



BEC (Biogeoclimatic Ecosystem Classification System) Update for new Stocking Standards and Climate Change

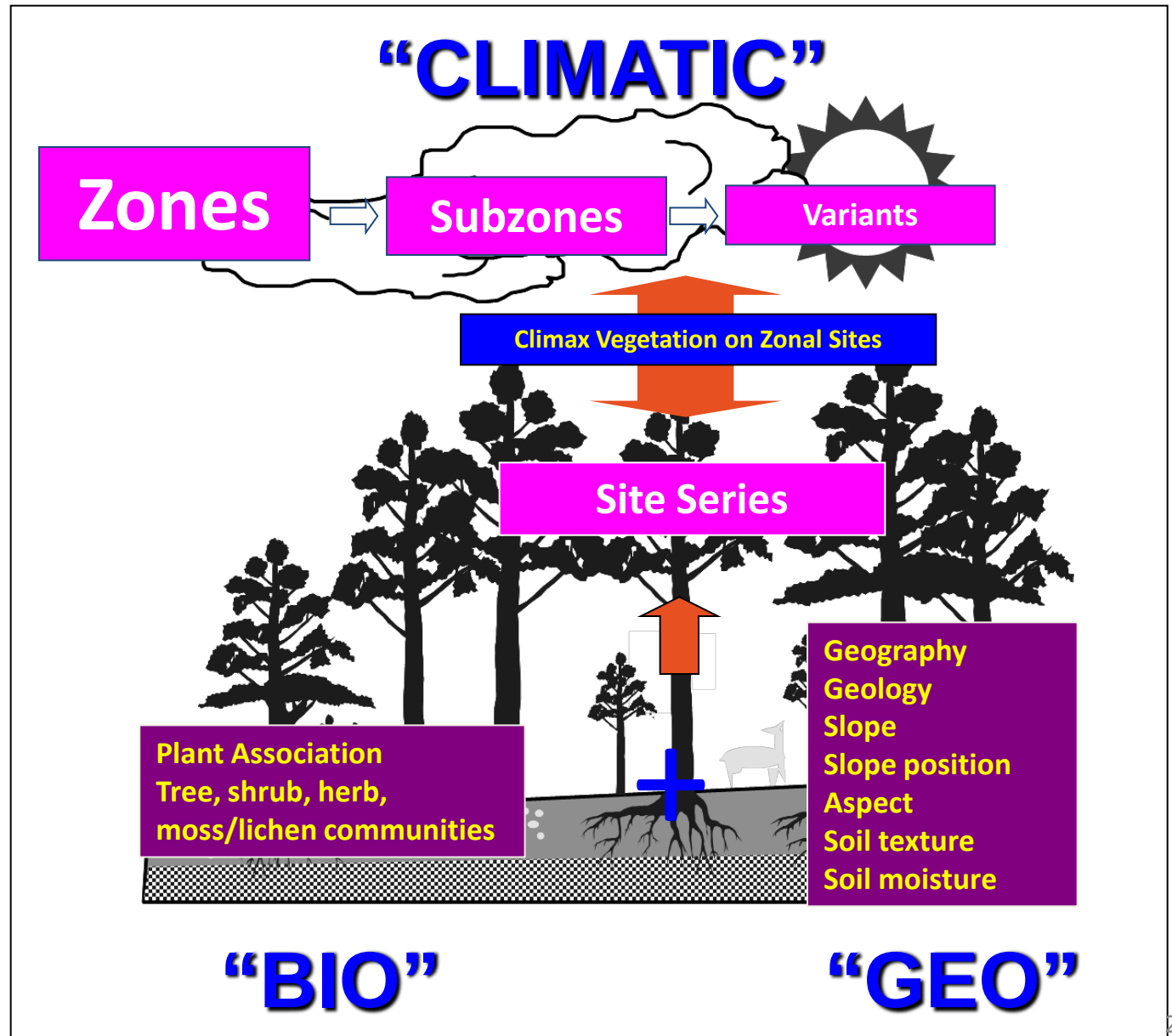
**Deb MacKillop - Research Ecologist
Audrey Ehman – Research Technician
Kootenay-Boundary Region, FLNR**

**Mike Ryan – Research Ecologist
Thompson-Okanagan Region, FLNR**

BEC: The Biogeoclimatic Ecosystem Classification System

*Biogeoclimatic
Classification
(BGC)*

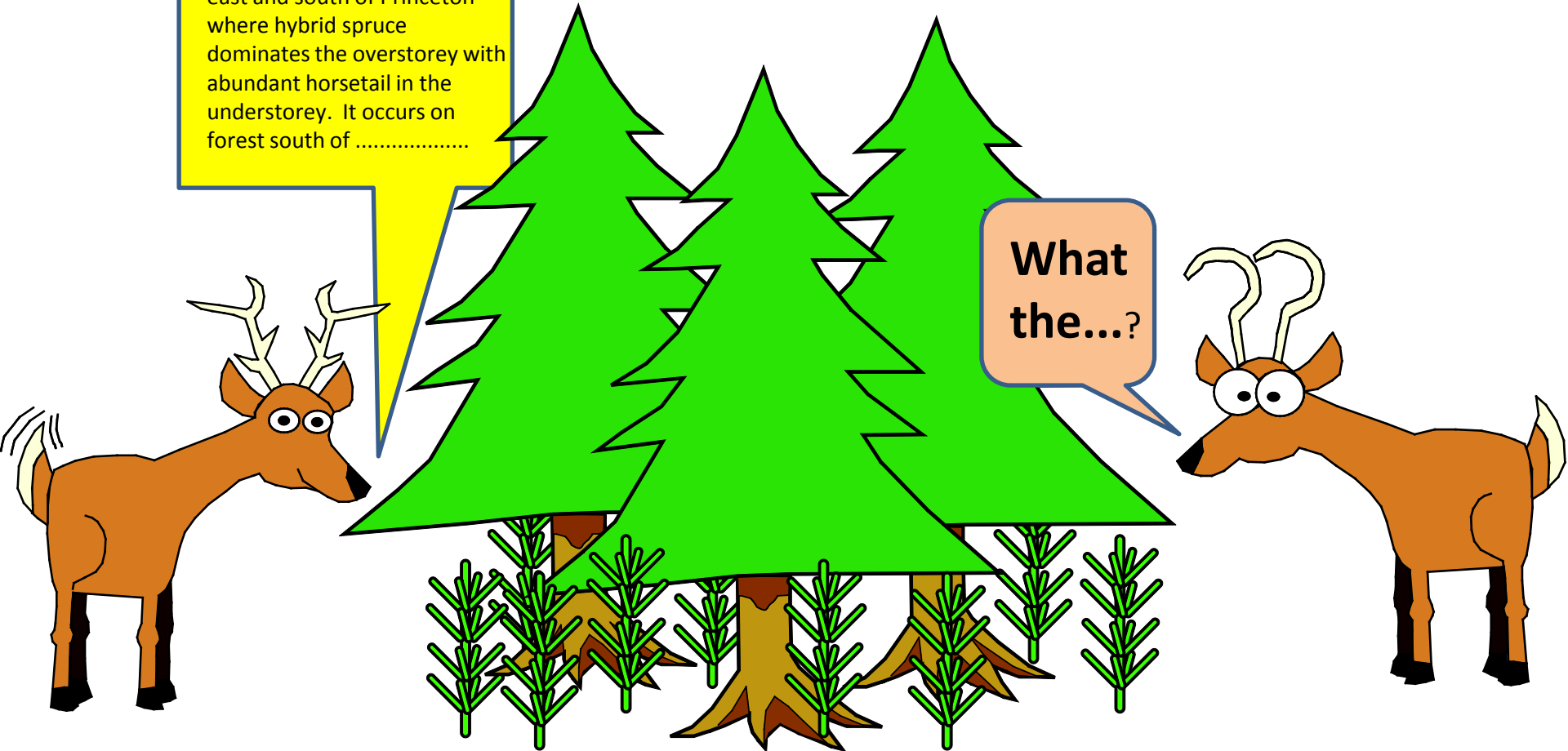
*Site Classification
(BEC)*



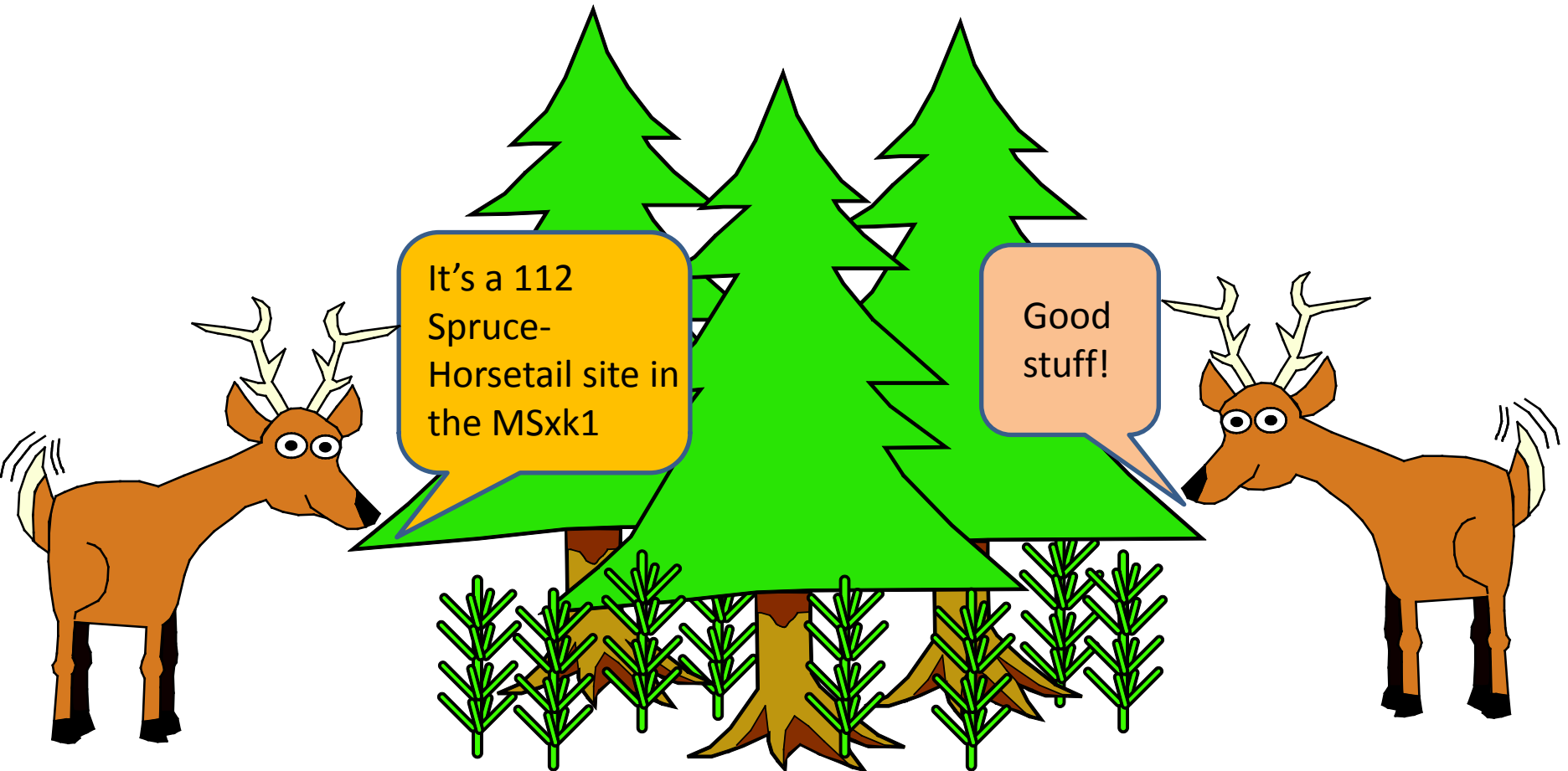
BEFORE BEC.....

It's a very wet forest that occurs in midmontane areas east and south of Princeton where hybrid spruce dominates the overstorey with abundant horsetail in the understorey. It occurs on forest south of

What the...?



AFTER BEC.....



Biodiversity Management

- Higher Level Plan
 - OGMAs / BEOs
- Rare ecosystems
 - CDC and CF
- NDT's and Fire Ecology
- Protected Areas Strategy
- Ecosystem representation
- Non-timber Forest Products

Forest Management

- Tree species selection
- Site Productivity (SIBEC)
- PEM/TEM mapping
- Timber Supply Review
- Silviculture:
 - RESULTS + Allowances
- Veg. Competition
- Forest health hazard

Range Management

- Range capacity
- Season of use
- Weed potential
- Forage seed mix
- At-risk communities

Soil Management

- Site sensitivity
- Slope stability hazard
- Rehabilitation

Climate Change

- Future ecosystem projections
- Vulnerability assessments
 - Fire / insect / drought risk

Environmental Assessment

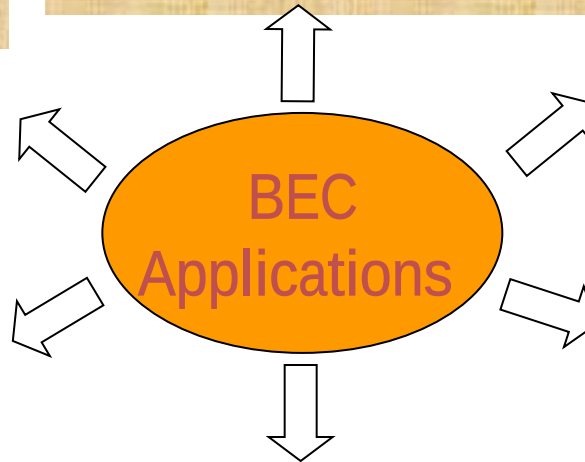
- Mining projects
- Oil & Gas / Clean Energy
- Recreation development

Wildlife Management

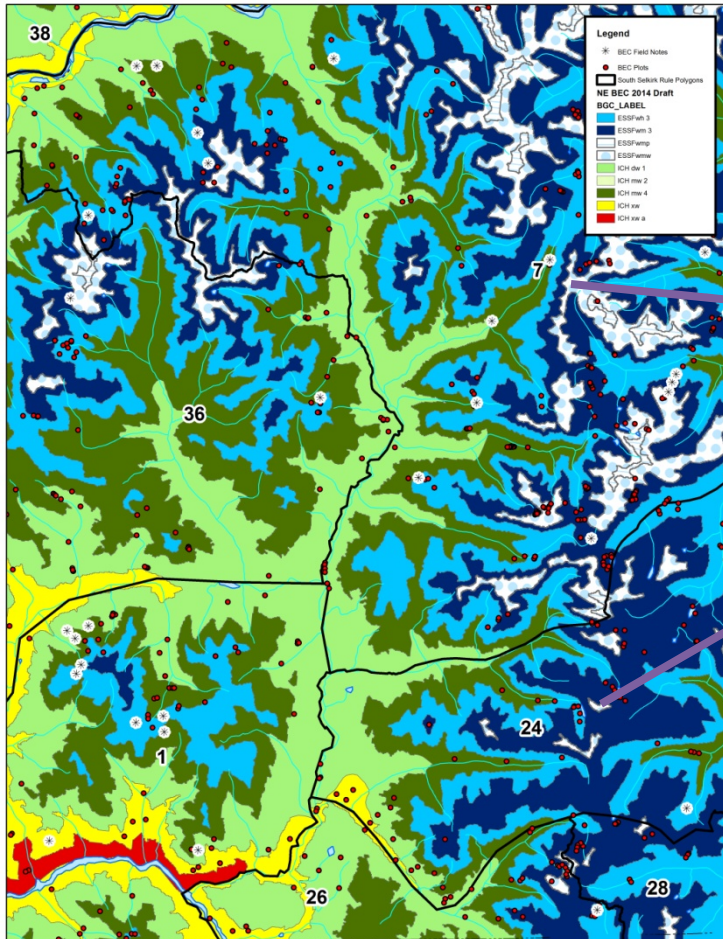
- Ungulate Winter Range
- Critical wildlife habitat
- Wildlife suitability / capability models
- Huckleberry models
- Forage potential

Cumulative Effects

- Riparian Areas
- Old Growth Forests
- At-risk Ecosystems



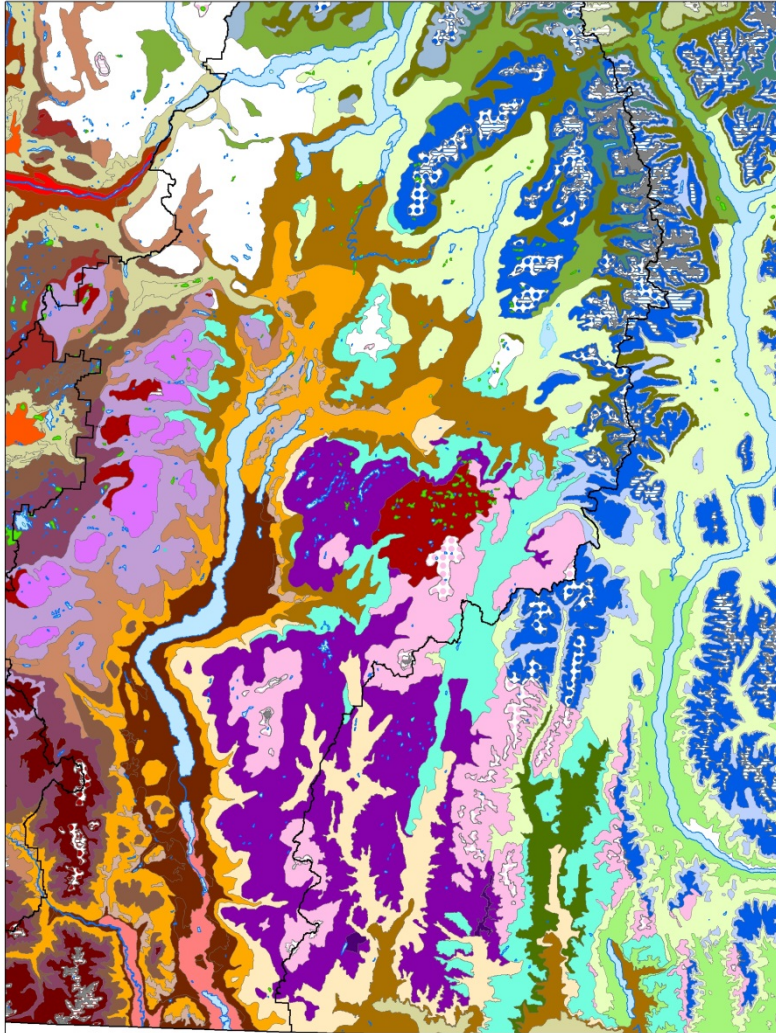
BGC – The Map



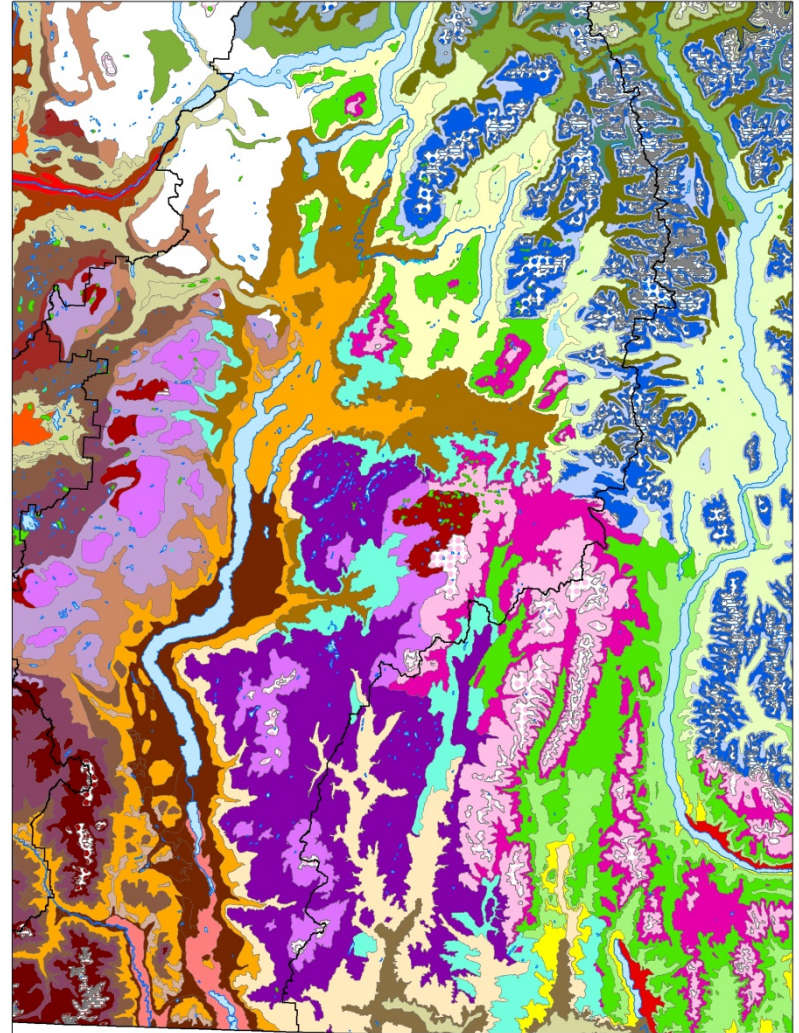
	A	D	E	F	G	H	I	J
1	BECLAE	COOL_LO	COOL_HIC	NEUT_LO	NEUT_HIC	WARM_LO	WARM_HIC	POLYGONNR
9	ICH dw 1	0	1070	0	1150	0	1275	7
10	ICH mw 4	1070	1450	1150	1475	1275	1500	7
11	ESSFwc 5	1450	1725	1475	1750	1500	1775	7
12	ESSFwc 6	1725	1950	1750	1950	1775	1950	7
13	ESSFwcw	1950	2150	1950	2150	1950	2150	7
14	ESSFwcp	2150	2400	2150	2400	2150	2400	7
15	IMA un	2400	20000	2400	20000	2400	20000	7
16	ICH dw 1	0	1100	0	1200	0	1300	24
17	ICH mw 4	1100	1450	1200	1475	1300	1500	24
18	ESSFwc 5	1450	1750	1475	1750	1500	1775	24
19	ESSFwc 6	1750	2050	1750	2070	1775	2100	24
20	ESSFwcw	2050	2250	2070	2270	2100	2300	24
21	ESSFwcp	2250	2500	2270	2500	2300	2500	24
22	IMA un	2500	20000	2500	20000	2500	20000	24
42	ICH dw 1	0	1100	0	1200	0	1300	36
43	ICH mw 4	1100	1475	1200	1500	1300	1530	36
44	ESSFwc 5	1475	1725	1500	1750	1530	1775	36
45	ESSFwc 6	1725	1950	1750	1950	1775	1950	36
46	ESSFwcw	1950	2150	1950	2150	1950	2150	36
47	ESSFwcp	2150	2400	2150	2400	2150	2400	36
48	IMA un	2400	20000	2400	20000	2400	20000	36
62								

New BEC in the Southern Interior

Official BEC (v9)

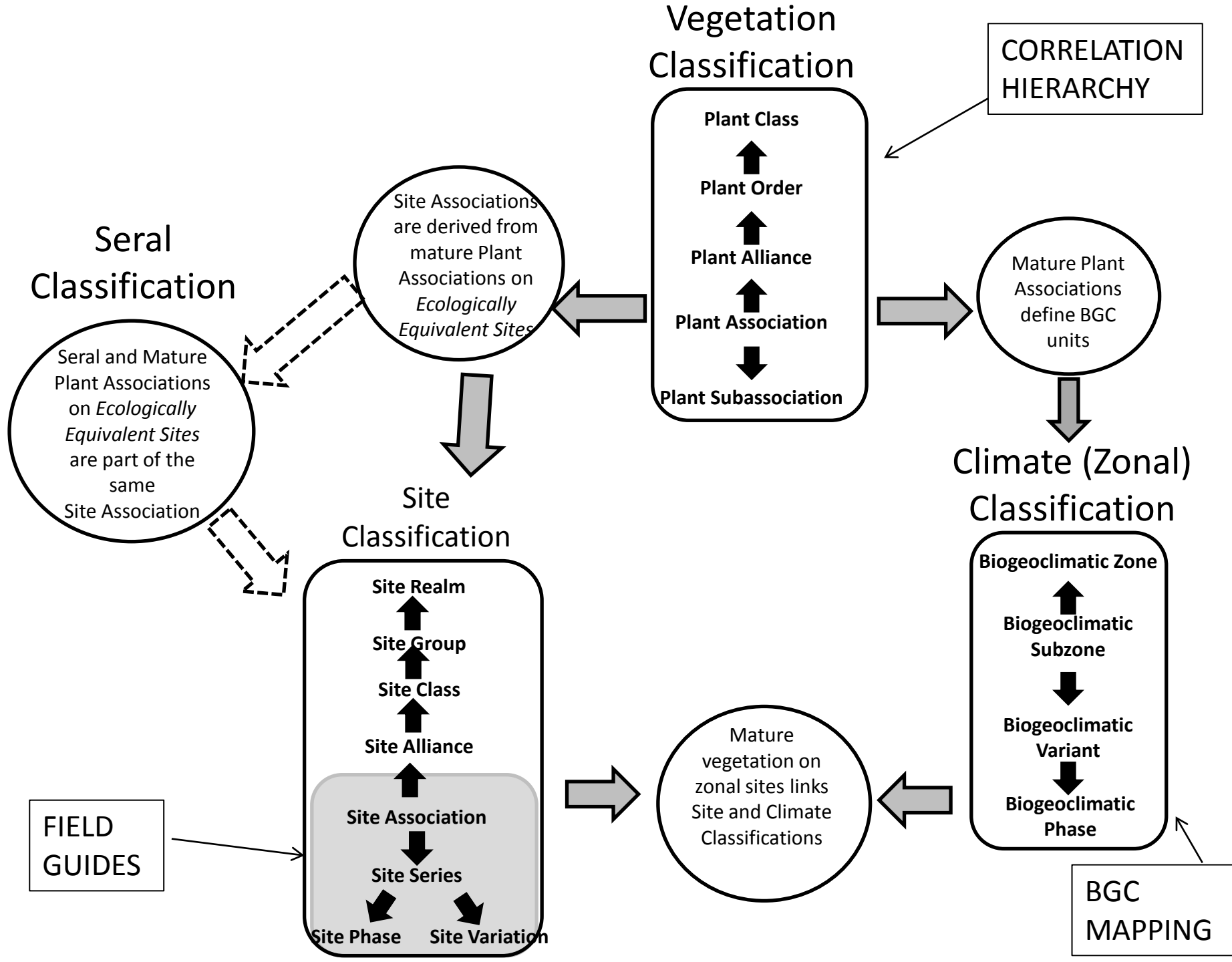


Draft BEC (in progress)

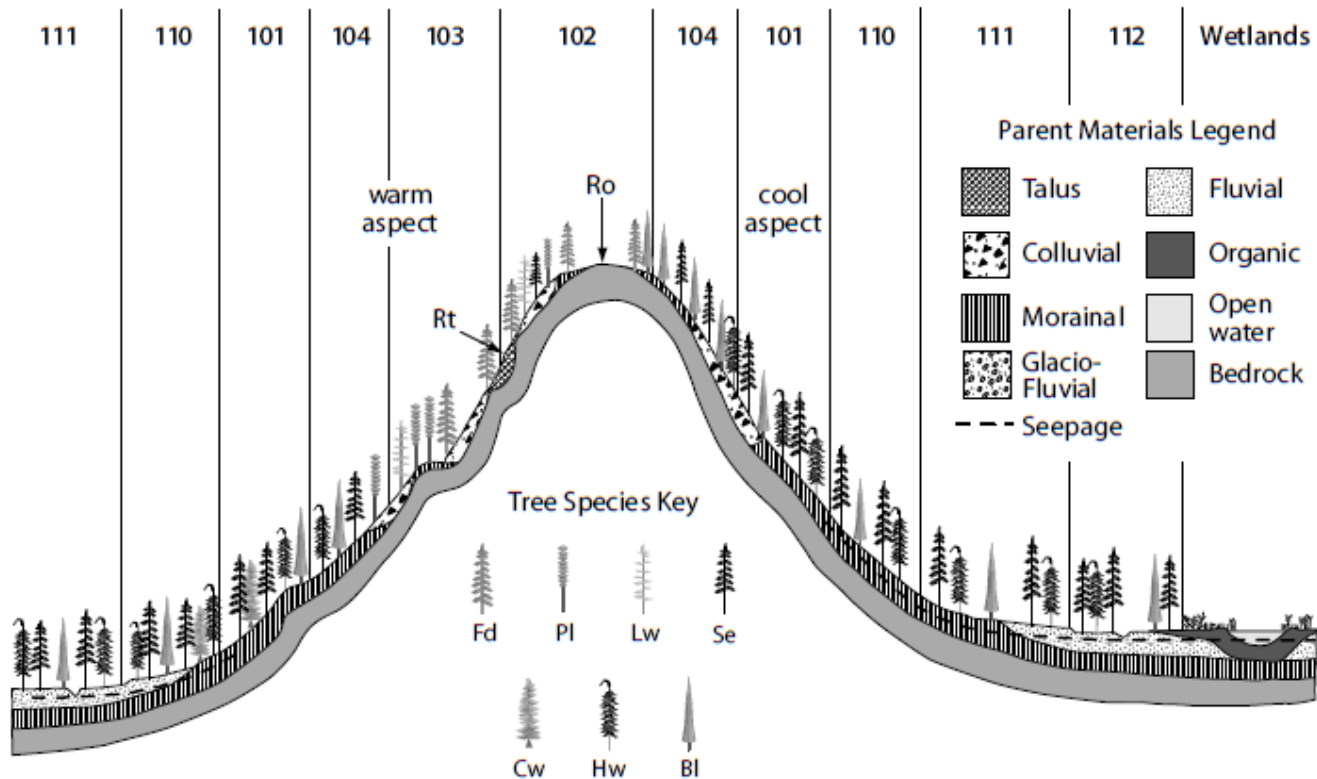


BEC is Not Vegetation Classification

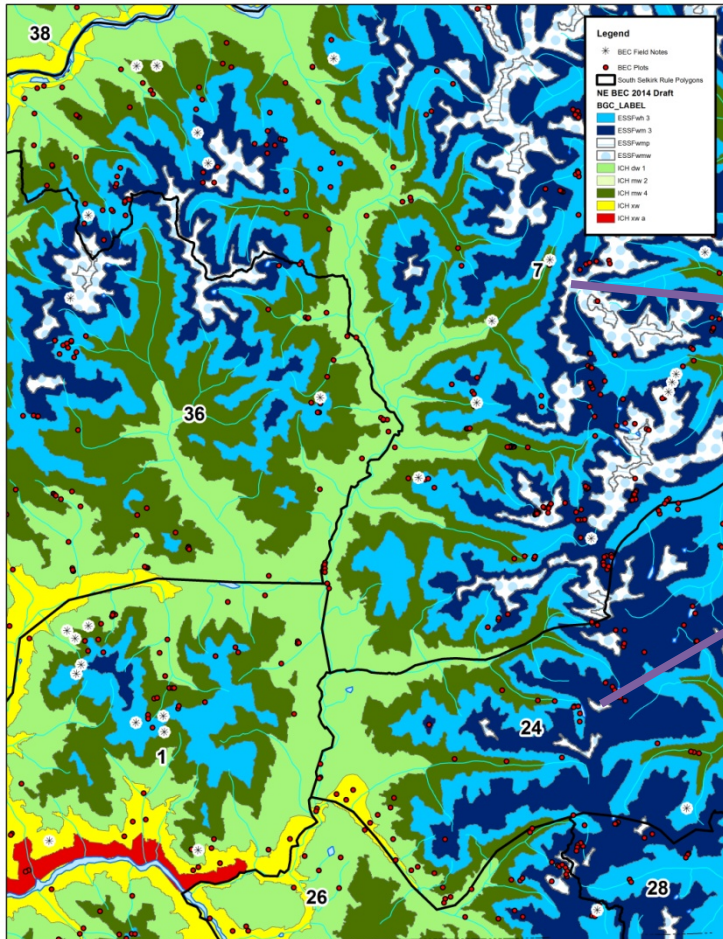
- BEC is a site based classification that uses vegetation as an indicator of site productivity and potential.
- Sites with similar physical characteristics have similar vegetation and productivity potential



Typical Site Series Pattern

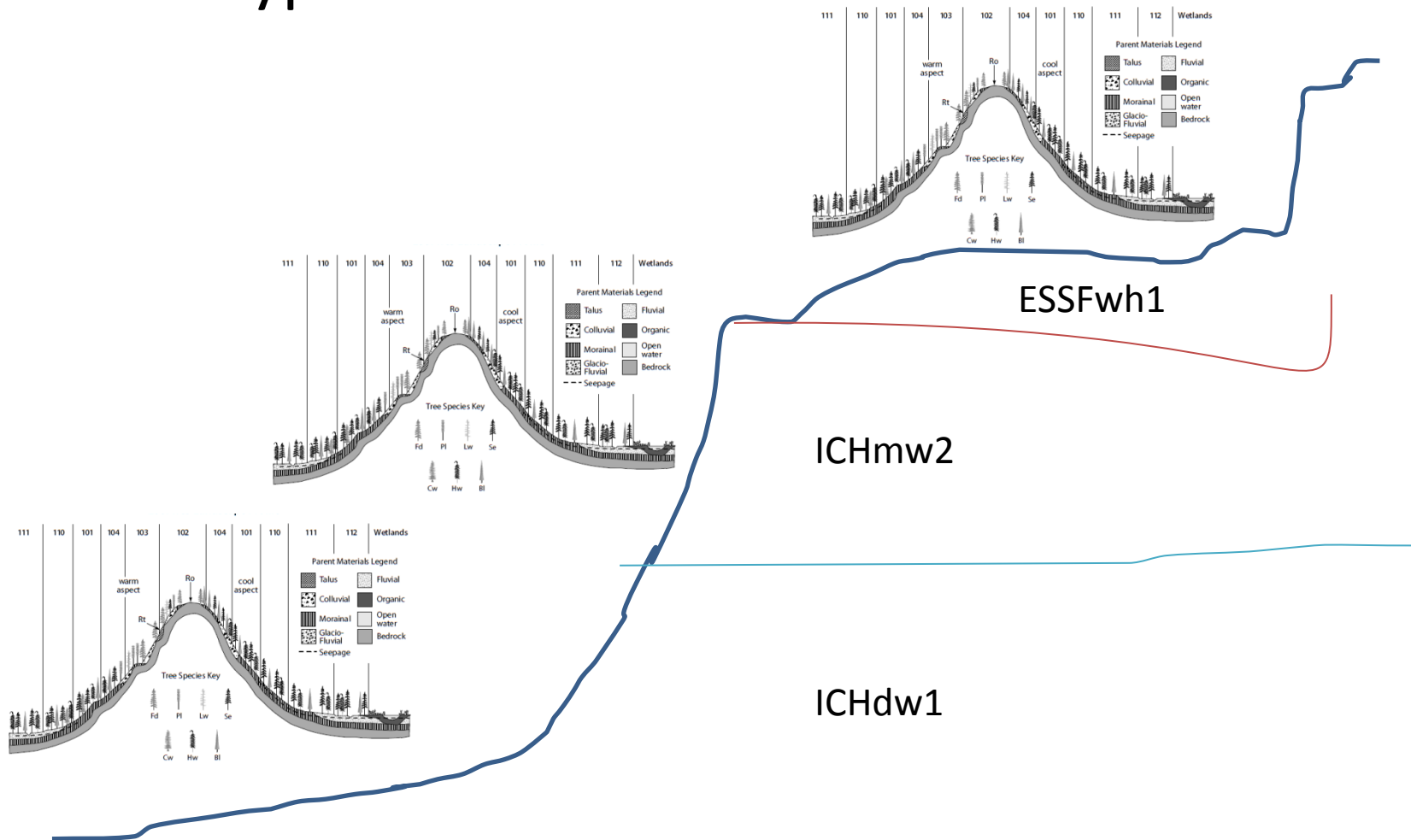


BGC – The Map

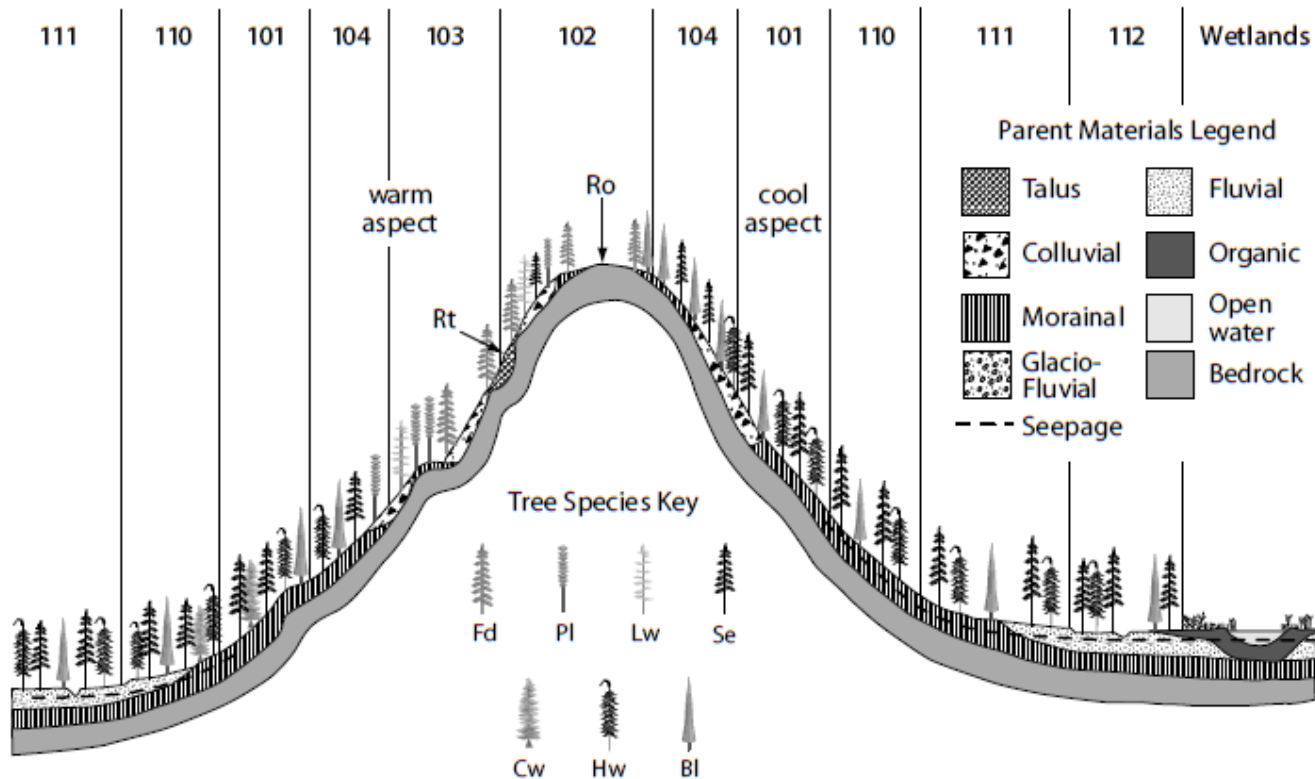


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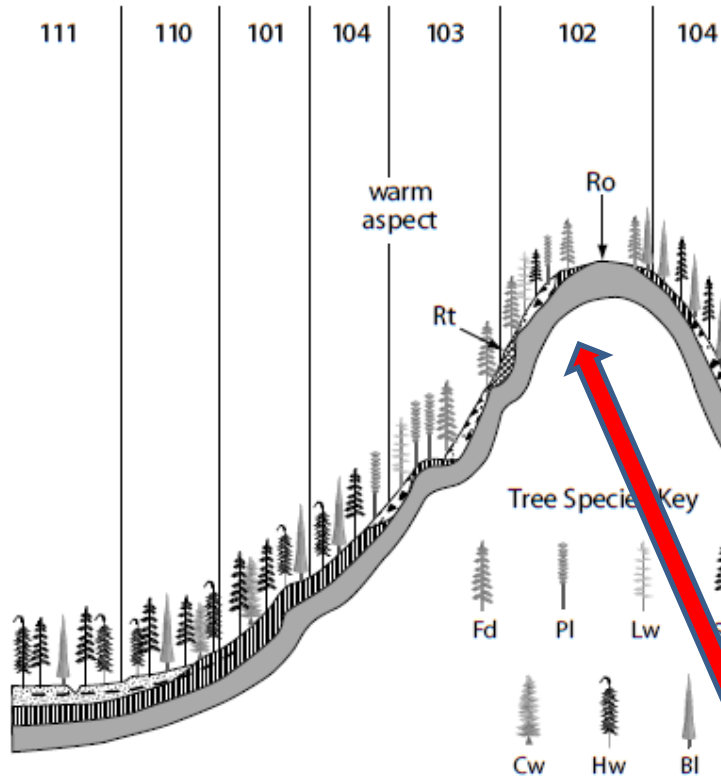
Typical Site Series Pattern



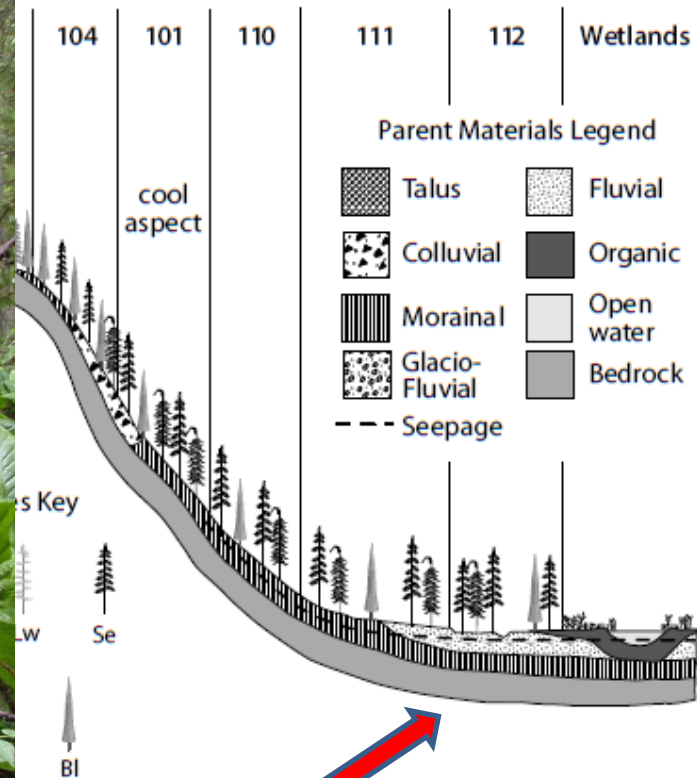
Typical Site Series Pattern



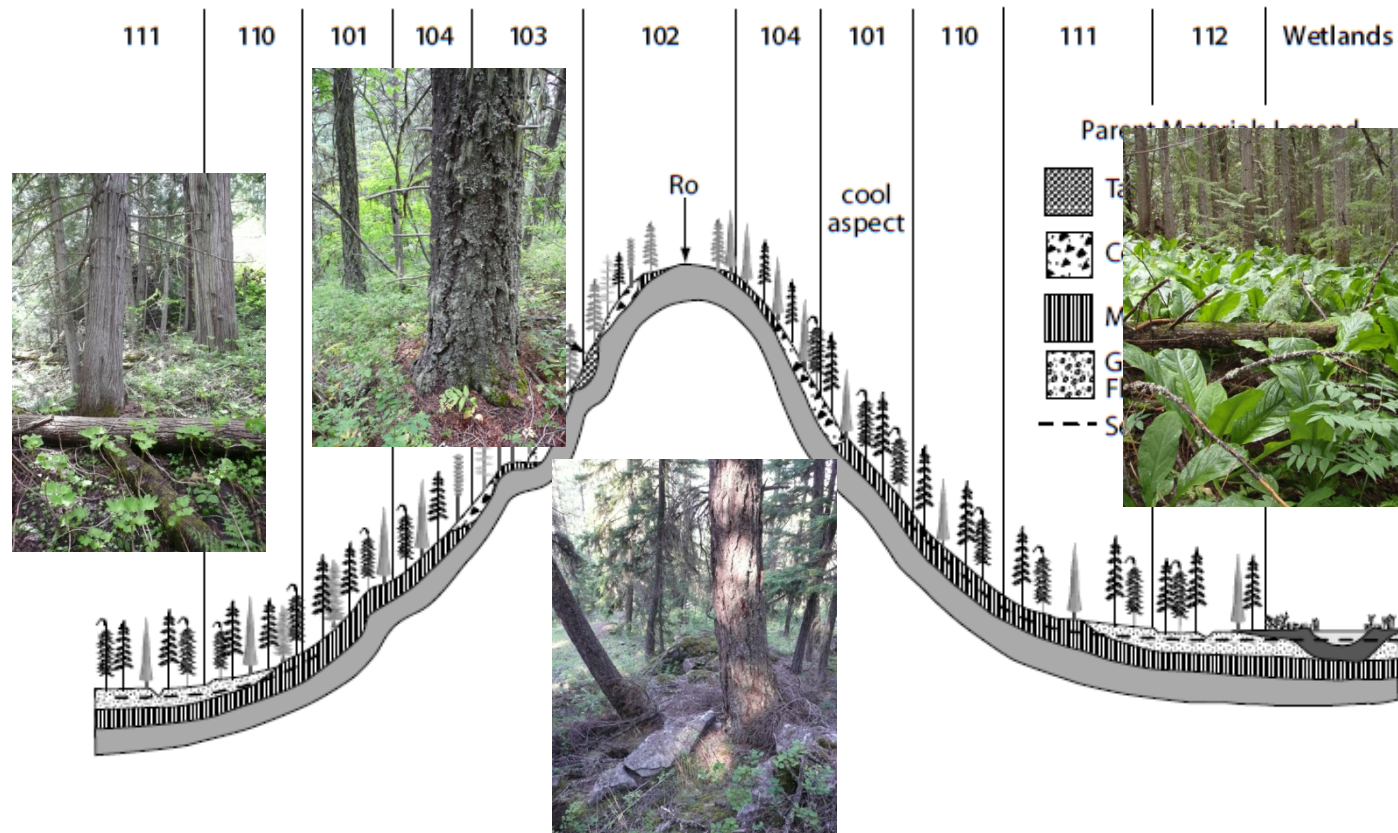
Typical Site Series Pattern



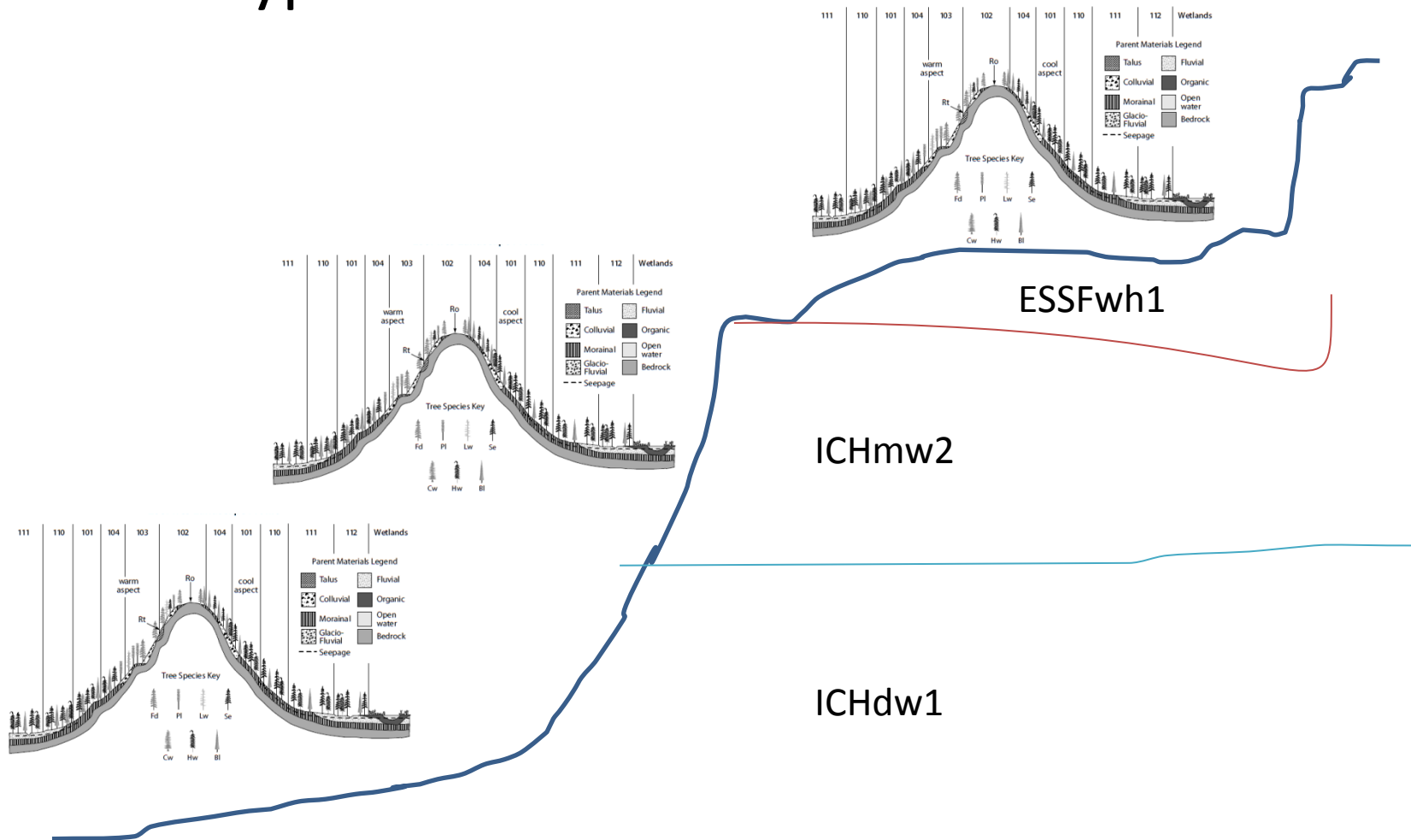
Typical Site Series Pattern



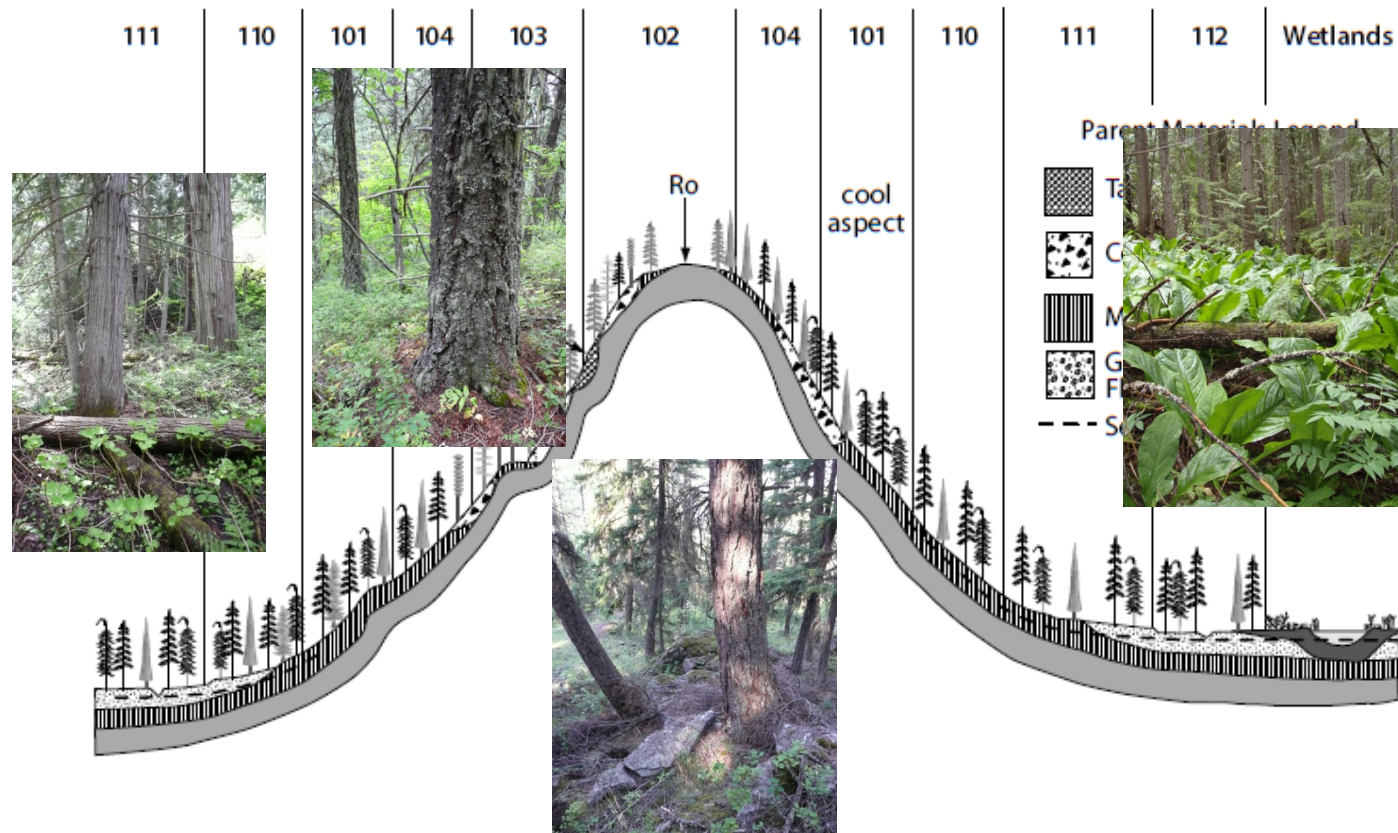
Typical Site Series Pattern



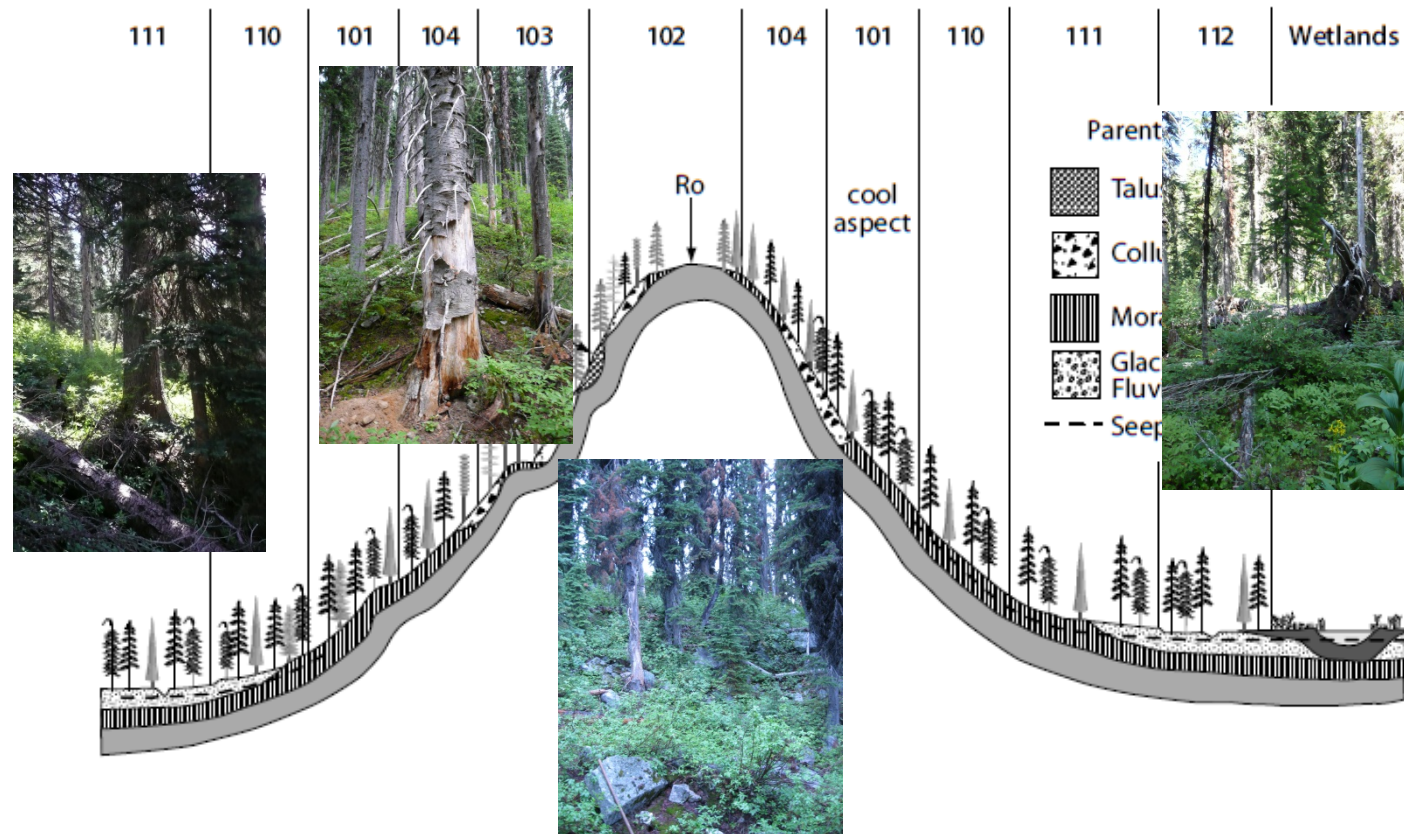
Typical Site Series Pattern



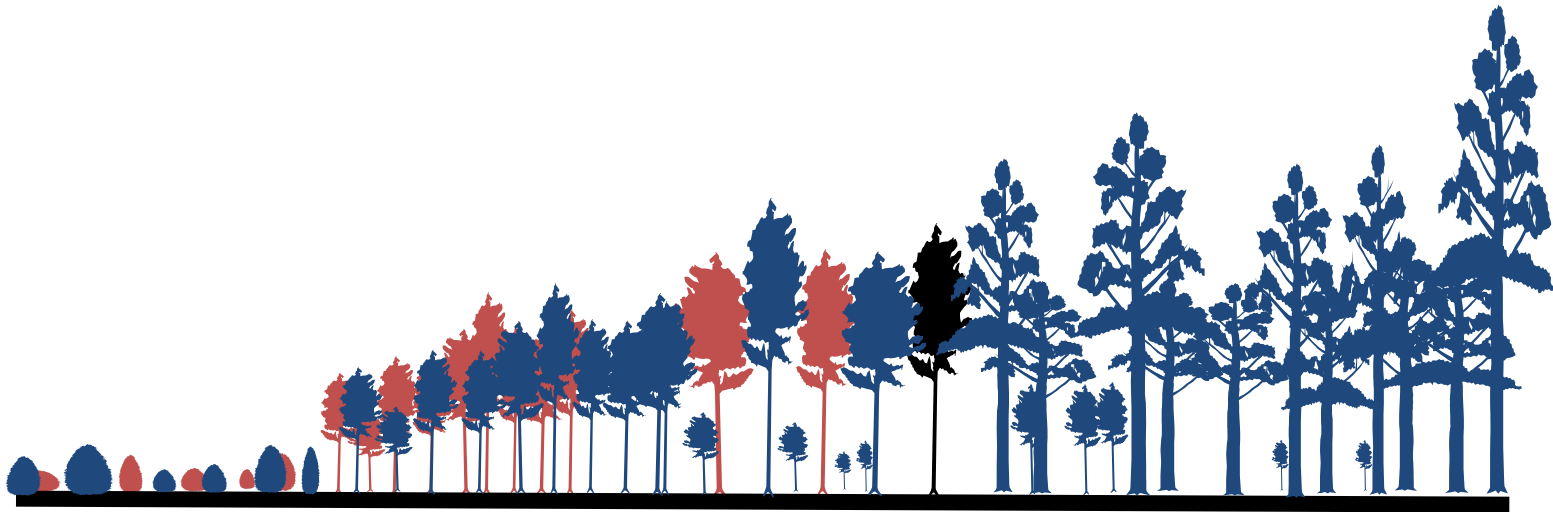
Typical Site Series Pattern



Typical Site Series Pattern



BEC: Succession & Site Potential



Seral
Stage

Shrub-herb
(SH)

Pole-sapling
(PS)

Young Forest
(YF)

Mature forest
(MF)

Old-growth
(OG)

Seral plant
association

\$ Fireweed -
Red
raspberry

\$ PI -
Thimbleberry

\$ PI -
Western
hemlock

CwHw -
Oak fern

Site
association

CwHw - Oak fern

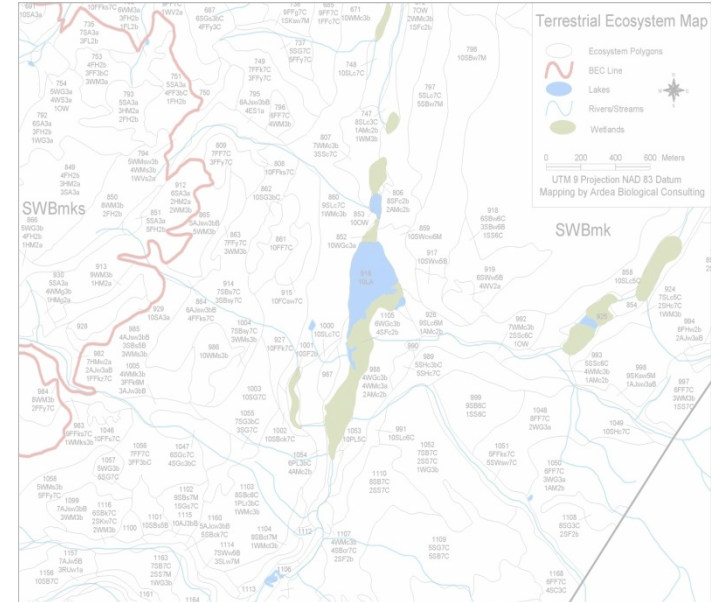
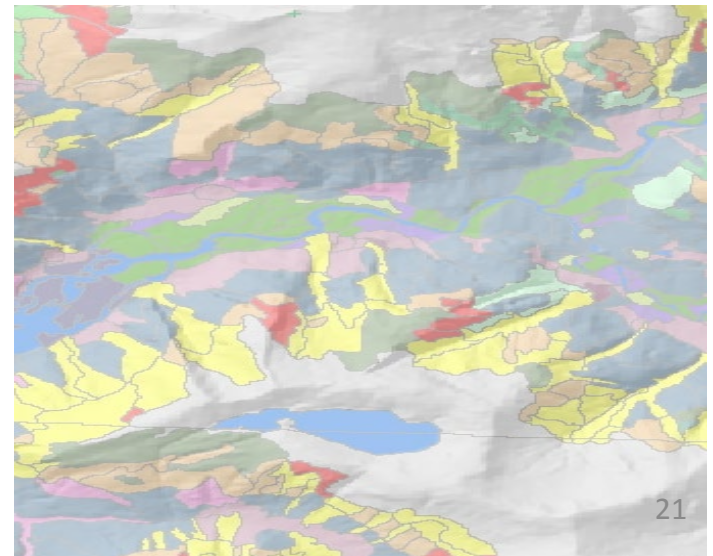
Ecosystem Mapping (e.g., Site Series Mapping)

TEM: Terrestrial Ecosystem Mapping

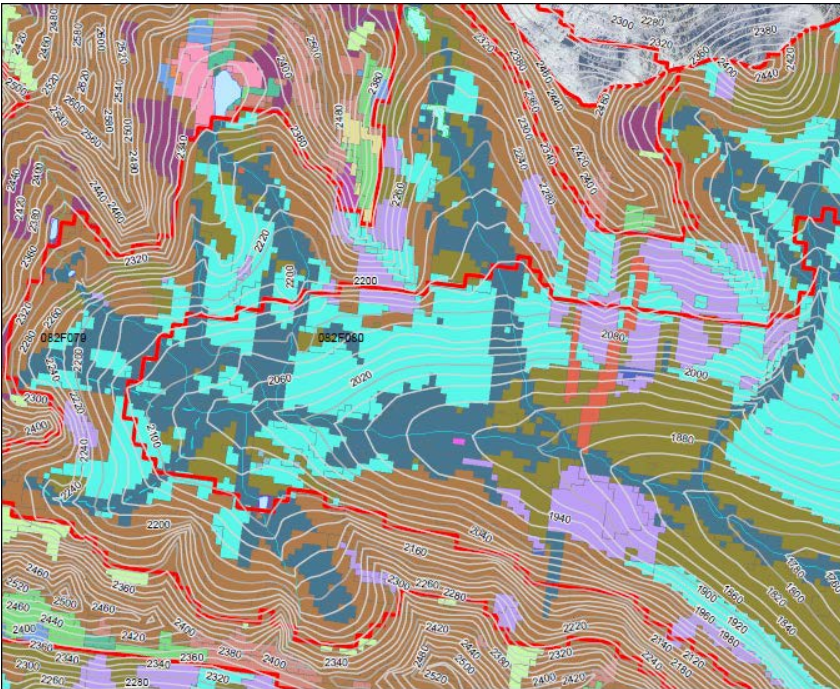
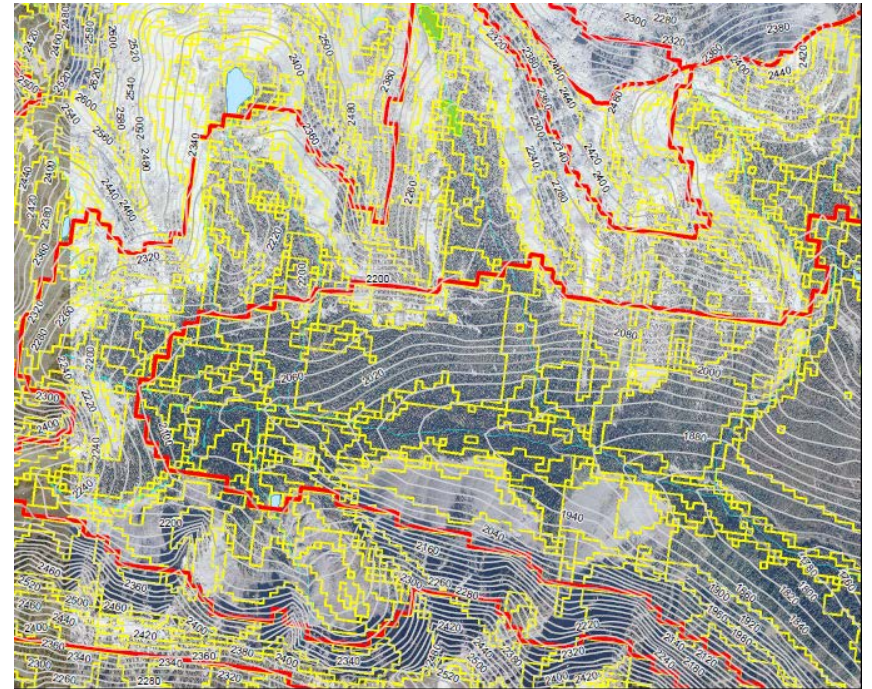
Air photo interpretation

PEM: Predictive Ecosystem Mapping

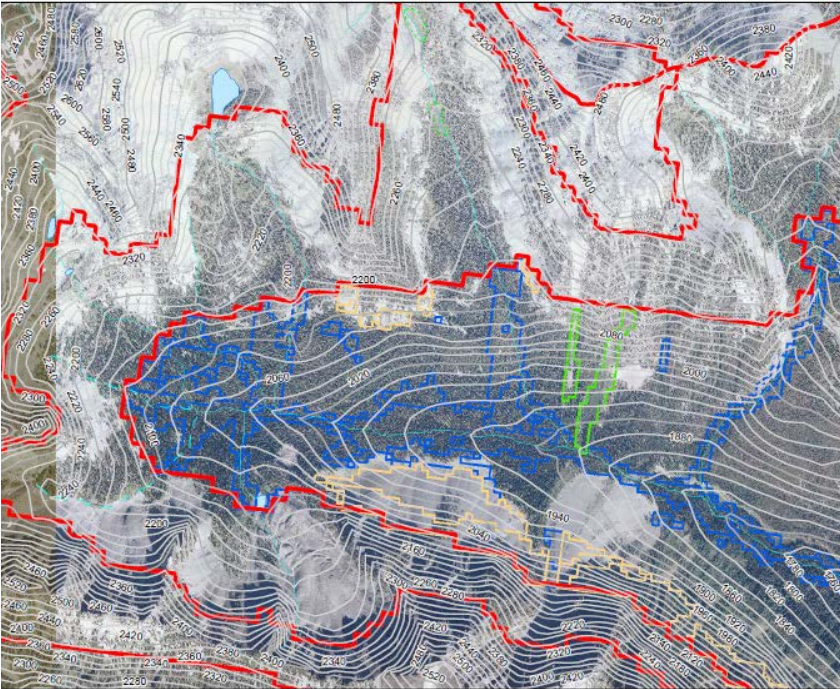
Computer modelling



PEM: Predictive Ecosystem Mapping (e.g., Site Series Mapping)



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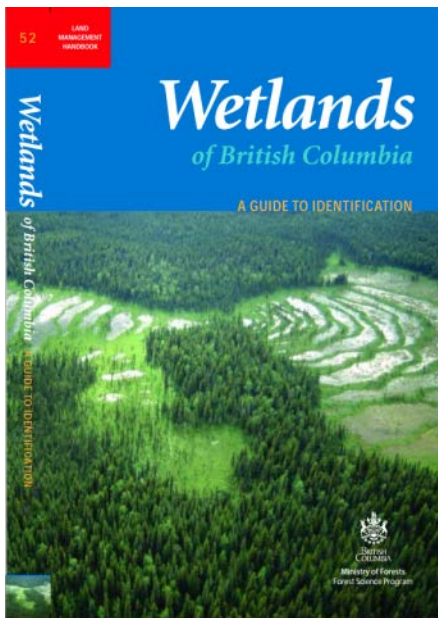
- Blue = Riparian forest (ESSFwm4 /110)
- Green = Shrubby Avalanche (Vs)
- Beige = Rock Outcrop (Ro)

Site Index and BEC Classification

Site index is the most common measure of forest site productivity and forest growth used in British Columbia. These estimates of site productivity serve as an important baseline for forest-level planning and help to formulate silviculture strategies.

Site index is the height of the largest diameter (at breast height) site tree on a 0.01 ha plot at breast height age 50

BGC Unit	Site Series	Site Association	Site Series Summary			
			Species	Sample Size	Mean Site Index	Standard Error
MSxk	02	Fd - Juniper - Grouseberry	Bl		9.0	
MSxk	02	Fd - Juniper - Grouseberry	Fd		12.0	
MSxk	02	Fd - Juniper - Grouseberry	Pl	9	11.9	0.8
MSxk	02	Fd - Juniper - Grouseberry	Sx		12.0	
MSxk	05	FdPl - Pinegrass - Arnica	Bl		12.0	
MSxk	05	FdPl - Pinegrass - Arnica	Fd		15.0	
MSxk	05	FdPl - Pinegrass - Arnica	Pl	12	16.0	0.5
MSxk	05	FdPl - Pinegrass - Arnica	Sx		12.0	
MSxk	06	Pl - Falsebox - Lupine	Bl		15.0	
MSxk	06	Pl - Falsebox - Lupine	Fd		18.0	
MSxk	06	Pl - Falsebox - Lupine	Pl	26	15.9	0.5
MSxk	06	Pl - Falsebox - Lupine	Sx	8	14.1	1.2
MSxk	07	Sxw - Trapper's tea - Grouseberry	Bl		12.0	
MSxk	07	Sxw - Trapper's tea - Grouseberry	Pl	18	17.1	0.7
MSxk	07	Sxw - Trapper's tea - Grouseberry	Sx	7	14.6	2.2
MSxk	08	Sxw - Gooseberry - Grouseberry	Bl		15.0	

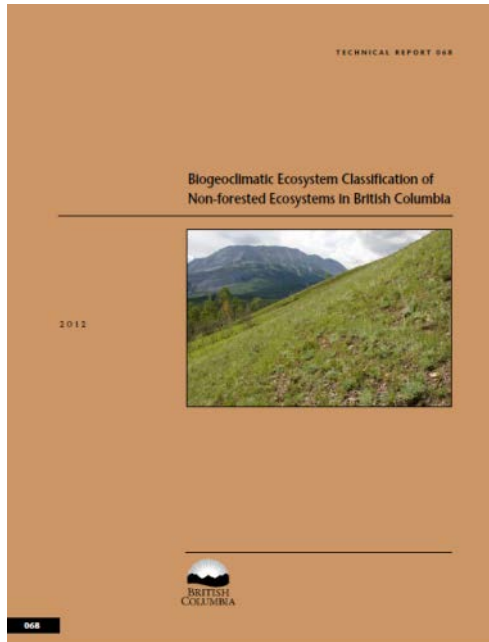


<http://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh52.htm>

Site Series Numbering Order Convention – Non-forested Units

2004 – introduction of BEC coding for wetlands

- Wf – fen
- Wb – bog
- Wm – marsh
- Ws - swamp



2012 – Biogeoclimatic Ecosystem Classification of
Non-forested Ecosystems in British Columbia

- expanded BEC codes to other non-forested ecosystems in BC

<http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr068.pdf>

Non-Forest – “N-BEC”

ALPINE



(Ag) Altai Fescue alpine grassland



(Am) Northern Alpine meadow

FLOOD PLAIN



(Fl) Drummond's willow - Bluejoint ecosystems occur on levees adjacent to low gradient streams



(Fm) Cottonwood ecosystems are found on active floodplain of small to large rivers at low elevations

Non-Forest – “N-BEC”

GRASS- LANDS



(Gg) Grasslands dominate the landscape in areas of arid macroclimate, junction of Fraser and Chilco Rivers.



(Gs) Dry sites that support shrubs are members of the Shrub-steppe class, often occur in conjunction with Gg ecosystems

SUB- ALPINE



(Sk) Whitebark pine and subalpine fir krummholz on rubbly insulated slope



(Vs) Sitka alder is common and dominant in many avalanche tracks in the snowy regions of BC

Field Guides

A Field Guide for Site Identification and Interpretation for the Nelson Forest Region

Part 1

Land Management Handbook NUMBER **20**

ISSN 0229-1622

May 1992

1996 Reprinted with corrections



Ministry of Forests

A Guide to Site Identification and Interpretation for the Kamloops Forest Region

Part 1

Land Management Handbook NUMBER **23**

ISSN 0229-1622

February 1990



A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region

Land Management Handbook NUMBER **28**

ISSN 0229-1622

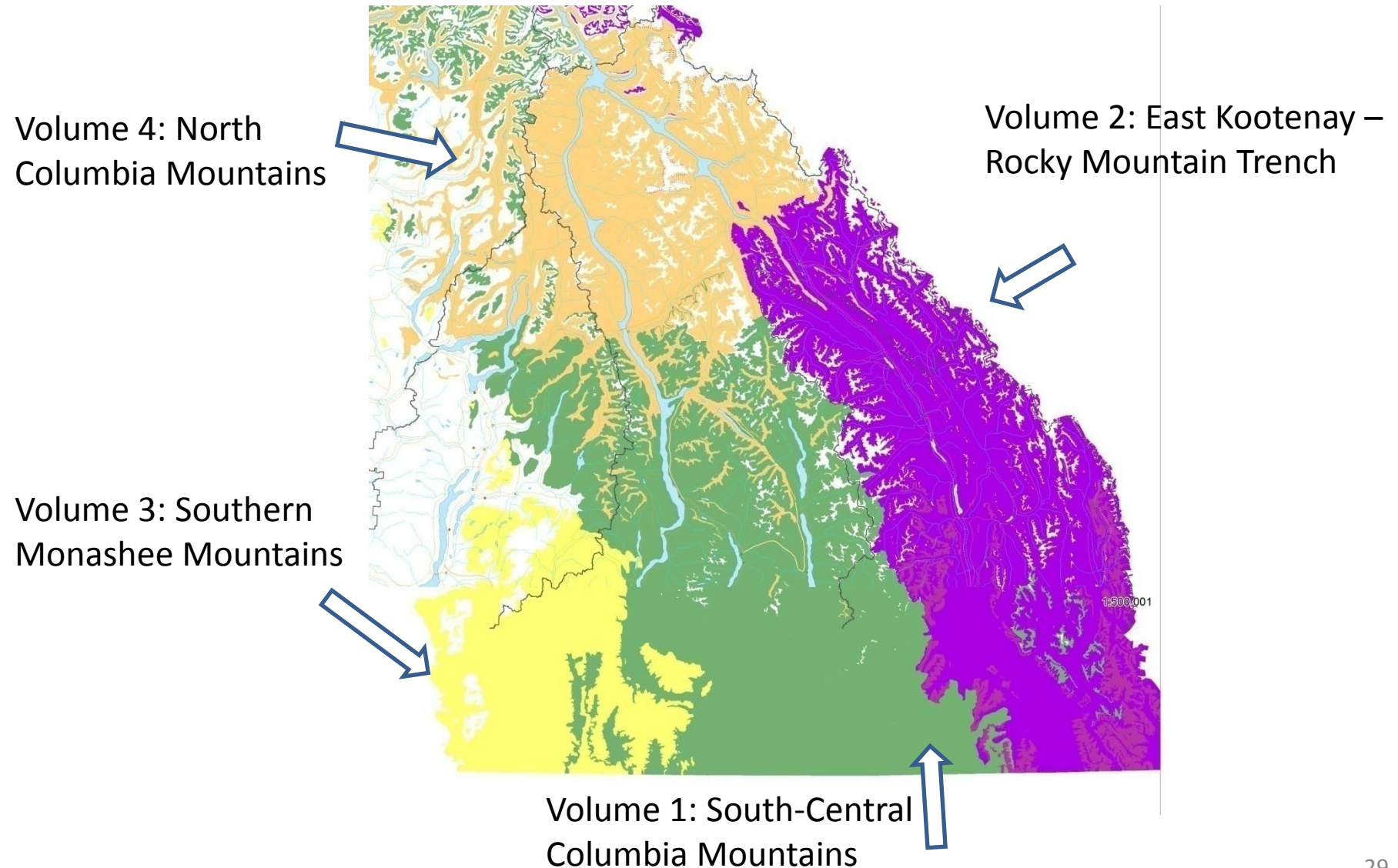
1994



Province of
British Columbia
Ministry of
Forests

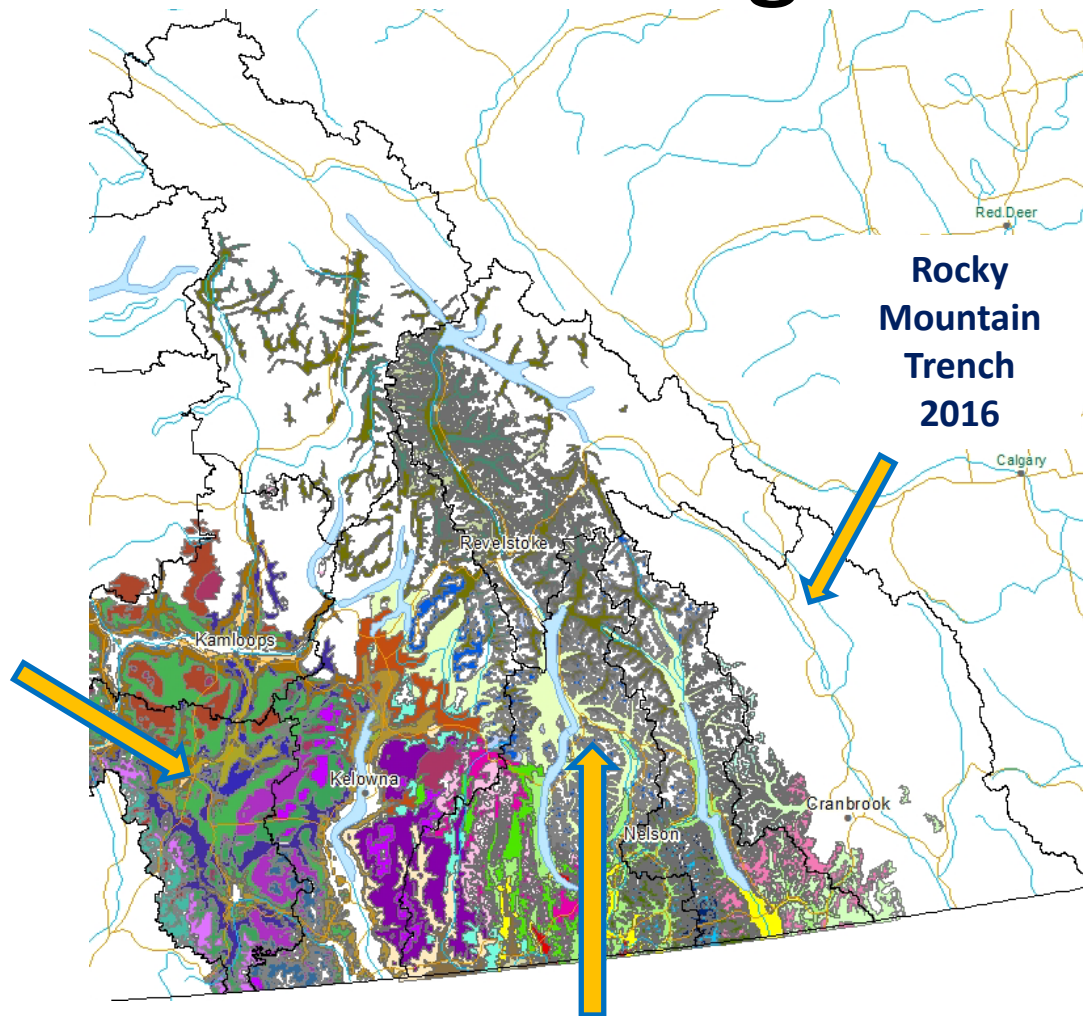


Field Guides and BGC Mapping



BEC Changes

**Merritt
TSA
2016**



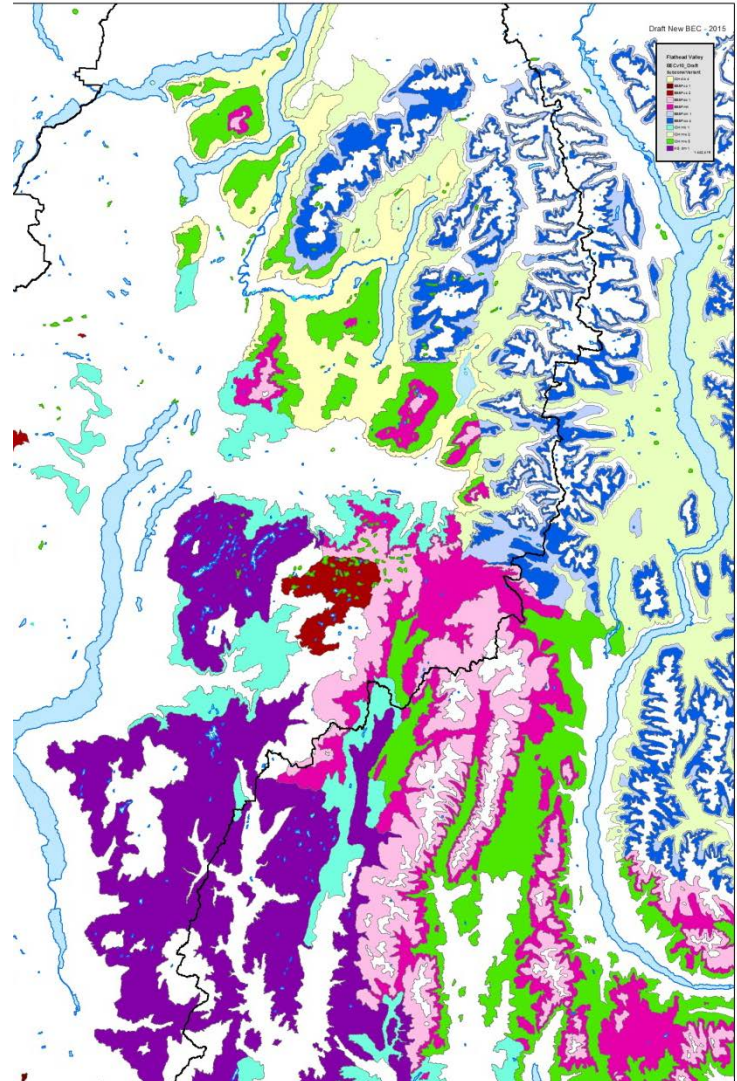
**Columbia
Mountains
2015 / 2016**

New field guides, along with a new set of stocking standards, are expected over the next two – four years.

Some changes of note

Okanagan-Shuswap

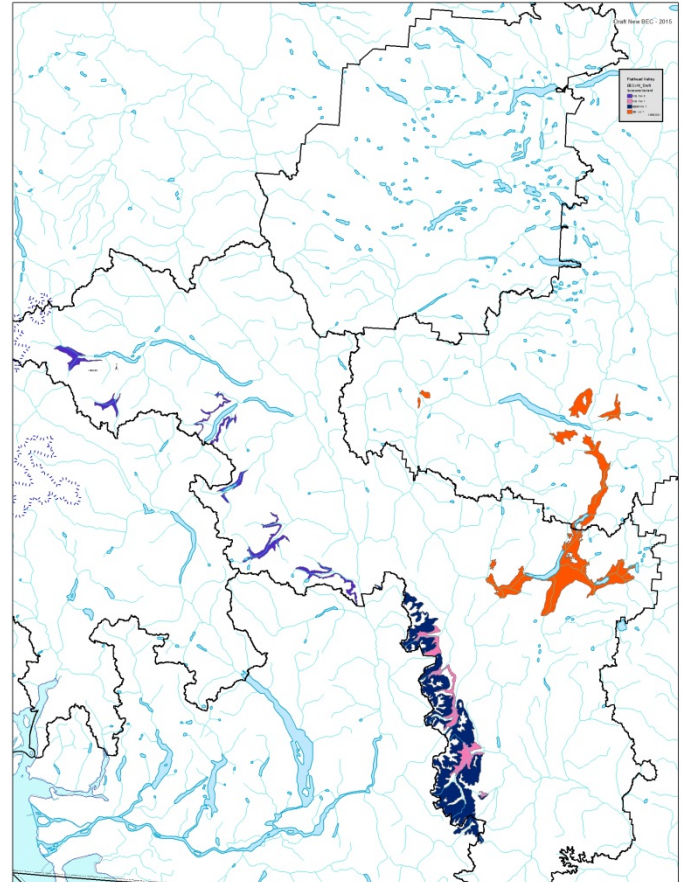
- ICHmw2 split; southern portion is ICHmw5
- ICHdw4 added
- ICHmk1 mapping adjusted
- MSdm1 / IDFdm2 mapping re-done
- ESSFdc1 / dc2 / xc2 / wc4 mapping changed
- New ESSFmh added
- ESSFwh1 expanded



Some changes of note

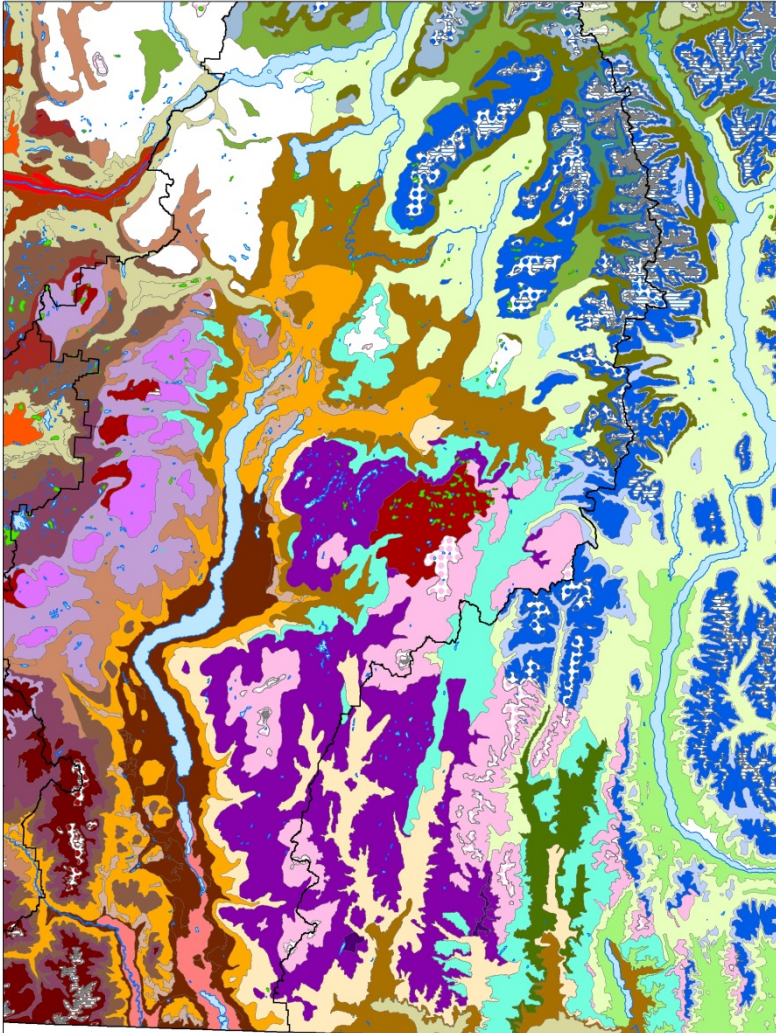
Merritt

- MSmw1 and mw2 changed to ESSFmw1 and mw2
- ESSFmw1 / mw2 changed to ESSFww1 / ww2
- BGxw added

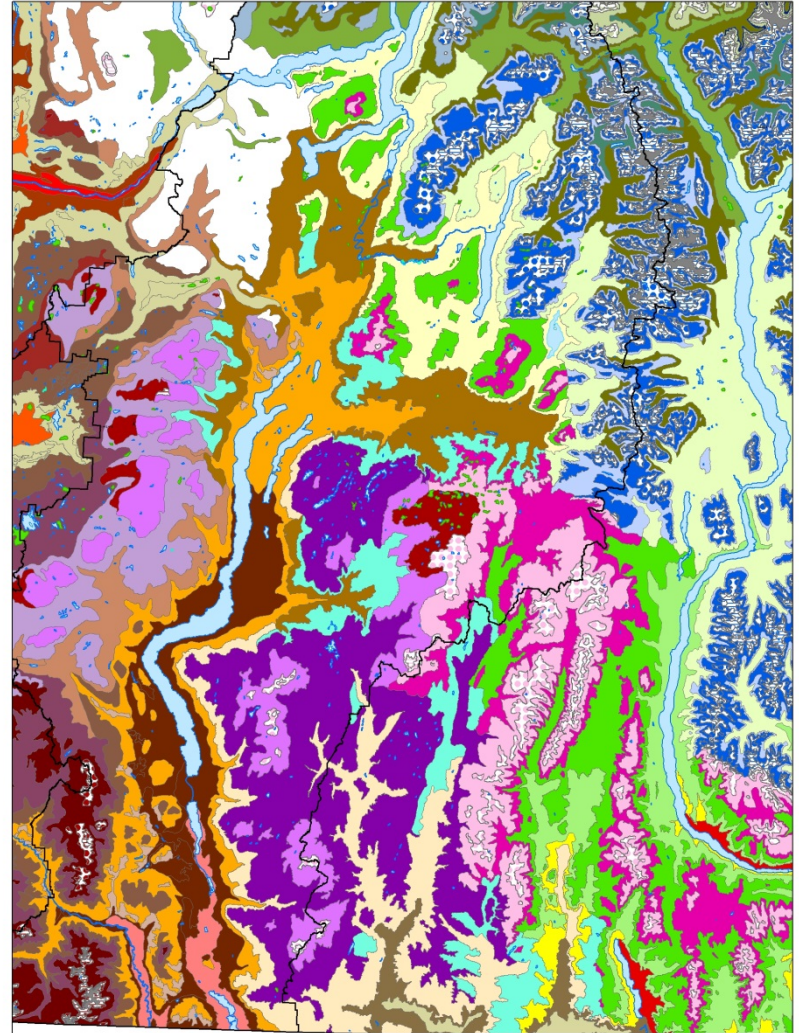


New BEC in the Southern Interior

Official BEC (v9)



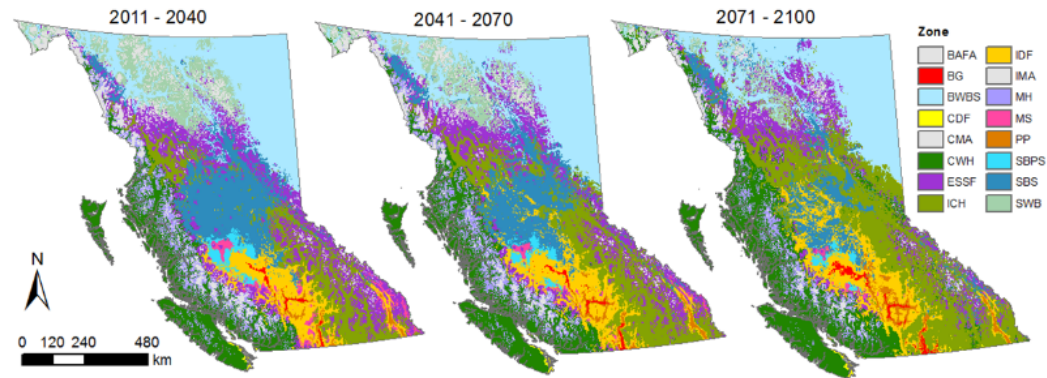
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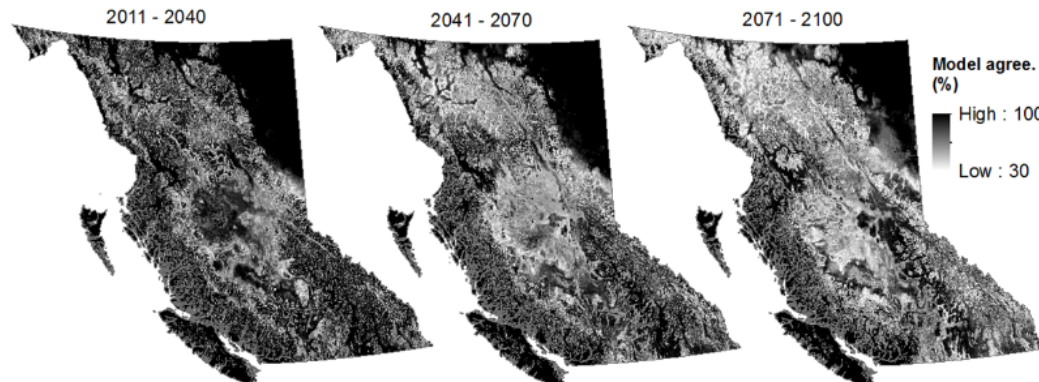
Projecting the Future

Consensus projections

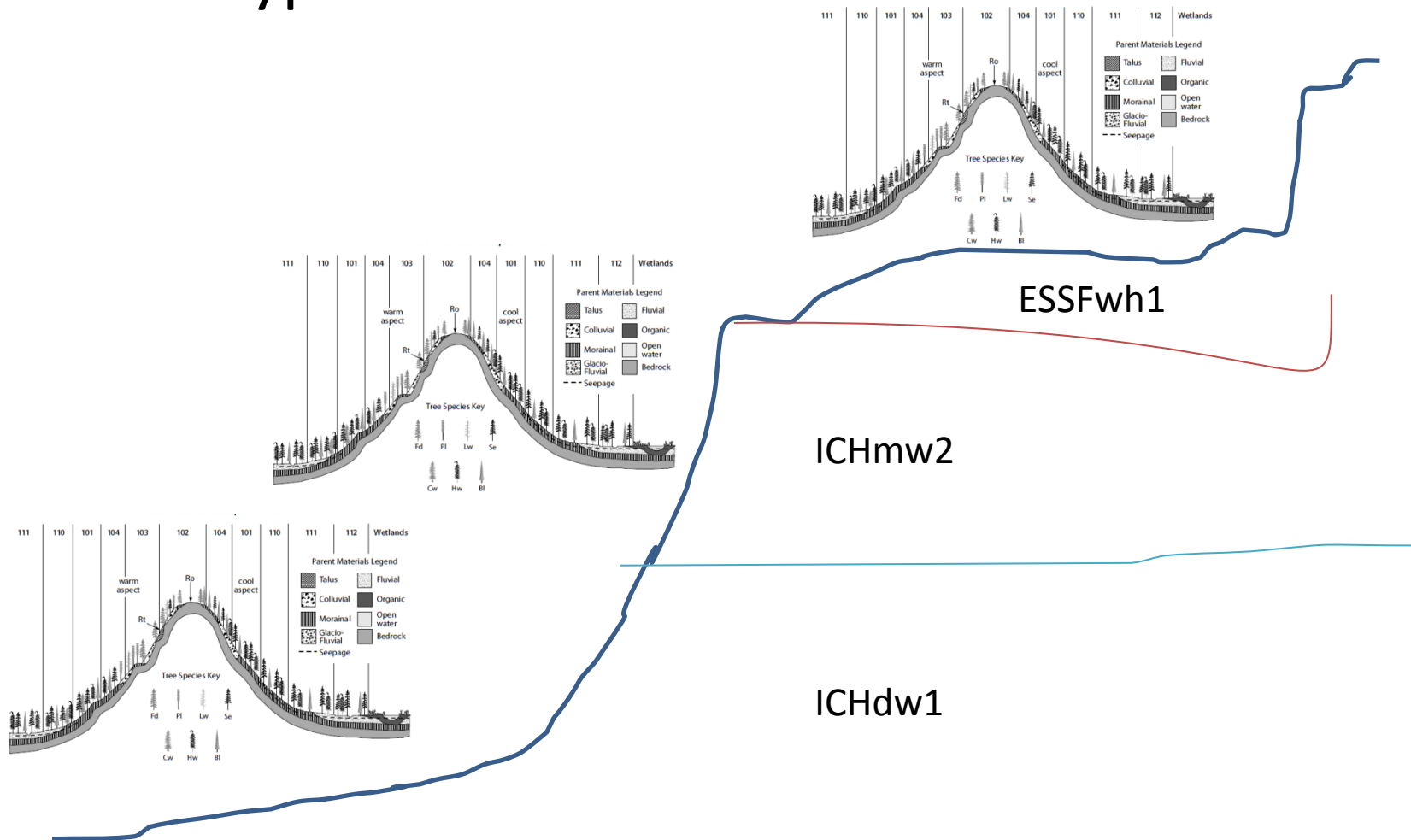
Based on projected changes in temperature and precipitation, 20 climate change scenarios were selected to represent the range and distribution of the projected changes by over 140 climate change scenarios from the IPCC Fourth Assessment. Shifts in bioclimatic envelopes for BC ecosystem zones were projected based on each of the 20 climate change scenarios. A consensus projection for a future period was generated based on the most frequently projected ecosystem zone for each pixel among the 20 individual projections.



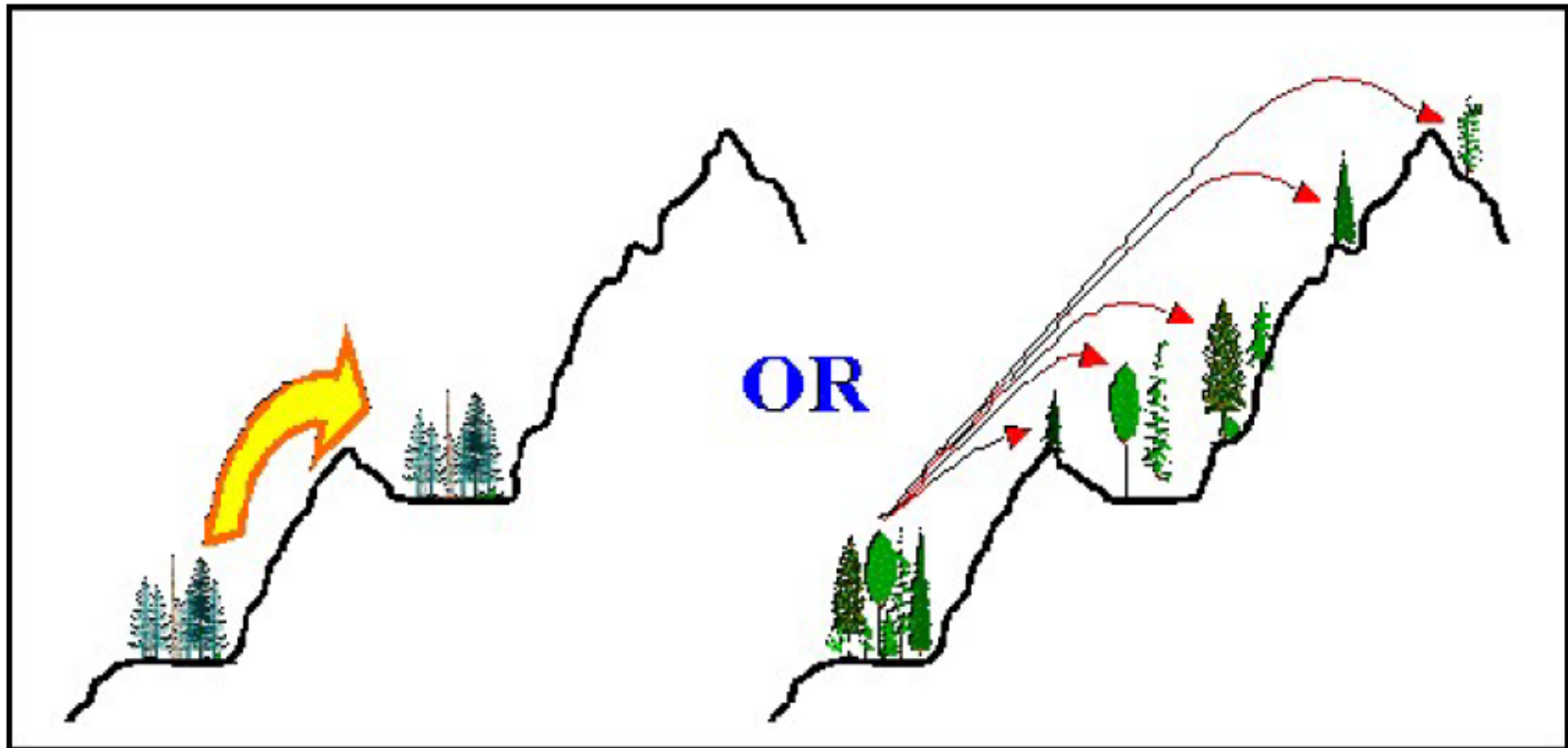
We used the level of the model agreement among the 20 individual projections to represent the level of uncertainty of the ecosystem climate niche under climate change.



Typical Site Series Pattern



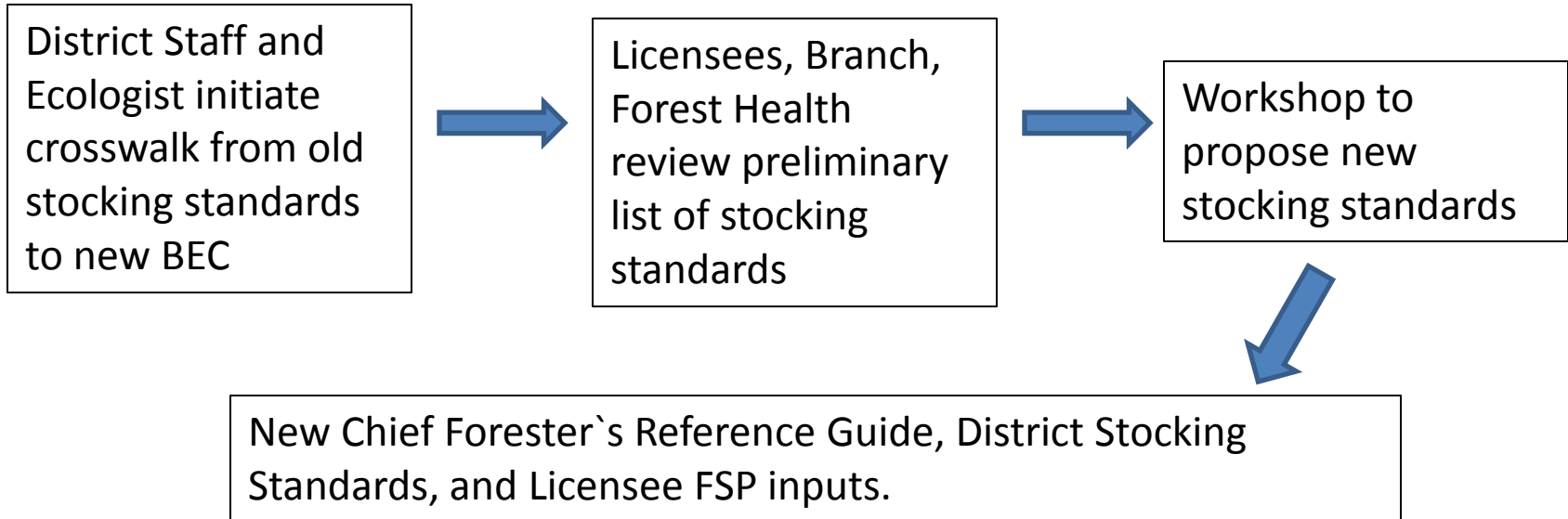
Ecosystem Change



A map of the Kootenai region in British Columbia, Canada. The map shows the Columbia River flowing through the area. Major cities and towns are marked: Kamloops, Kelowna, Revelstoke, Nelson, and Cranbrook. The Kootenay Lake is also shown. The map is divided into three colored regions: Columbia (orange), Rocky Mountain (pink), and Cranbrook (light blue). The Columbia region is the largest and is located in the north. The Rocky Mountain region is to the east of the Columbia region. The Cranbrook region is to the south of the Rocky Mountain region. The map also shows the border between British Columbia and the United States.

[illegible][illegible]

Stocking Standards



Advantages are many – by working together, we can develop a consistent set of stocking standards that are supported by Districts. This will reduce overall workload since each licensee will not have to develop their own (unless they choose to), and District staff will have `pre-reviewed` standards in the development stage.

Licensees will still be able to propose alternatives where desired.

Districts will still have the ability to review Stocking Standards

Management Applications: Stocking Standards

A45																											
BGC				Regeneration Guide																Free Growing Guide				DKL differences		DCO differences	
Classification				Species				Stocking(I)				Regen				Assessment				Min. Height(u)							
				Conifer				Target				Delay				Earliest				Latest		Species		Ht			
								(web-spaced/ha)				(Mm-yr)				(yr)				(yr)							

Management Options

**Use Redundancy*



Spread risks



TRIAGE: Sort & Tag

Red	Urgent, treatable
Yellow	Mid urgency; soon to become red
Green	Stable, low priority
Black	Untreatable, lowest priority

FRAMEWORK FOR MANAGEMENT

- *Create **Resistance** to Effects of Climate
- *Increase **Resilience** to Climate Change
- *Allow Ecosystems to **Respond** to Climate Change
- ***Realign** Highly Altered Ecosystems to Current Processes
- ***Reduce** Greenhouse Gases & Ecologic Footprint
- *Set **Priorities** and Practice **Triage**

Toolbox Approach

- ✧ No single solution fits all cases
- ✧ **Suite of options available**
- ✧ Mix & match tools to create appropriate strategy

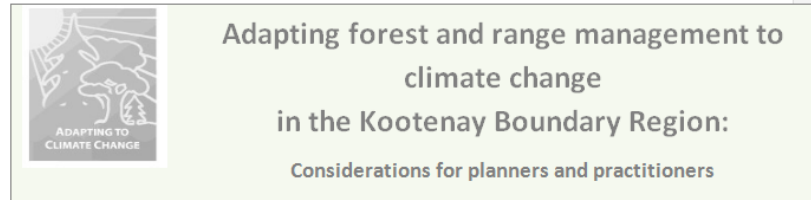
Role of models:

Evaluate uncertainty of information and risk of uncertainty to management outcome

→ deterministic or indeterministic strategy?
("eggs in one basket" vs "bet-hedging")

Source: Millar 2013

Regional Extension Notes



1. About this Series

Climate change will fundamentally change ecosystems in British Columbia. Therefore, adapting forest and range management to climate change is necessary to foster resilient¹ 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 research² to summarize, for each region, projected climate changes, impacts to ecosystems, and adaptation strategies. Where regional information is limited, information is drawn from provincial-scope research.

This extension note is intended to help planners, practitioners and decision-makers with planning under the *Forest and Range Practices Act*, assessing cumulative effects, developing climate change action plans, and monitoring the effectiveness of adaptation practices. Endnotes provide references and further sources of information.

FLNR: Regional Extension Notes

20-25 page summaries for each of the 8 Natural Resource Regions in BC

Expected release: December 1, 2015

For more information:

- BECweb website:

<http://www.for.gov.bc.ca/hre/becweb/>

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