

The Distribution & Ecology of Western White Pine (*Pinus monticola*)

Dennis Lloyd & Mike Ryan
MoF&R Research, Kamloops



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- *Implications of Climate change*
- *Summary*

Taxonomy

- **Pinus monticola**
 - Douglas ex D. Don 1832
- **Some common names**
 - Western white pine,
 - Silver pine,
 - Soft pine,
 - Fingercone pine,
 - Mountain pine,
 - Idaho pine,
 - Little sugar pine

“Pw”

The State Tree of Idaho

Needles

- 4-10 cm long by 0.7-1 mm wide
- Needles 5 per fascicle
- straight, slightly twisted spreading to ascending
- persisting 3-4 years
- blue-green
 - lower surfaces lacks stomatal lines
 - upper surfaces have stomatal lines
- margins minutely serrated
- tips broadly tonarrowly acute
- sheath 1-1.5 cm, shed early





Cones

- Staminate cones ellipsoid, 10-15 mm, yellow
- 10-25 cm long, creamy brown with purple or gray tints, resinous, stalks to 2 cm
- Ovulate cones maturing in 2 years
- sheds seeds soon after mature



Pw Bark

Characteristics

- grey and thin,
- smooth when young,
- furrowed into distinctive rectangular to hexagonal scaly plates in large older individuals



Relative Thickness

Thick - Lw, Fd

- Py

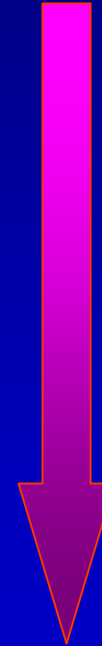
- Bg,

- Pw, Hw, Hm

- Cw

- Ss, Se, Sx,

Thin Pl, Bl, Yc,



Reproductive Cycle



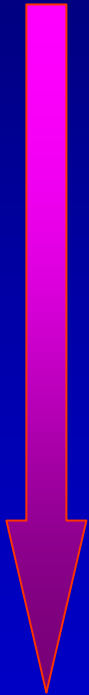
- monoecious,
- 3 seasons for seed to mature
- can begin cone production at 7 yrs
- cone production not increased by adding water, fertilizer
- thinning plus fertilizer shown to increase cone production
- seeds viable 3-4 yrs 40% yr 1 25% yr 2 1-2% yr 3-4

Additional Regeneration Info.

- Pw among the most consistent seed producers
- Among the easiest to store
 - least susceptible to high or low temperatures
- Among the slowest to germinate
- Heavy seed,
 - generally falls with 120 m of parent (to 800m)
- Prefers mineral seedbed

Seed Crop Frequency

Frequent & Regular



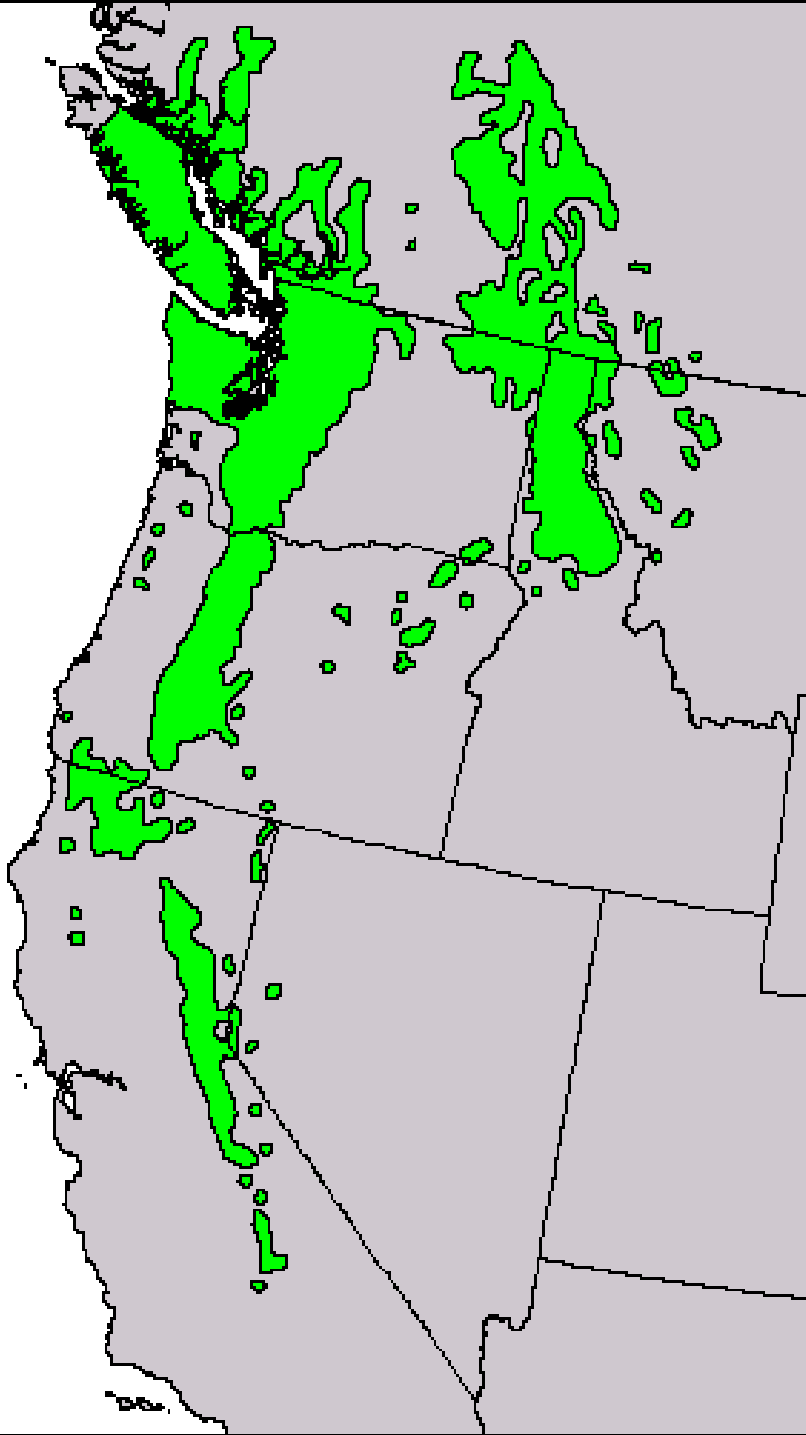
- Act
- **Pw**, Pl
- Hm, Hw, Bl, Bg, Ba, Se
Cw
- Fd, Lw
- Py, Sb, At

Least Frequent
& Irregular

Genetic Variation

- Evidence of little geographic or ecologic differentiation of Pw populations
 - small genetic variation detected
- Seed can be transferred with less regard to elevation, latitude, longitude, or habitat type.

The Distribution of Western White Pine



The occurrence of Pw in BC by Biogeoclimatic Zone

Relative abundance of Western White Pine			
> 90%	5 - 10%		0%
Common & Abundant	Minor or Locally abundant		Absent
ICH & CWH			
	MH, ESSF	CDF	IDF & MS
	<div> <div>BG, PP, (IDF & MS)</div> <div>SBPS, SBS, SWB, BWBS, AT</div> </div>		

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	MH, ESSF	IDF & MS			
			CDF	BG, PP, (IDF & MS)	SBPS, SBS, SWB, BWBS, AT
Geographic Restrictions			Limiting Climatic Factor		
South of 52 degrees Latitude	Lower elevations & Southern Latitudes	Coast-Interior transition & Interior Wetbelt-Drybelt transition	Drought	Drought	Temperature

Alaska

The Presence and Abundance of Pw in BC

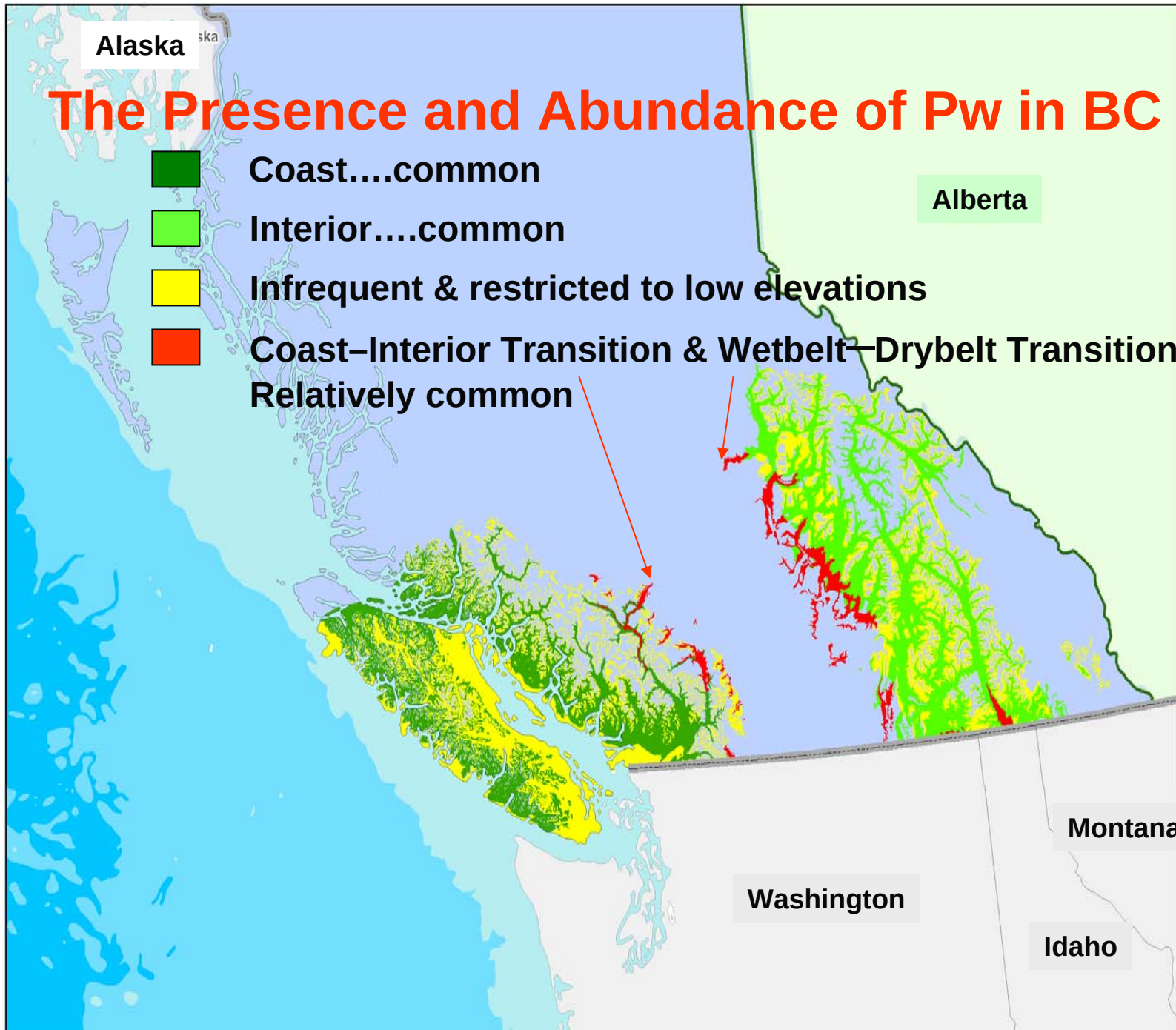
- Coast....common
- Interior....common
- Infrequent & restricted to low elevations
- Coast-Interior Transition & Wetbelt-Drybelt Transition
Relatively common

Alberta

Montana

Washington

Idaho



Elevation Range



- In British Columbia
 - Coast 0 - 1200 m
 - Interior 300 - 1600 m
- Washington, Oregon, Idaho & Montana
 - Coast 500 - 1500 m
 - Inland 300 - 1900 m
- California
 - Sierra-Nevada 2000 - 2500 m
 - San Bernardino Mtns. to 3500m

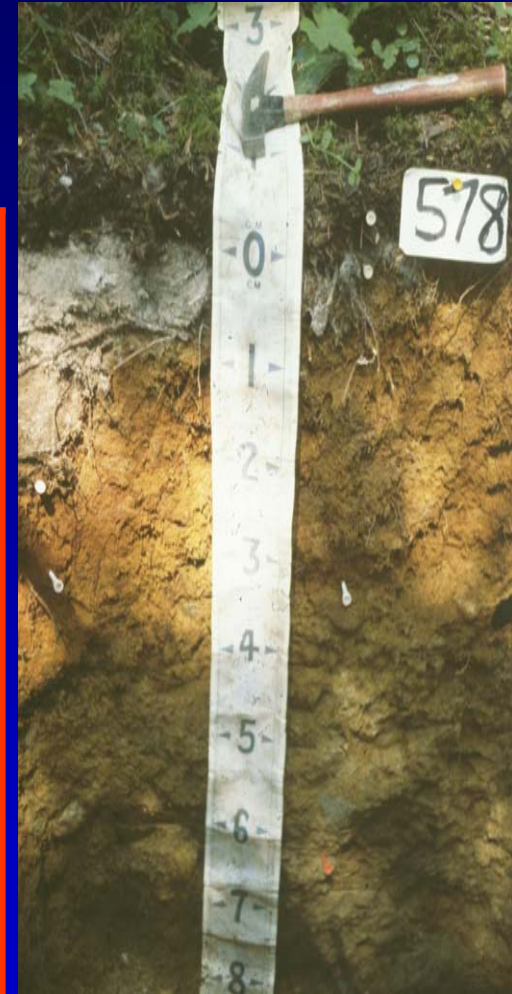
Climatic Profile for Western white pine

- Mean annual precipitation 270 - 1800 mm
- Growing season precipitation 80 - 460 mm
- Mean annual temperature 2.5 - 7.9⁰ C
- Frost-free days 50 - 150 days
- Growing degree days 750 - 2000

What does it really mean ??

Soil Characteristics

	Present	Absent
Parent Materials	Morainal, Colluvial, Eolian, Fluvial (Lacustrine)	Organic
Soil Development	Brunisols, Podzols , Regosols	Organic, Chernozems
Humus Form	Mors and Moders	Mulls
Soils pH	Range 3.5 – 6.5 Common 4.0 – 5.0	



Podzols

Soil Moisture Regime

Rock
Outcrops



Wetlands

Interior BC

ESSF

WC, WM, MW

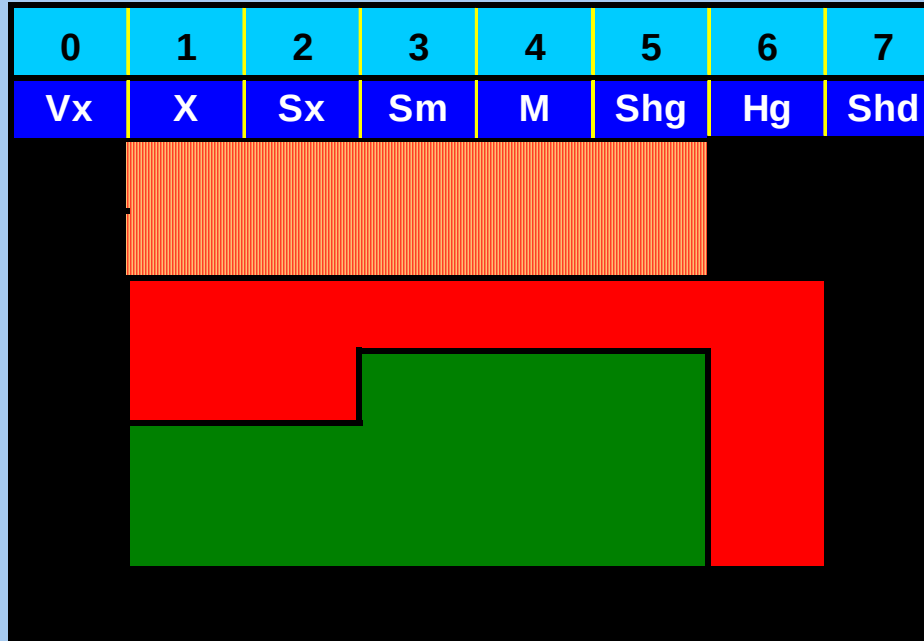
IDF_{MW}

IDF_{WW}

MS_{MW}

ICH southern

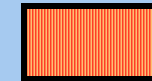
ICH northern



Common



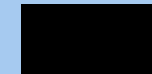
Uncommon



Restricted

- low elev. &

- S. latitude



Absent

Coastal BC

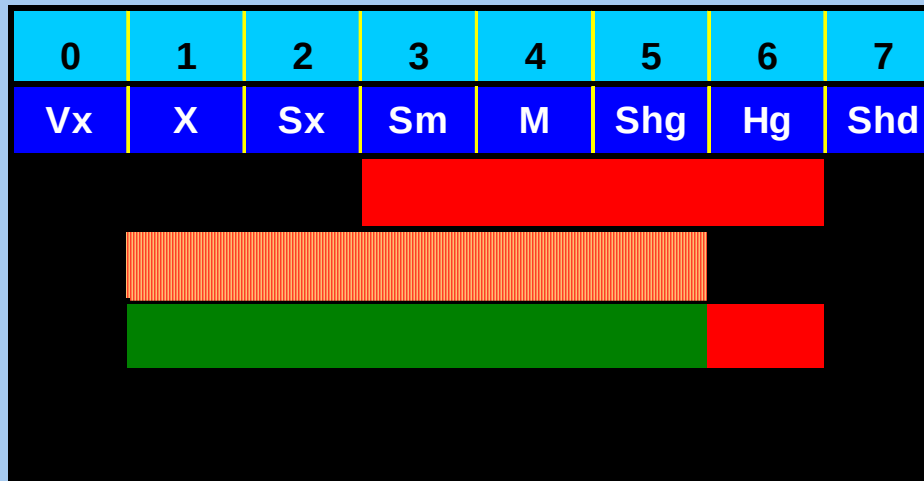
CDF

MH

CWH southern

MH & CWH

northern

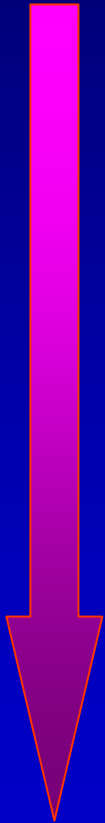


Source BEC Database

Some Autecological Characteristics

Drought Tolerance

High Tolerance

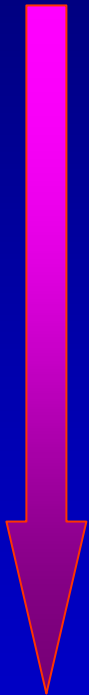


Low Tolerance

- Py Ponderosa pine
- Pa Whitebark pine
- Fd Douglas-fir
- Pl Lodgepole pine
- Lw Western larch
- Se/Sx Spruces
- Bl Subalpine fir
- Cw Western red cedar
- **Pw Western white pine**
- Hw Western hemlock

Tolerance to Excessive Water

High Tolerance



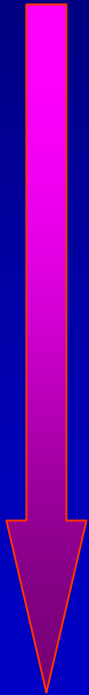
Low Tolerance

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- Cw Western red cedar
- Se/Sx Spruces
- Hw Western hemlock
- Bl Subalpine fir
- Pw Western white pine
- Lw Western larch
- Fd Douglas-fir
- Py Ponderosa pine

Flooding or Shallow Water Table & **Poor Drainage**

Shade Tolerance

High Tolerance



Low Tolerance

- Hw Western hemlock
- Cy Yellow Cedar
- Hm Mountain Hemlock
- Cw Western red cedar
- Bl Subalpine fir
- Se/Sx Spruces
- Pw **Western white pine**
- Fd Douglas-fir
- Pl Lodgepole pine
- Lw Western larch
- Py Ponderosa pine

Frost Tolerance

High Tolerance

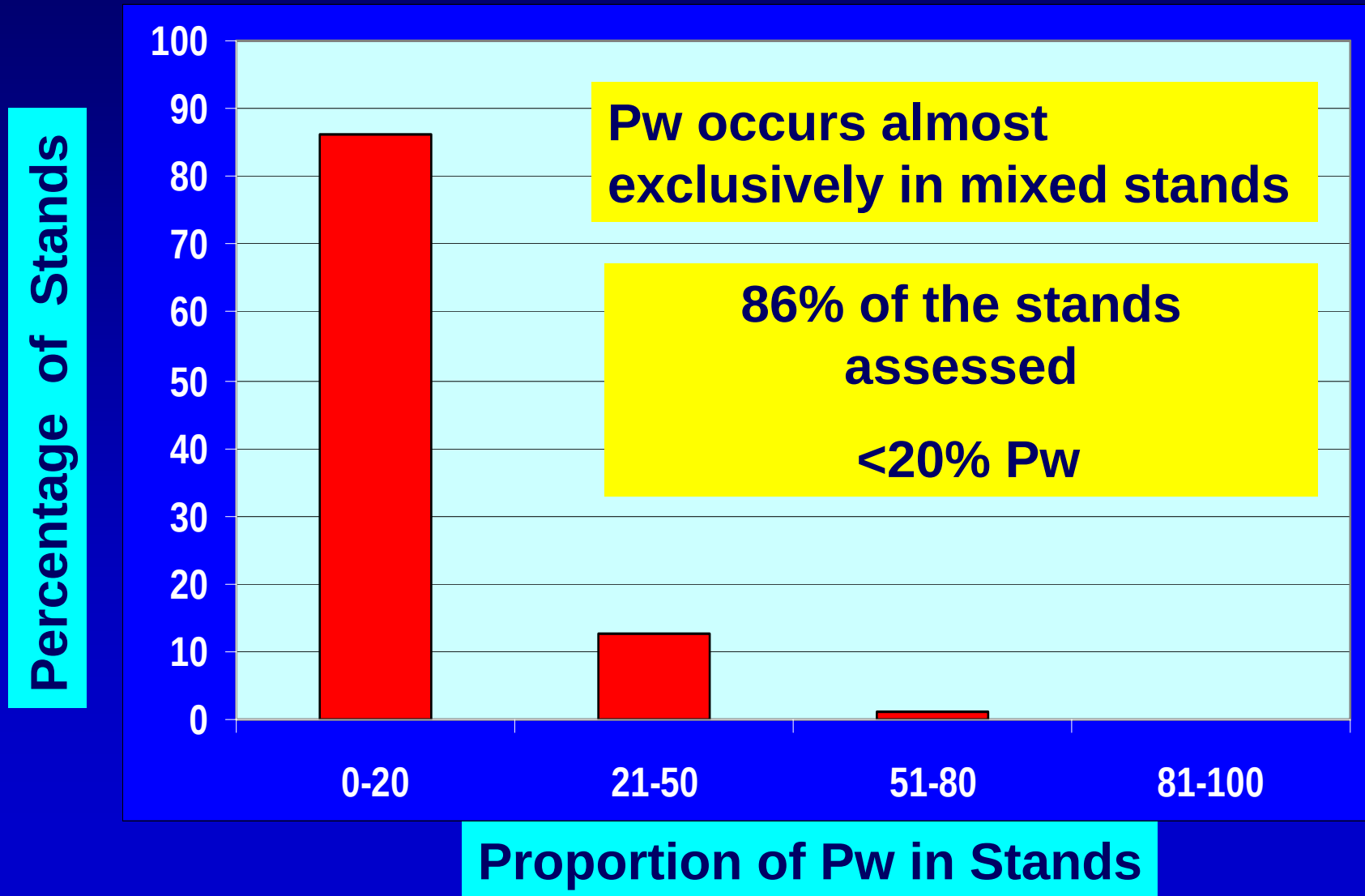


Low Tolerance

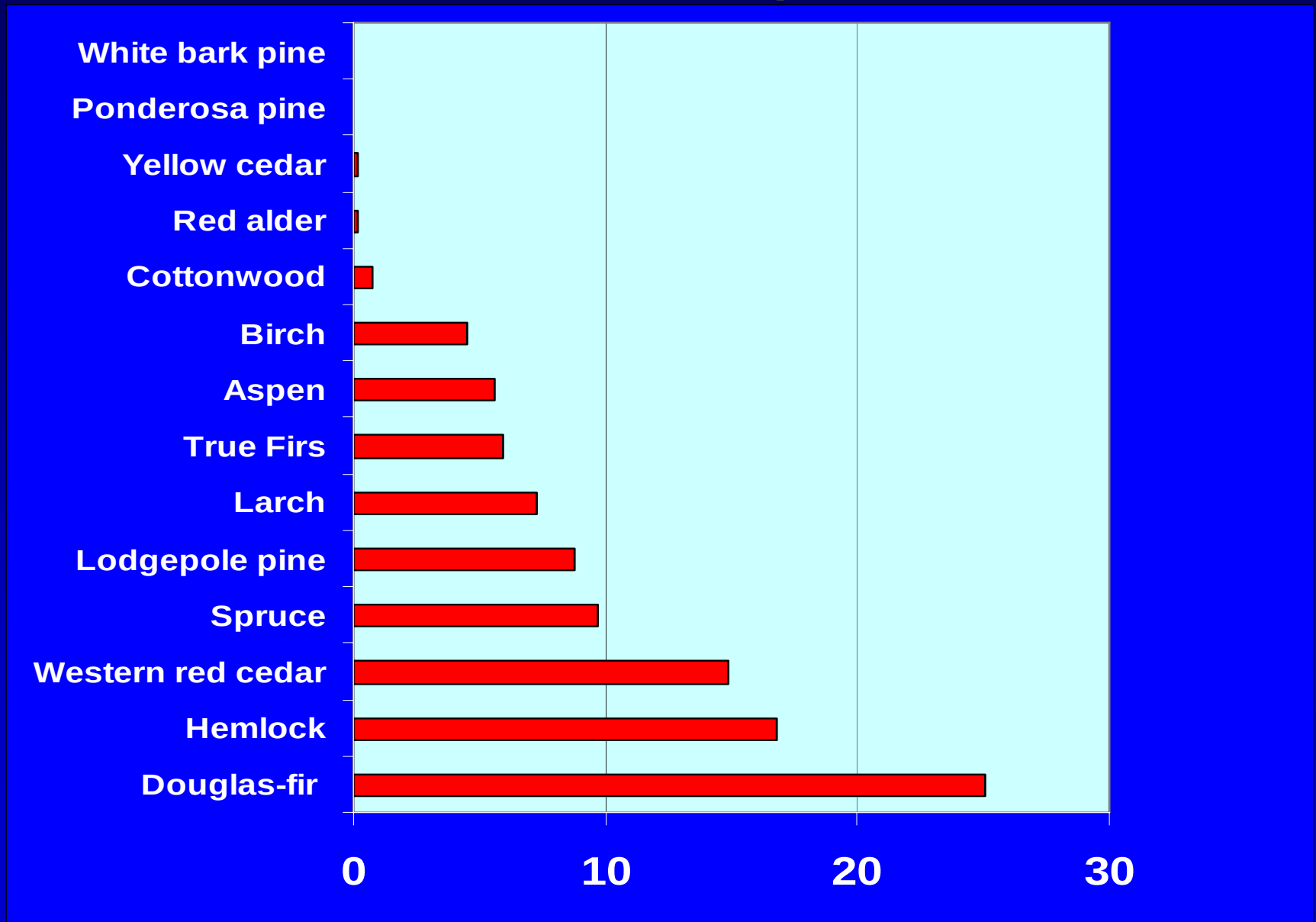
- Pl Lodgepole pine
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- Cw Western red cedar
- Hw Western hemlock

Stands with Western White Pine

Stand Composition and Relative Abundance of White Pine



Associated Tree Species in BC

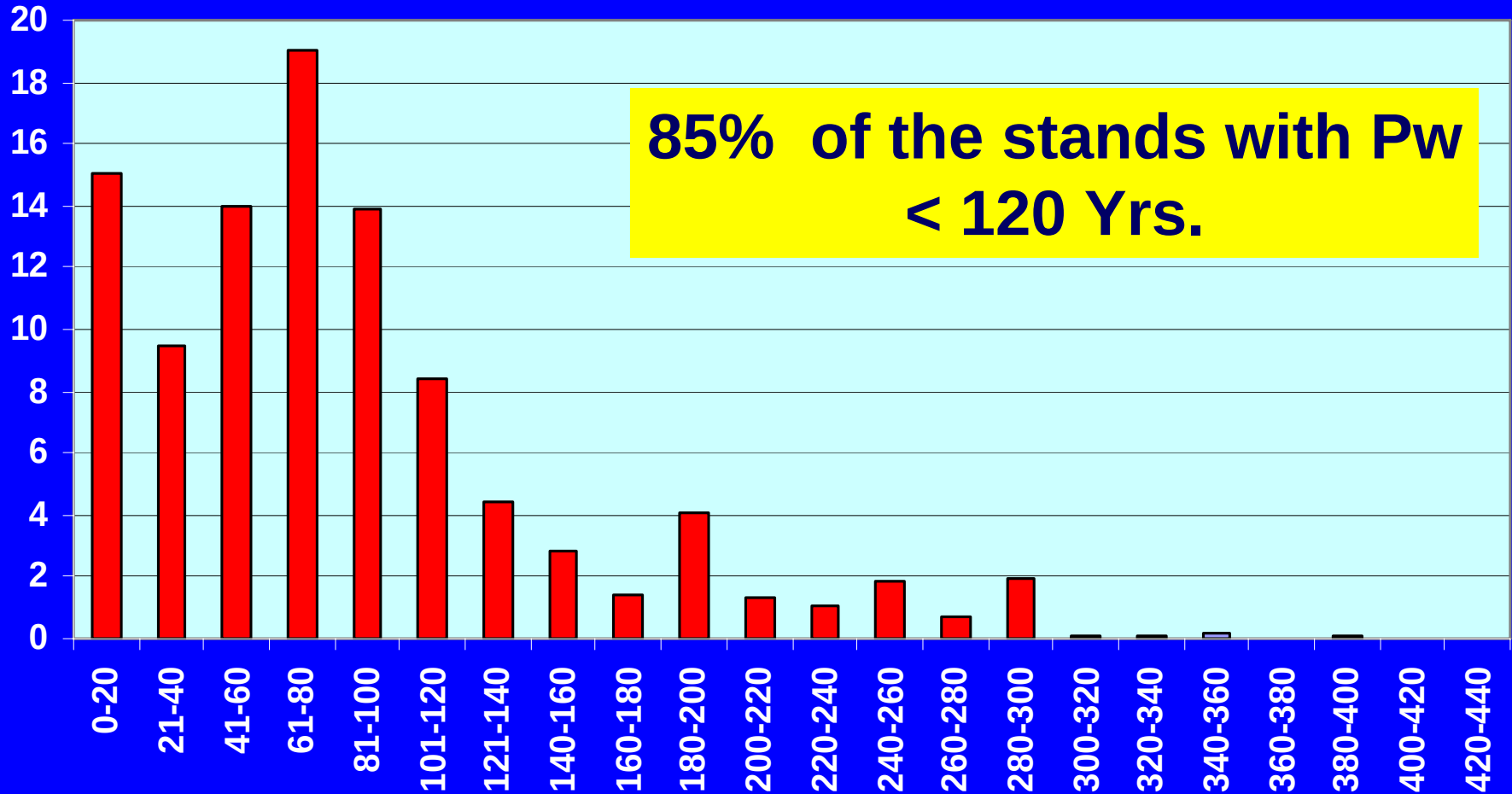


Frequency of Association

Age Class of Stands with White Pine

Percentage of Stands

85% of the stands with Pw
< 120 Yrs.



Age Class

Largest & Oldests

Oldest 615 years

Tallest tree 70.7 m 232ft.

Largest Diameter 205 cm dbh (81 inches)

Rogue River National Forest, Oregon.



Most Pw does not reach larger status due to
blister rust, logging and/or fire

BC...Jim Wright **upper Ratchford-Myoff** 61.8 m 5.37 m circum..

Other largest... Upper Seymour & Shuswap rivers in the ICHwk/vk

Site Index (50 years)

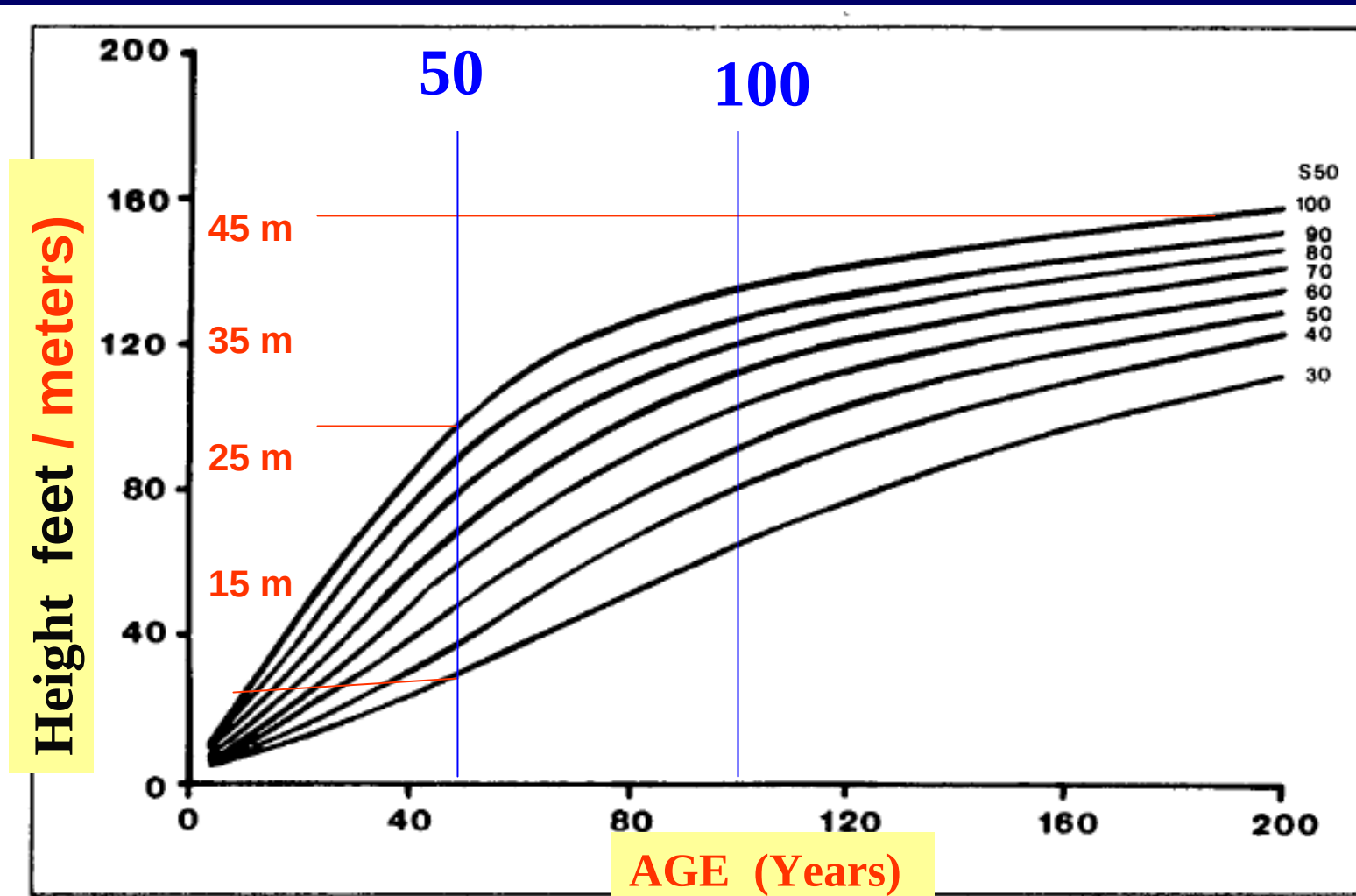


Figure 1—Height growth curves based on index age 50 years b.h., corresponding to equation (1).

Site Index (meters in 50 yrs.) *

Soil Moisture Regime

Interior BC

ESSF

wc, wm, mw

IDF_{mw}, ICH_{dw}

IDF_{ww}

MS_{mw}

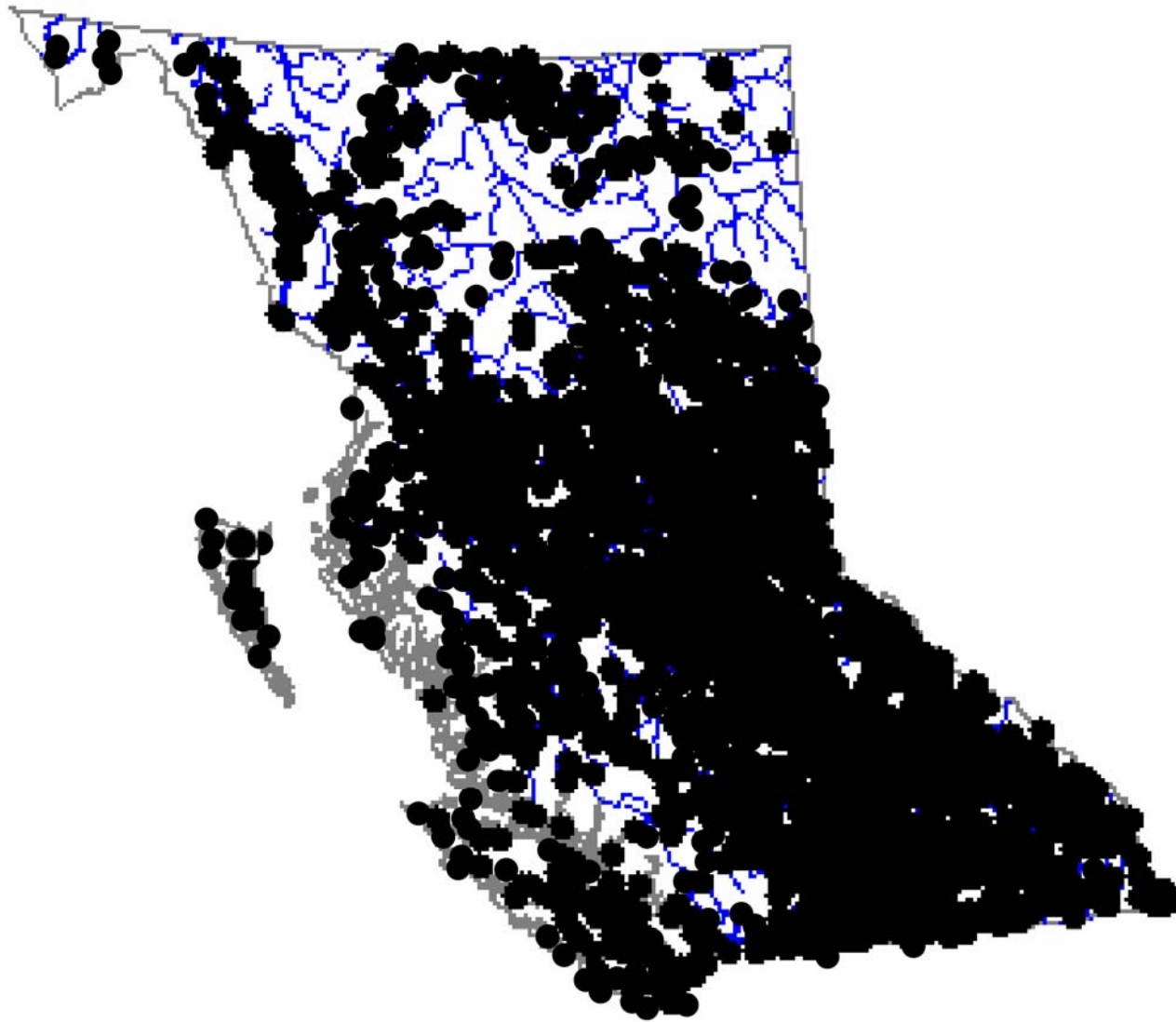
ICH_{southern}

0	1	2	3	4	5	6	7
Vx	X	Sx	Sm	M	Shg	Hg	Shd
<18m							
						<24m	
		18-24m	21-24m				
			24-30m		27-32m		

* Best Guess and limited SIBEC data

Forest Health Issues

- **White pine blister rust** (*Cronartium ribicola*), an introduced fungal disease
- Principle root disease is **Armillaria** spp
 - generally considered resistant to *Phellinus*
- The bark beetles
 - mountain pine beetle (***Dendroctonus ponderosae***)
 - sometimes red turpentine beetle (*Dendroctonus valens*).
- Foliar diseases
 - Red needle blight (***Dothistroma***)
 - needle cast caused by *Lophodermella arcuata*.
Lophodermium nitens, attacks isolated trees.



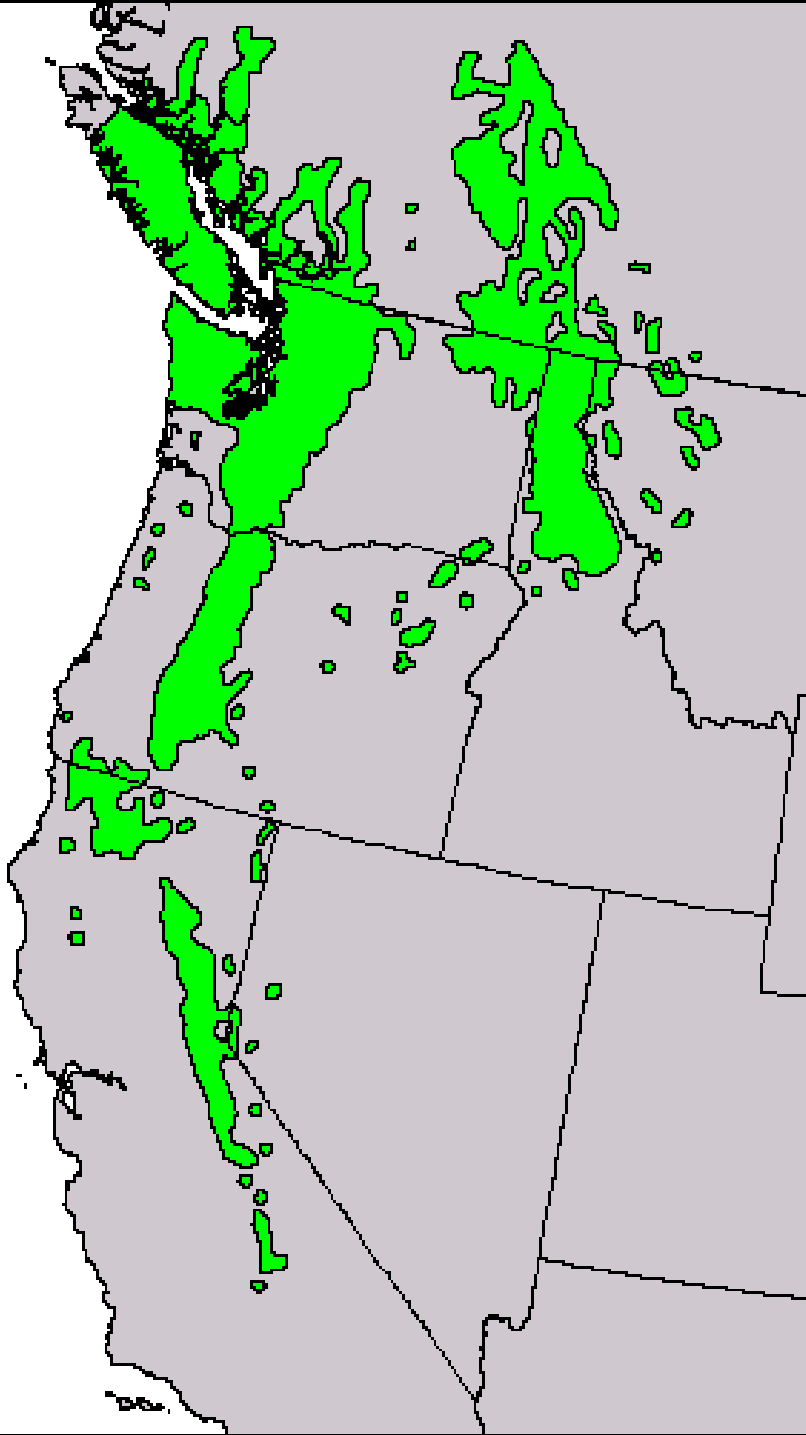
Distribution of *Ribes* in British Columbia

Additional Silvicultural Titbits

- Western white pine depends on fire or harvesting to remove competing conifers to become established
 - It's primarily a **seral species**.
- Depending on the site, is relatively **windfirm**,
- **Snow breakage** common in young pole-sapling stands
- A good regeneration alternative in *Phellinus* infected sites

Implications of Climate Change

Pw Distribution



Flying BEC Zones

1970

2020

2050

2080

CWH

Coastal Western Hemlock

ICH

Interior Cedar - Hemlock

Source: Tongli Wang, UBC....May 2008



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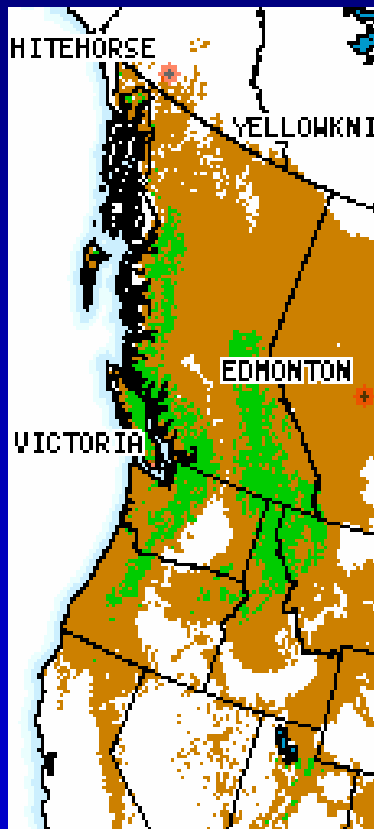
[Plant Hardiness](#)

[Canadian Forest
Service \(CFS\)](#)

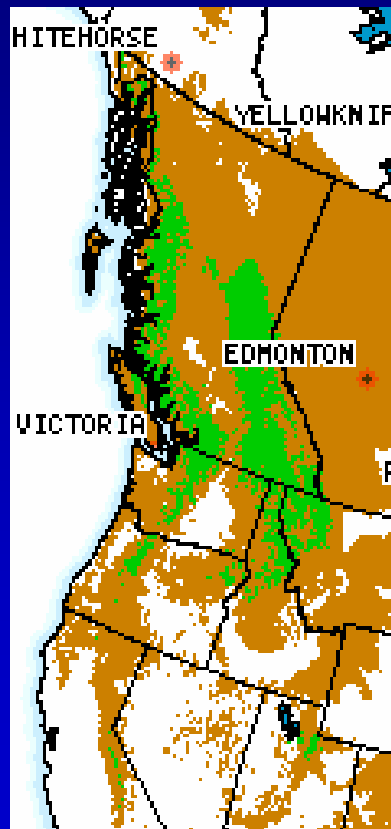
[CFS Home](#)



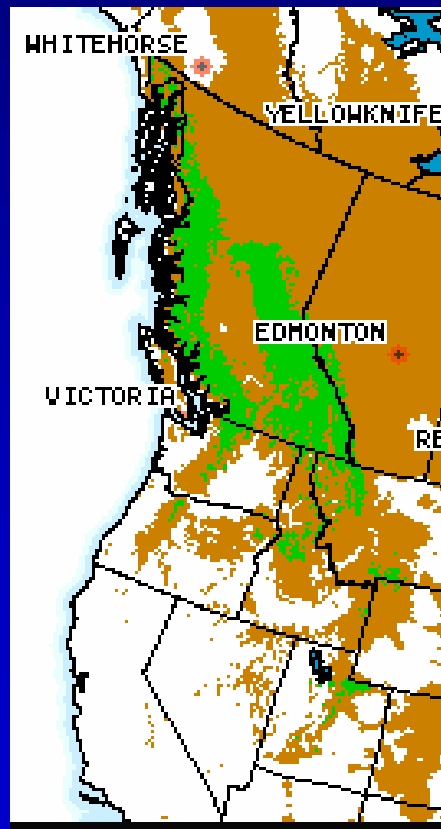
Canada's Plant Hardiness Site -
Going Beyond the Zones



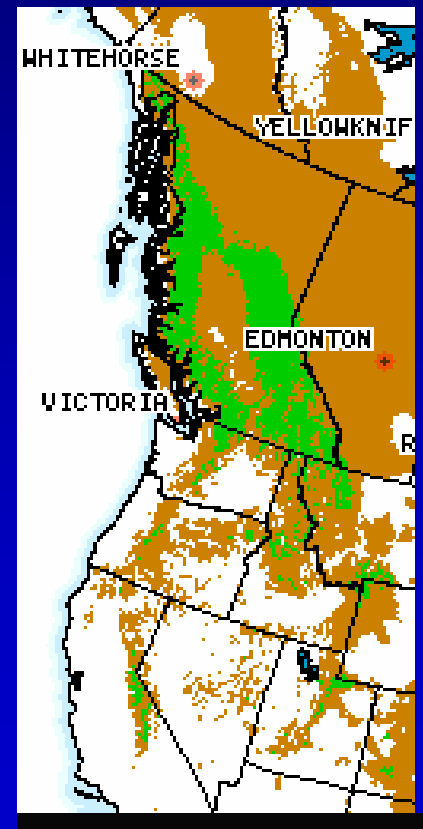
1971-2000



2011-2040



2041-2070



2071-2100

CGCM2 A2 Senario 2 ...Canadian General Circulation Model



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Plant Hardiness

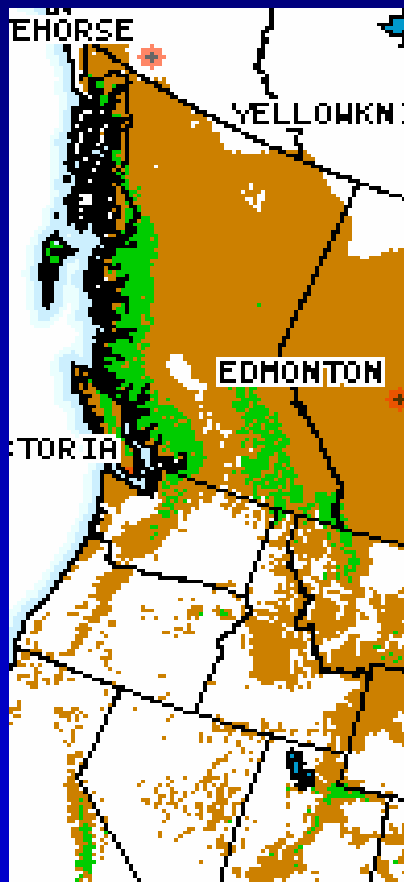
Canadian Forest
Service (CFS)

CFS Home

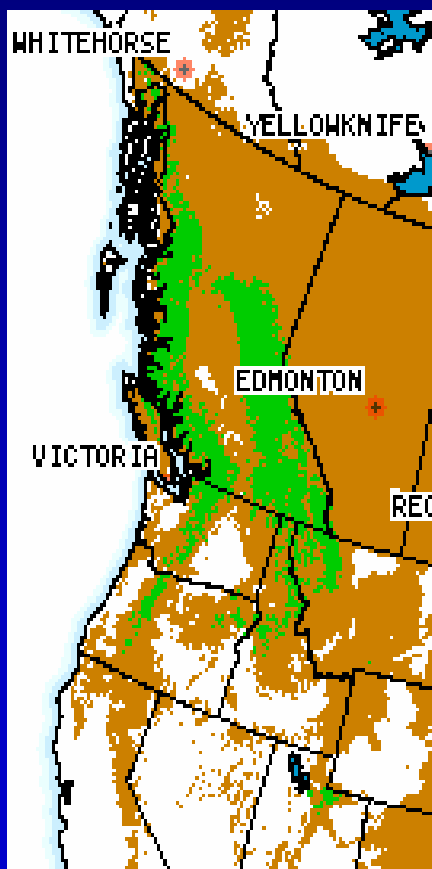


Canada's Plant Hardiness Site -
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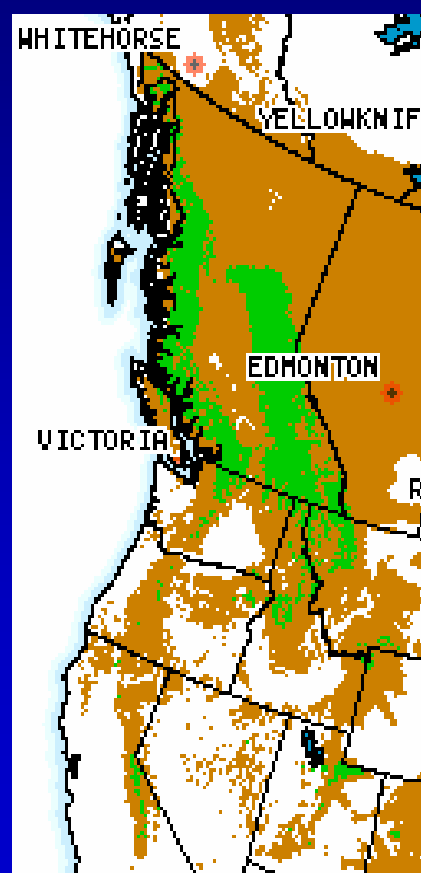
Pinus Monticola



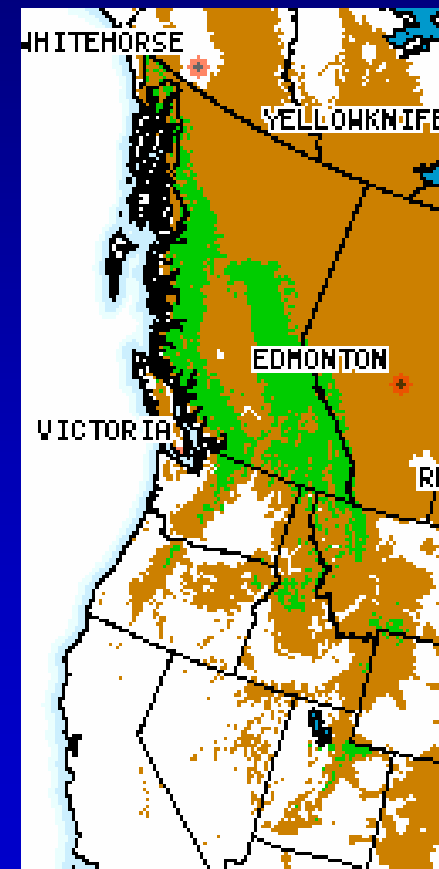
2041-2070
HADLEY-a2



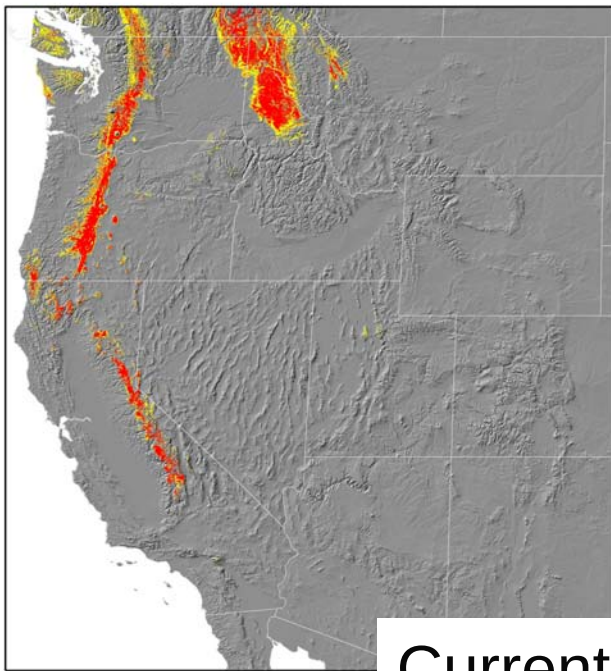
2041-2070
NCAR-a2



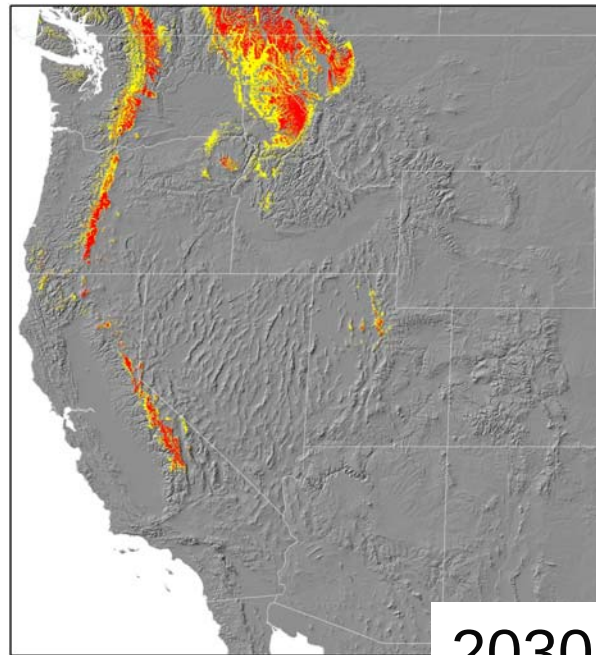
2041-2070
CGCM-a2



2041-2070
CSIRO-a2



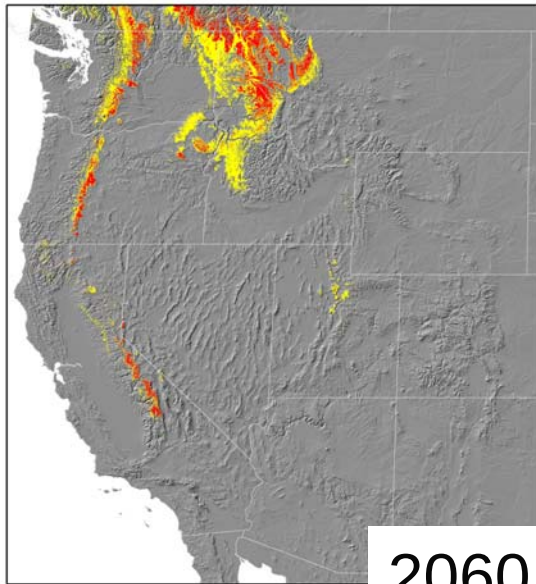
Current



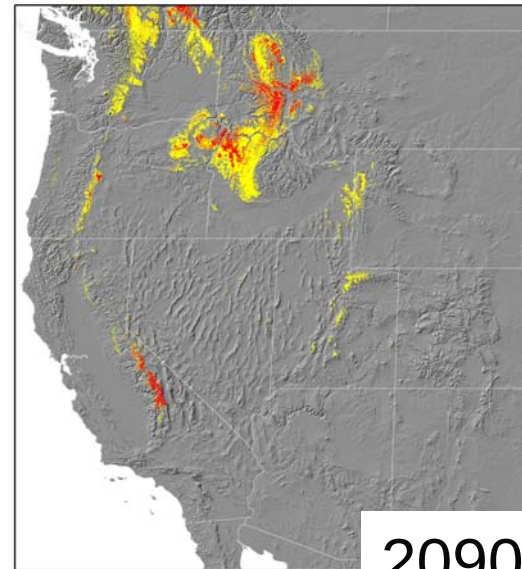
2030

 Presence

 Some potential



2060



2090

Take Home Message

- In BC, there is a strong correlation with Pw distribution and the ICH and CWH south of 52°
 - primarily restricted by drought and winter extremes
 - Pw seems to tolerate a wide range of soil moisture regimes within the ICH and CWH
 - a seral tree species
- Shade intolerance, forest harvesting and fire have had a strong additive influence to “blister rust” on the reduction of Pw on BC’s landscape
- Climate change may lead to further reductions in the USA but may lead to natural expansion in BC

