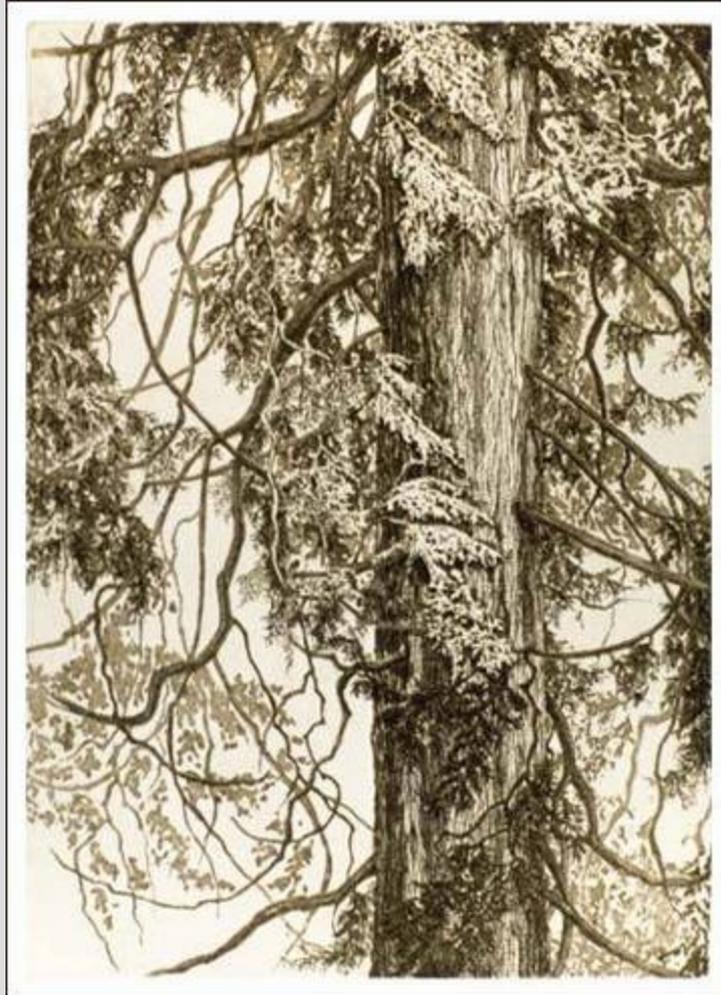


# Blending Traditional Knowledge with Science to Develop a Teaching Curriculum on Cedars in Alaska



## 2009 Clan Conference

March 24-28, 2009  
Juneau, Alaska

Paul Hennon, PhD  
Forest Pathologist  
USFS, Juneau



<http://www.fs.fed.us/r10/spf/fhp/cedar/index.html>

# Goal: Blend Traditional Knowledge with Science on Cedars



laax

Western redcedar  
*Thuja plicata*

## Topics

- 1) Background on Cedars
- 2) 8 Curriculum ideas:  
ID the 2 Cedars  
to  
Mt Edgecumbe climate
- 3) Cedar Management

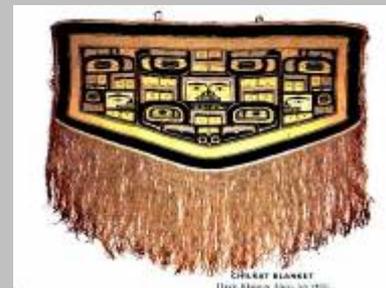
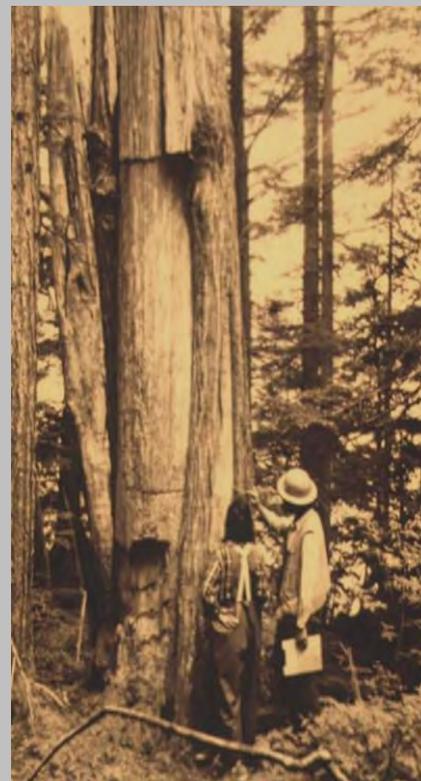


xáay

Yellow-cedar, Alaska-cedar  
*Chamaecyparis nootkatensis*



# Traditional use of cedar wood, bark

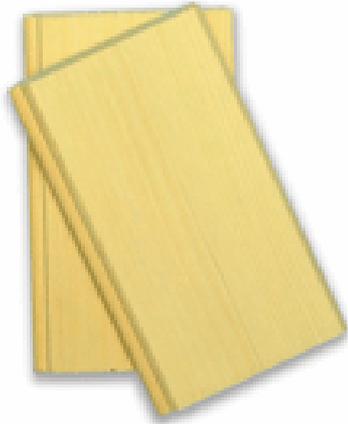


See: **Nancy Turner**. 1997. Traditional Ecological Knowledge. In: *The Rain Forests of Home. Profile of a North American Bioregion*. Edited by P. K. Schoonmaker, B. Von Hagen, and E. C. Wolf, Ecotrust. Covelo, CA; Washington, DC: Island Press. (pp. 275-298).  
**Hilary Stewart**, Cedar: Tree of Life to the Northwest Coast Indians

# Commercial value of cedar wood

## *Yellow-cedar*

## *Western redcedar*



JAPANESE POST & BEAM CONSTRUCTION



# Cedars as ornamental trees

## *Yellow-cedar*



Gift from Alaska Native Brotherhood ~1912

## *“Arborvitae”*



Arborvitae is a close relative of redcedar (Eastern redcedar)





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Western redcedar  
*Thuja plicata*

Origins of the Cedars:

How long have  
they been here?



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Yellow-cedar, Alaska-cedar  
*Chamaecyparis nootkatensis*



Fossils show that close relatives of cedars grew in the Jurassic Period with the Dinosaurs, about 150 million years ago.

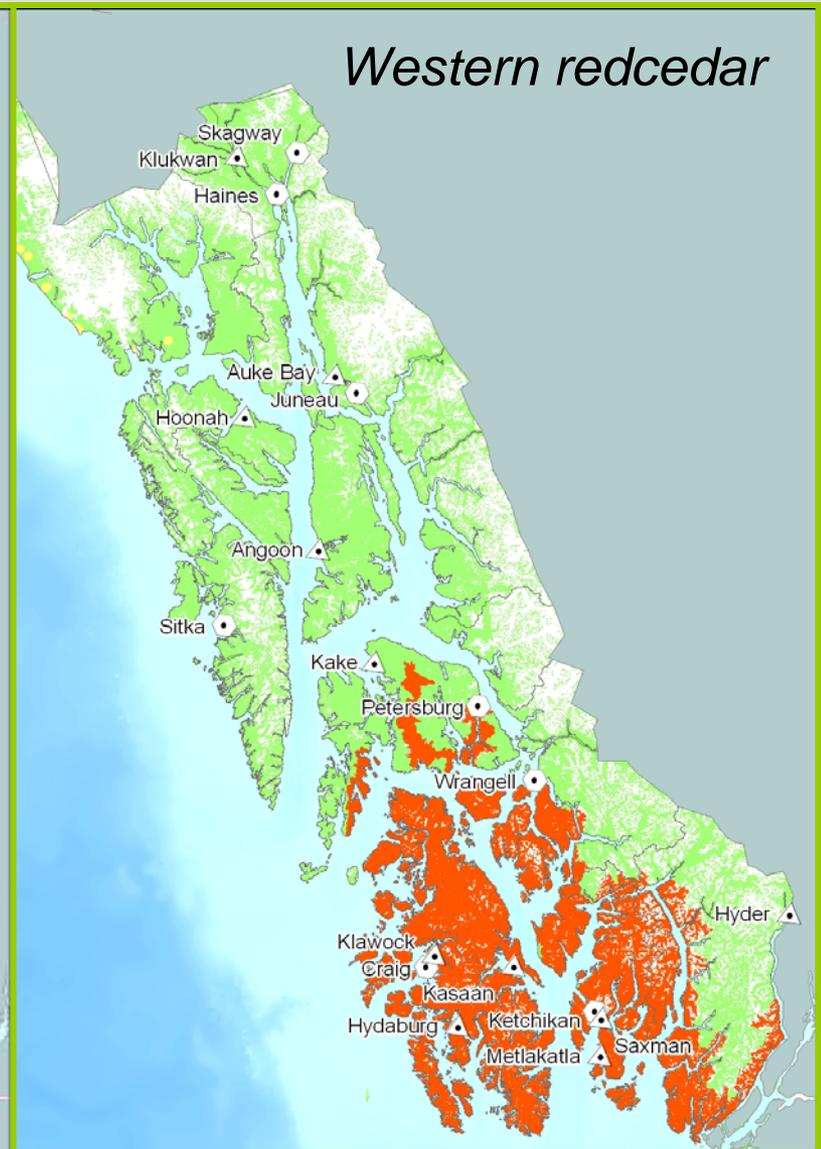
# Climate interpretation from pollen cores in coastal Alaska and British Columbia (Heusser, Munday, Ager, Banner, etc).

<u>Years ago</u>	<u>Climate</u>	<u>Dominant vegetation</u>
16,000 - 12,500	cool, dry	ice retreating, tundra/shrubs
12,500 - 9,000	warm, dry	pine, alder
9,000 - 6,800	warm, wet	spruce, hemlock
6,800 - 4,500	cool, wet	hemlock, spruce, cedar
<b>4,500 – present</b>	<b>cooler, wetter</b>	<b>modern flora, w/ cedar</b>

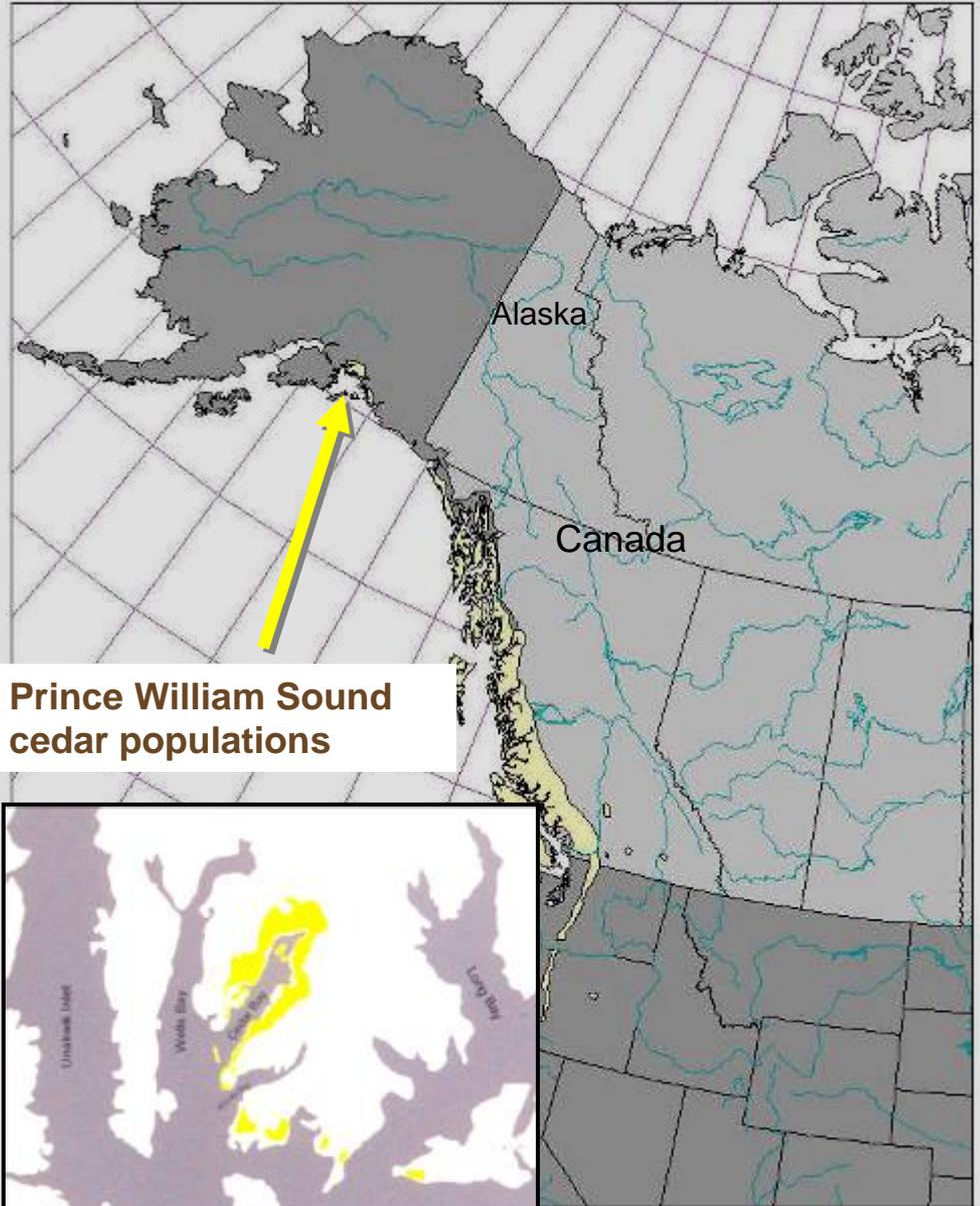


# Where do cedar grow?

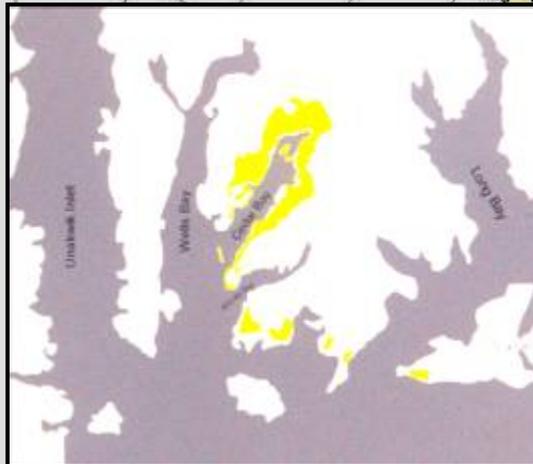
Cedar maps and Native villages (maps from 1990s FIA inventory data)



# Yellow-cedar in Prince William Sound



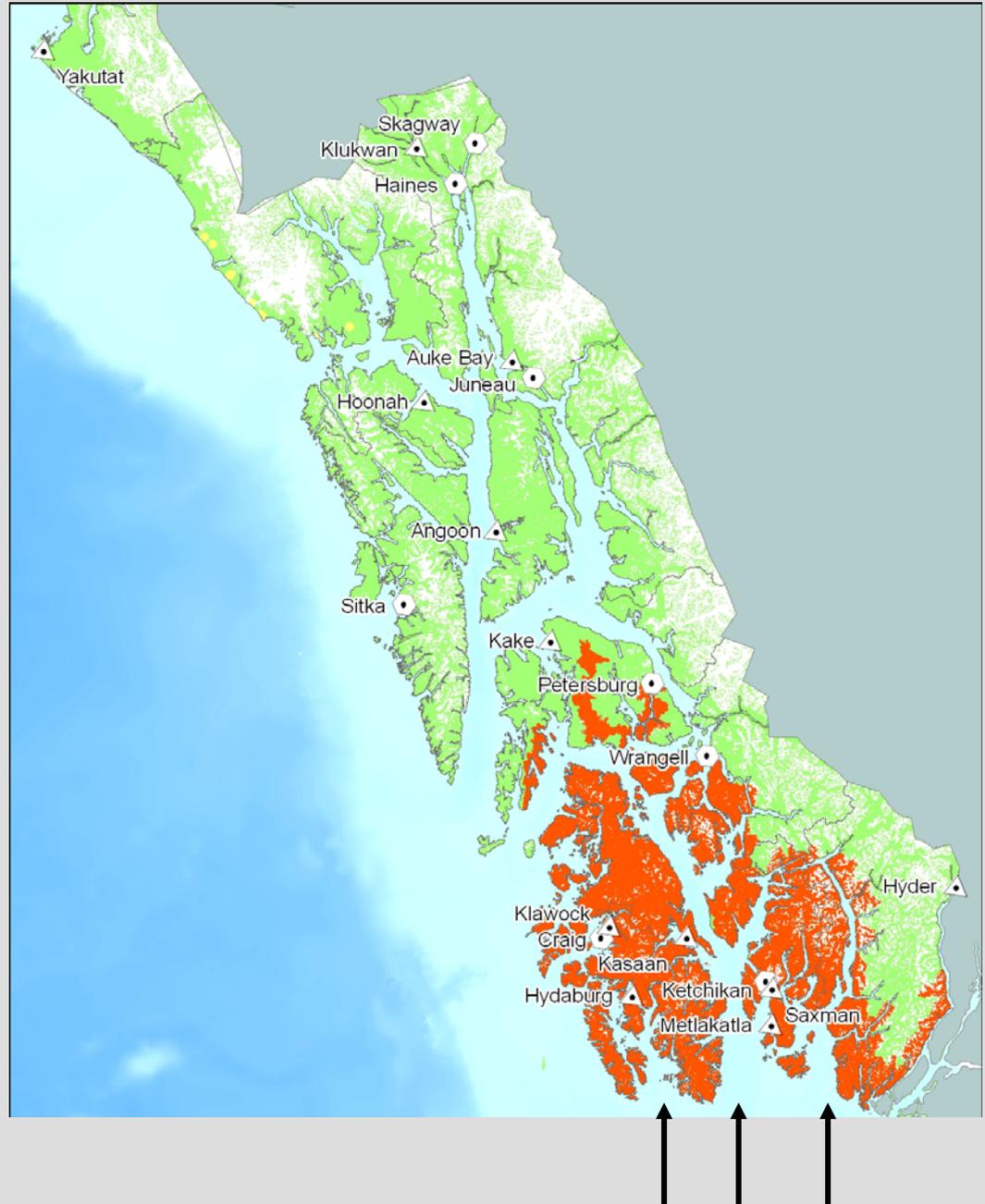
Prince William Sound cedar populations





# Redcedar history,

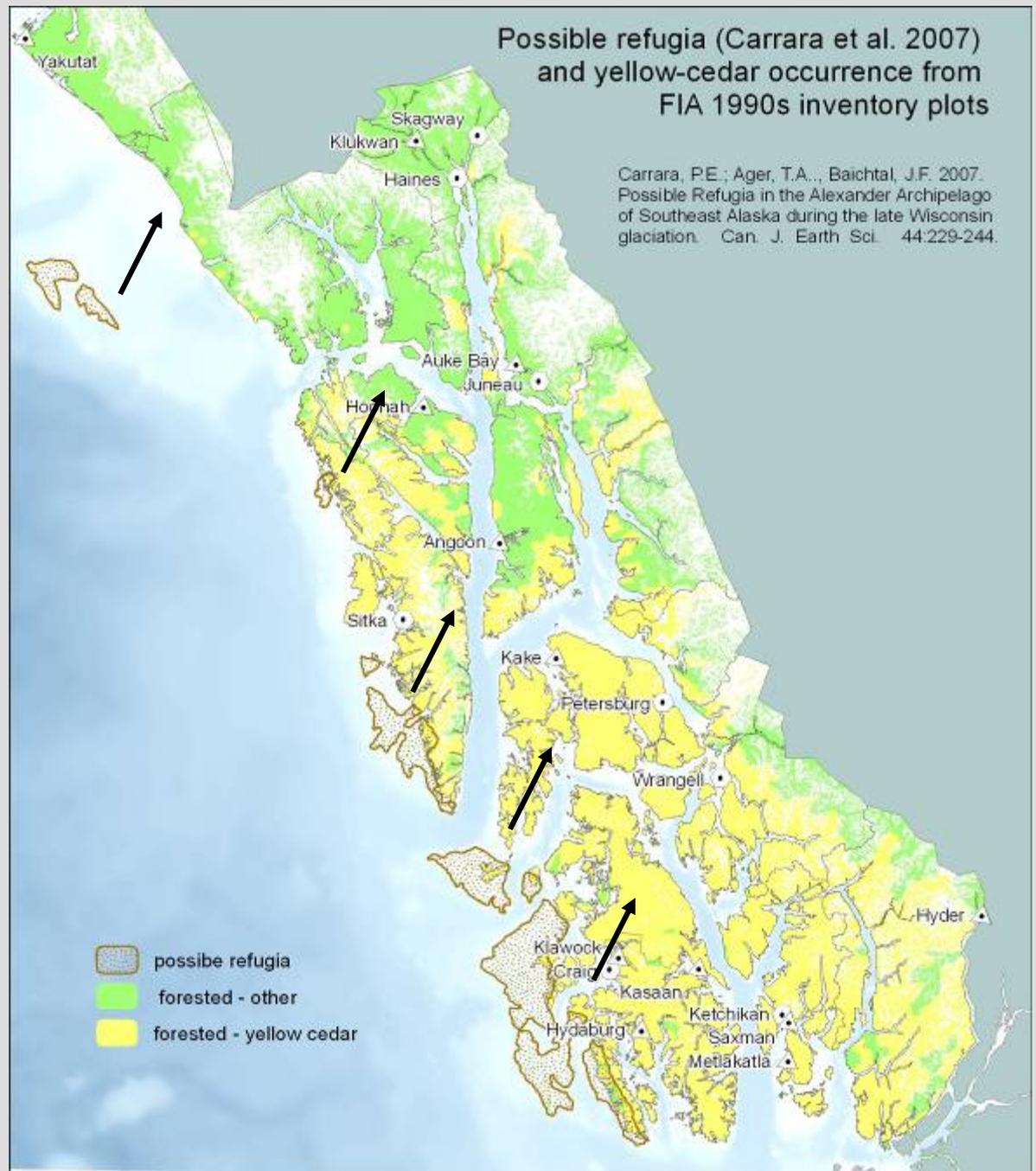
Migrated from southern sources (British Columbia)





# Yellow-cedar, history:

Survived Pleistocene Ice  
Age; migrated from  
refugia

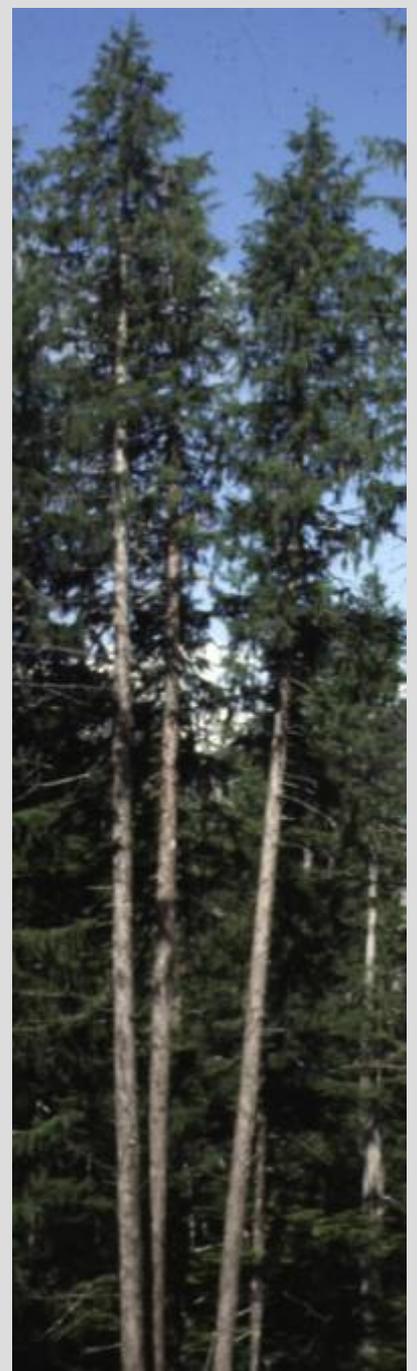


# The Legend of the Yellow Cedar

Long ago, when the world was not as it is now, Raven, the great creator and trickster came across three young women who were drying salmon on the beach. Ever hungry, the wily bird approached the women and asked. "Are you not afraid of bears?" And again they replied. "No." Persistent, Raven asked if they were afraid of wolves, marten and various other creatures. Each time they answered no, until he mentioned owls, at which time the three women confessed their terrible fear of owls.

Raven went off and quickly hid himself in some nearby bushes, where he began making owl calls. Terrified, the women fled, running and running until they were halfway up the mountain. They stopped, finally, out of breath. Standing together on the mountainside, the three of them turned into yellow cedar trees. That is why yellow cedars are always found on high slopes and why they are so beautiful; their long graceful branches and silky inner bark resemble the women's hair and their young trunks are smooth to the touch.

Story as told by Alice Paul in Hesquiat, with permission: Turner, Nancy J. and Barbara S. Efrat. 1982. *Ethnobotany of the Hesquiat Indians of Vancouver Island*. Victoria: British Columbia Provincial Museum. Cultural Recovery Paper No. 2. 99 pp.



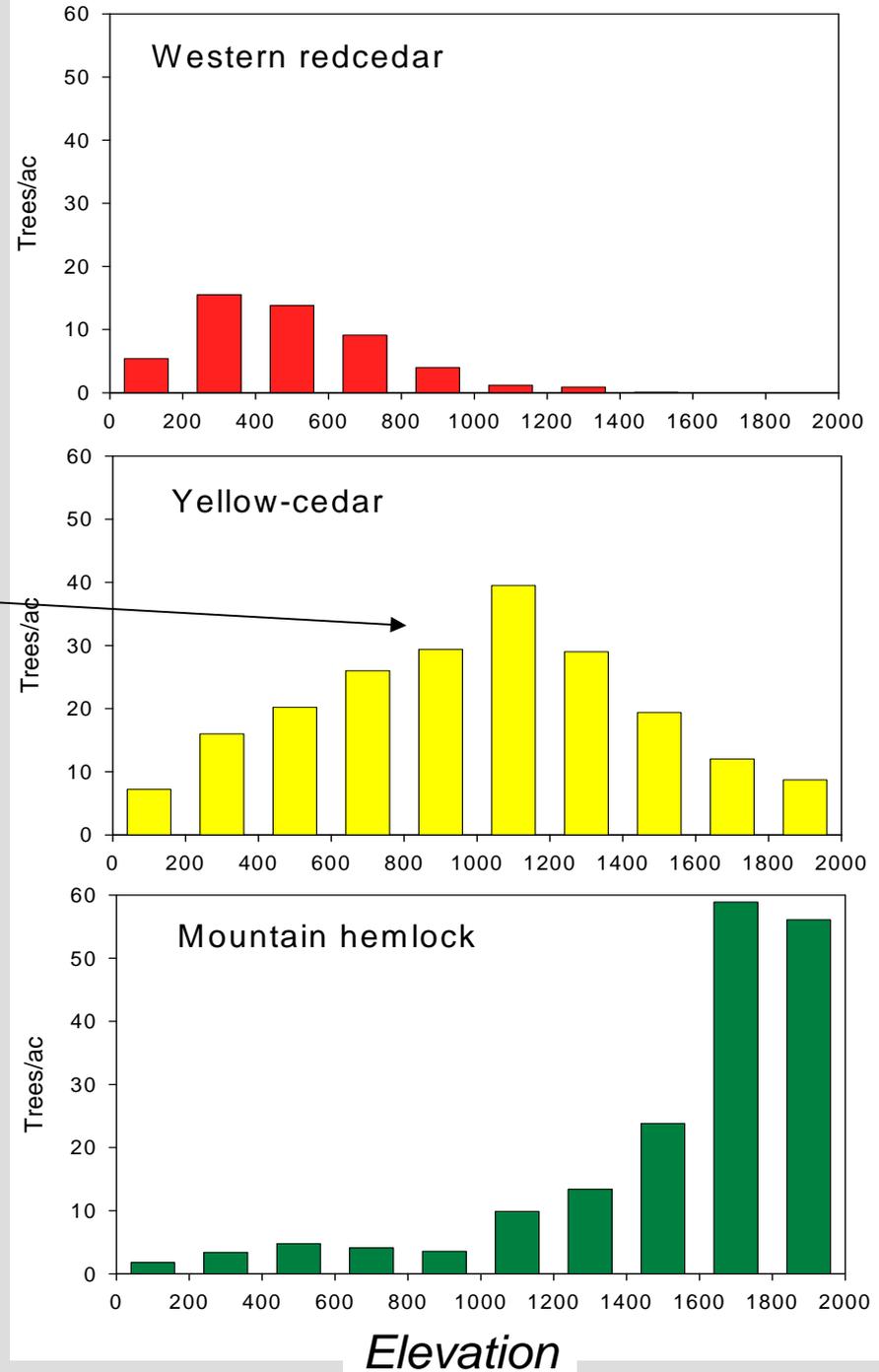
## The Legend of Yellow-cedar

...Terrified, the women fled, running and running until they were

**halfway up the mountain.** They

stopped, finally, out of breath. Standing together on the mountainside, the three of them turned into yellow cedar trees....

*Source:  
Zarembo Island,  
Live trees,  
Stand Exam plots*





# Cedar Curriculum Ideas

- 1. Learn to identify the two cedars*
- 2. Bark collection and tree anatomy*
- 3. Carving and cedar wood chemistry*
- 4. Cedar wood engineering properties*
- 5. Ring counts: ages and growth of cedar*
- 6. Complex scenario of yellow-cedar decline*
- 7. Forest ecology-management game*
- 8. Cedar on Mount Edgecumbe--mapping*



# Cedar Curriculum Ideas: 1. Learn to ID the two cedars

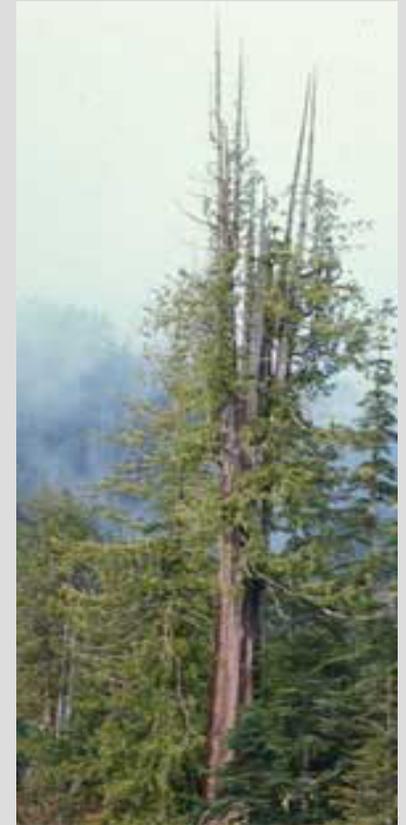
## Yellow-cedar

*Chamaecyparis nootkatensis*



## Western redcedar

*Thuja plicata*



# ID the two cedars

## Yellow-cedar



## Western redcedar



## Foliage and cones

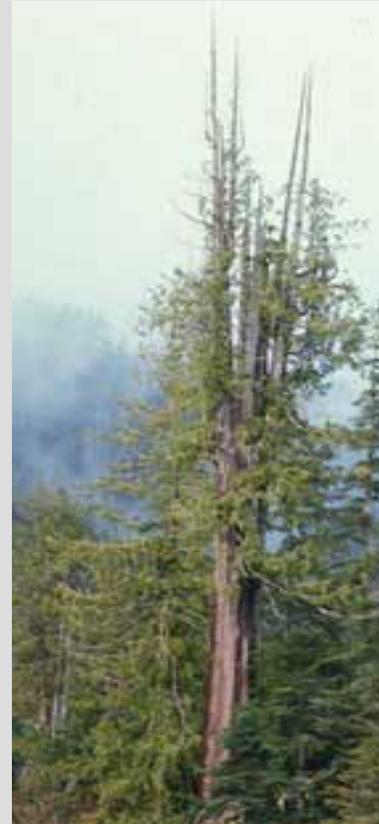
# ID the two cedars

## *Yellow-cedar*



- Tops generally intact tops
- Shade prunes lower branches
- Less symmetrical shoots
- “Droopy” appearance
- Darker green

## *Western redcedar*



- Spike tops
- Maintains lower branches
- Symmetrical shoots
- Lighter yellow-green

Form



# ID the two cedars

*Yellow-cedar*

*Western redcedar*



Pitch tubes

Bark

# ID the two cedars

Yellow-cedar	Common name	Western redcedar
<i>Chamaecyparis nootkatensis</i> Soon: <i>Xanthocyparis nootkatensis</i>	<b>Scientific name</b>	<i>Thuja plicata</i>
CHNO	<b>Code</b>	THPL
Small, spherical with spikes	<b>Cones</b>	Small, shaped as a rosebud
Less flattened, darker green, little to no to no white stomatal banding but if so, in if so, in shape of 'X'	<b>Foliage</b>	Flattened, bright green, shiny, white stomatal banding on underside in shape of 'W' or butterfly
Shoots and foliage arranged haphazardly, droopy, hanging	<b>Shoots</b>	Shoots emerging from branches branches very systematically, usually in flat sprays
Branches sometimes with sweep, lower lower boles tend to be branch-free, free, bayonet branches uncommon uncommon	<b>Branches</b>	Branches with sweep, branches branches often maintained on lower bole, bayonet branches and and forks near top common
Bark gray, whitish, or reddish brown, brown, less fibrous, resin ducts present present in bark and phloem	<b>Bark</b>	Bark reddish brown with vertical vertical furrows, very fibrous, without resin ducts
Pale to bright yellow, aromatic	<b>Heartwood</b>	Variable in color, often dark reddish brown, aromatic
Develop mature, scale-like foliage gradually, by the 4 <sup>th</sup> or 5 <sup>th</sup> year	<b>Seedlings</b>	Develop mature, scale-like foliage foliage abruptly in spring of 2 <sup>d</sup> or or 3 <sup>d</sup> year

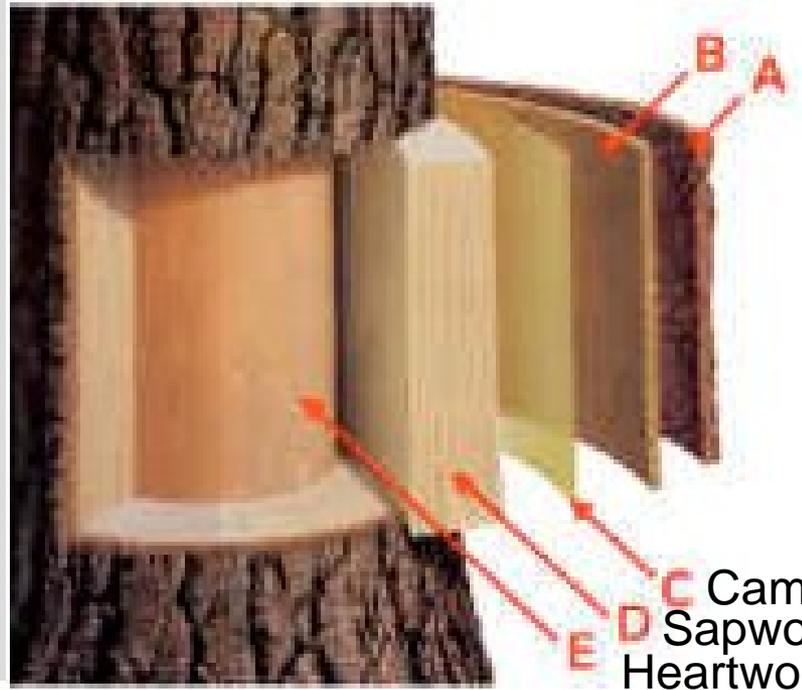


# Cedar Curriculum Ideas

## 2. *Bark collecting + tree growth/anatomy/protection*

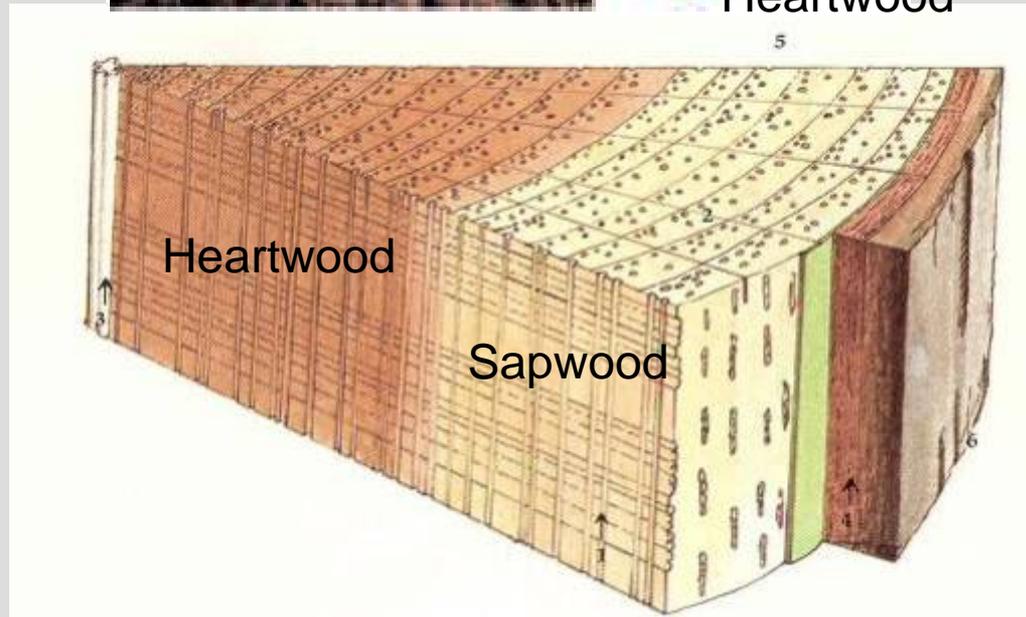


# Anatomy of a tree



Phloem  
Outer bark

Cambium  
Sapwood  
Heartwood



Heartwood

Sapwood



**Brown bears bark-strip  
yellow-cedars in spring!**



**Cedar's heartwood  
protects it from long-term  
decay problems**



# Cedar Defenses:

*Long-term decay issues are minimal*





# Yellow-cedar, longitudinal section



## Heartwood Compounds

- Alaskene
- Carvacrol
- Chamic acid
- Chaminic acid
- Chanootin
- Isochamic acid
- Nootkatene
- Nootkatin
- Nootkatone
- Valerianol
- Vetivone

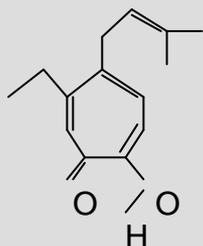
Heartwood

Sapwood

# Cedar Curriculum Ideas

## 3. Carving and cedar wood chemistry

### Yellow-cedar



Structure of nootkatin

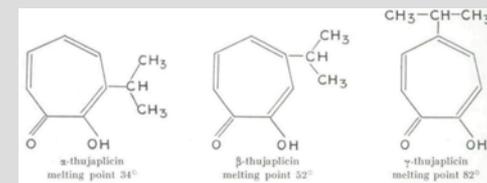
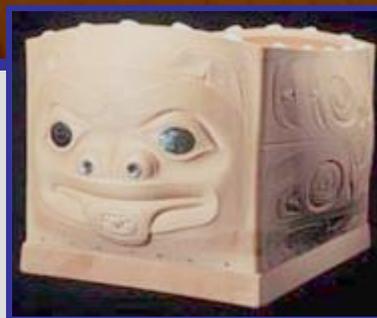


### Western redcedar



### Heartwood Compounds

- Alskene
- Carvacrol
- Chamic acid
- Chaminc acid
- Chanootin
- Isochamic acid
- Nootkatene
- Nootkatin
- Nootkatone
- Valerianol
- Vetivone



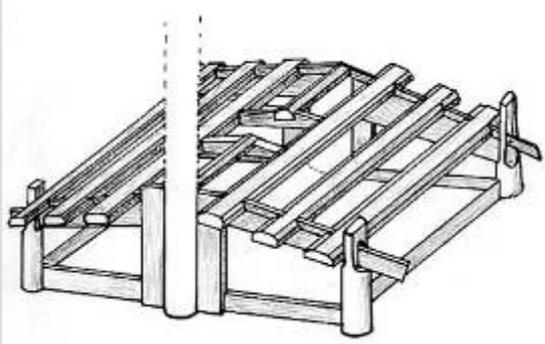
### Heartwood Compounds

- Thujaplican
- Thujic acid
- Thujaplicinol
- Methyl thujate

Wood color, aroma, chemistry

# Cedar Curriculum Ideas

## 4. Cedar wood and engineering properties



### Yellow-cedar

#### Compression

	Specific gravity	MOE $\times 10^6$ lbf/in <sup>2</sup>	MOR lbf/in <sup>2</sup>	Parallel lbf/in <sup>2</sup>	Perpendicular lbf/in <sup>2</sup>	WML <sup>a</sup> in-lbf/in <sup>3</sup>	Hardness lbf	Shear lbf/in <sup>2</sup>
Green	0.42	1.14	6,400	3,500	350	9.2	440	840
Dry	0.44	1.42	11,100	6,310	620	10.4	580	1,130

<sup>a</sup>WML = Work to maximum load.  
Reference (12).



# Cedar Curriculum Ideas

## 5. Ring counts: tree age and growth history (climate)

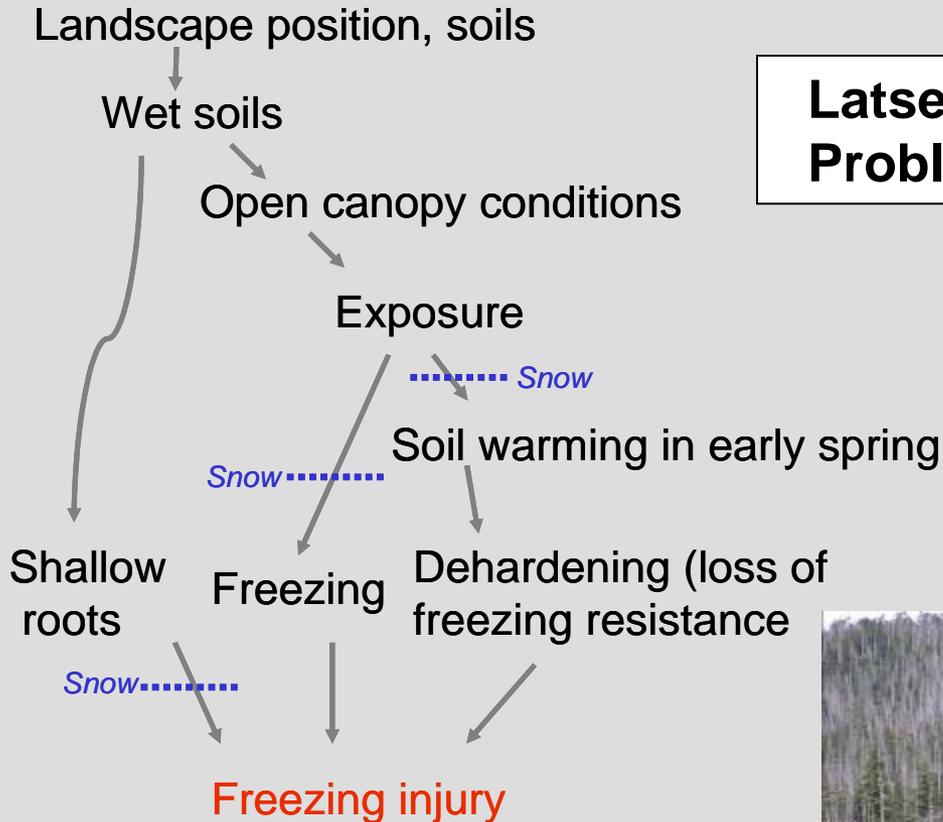


Large cedars can be  
> 1,000 years old

# Cedar Curriculum Ideas

## 6. Complex scenario of yellow-cedar decline

### Hypothetic scenario to explain tree death



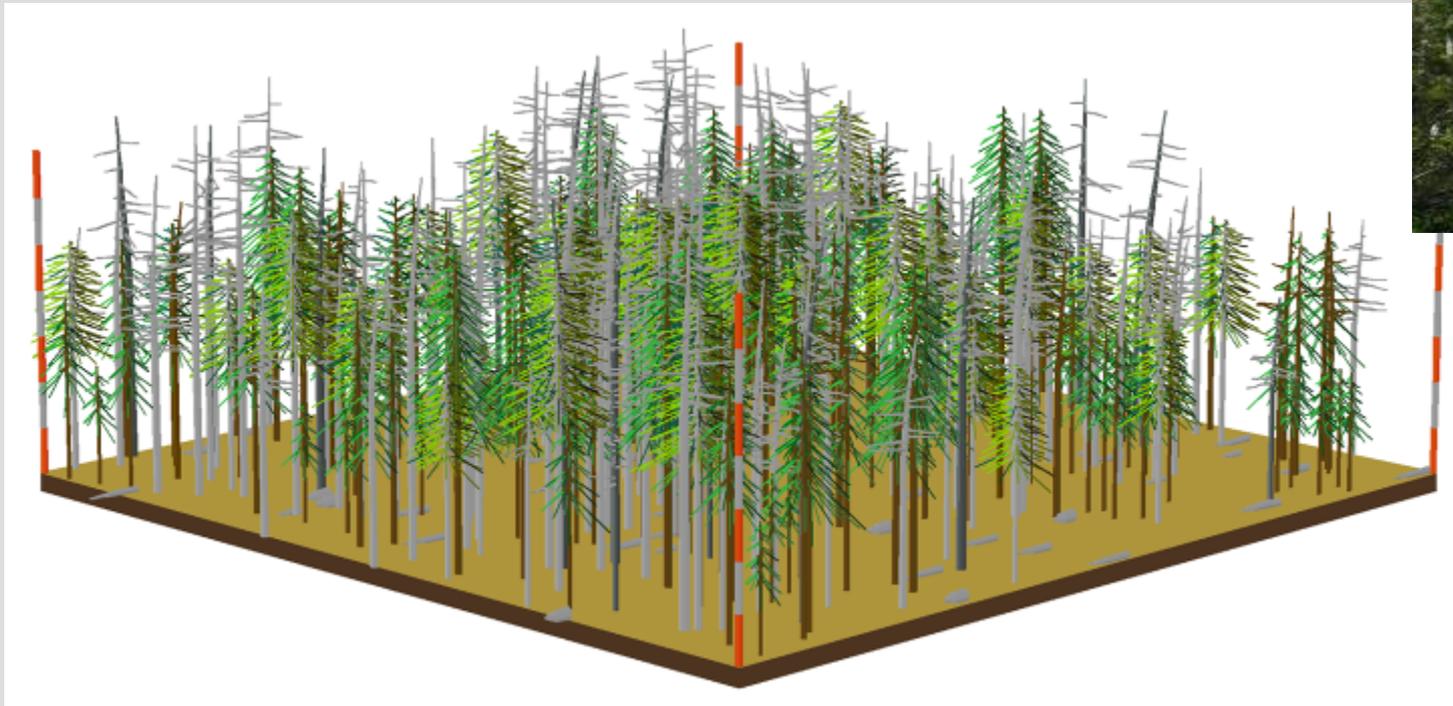
**Latseen Camp, 2008**  
**Problem solving exercise**





# Cedar Curriculum Ideas

## 7. *Forest ecology-management game*



SVS-Stand Visualization Software, or Envision

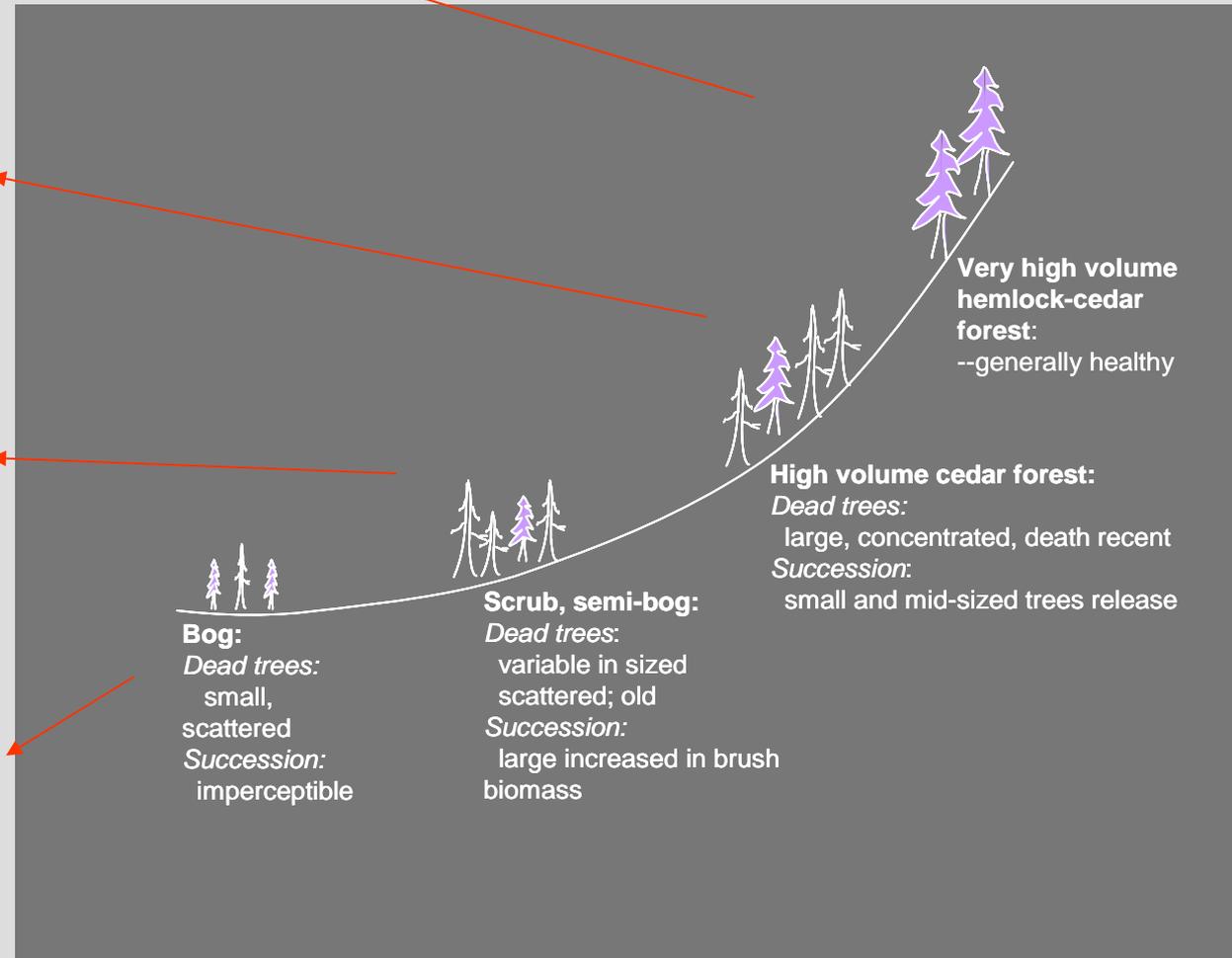
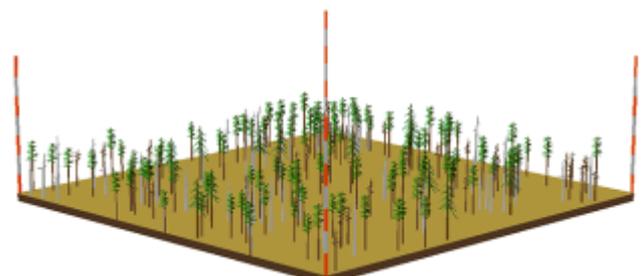
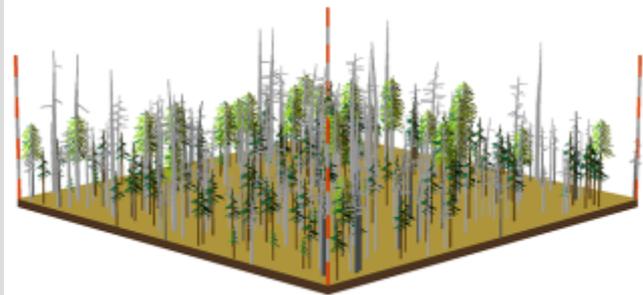
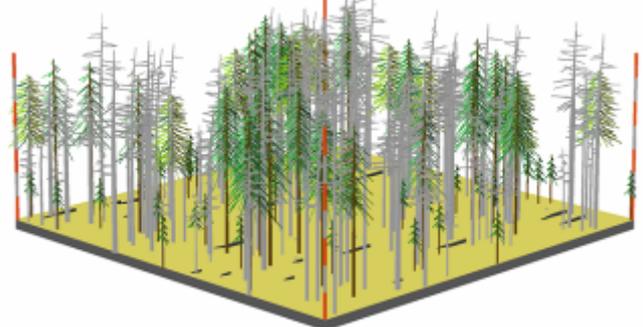
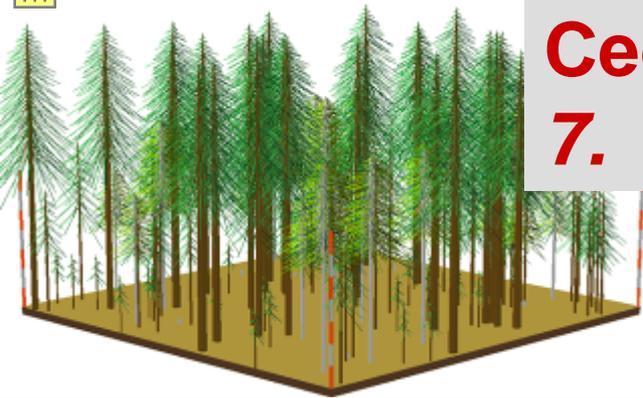


# Cedar Curriculum Ideas

## 7. Forest ecology-management game

2<sup>nd</sup> Life

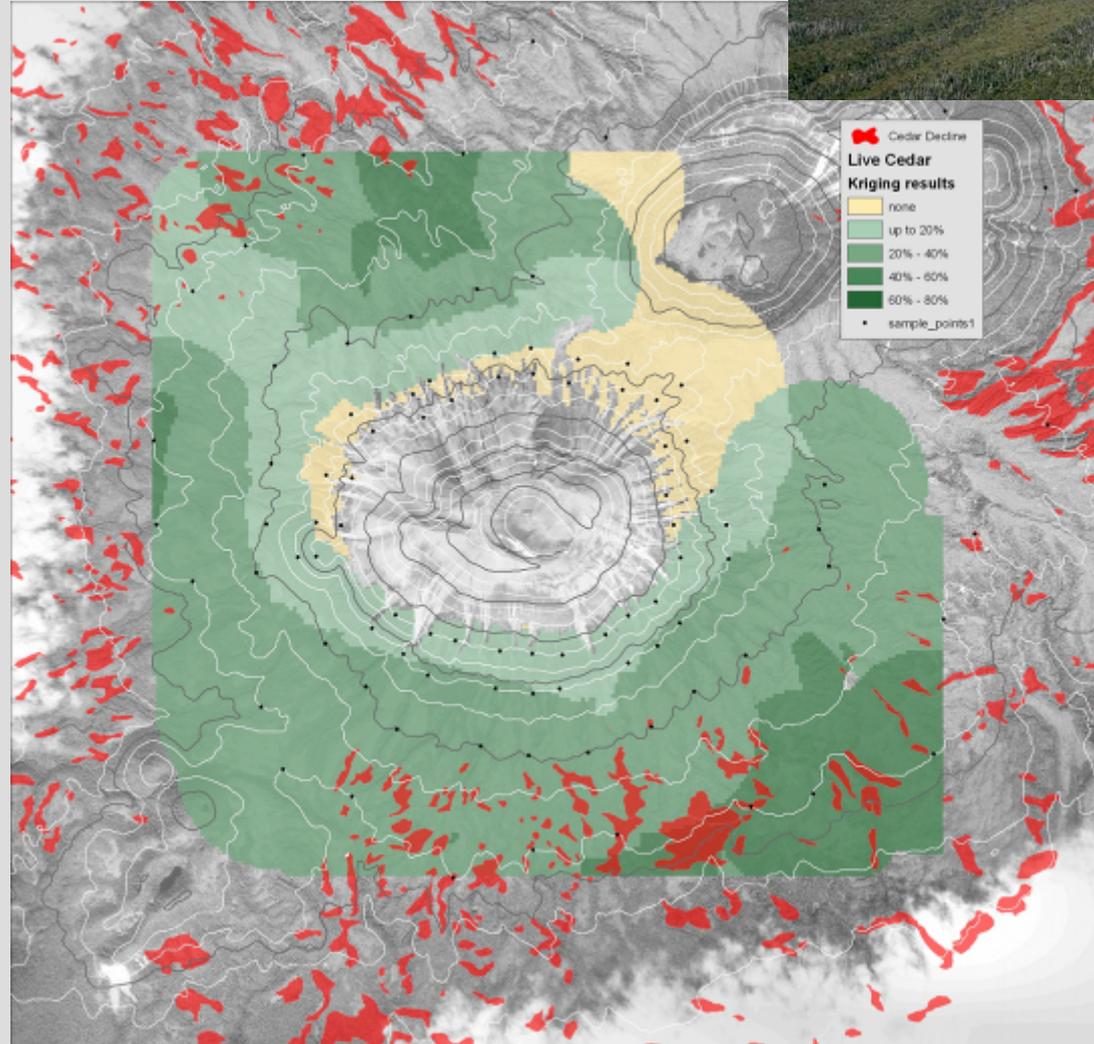
Chip McMillan, UAS



# Cedar Curriculum Ideas

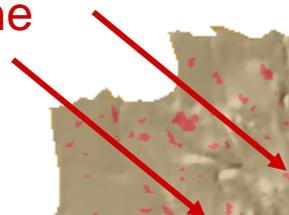
## 8. Cedar on Mt. Edgecumbe (Sitka)

Mapping, GIS, Landscape features, climate





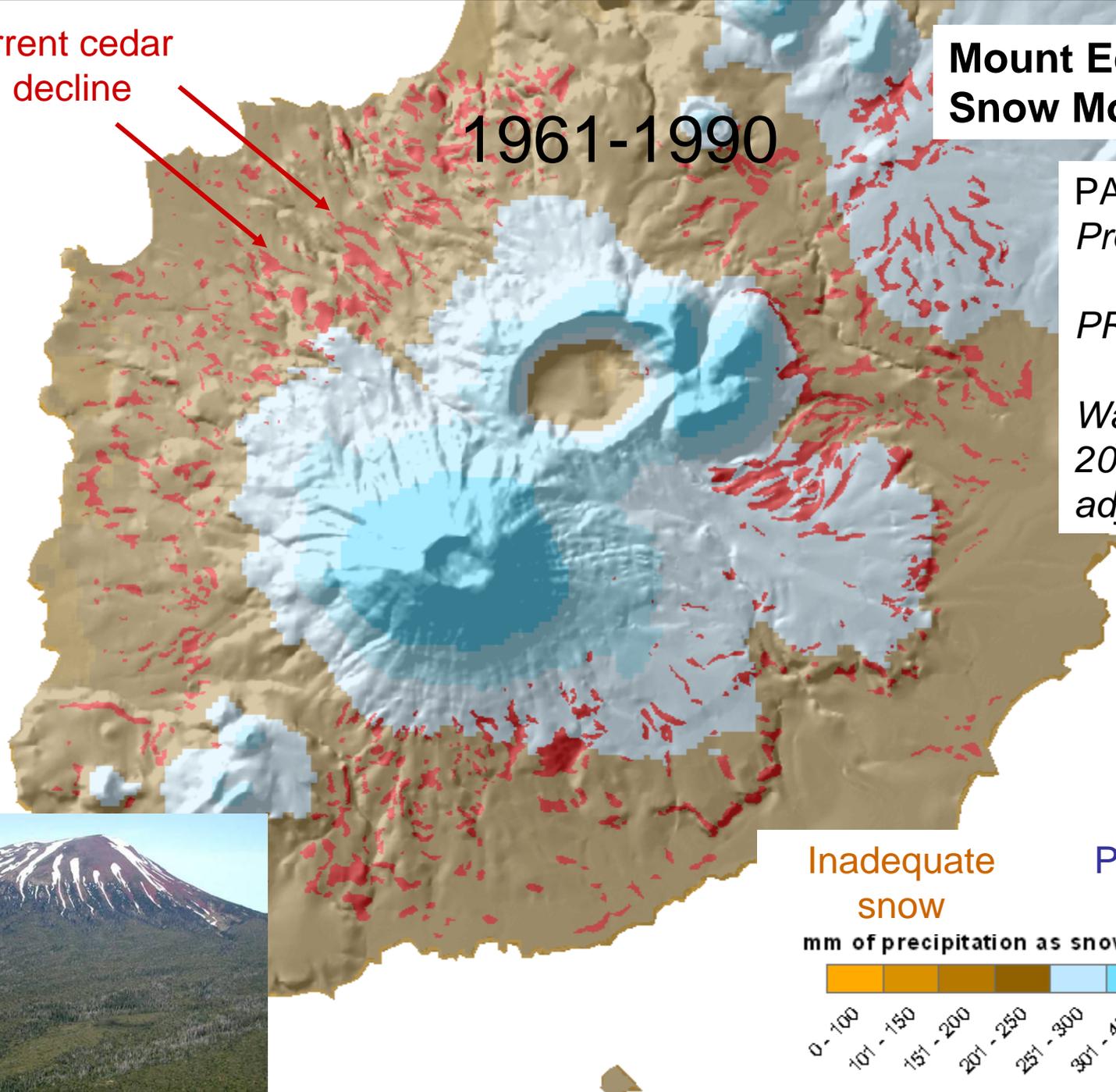
Current cedar decline



1961-1990

# Mount Edgecumbe Snow Model

PAS =  
*Precip as snow,*  
*PRISM,*  
*Wang et al.*  
*2006 elevational*  
*adjustment*



Inadequate snow

Protective snow

mm of precipitation as snow



0 - 100  
101 - 150  
151 - 200  
201 - 250  
251 - 300  
301 - 400  
401 - 500  
501 - 700  
701 - 900





# Cedar management

*Cedar regeneration following harvests*

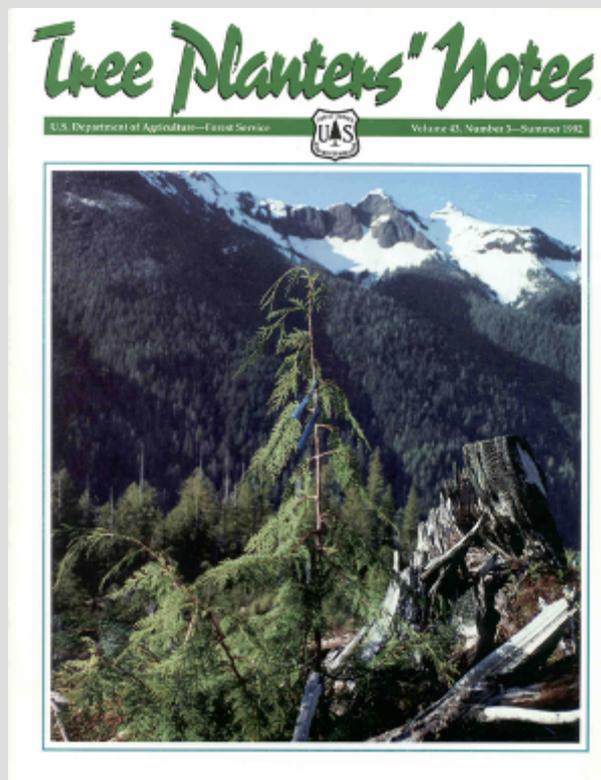


*thinned stand at Klu Bay, KRD*



# Cedar management

Planting trial at Anita Bay, Etolin Island in southeast Alaska, initiated in 1986.



# Goal: Blend Traditional Knowledge with Science on Cedars



**laax**  
Western redcedar  
*Thuja plicata*

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Paul Hennon  
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586-8769



**xáay**  
Yellow-cedar, Alaska-cedar  
*Chamaecyparis nootkatensis*