST	D_WET
a_Extreme	a_Extreme	a_Extreme	a_High	d_V_Low
a_High	a_Extreme	a_High	b_Mod	d_V_Low
b_Moderate	a_High	b_Mod	C_Low	d_V_Low
c_Low	b_Mod	C_Low	C_Low	d_V_Low
d_Very_Low	d_V_Low	d_V_Low	d_V_Low	d_V_Low

Adjust rating based on

- **Slope**
- **% dead pine/ balsam**
- **cedar/hemlock component**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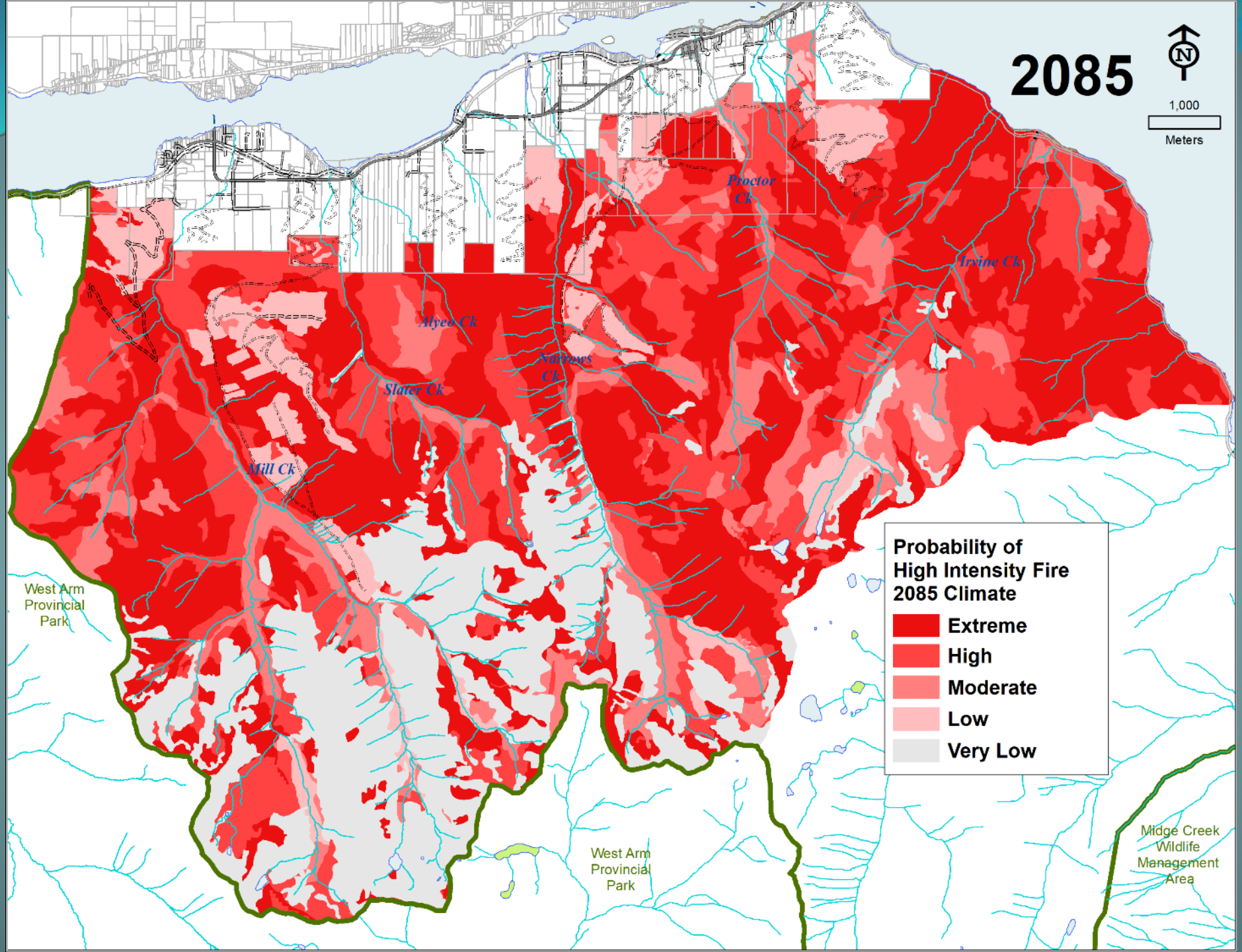
Probability of High Intensity Fire 1990 Climate
Extreme
High
Moderate
Low
Very Low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Probability of High Intensity Fire 2085 Climate
Extreme
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Moderate
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Very Low

Risk Assessment (*review*)

RISK = Probability X Consequence

Probability of:

- Fire
- Drought
- Altered stream flows

Consequence to:

- Homes
- Water
- Biodiversity
- Timber

RISK MATRIX					
		Fire Consequence			
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Fire Probability	Extreme	Extreme	High	High	Low
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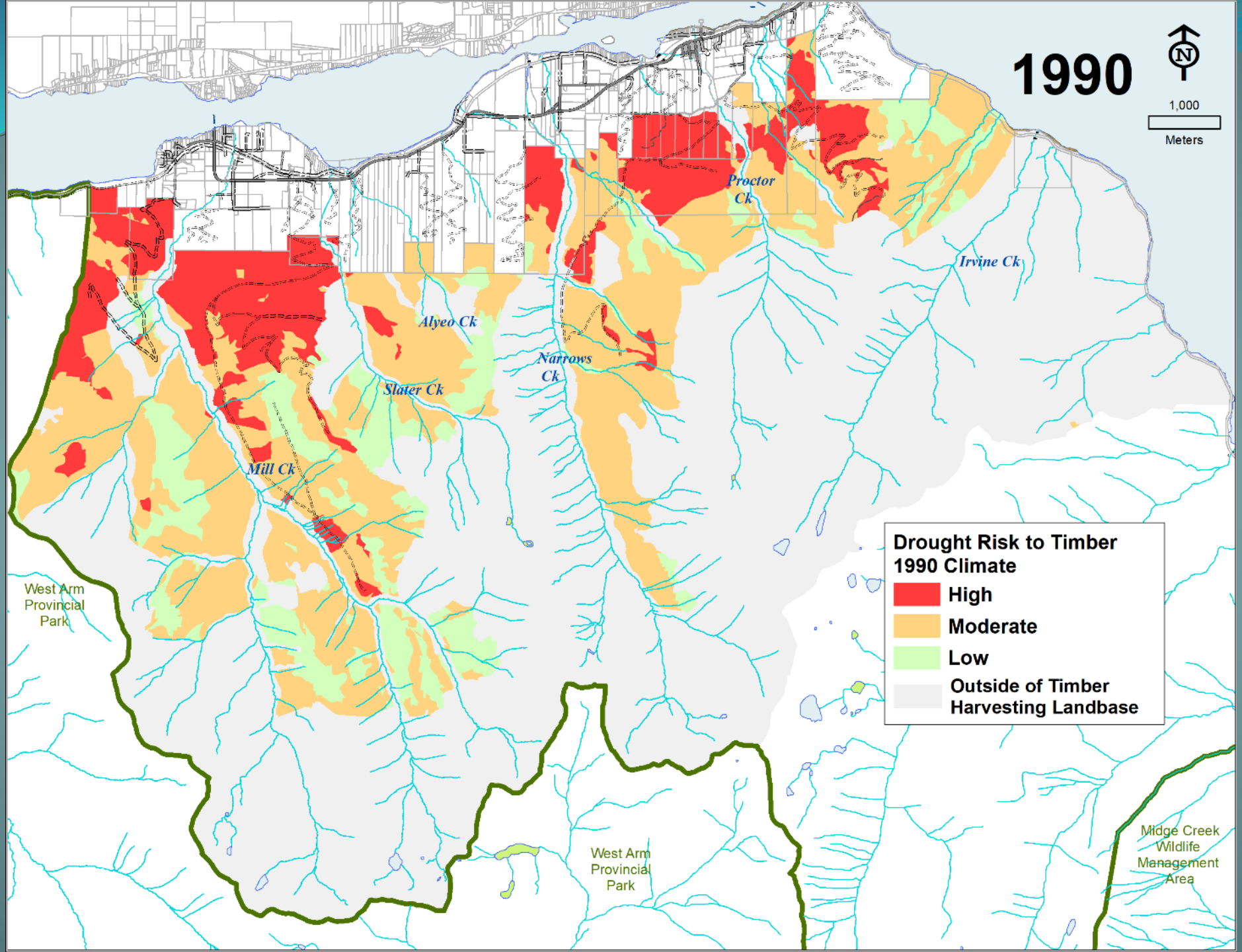
	Moderate	High	Moderate	Moderate	Low
	Low	Moderate	Moderate	Low	Low
	Very Low	Moderate	Low	Low	Low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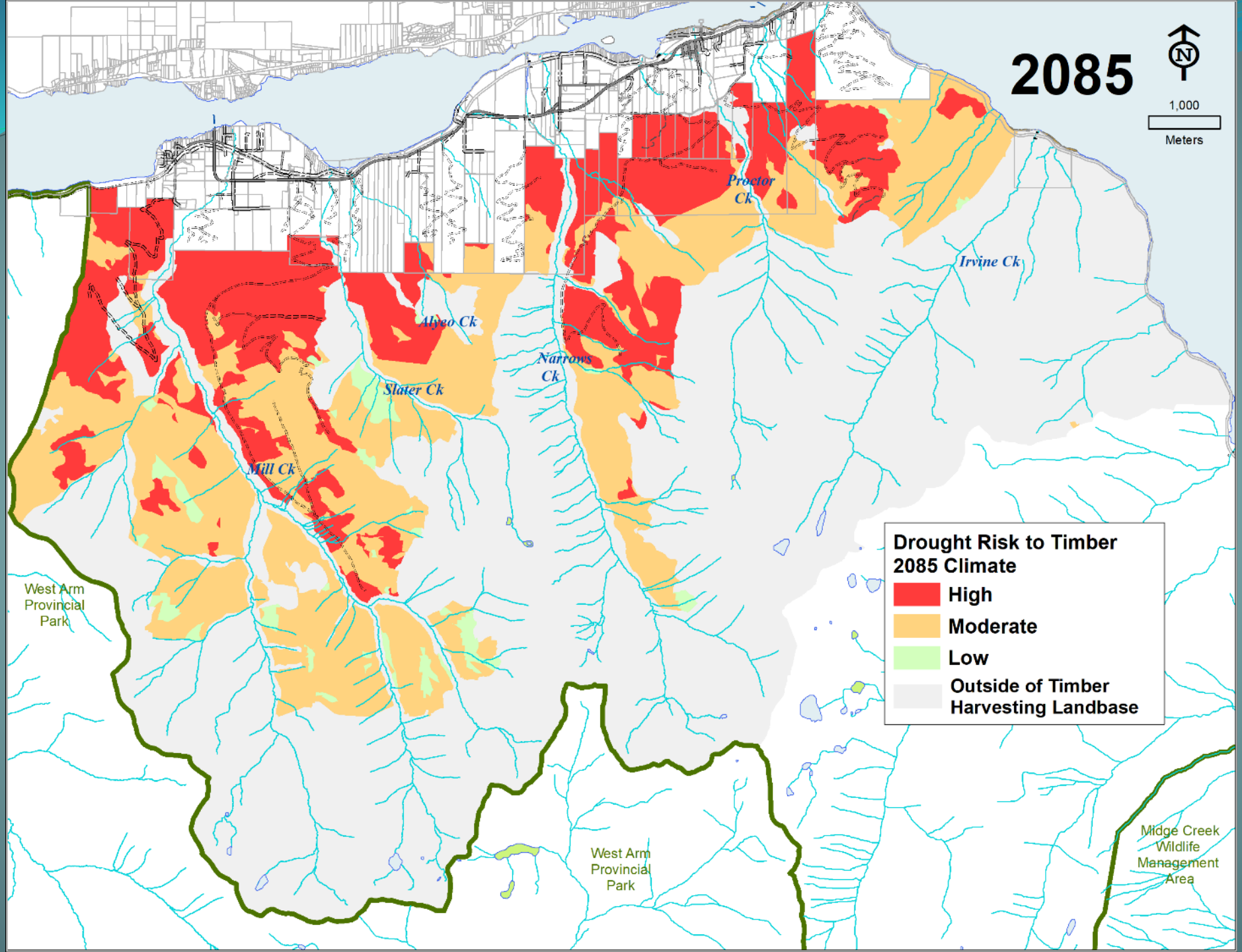
Midge Creek Wildlife Management Area
Drought Risk to Timber
1990 Climate
High
Moderate
Low
Outside of Timber Harvesting Landbase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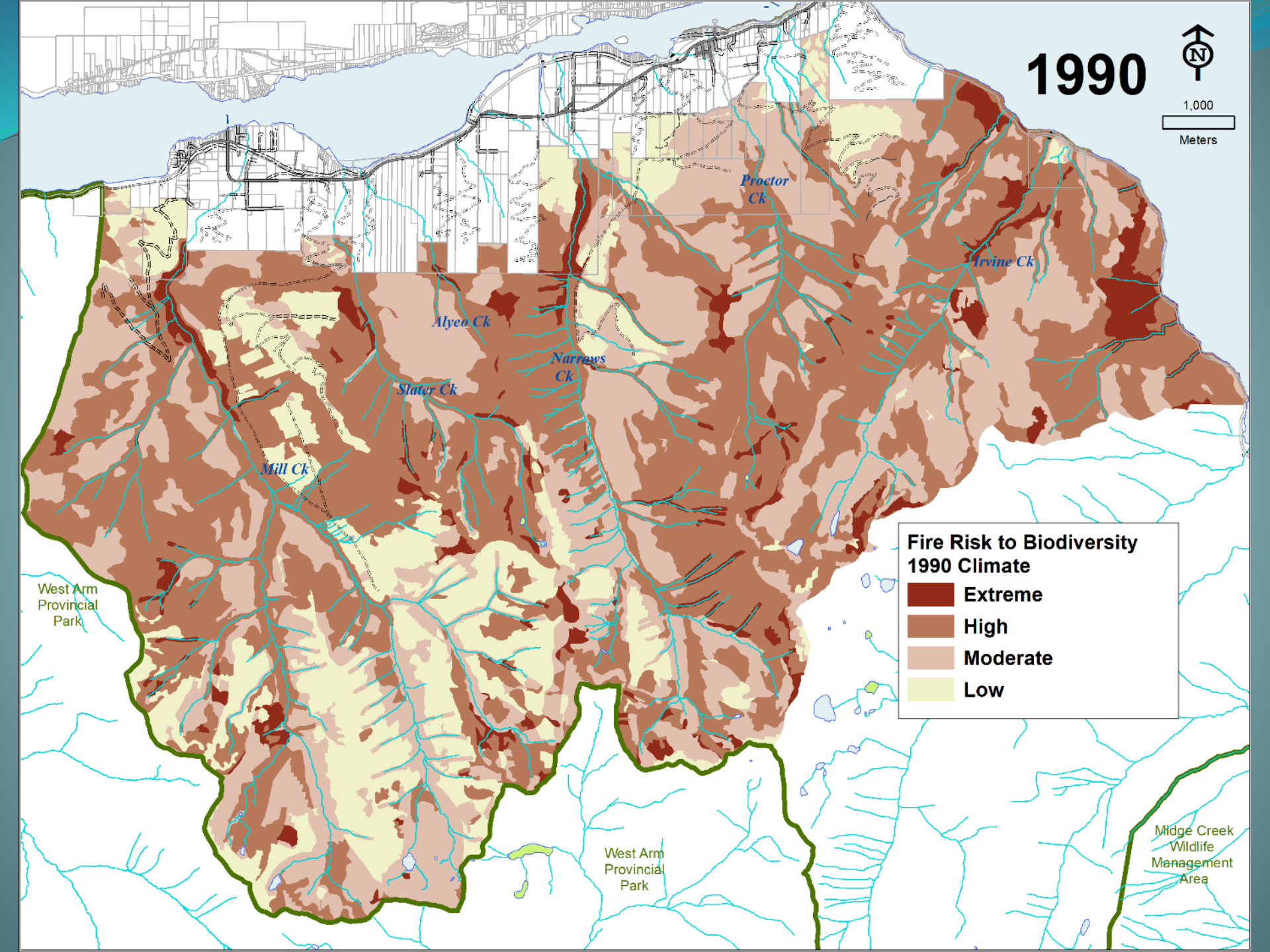
Outside of Timber Harvesting Landbase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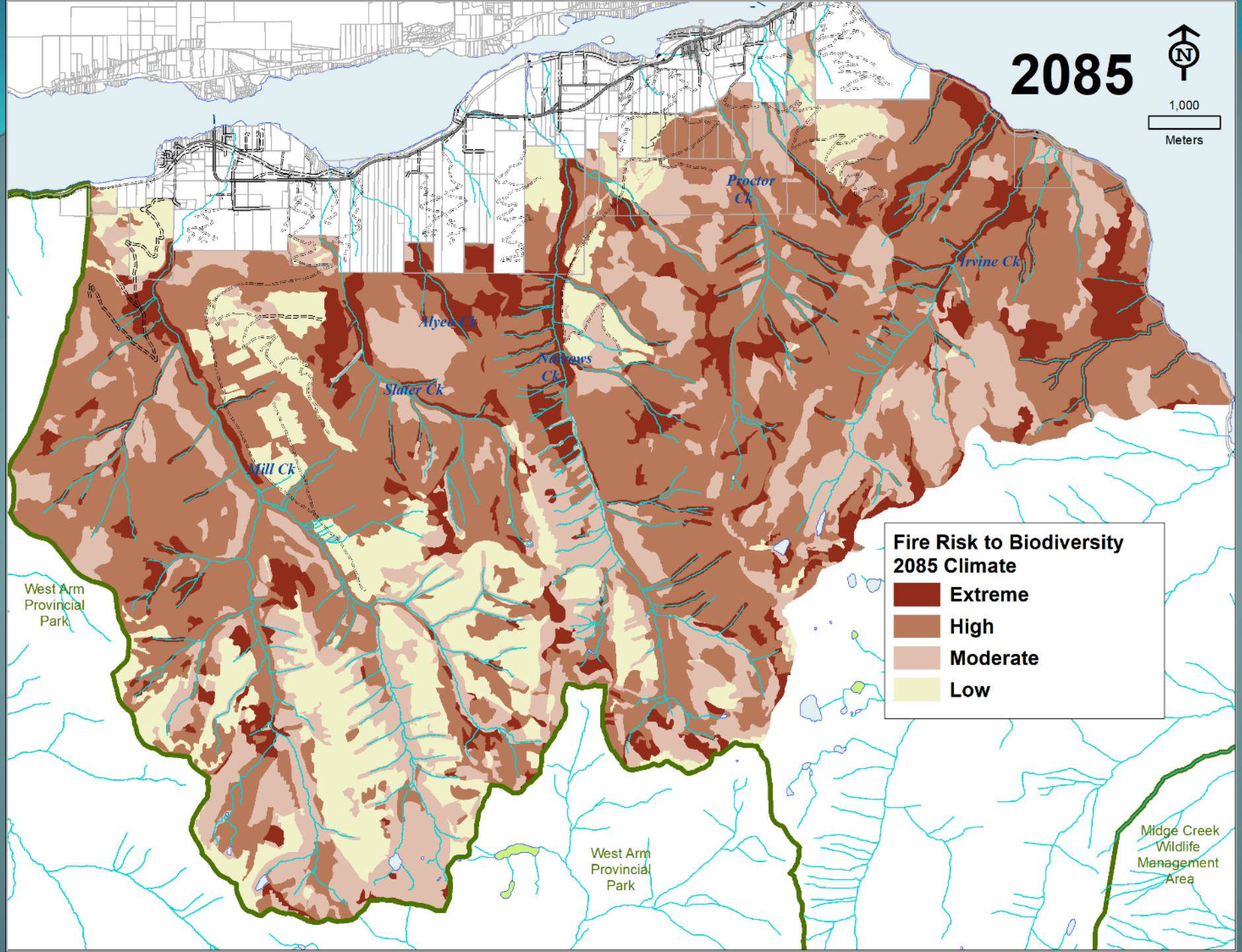
Midge Creek Wildlife Management Area
Fire Risk to Biodiversity
1990 Climate
Extreme
High
Moderate
Low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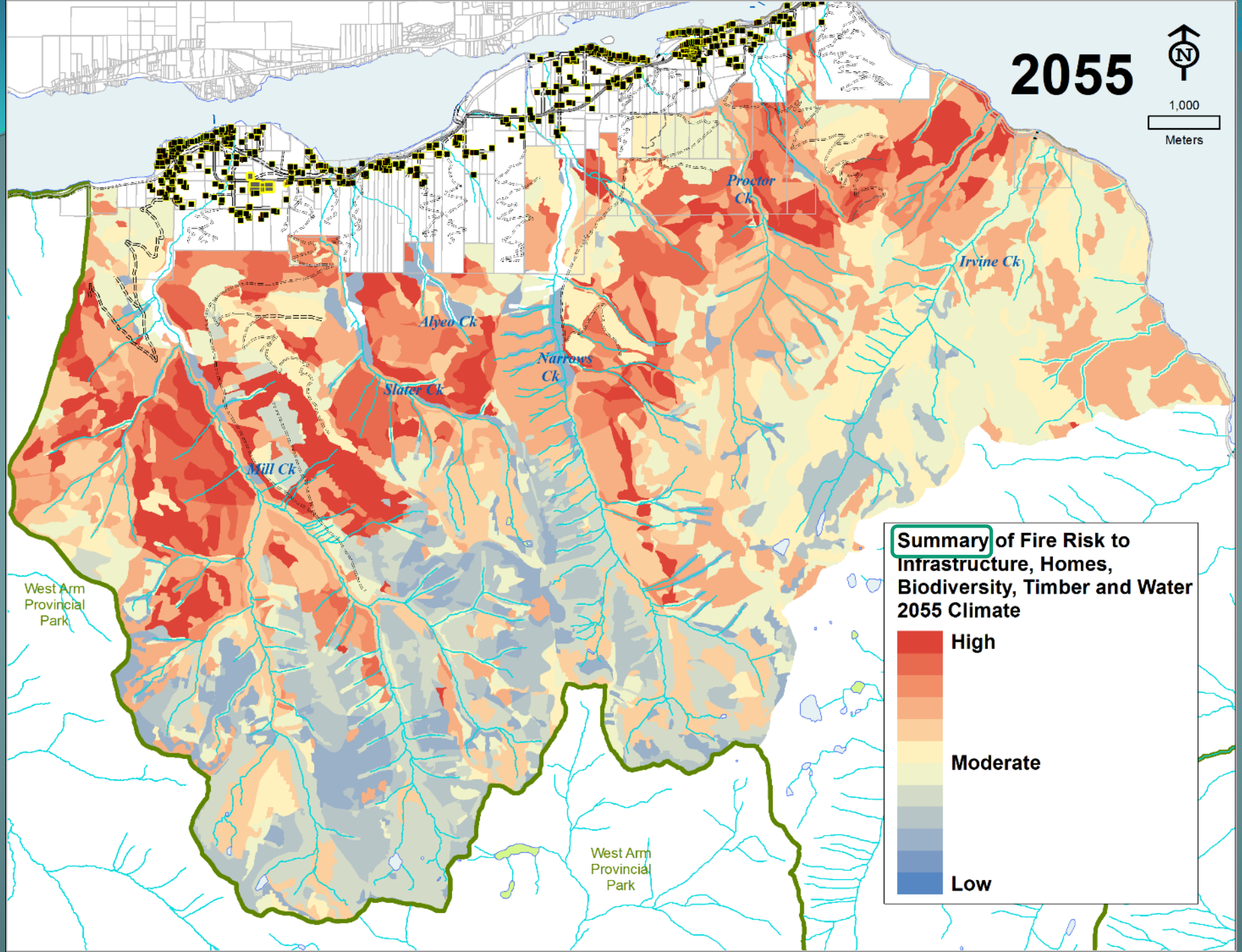
Midge Creek Wildlife Management Area
Fire Risk to Biodiversity
2085 Climate
Extreme
High
Moderate
Low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Mill Ck
West Arm Provincial Park
West Arm Provincial Park
Summary of Fire Risk to Infrastructure, Homes, Biodiversity, Timber and Water 2055 Climate
High
Moderate
Low

Risk assessment conclusions

Highest risk areas = top priorities

Homes: Untreated WUI (except moist sites)

Water: Headwaters areas with high fire likelihood

Biodiversity: Old forests on drier sites

Timber: Accessible stands on drier sites, especially cedar/hemlock

Noteworthy

Drought acceleration at lower elevations

Harrop Creek (granitic) *vs.* Narrows Creek (metasedimentary)

Operations strategy

Resist (protect)

- WUI treatments—fuels
- Landscape fuel breaks
- Protect old forests & riparian
  - Caribou habitat
- Connectivity—reserves

Realign (transition)

- WUI treatments—stand composition & structure
- New stocking standards
  - Assisted migration
- Connectivity—treatments

Triage: *Which priority sites can we effectively address now?*

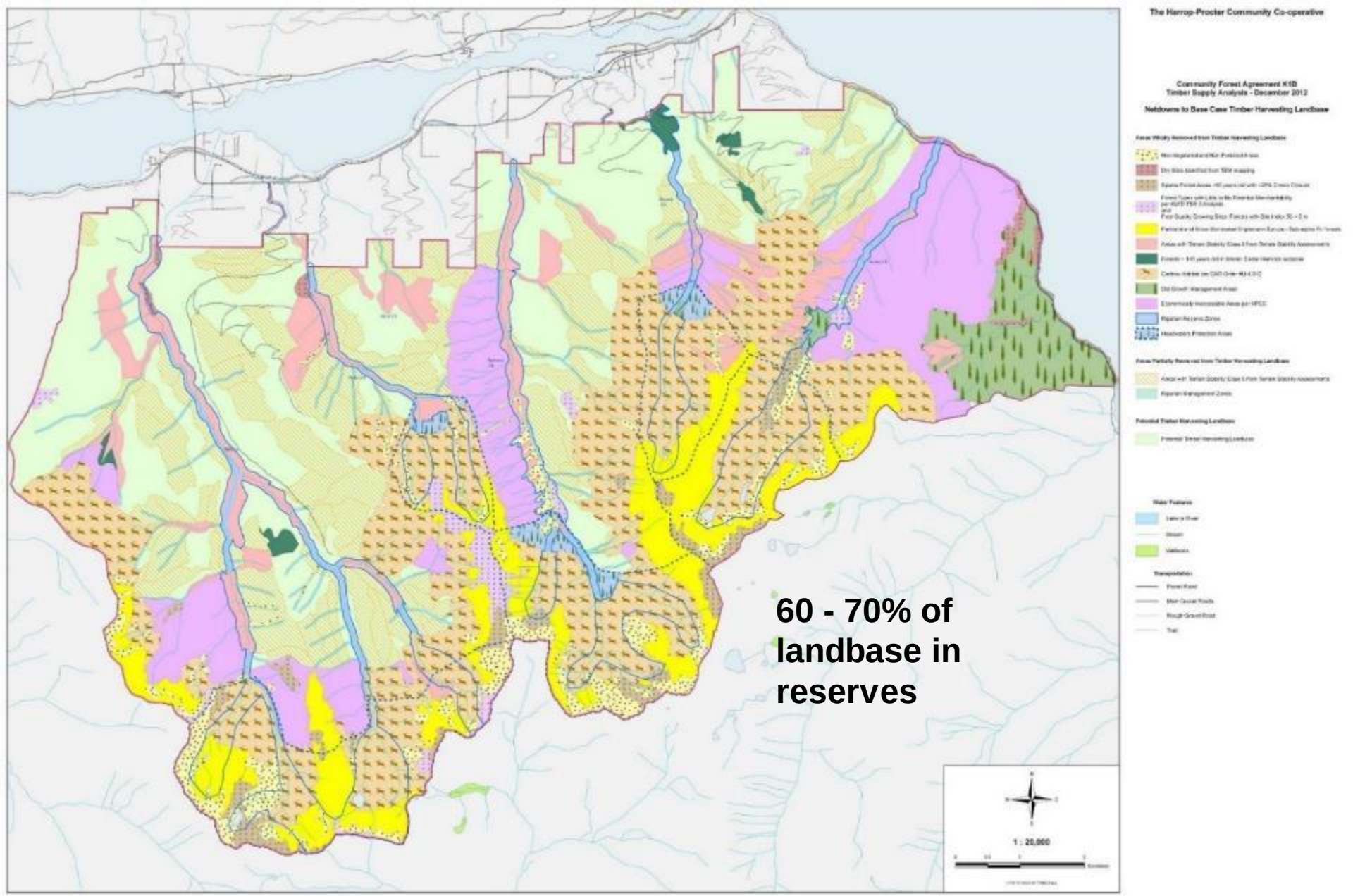
Operations strategy

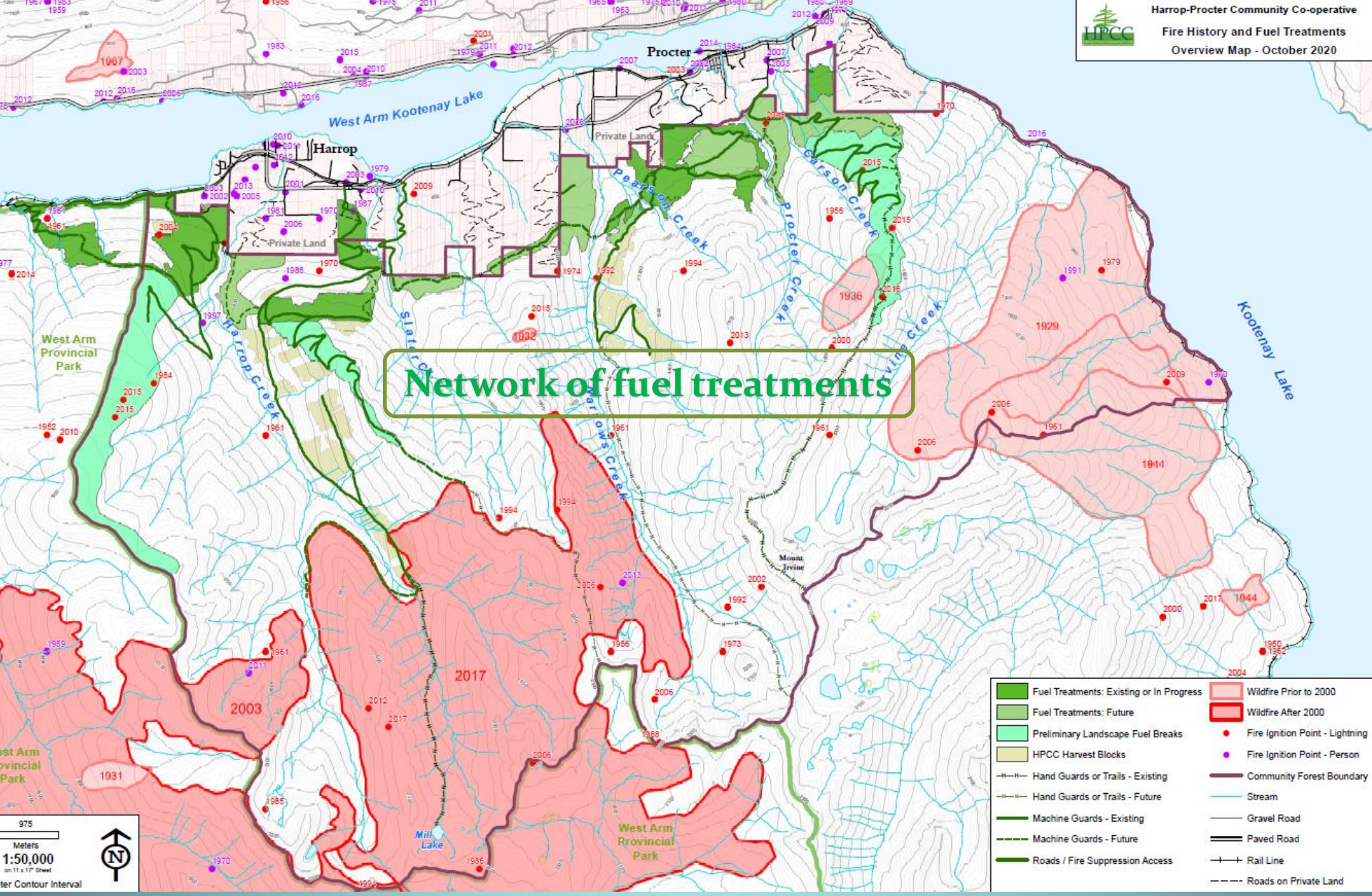
Carbon carrying capacity

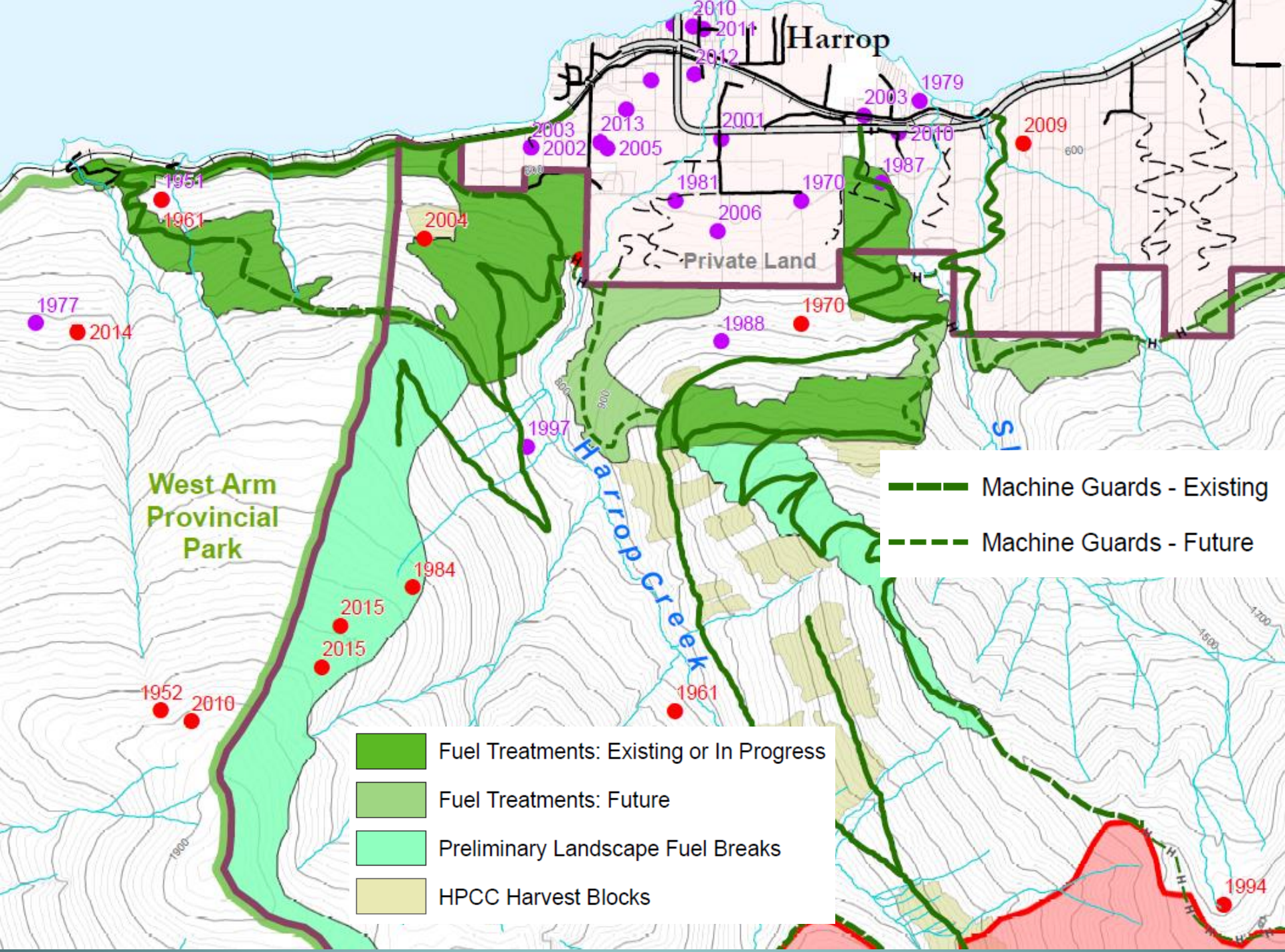
Peak carbon: June 2003

Where can we hold carbon?

- *short-term vs long-term*
- *manage transition*

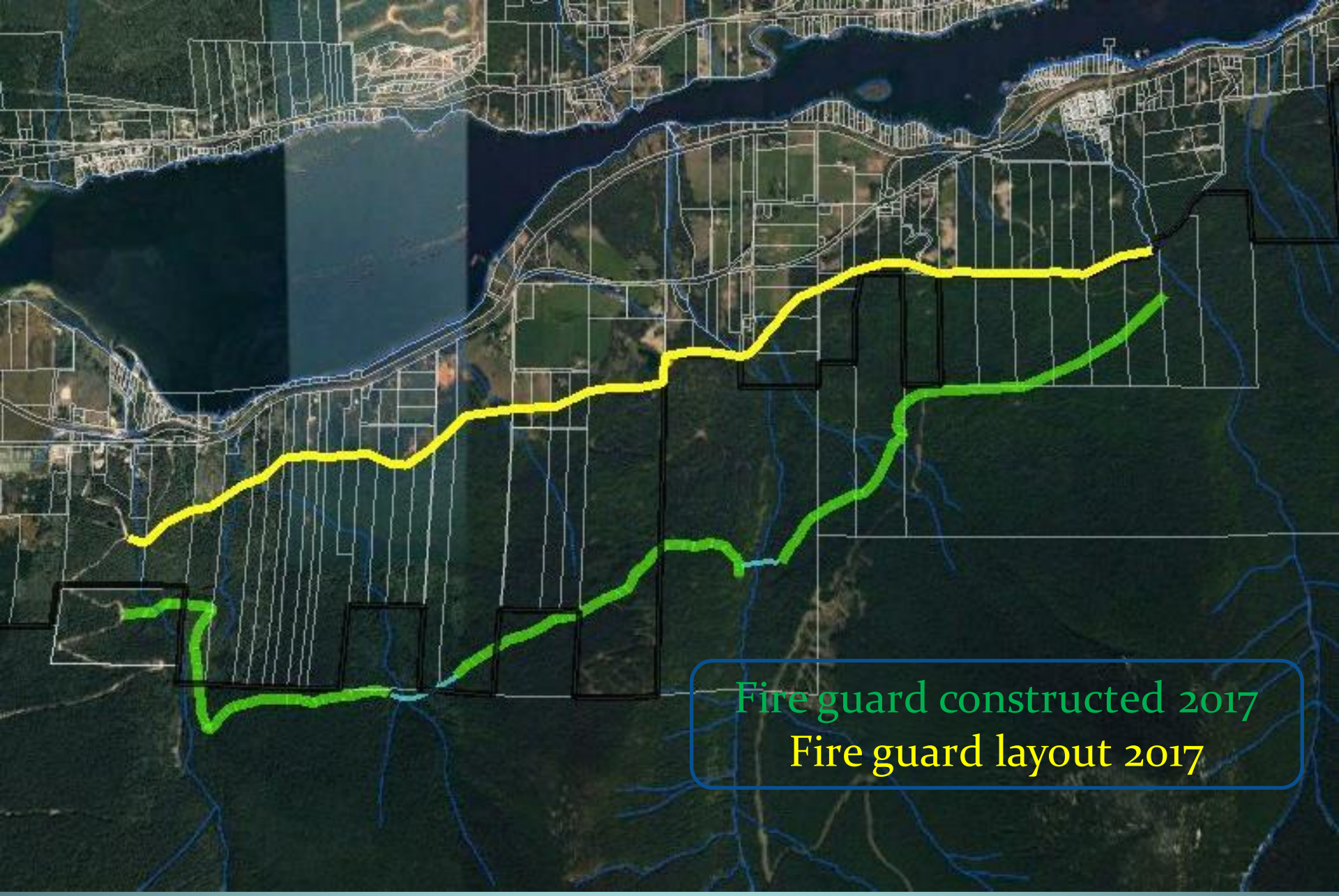

The Harrop-Procter Community Co-operative
Community Forest Agreement K1B
Timber Supply Analysis - December 2012
Netdowns to Base Case Timber Harvesting Landbase
60 - 70% of landbase in reserves
1 : 20,000

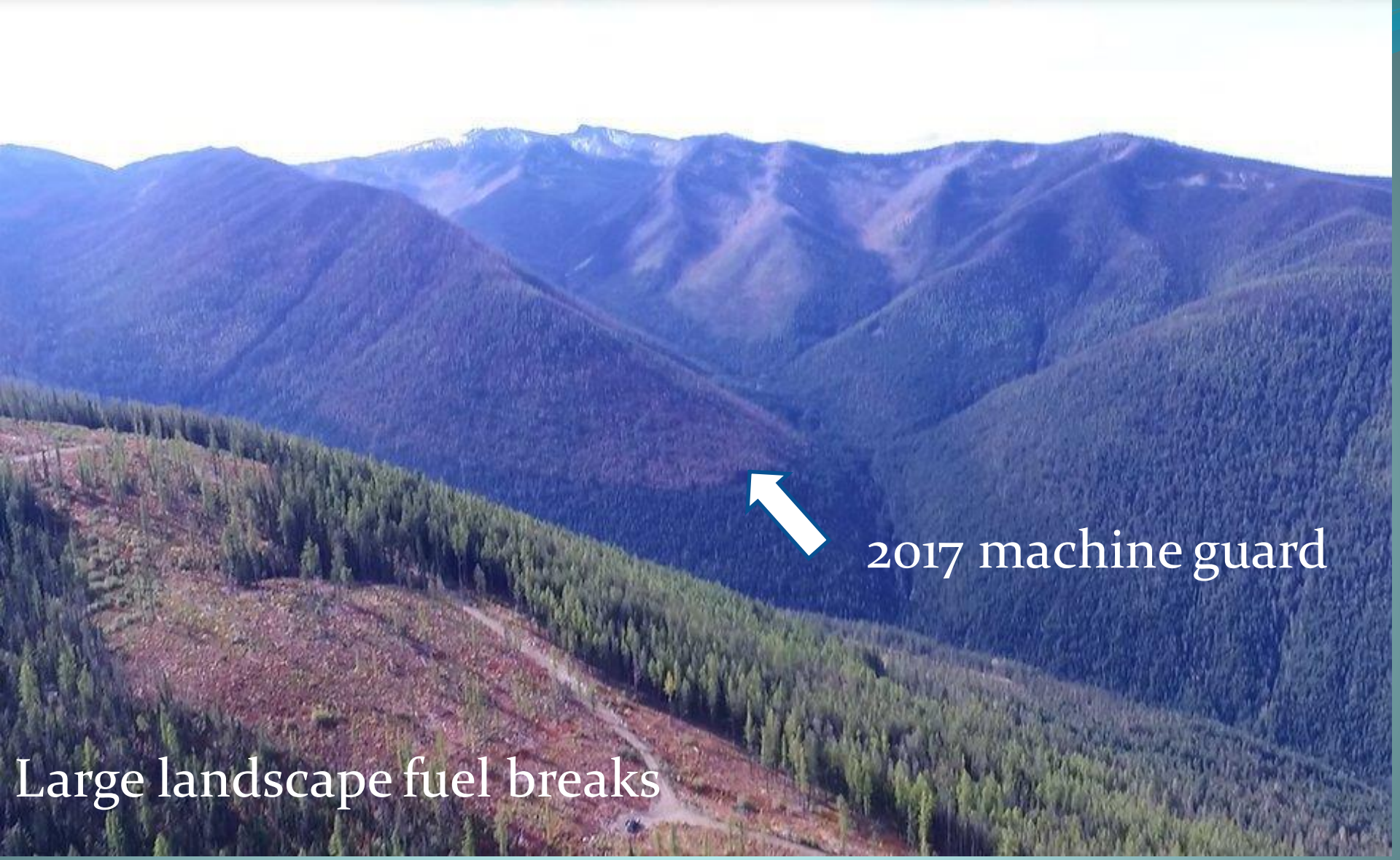

Harrop-Procter Community Co-operative
Fire History and Fuel Treatments
Overview Map - October 2020
Network of fuel treatments
West Arm Kootenay Lake
Harrop
Procter
Private Land
Private Land
Pearson Creek
Procter Creek
Carson Creek
Irvine Creek
Harrop Creek
Slaterbows Creek
Kootenay Lake
West Arm Provincial Park
Mount Irvine
Mill Lake
West Arm Provincial Park
2017
2003
1931
1936
1929
1944
Fuel Treatments: Existing or In Progress
Fuel Treatments: Future
Preliminary Landscape Fuel Breaks
HPCC Harvest Blocks
Hand Guards or Trails - Existing
Hand Guards or Trails - Future
Machine Guards - Existing
Machine Guards - Future
Roads / Fire Suppression Access
Wildfire Prior to 2000
Wildfire After 2000
Fire Ignition Point - Lightning
Fire Ignition Point - Person
Community Forest Boundary
Stream
Gravel Road
Paved Road
Rail Line
Roads on Private Land
975
Meters
1:50,000
N


Harrop
Private Land
West Arm Provincial Park
Harrop Creek
Machine Guards - Existing
Machine Guards - Future
Fuel Treatments: Existing or In Progress
Fuel Treatments: Future
Preliminary Landscape Fuel Breaks
HPCC Harvest Blocks
2010
2011
2012
1979
2003
2001
2013
2003
2002
2005
2010
2009
1987
1981
1970
2006
1951
1961
2004
1977
2014
1970
1988
1997
1984
2015
2015
1952
2010
1961
1994


Re-opening strategic old roads


Building helipads

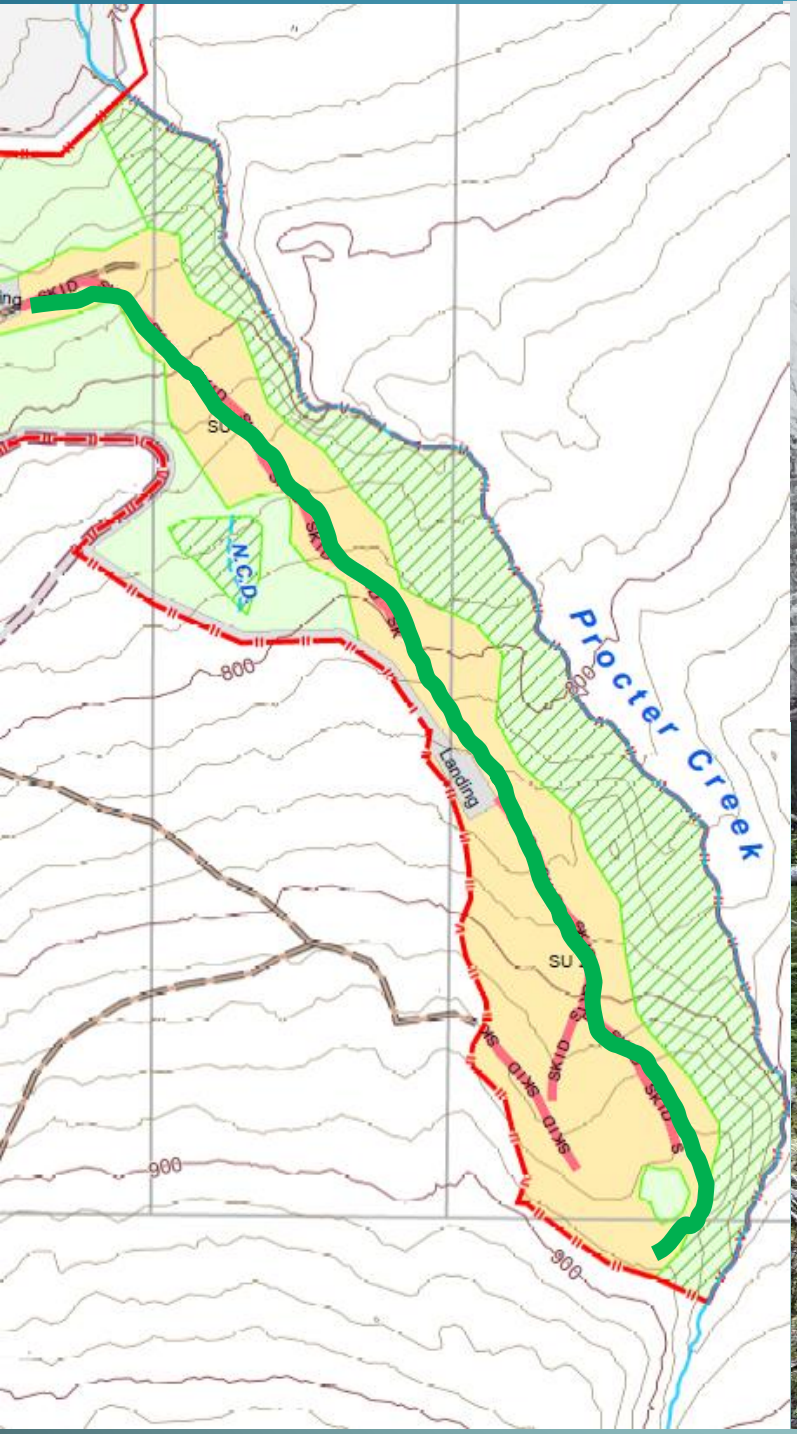

Fire guard constructed 2017
Fire guard layout 2017


2017 machine guard
Large landscape fuel breaks


150 meters wide


Landscape fuel break maintenance


Connectivity



Permanent access

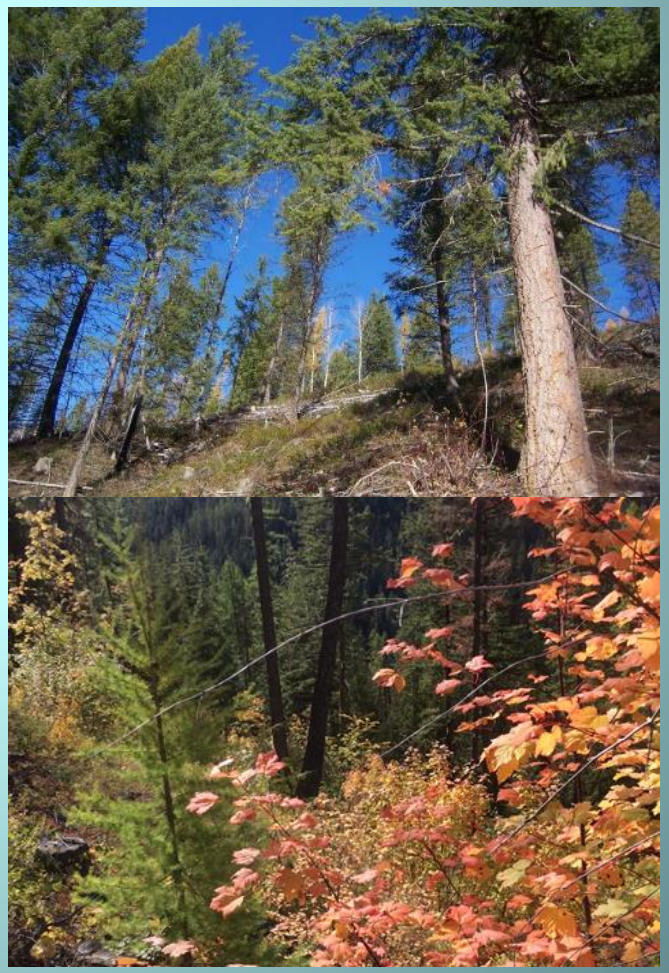
Realign

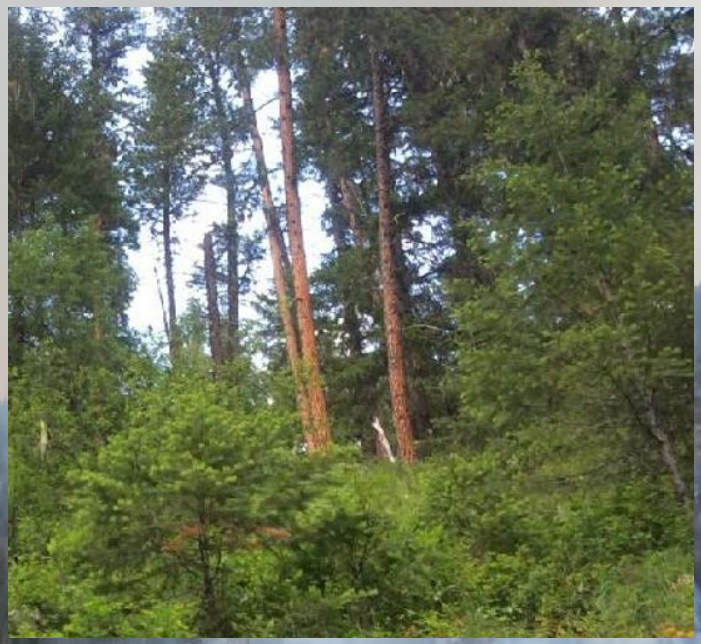
Desired future conditions:
Realign drought-prone sites

ICHdw1-104 (submesic)

- Py Fd (At) / Fd Lw (Pl)
- 150 to 400 sph
- Fine fuels <5 tonnes/ha
- Retain large/old trees
- Small patch reserves

Target: address 60% of high risk THLB by 2040





Re-introduction of fire—dry forest (Winlaw Creek 2021)

1961-1990	ICH dw 1	1.5	2	2.5	3	4	5.5
2085	ICH dw 1	0	1	1.5	2	2.5	4.5

1961-1990	ICH dw 1	1.5	2	2.5	3	4	5.5
2085	ICH dw 1	0	1	1.5	2	2.5	4.5

Fire management partial cut standard: SSID# 1062309

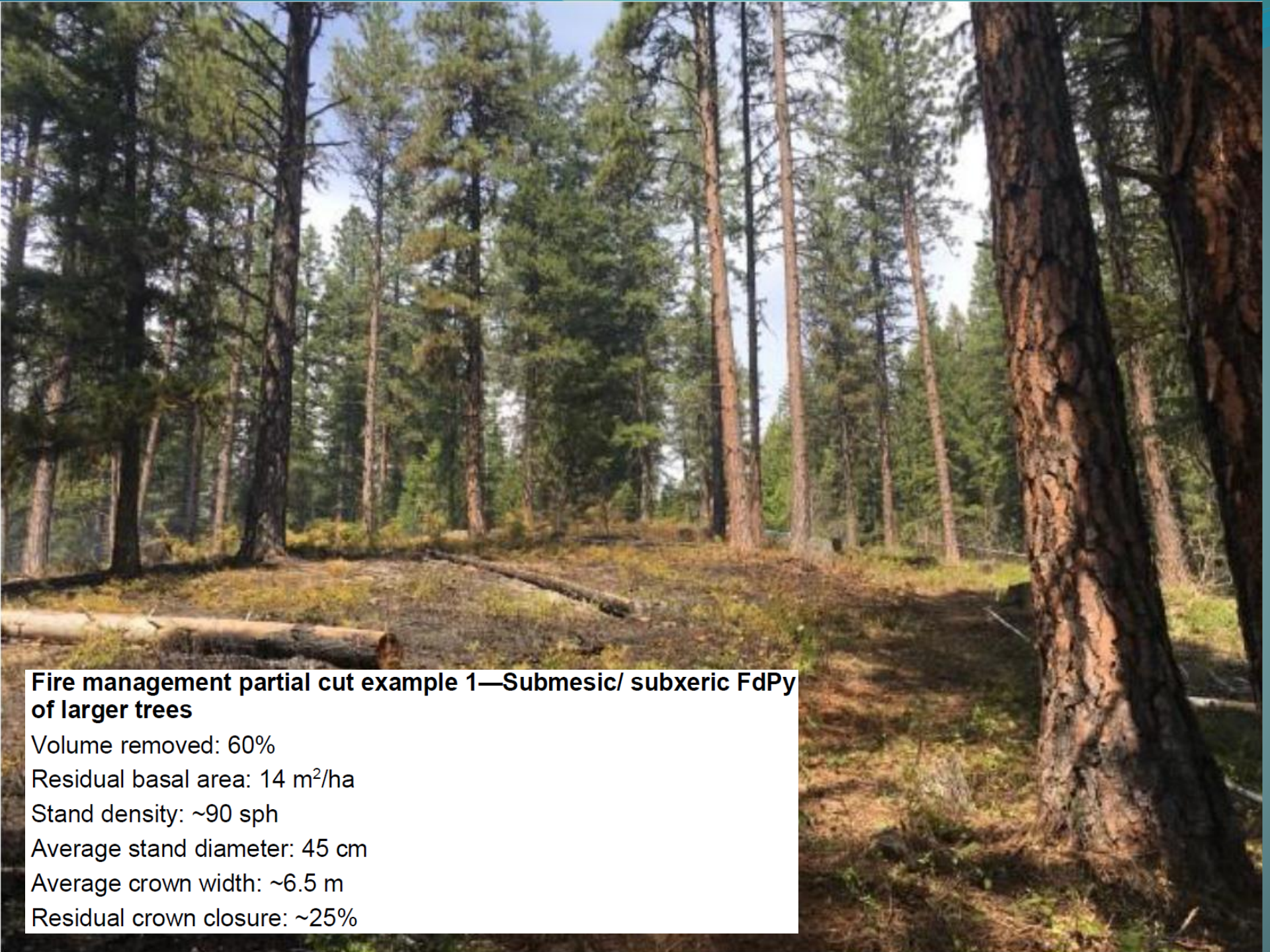
Retain a minimum of 12 m^2/ha of healthy mature trees.

Acceptable leave trees must be dominant or co-dominant layer trees >17.5 cm dbh, and:

- > 25% live crown with no indicators of decline;
- Free of gouges and wounds > 1/3 of stem circumference; and
- Free of wounds on a supporting root within 1 m of the stem.

Preferred leave trees include fire resistant species (i.e., Lw, Py, Fd, Pw, At, Act, Ep) that are likely to be windfirm. Other species are acceptable where no fire resistant species of suitable form and health are available and prescribing a WUI treatment has been deemed approriate.

Partial cut 2019, understory burn 2020



Fire management partial cut example 1—Submesic/ subxeric FdPy of larger trees

Volume removed: 60%

Residual basal area: 14 m^2/ha

Stand density: ~90 sph

Average stand diameter: 45 cm

Average crown width: ~6.5 m

Residual crown closure: ~25%

Fire management even-aged stocking standards

SSID #	BGC	Site Series	Preferred species	Acceptable Species	Target WS/ ha	MIN pa	MIN p					
	ICHdw1	101	Fd[58] Lw Py Pw[31]	Pl Cw Bg At Ep	400	250	200					
		102	Fd Py	Lw Pl	400	250	200					
		103	Fd[58] Lw Py	Pl Pw[31]	400	250	200	*800*	4	7	12	20

Climate Change Research Site

Harrop Procter Community Co-op is participating in a research project that evaluates the effects of overstory trees on forest regeneration in a changing climate. This long-term study includes research sites in six climate zones across the BC Southern Interior.

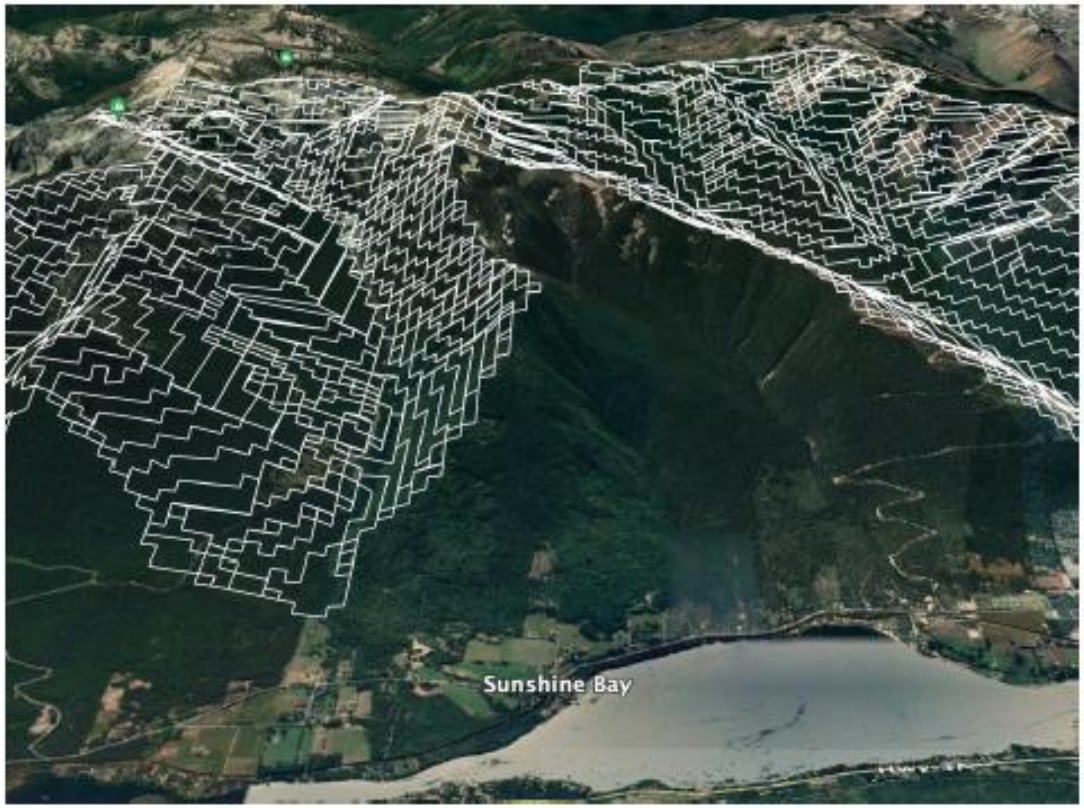
This 20 hectare research site includes 5 distinct treatment types, each covering 4 hectares. The treatment types include single tree retention, small group retention, large group/ shelterwood retention, clearcut, and an unlogged control.

Douglas-fir, larch, lodgepole pine, and Ponderosa pine seedlings will be planted in each treatment area. Seed from several different climate zones will be used, including seed from the climate expected for this site in 80 years.

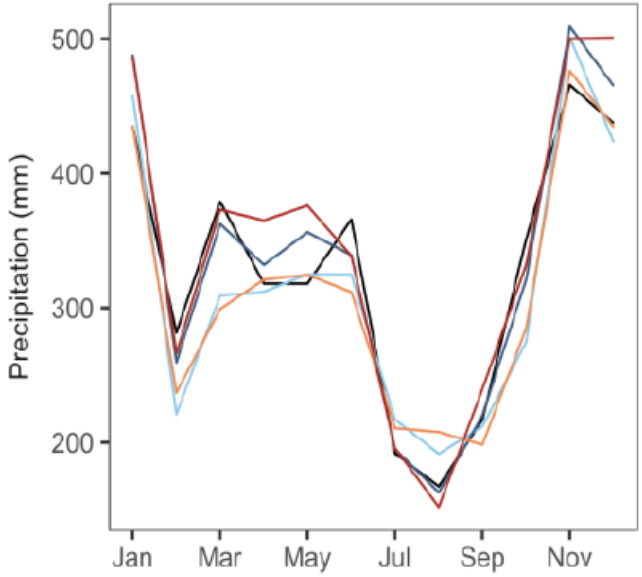
eedling linkages to the mycorrhizal networks of retained
Carbon cycling and soil biodiversity will also be

Dr. Suzanne Simard and a team of co-investigators from

Hydrological Modeling for Forest Management



October 2021

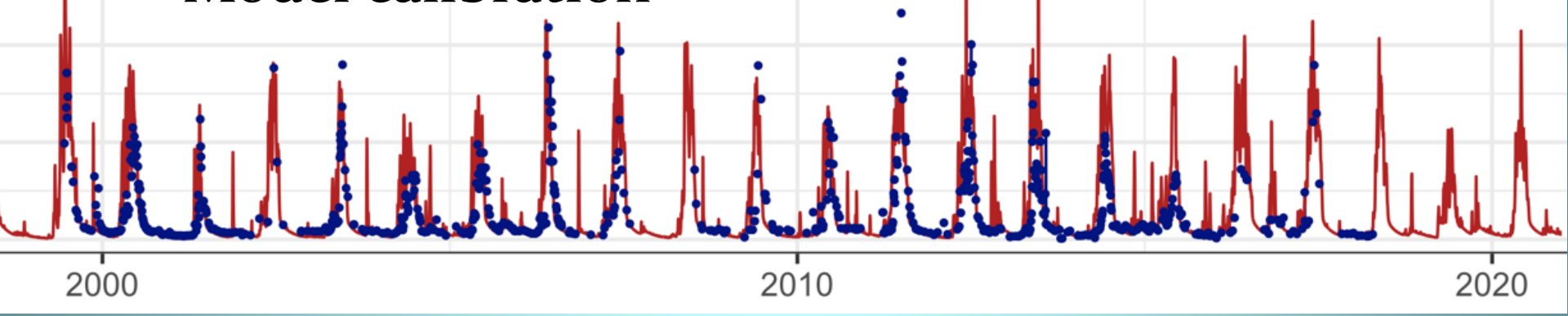


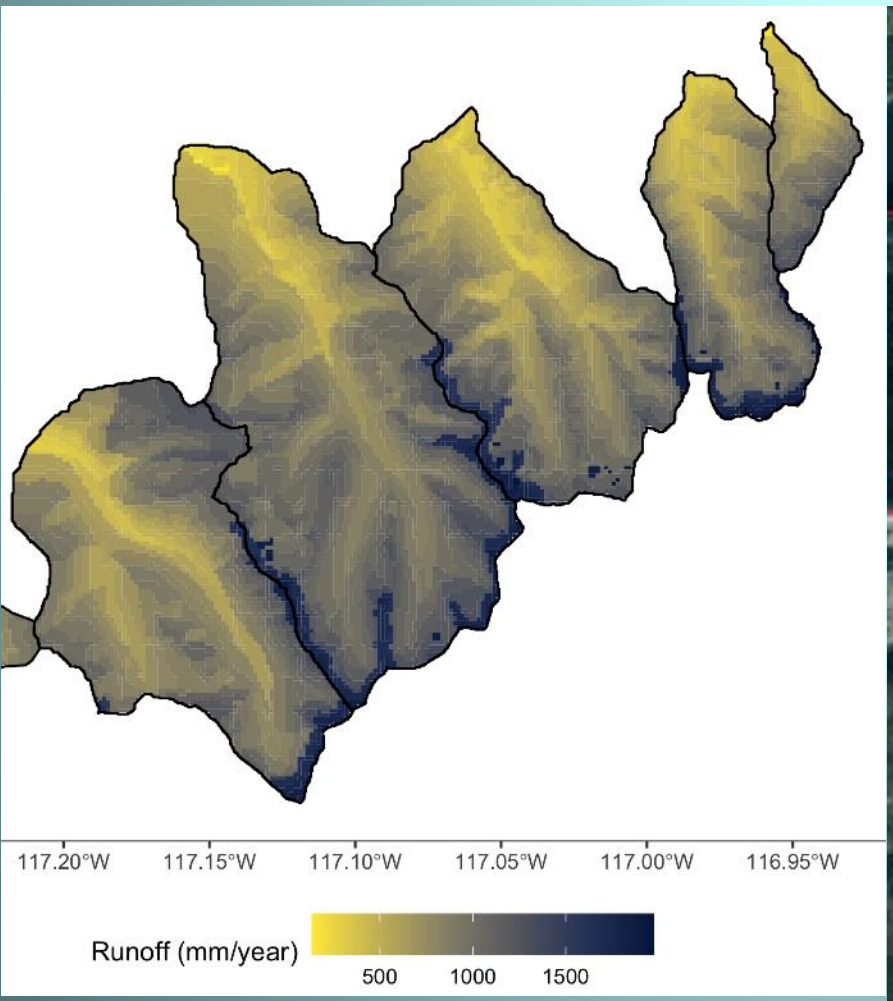
HARROP - PROCTER
FOREST PRODUCTS

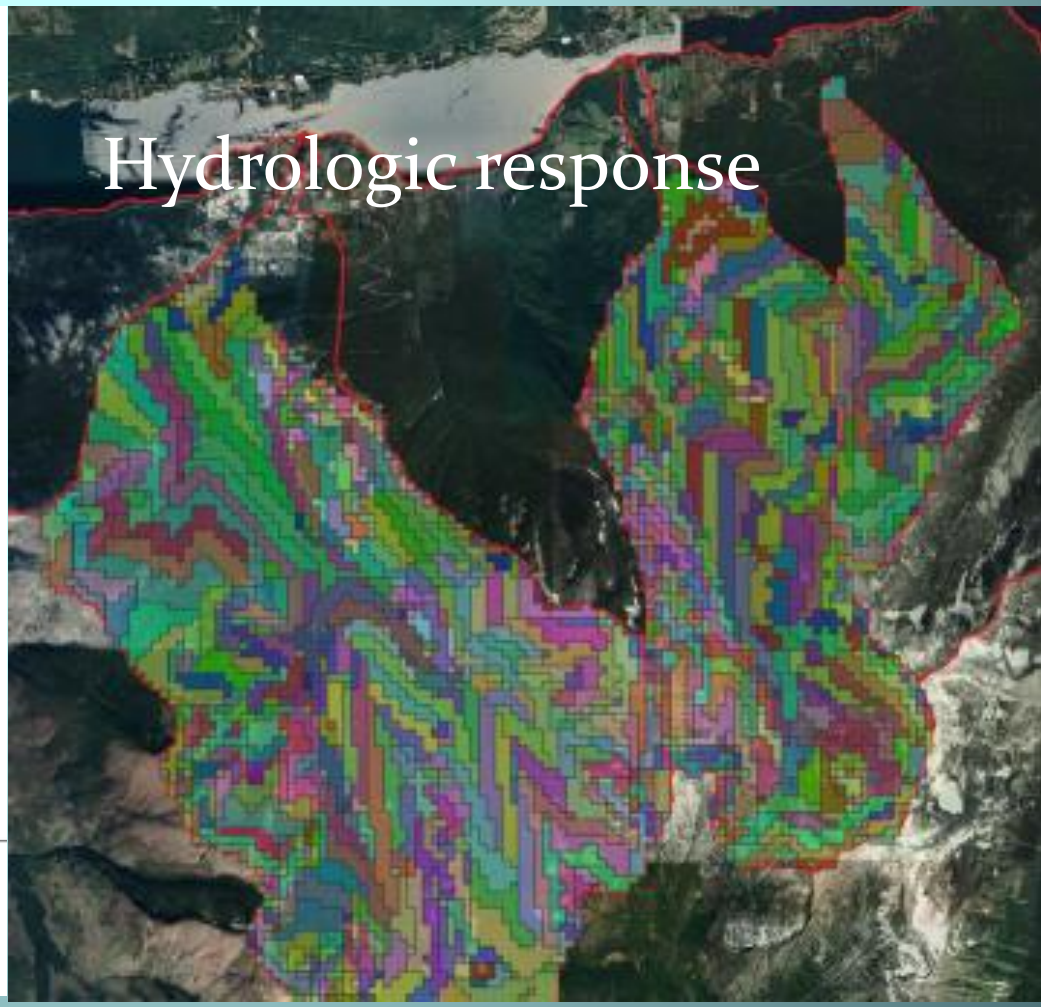
APPLIED & INNOVATION RESEARCH CENTRE Selkirk College

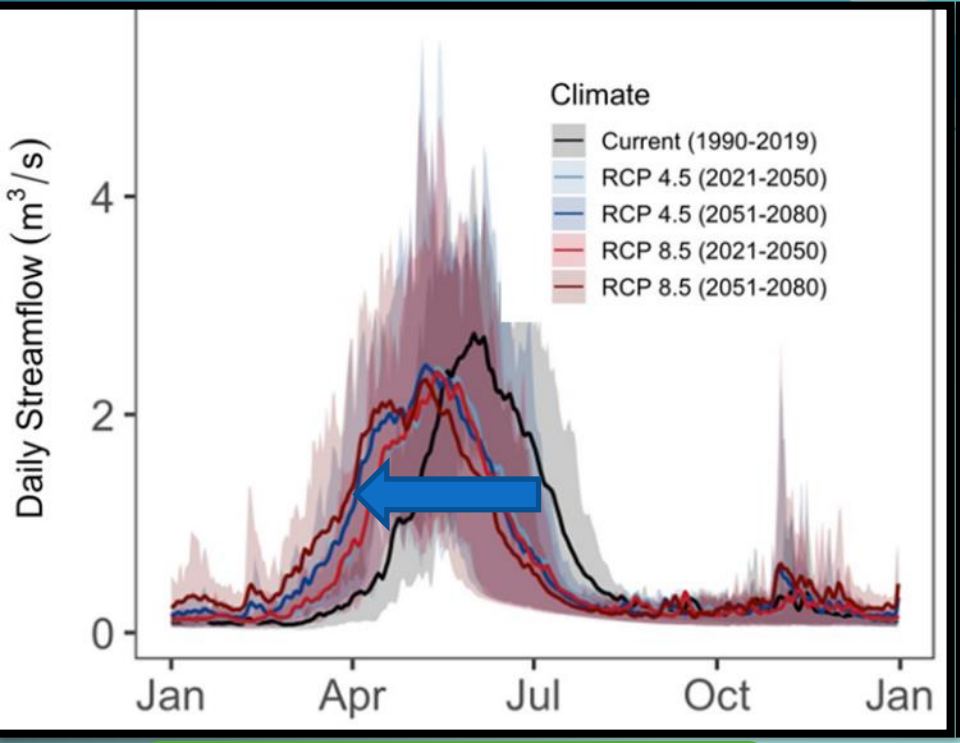
NSERC CRSNG

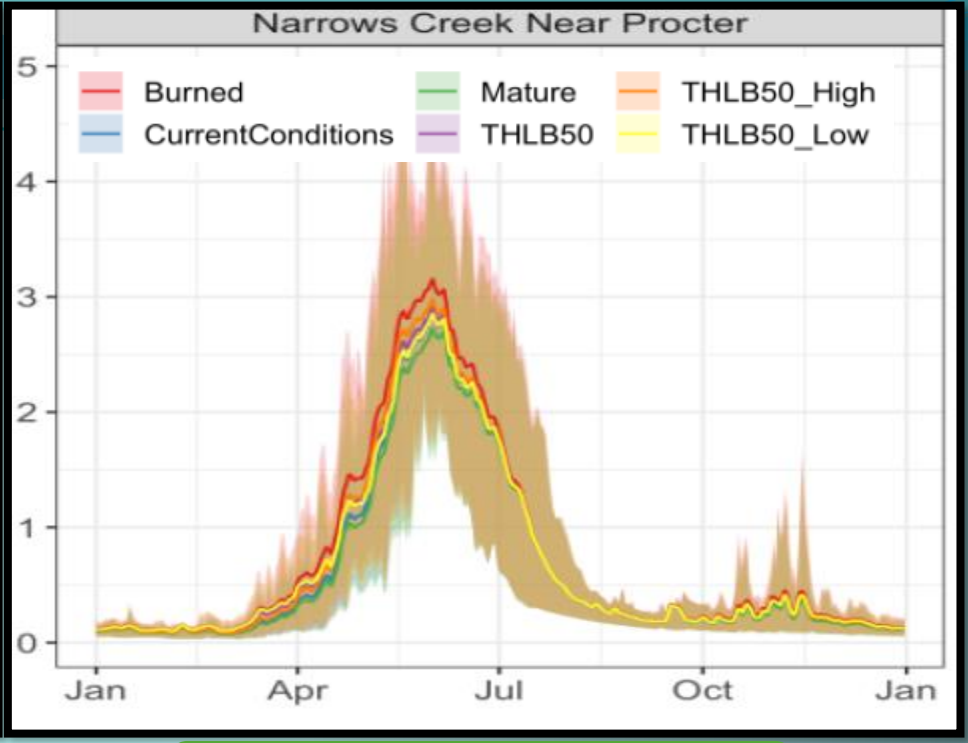
Model calibration

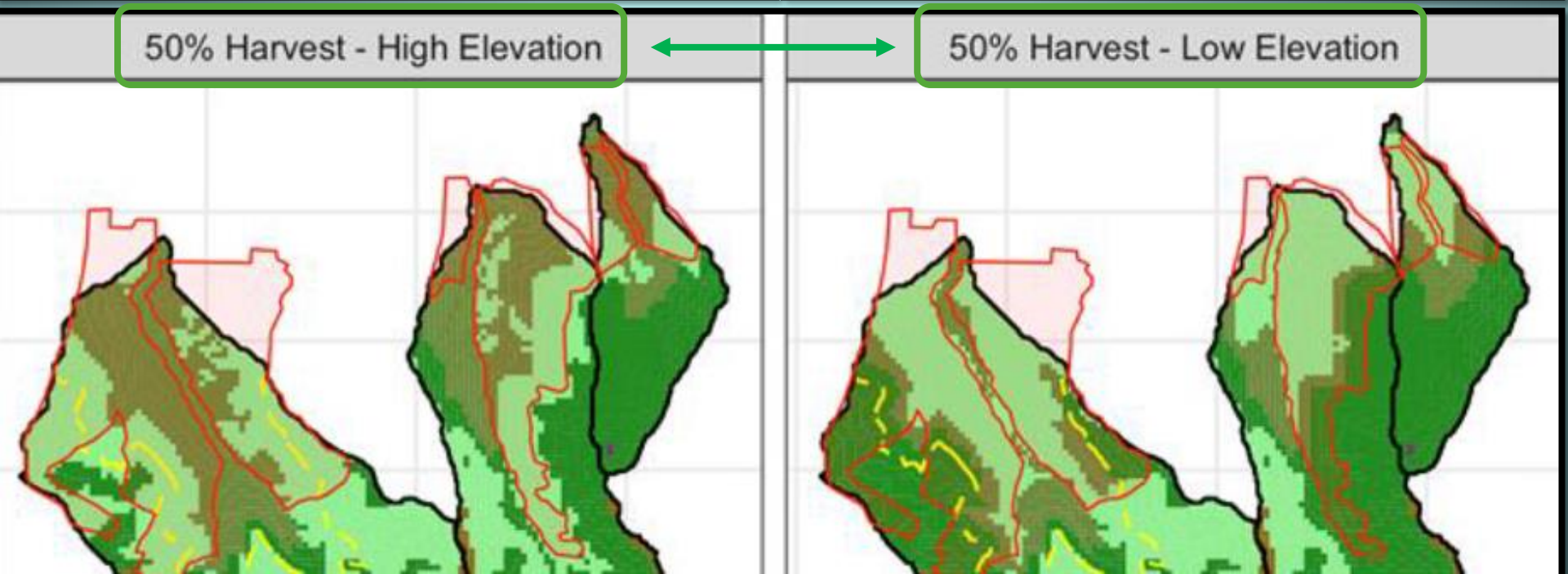







Climate
Current (1990-2019)
RCP 4.5 (2021-2050)
RCP 4.5 (2051-2080)
RCP 8.5 (2021-2050)
RCP 8.5 (2051-2080)
Daily Streamflow (m³/s)
0
2
4
Jan
Apr
Jul
Oct
Jan


Narrows Creek Near Procter
Burned
CurrentConditions
Mature
THLB50
THLB50_High
THLB50_Low
0
1
2
3
4
5
Jan
Apr
Jul
Oct
Jan


50% Harvest - High Elevation
50% Harvest - Low Elevation

Management Plan and AAC

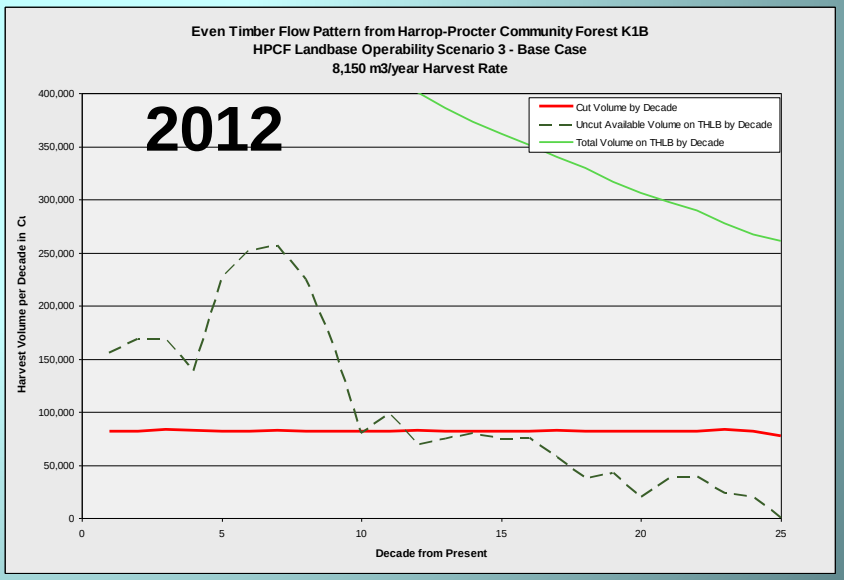
How much do we cut?

Revise TSR assumptions

- Unsalvaged losses
- Growth rates
- Adjust THLB
- Hydrology—ECA limits
- Reconsider 'sustained yield' & 'even flow'

How fast do we realign?

- Fuel breaks—how many/ how fast?



Social choices—based on risks

Outreach

Handbook

Workshop

Educational films

Thank you!

ErikL@netidea.com
www.hpcommunityforest.org

HPCC
Harrop Procter Community Co-Op

Woodlot Forestry Services Ltd.

Columbia Basin trust