South Sound Conservation Districts' Forestry Education Series

General Forest Health & Risk Trees: Is this a Habitat Tree or a Hazard Tree?

January 20, 2022

Kitsap Conservation District

Mason Conservation District

Thurston Conservation District EST 1948

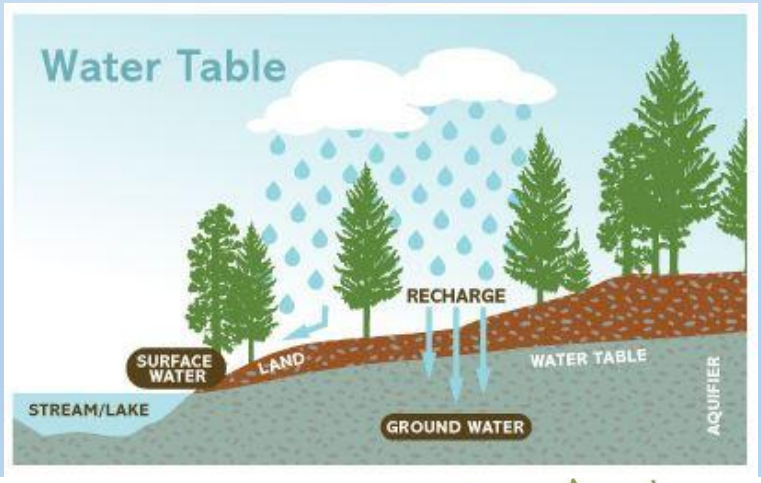
King Conservation District

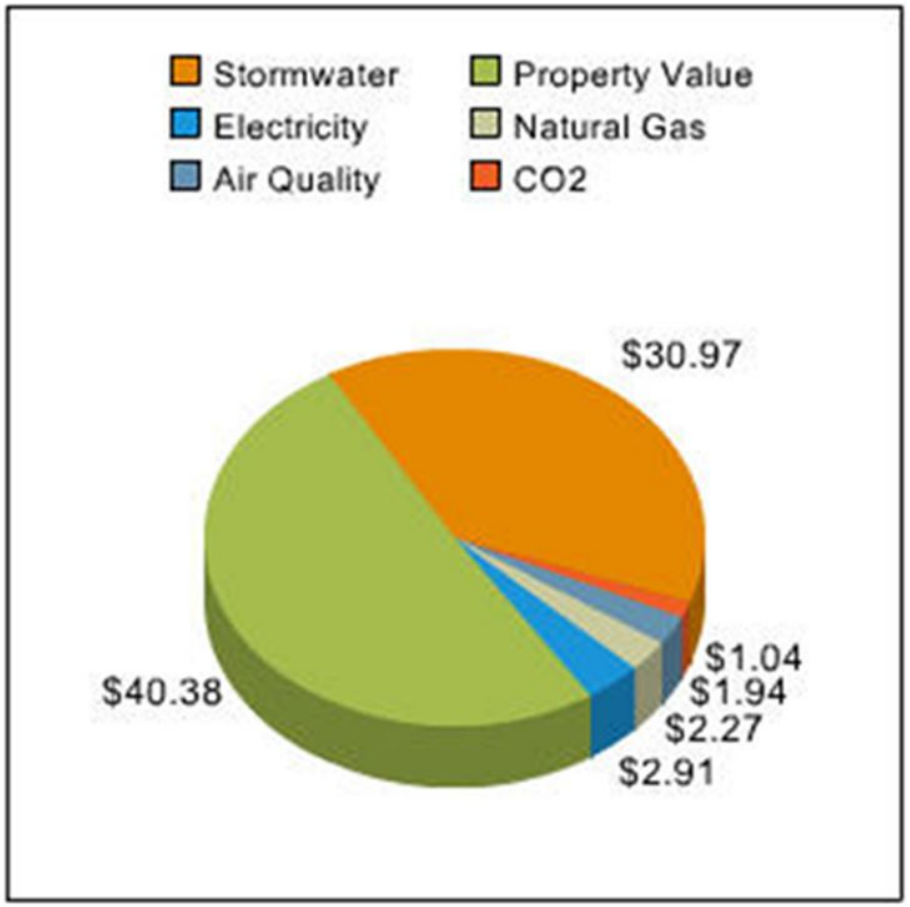
Pierce Conservation District Over 70 Years of Conservation

Importance of Forests

Main Benefits

- Economic
- Water Quality
- Habitat & Ecosystems
- Recreation & Human Health





Breakdown of your tree's benefits

Click on one of the tabs above for more detail

This 15 inch Red alder provides overall benefits of: $79 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 20 inches, it will provide **$105** in annual benefits.

How Trees Calm Us Down

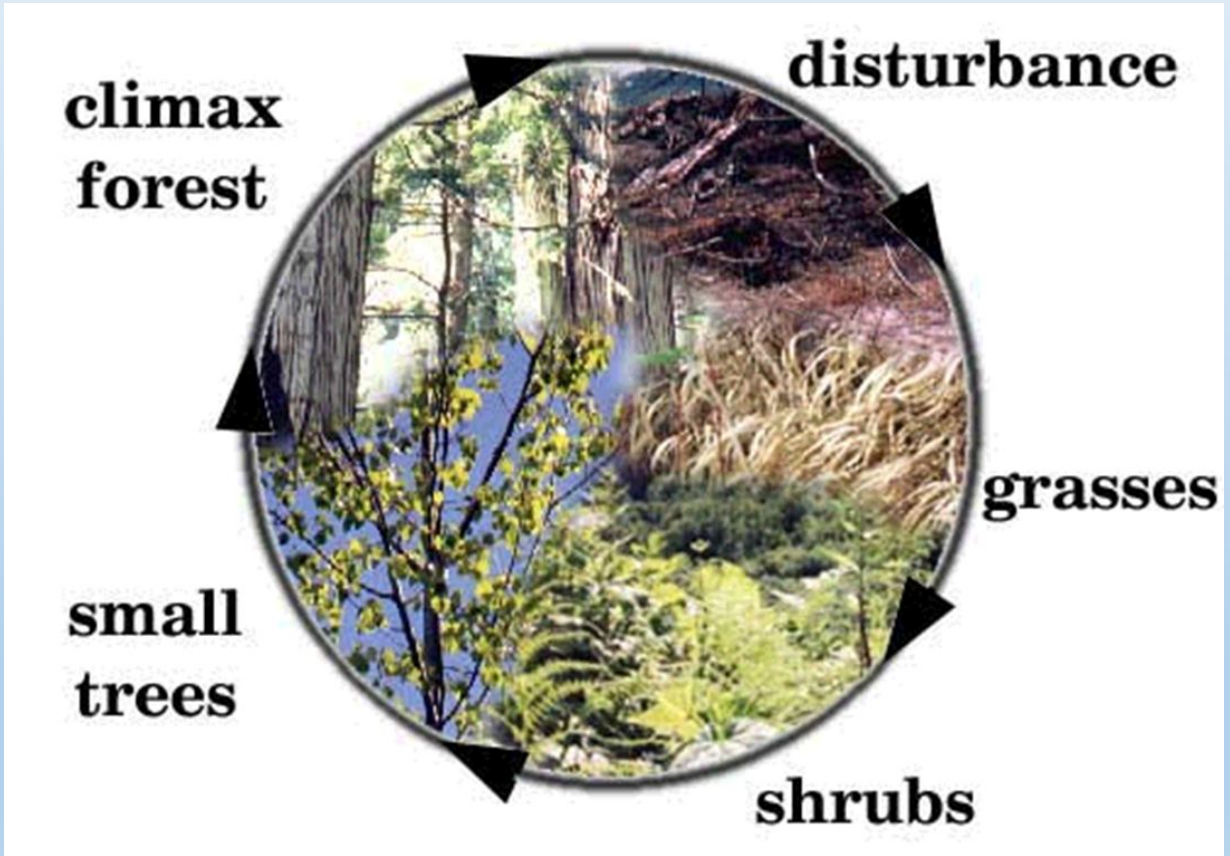
By Alex Hutchinson
July 23, 2015

THE NEW YORKER

Forests and Trees Are Dynamic

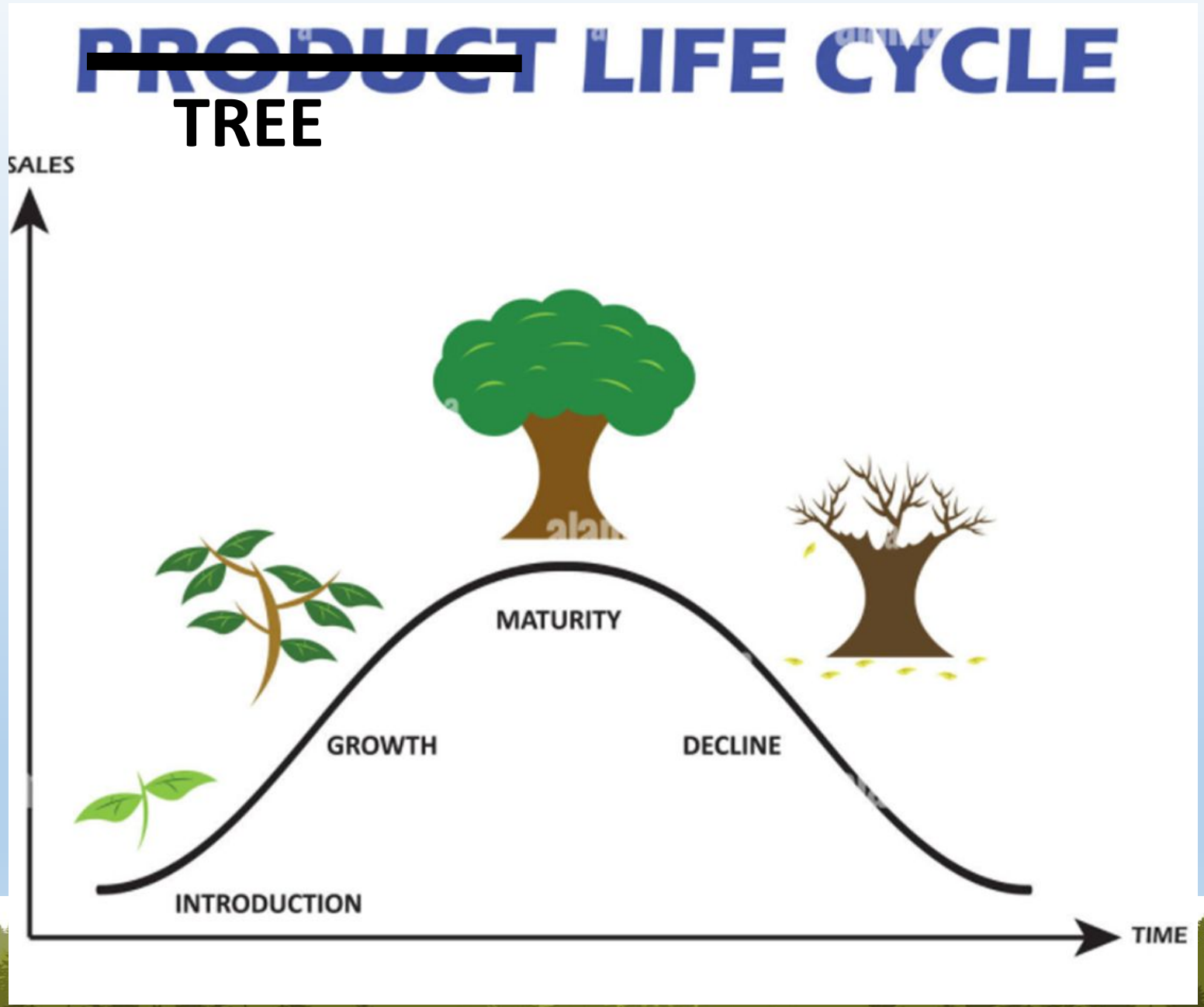
Forests and trees are dynamic systems that are constantly changing, growing, and adapting.

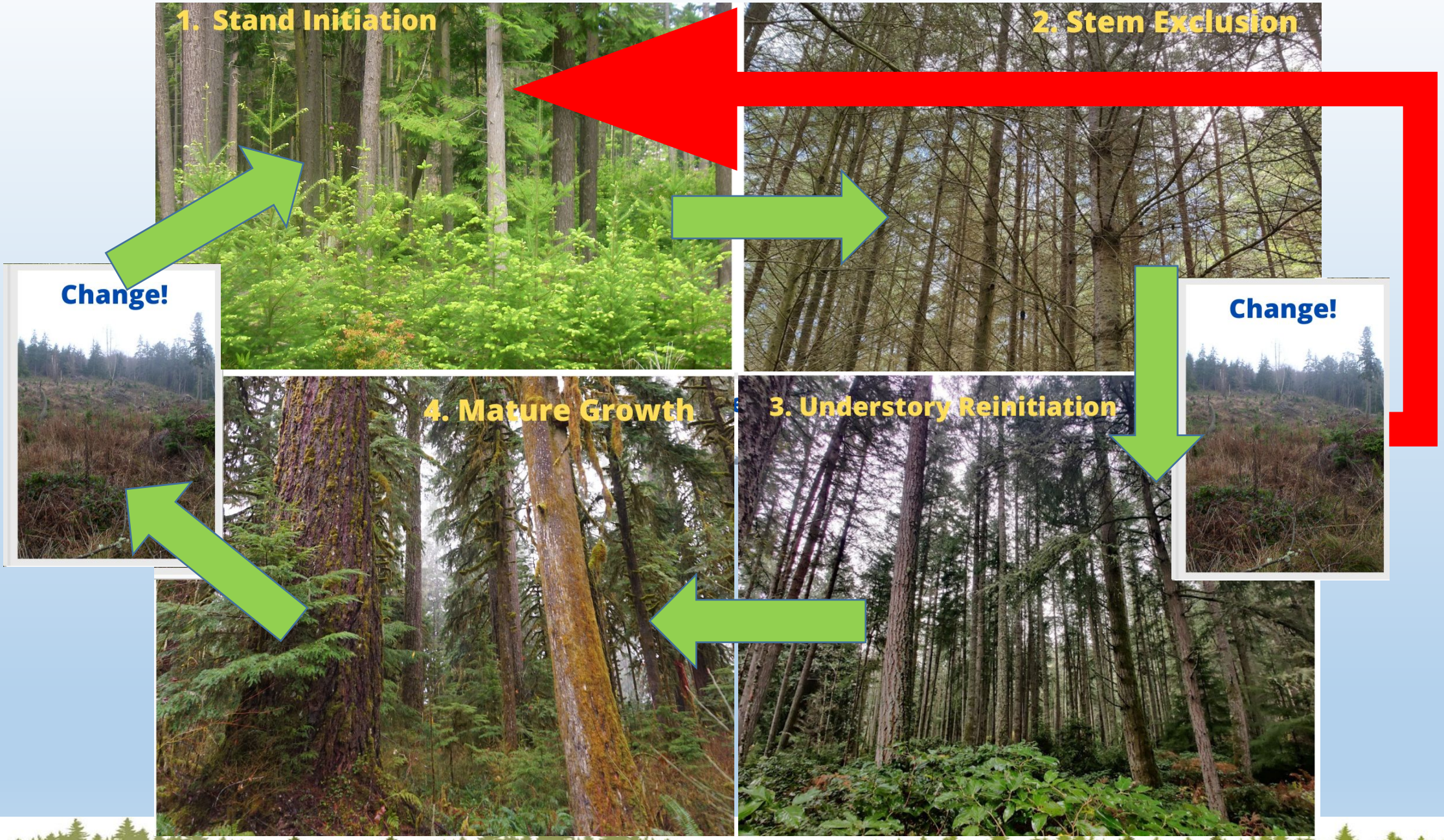
Forest management aims to work with these systems to increase benefits for people and the environment.

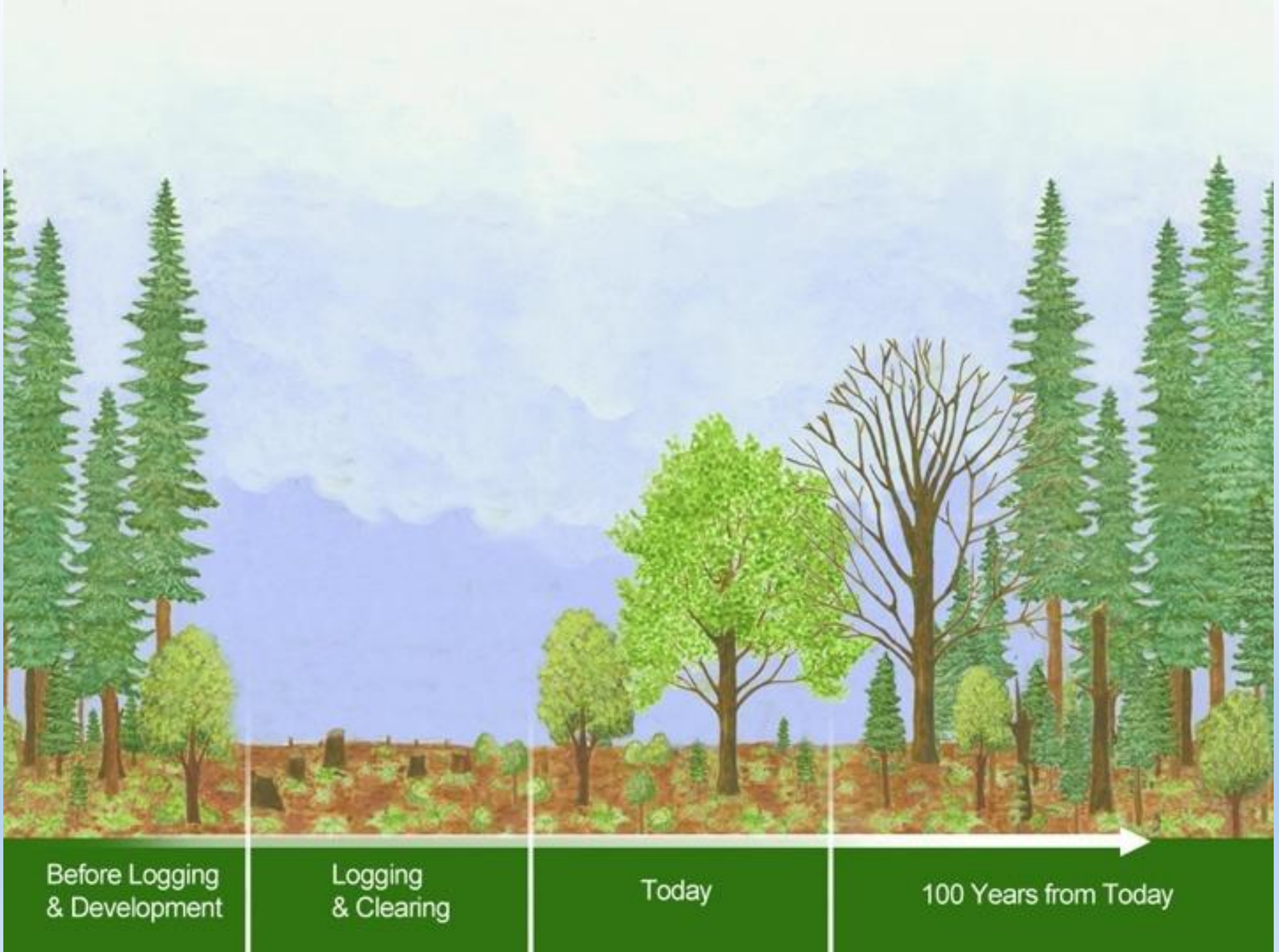


~~PRODUCT~~ LIFE CYCLE

TREE




1. Stand Initiation
2. Stem Exclusion
Change!
Change!
4. Mature Growth
3. Understory Reinitiation


Before Logging
& Development
Logging
& Clearing
Today
100 Years from Today

Changes in Tree Health Are Necessary

Diversity

Wildlife habitat

Alters forest:

- **Structure**
- **Composition**
- **Succession**

Healthy Forest Are Diverse

All Forest Layers Are Diverse

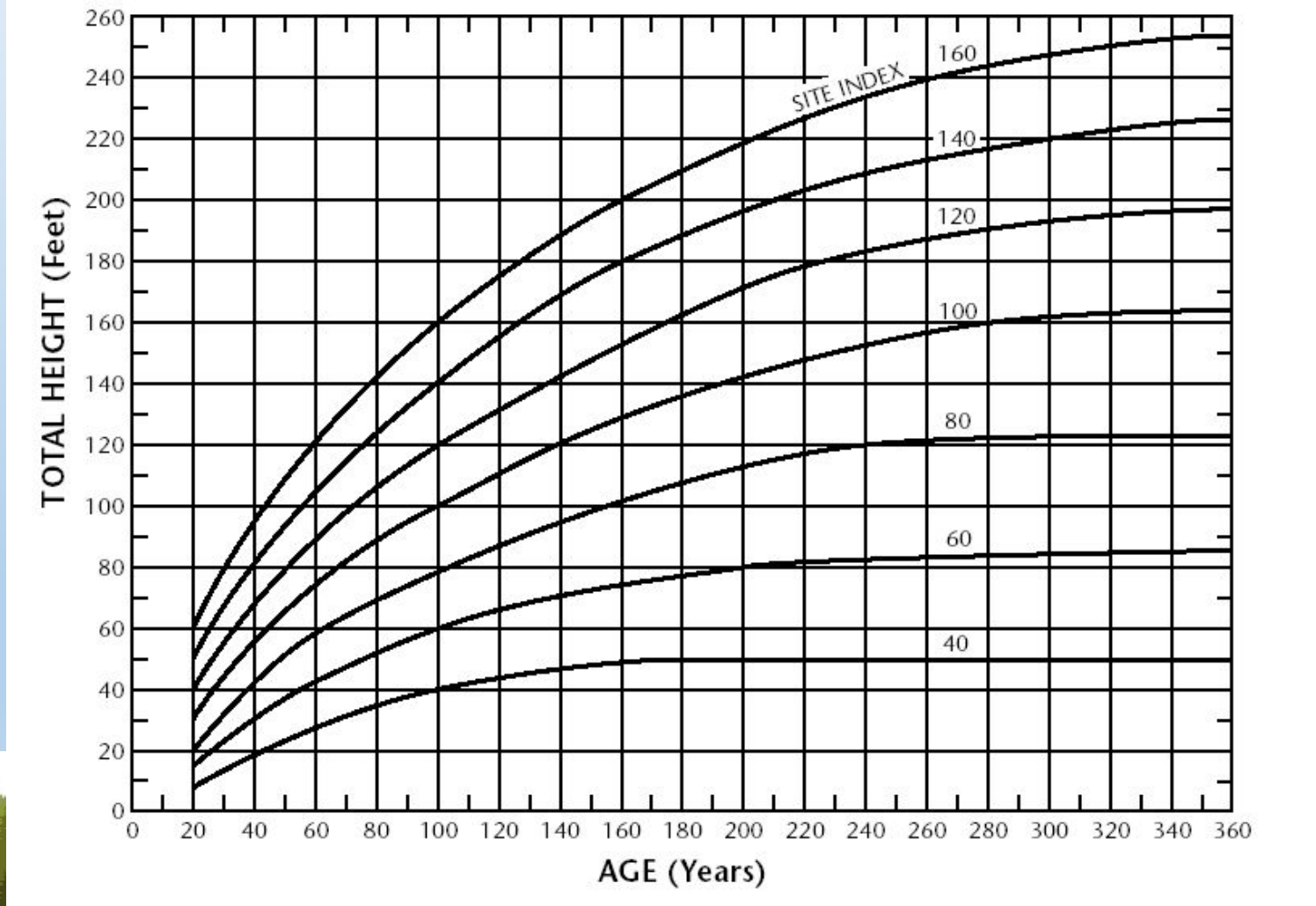
Douglas-fir/western hemlock/salal/sword fern

	Species
Trees	14
Shrubs	32
Grasses	9
Forbs/Ferns (non-grassy herbaceous)	47

Chappell, C.B. 2006.

One tree species present	Not as healthy as it could be.
Two tree species present	Usually indicates fair health.
Three or more tree species present	Indicates good forest health.

Healthy Forests Are Productive



The Fox

Your goals determine health -

- **Goals determine value**
- **Value determines investment**
- **Investment equals health**

You become responsible, forever, for what you have tamed.

***The Little Prince*‘; Antoine de Saint-Exupéry, 1943**

Which forest is healthier?

- It depends on you!

Uneven-aged: a stand with trees of three or more distinct age classes, either intimately mixed or in small groups.

Two-aged: a stand with trees of two distinct age classes separated in age by more than plus or minus 20% of the rotation age.

Even-aged: a stand composed of a single age class of trees in which the range of tree ages is usually plus or minus 20% of the rotation age.

Measuring Health

- $ Value
- Numbers of trees
- Number of dead trees
- Size of trees-growth
- Diversity of species
- Structure
- Wildlife
- Insects
- Looks good

Basic Plant Needs and Cost to Fix

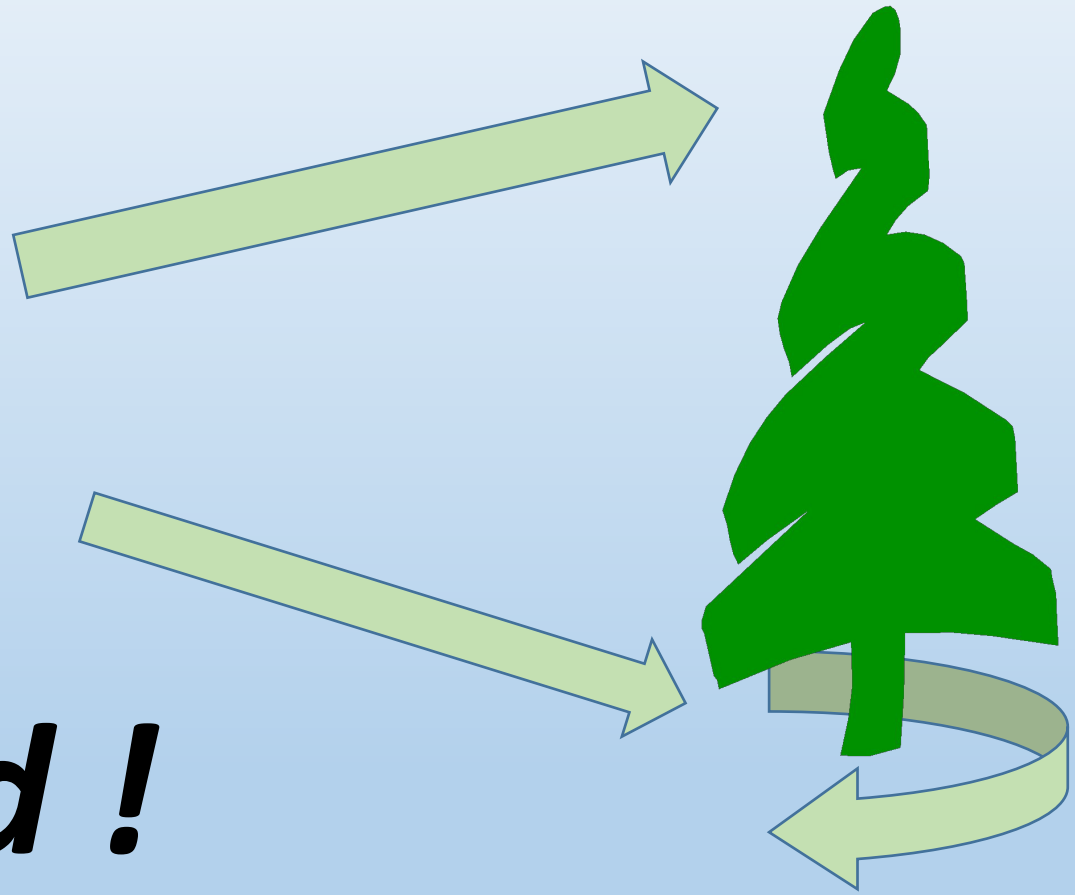
Plant Need	Easy Fix	Cost
Water	Yes	Low-High
Light	Yes	Moderate
Nutrients – Soil	Yes/No	Moderate-High
Air	?	?
Temperature	Maybe	?
Time	No	High
Room to Grow	Yes	Low-High

So how do we tell if a forest or a tree is healthy?

Look up !

Look down !

Look all around !



Look down !

Look all around !

Look up !

Table 1. Diseases of madrone.*

Disease category	Pathogen	Disease name
Root rots	*Pythium* spp.	Damping-off
	Phytophthora cactorum	Collar rot *or* basal canker
	*Phytophthora cinnamomi***	Phytophthora root rot
	Armillaria spp.	Armillaria root disease
	Heterobasidion annosum	Annosus root rot
Twig dieback and branch cankers	*Neofusicoccum arbuti (Nattrassia mangiferae, Fusicoccum arbuti, Hendersonula toruloidia)*	Madrone canker
	Botryosphaeria dothidea (Fusicoccum aesculi)	Madrone twig dieback
Wood-decay fungi	*Phellinus igniarius*	
	Fomitopsis cajanderi	Brown top rot
	Poria subacida	Yellow root rot
Foliage diseases	*Ascochyta hanseni*	Leaf spot
	Coccomyces quadratus	Tar spot
	Cryptostictis arbuti	Leaf spot
	Didymosporium arbuticola	Leaf spot
	Diplodia maculata	Leaf spot
	Disaeta arbuti	
	Elsinoe mattirolianum	Spot anthracnose
	Exobasidium vaccinii	Blister blight
	Mycosphaerella arbuticola	Madrone foliage blight
	Phyllosticta fimibriata	Leaf spot
	Pucciniastrum sparsum	Rust
	Rhytisma arbuti	Speckled tar spot

*Adapted from Elliott (1999) ** Hansen (unpublished)

Photos by Marianne Elliott, Gary Chastagner
Table from Bennett and Shaw

Reference Forests and Trees

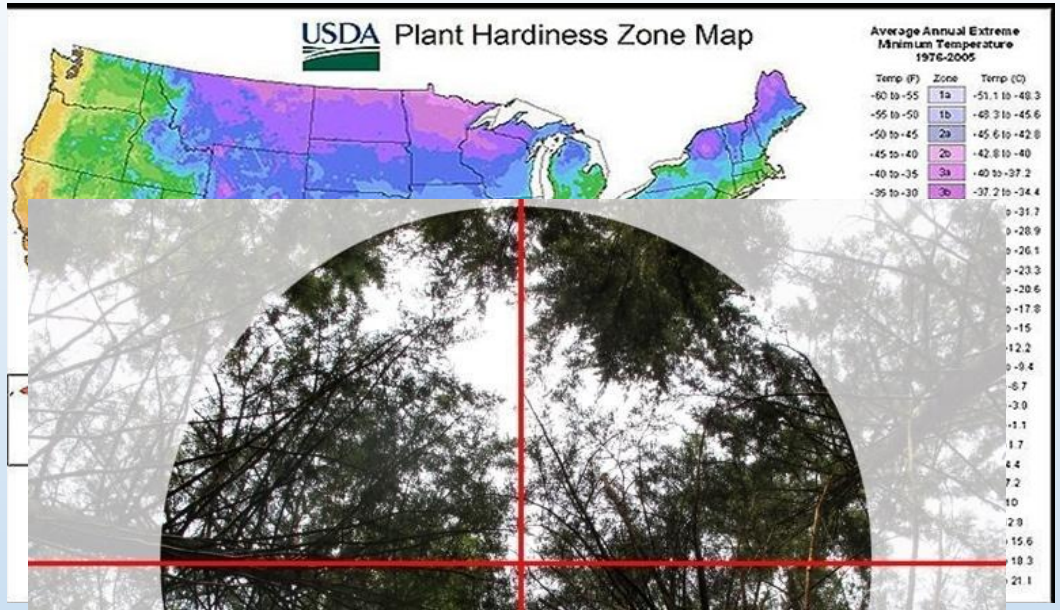
Best time to look at your forest is now.

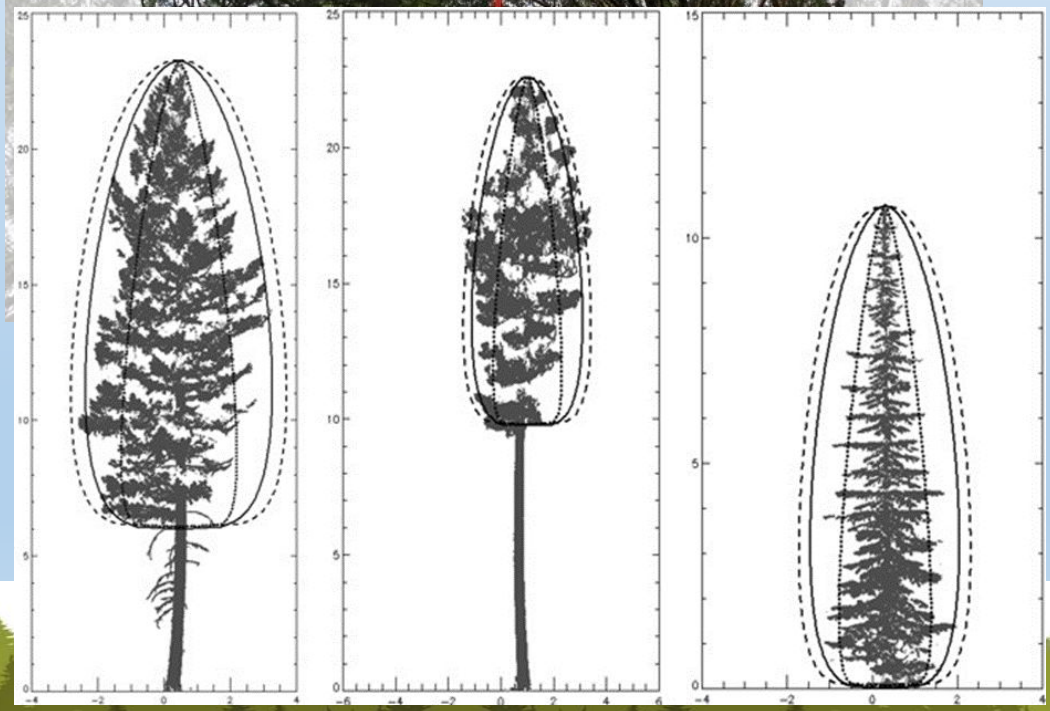
- **Get to know the forest through the seasons**
- **Look at your neighbors trees**
- **Go to your local park**

Look up!

Look up!

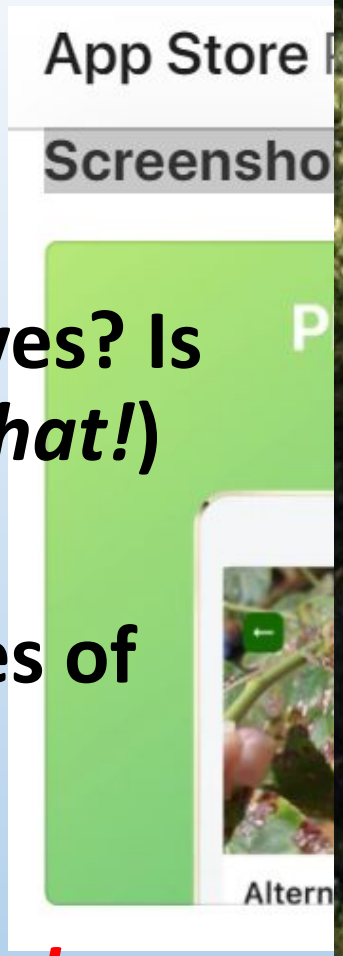
- Where do your trees live?
- Canopy cover
  - How much sky can you see? Google Earth!
- Canopy spread
  - How wide are the trees branches?
  - Is that normal?
- Live Canopy Ratio
  - How much of the tree has branches on it?





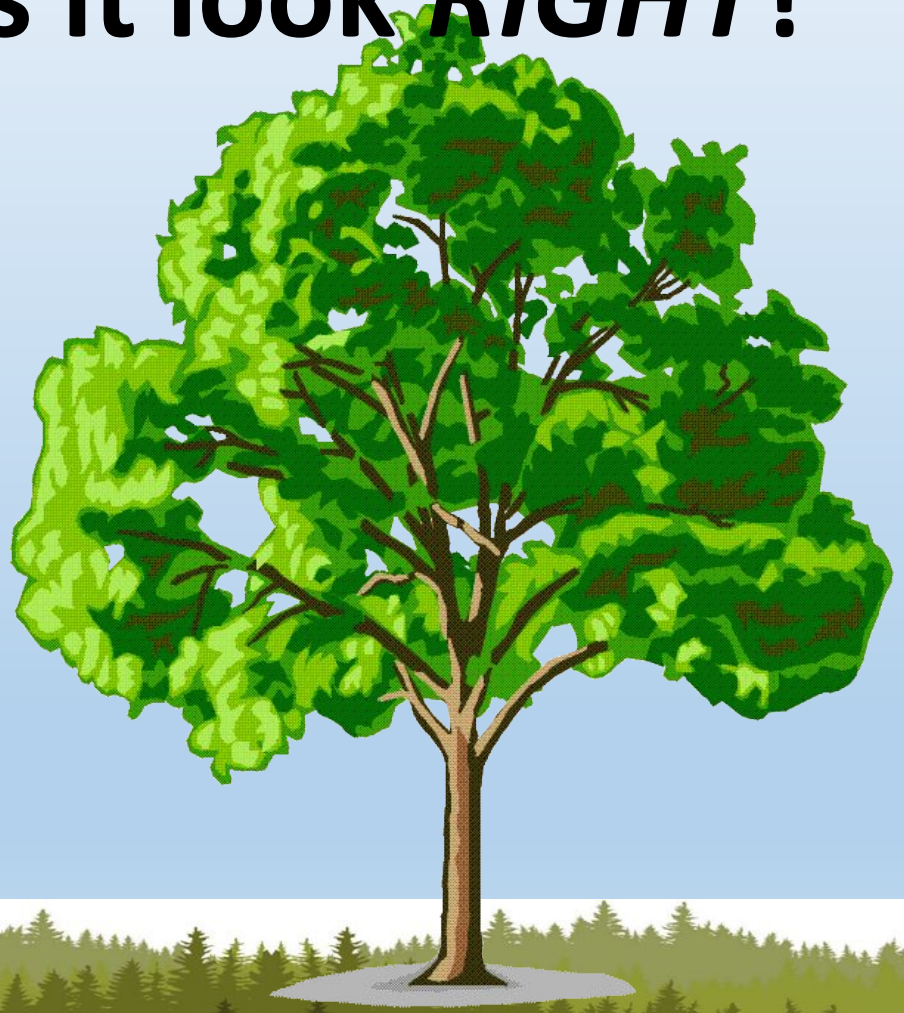
Look up!

- Color
  - What color are the needles or leaves? Is that normal? (*There's an app for that!*)
- Fruit production
  - More cones than all the other trees of the same species?
- Is the top dead or dying?
  - *Root rot shows up in the top of the tree*
- Is the top 1/3 of the tree straight up?



What to look for:

Does it look *RIGHT*?



What to look for:

Does it look *RIGHT*?

What you see	*Could be*	What you see	*Could be*
• Ragged leaves with holes	• *Insects are feeding on the leaves*	• Peeling or broken bark, or holes in the bark	• *Trunk wound, canker disease, or damage caused by humans or animals*
• Black or brown leaves	• *Stem or leaf disease; cou also be frost or salt dam*		*root injury or m disease, insect*
• Red needles	• *Possible insect infestatio*		*ction*
• Green or brown spots on needles	• *Air pollution*		*nches, wind exposure to y conditions*
• Spots or bumps on the leaves	• *Insects and mites could b damaging the tree*		*ring the tree wounds and al wood decay*
• Twisted or malformed leaves	• *Herbicides, insects or disease are damaging the tree*	• Fungi or mushrooms growing on the tree	• *Internal decomposition of the wood by fungi*
• Leaves are changing color before fall	• *Trunk or root damage; drought or pollution could also be the cause*	• Branch decay	• *The tree may have unhealed wounds*

Swiss Needle Cast

Fungus: *Phaeocryptopus geaumannii*

Host: Douglas-fir

Underside of needle

Pseudothecia (fungal sporulating structure)

Amy Ramsey Forest Pathologist

WA Dept. of Natural Resources

amy.ramsey@dnr.wa.gov

Look up!

Top 4 Landscape Tree Diseases in PNW

PHYTOPHTHORA ROOT ROT - Dead leaves or needles

Affected Trees: Cherry, Dogwood, Holly, Madrone, Oak, Arborvitae, Cypress, Juniper, Cedars, Pines, Firs, & Fruit-Bearing Trees

VERTICILLIUM WILT - Wilting, decline in new growth, yellowing leaves.

Affected Trees: Ash, Box elder, Oak, Linden, Walnut, Maple, & Other Hardwoods.

ANTHRACNOSE - Curling leaves, spotting leaves, and early leaf drop.

Affected Trees: Dogwood, London Plane, American Sycamore, Ash, Maple, Walnut, & Oak

BRONZE BIRCH & EMERALD ASH BORERS -Yellowing leaves, loss of leaves, Woodpeckers

Affected Trees: Birch & Elm

How do insects impact trees?

- Foliage Feeding
- Bark Beetles & Phloem Boring
- Wood Boring
- Feed on
  - Terminal Shoot, Twig & Root
  - Seed, Cone, Flower & Fruit
- Sapsucking Insects & Mites
- Gall Makers
- And More ……

Donald Owen, California Department of Forestry and Fire Protection, Bugwood.org

https://www.forestpests.org/

Which trees do insects and disease impact?

- Conifers
  - Fir (Abies)
  - White Cedar (Chamaecyparis)
  - Juniper (Juniperus)
  - Larch (Larix)
  - Incense-cedar (Libocedrus)
  - Spruce (Picea)
  - Pine (Pinus)
  - Douglas-fir (Pseudotsuga)
  - Redwood (Sequoia)
  - Giant sequoia (Sequoiadendron)
  - Bald cypress (Taxodium)
  - Yew (Taxus)
  - Cedar (Thuja)
  - Torreya (Torreya)
  - Hemlock (Tsuga)

- Hardwoods
  - Maple (Acer)
  - Buckeye (Aesculus)
  - Alder (Alnus)
  - Madrone (Arbutus)
  - Birch (Betula)
  - Hornbeam (Carpinus)
  - Hickory (Carya)
  - Chinkapin (Castanopsis)
  - Hackberry (Celtis)
  - Redbud (Cercis)
  - Dogwood (Cornus)
  - Persimmon (Diospyros)
  - Beech (Fagus)
  - Ash (Fraxinus)
  - Honeylocust (Gleditsia)
  - Gordonia (Gordonia)
  - Silverbell (Halesai)
  - Holly (Ilex)
  - Walnut (Juglans)
  - Sweetgum (Liquidambar)

https://www.forestpests.org/

What to Look For:

Bees in trunk = decay = runaway

Borers = small holes with frass

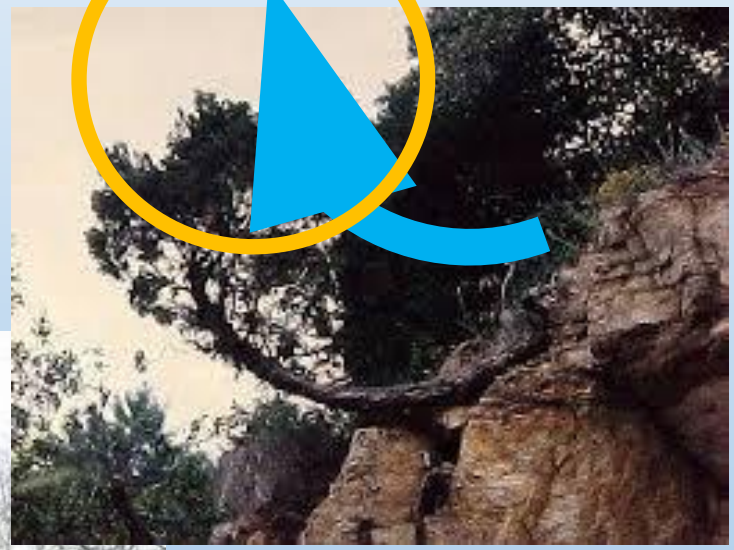
Bark beetles = bark sloughing

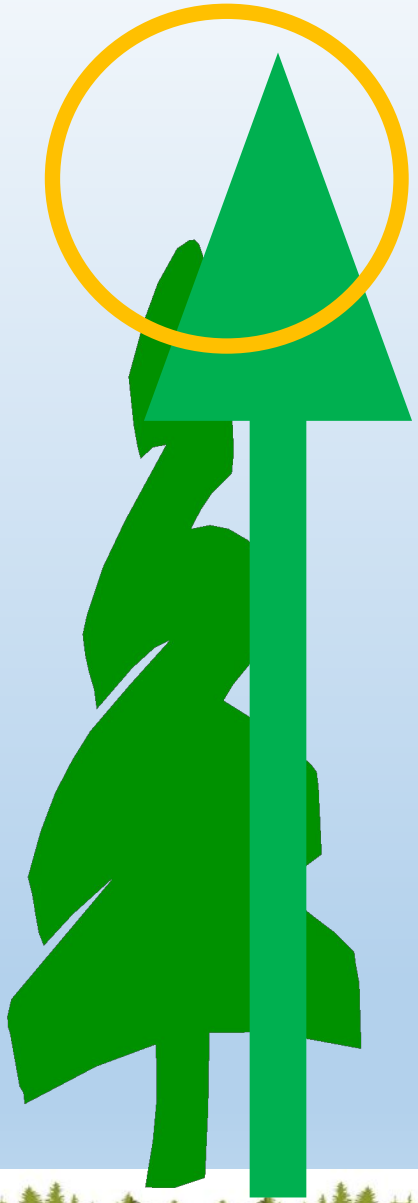
Carpenter ants = sawdust

Termites = Orkin

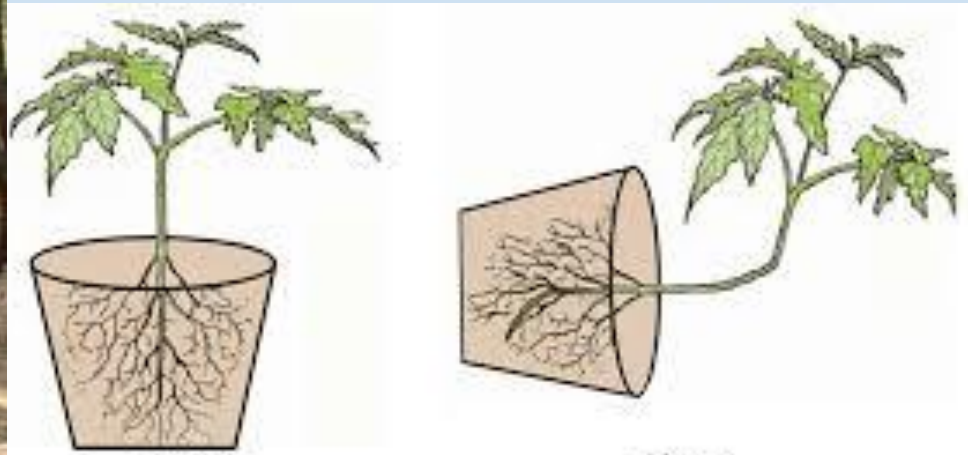
What to look for:

Lean vs. growth





What to look for:
Lean vs. growth

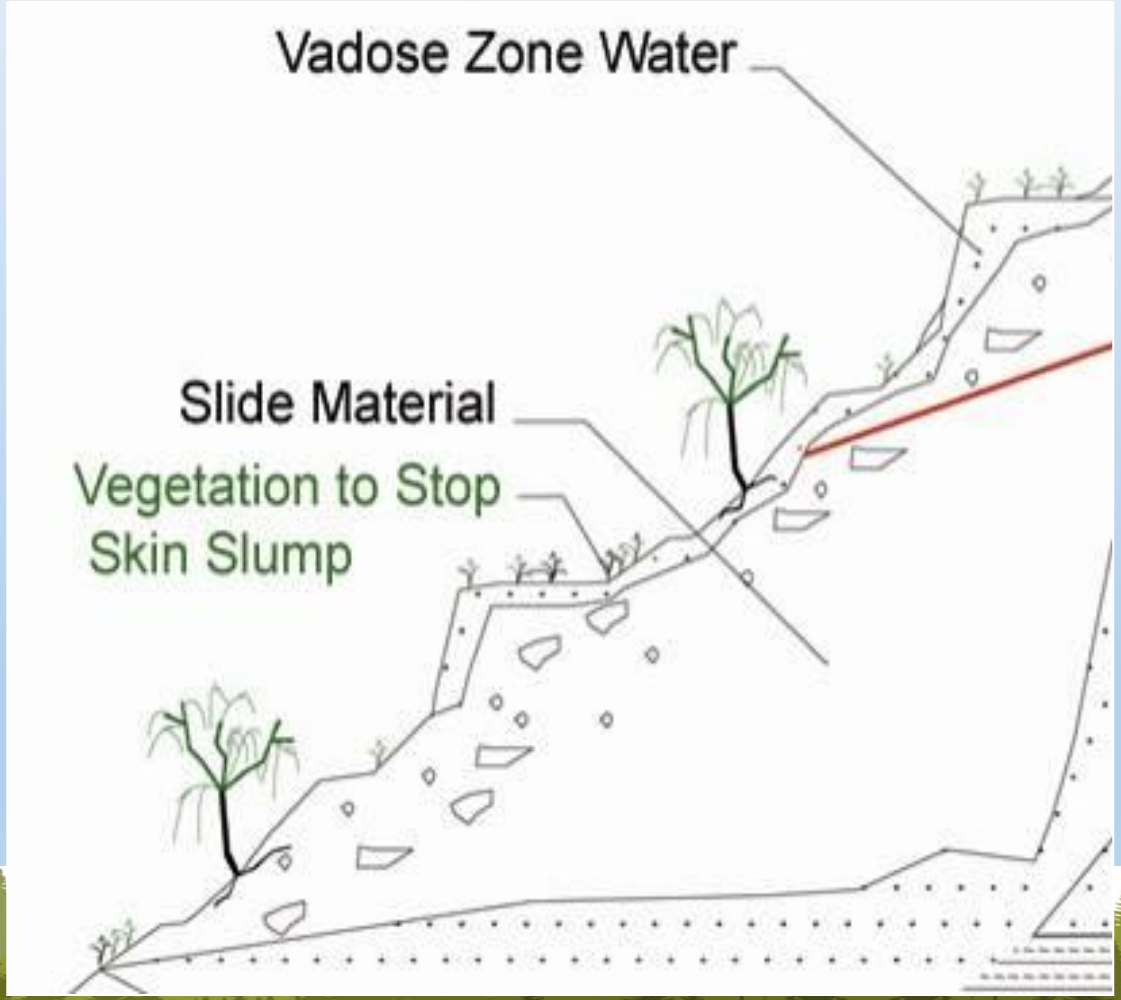


Experiment showing Geotropism

Side Note:

Trees on Moving Slopes

- Trees don't prevent deep-seated slides

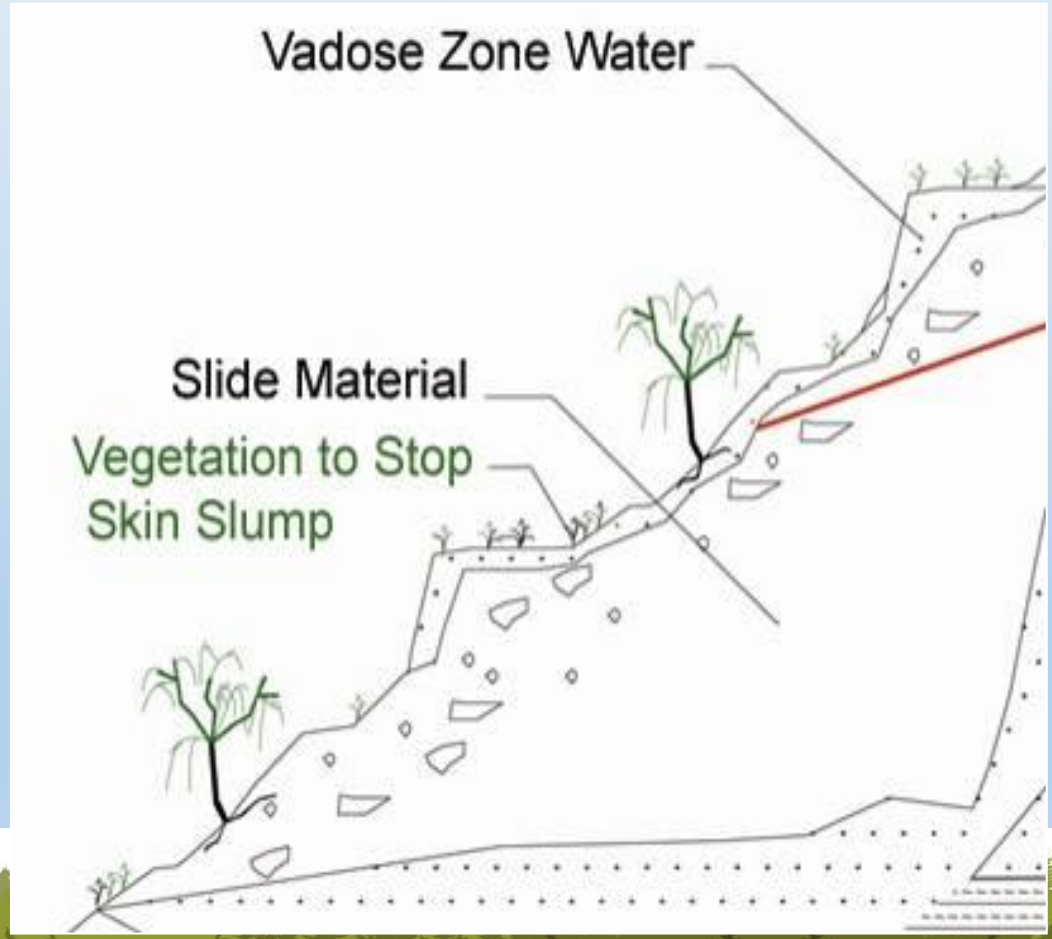


Side Note:

Trees on Moving Slopes

Trees do:

- Reduce erosion
- Roots hold soil
- Pump water out of slope
- Reduce rate and volume of rainwater on slope



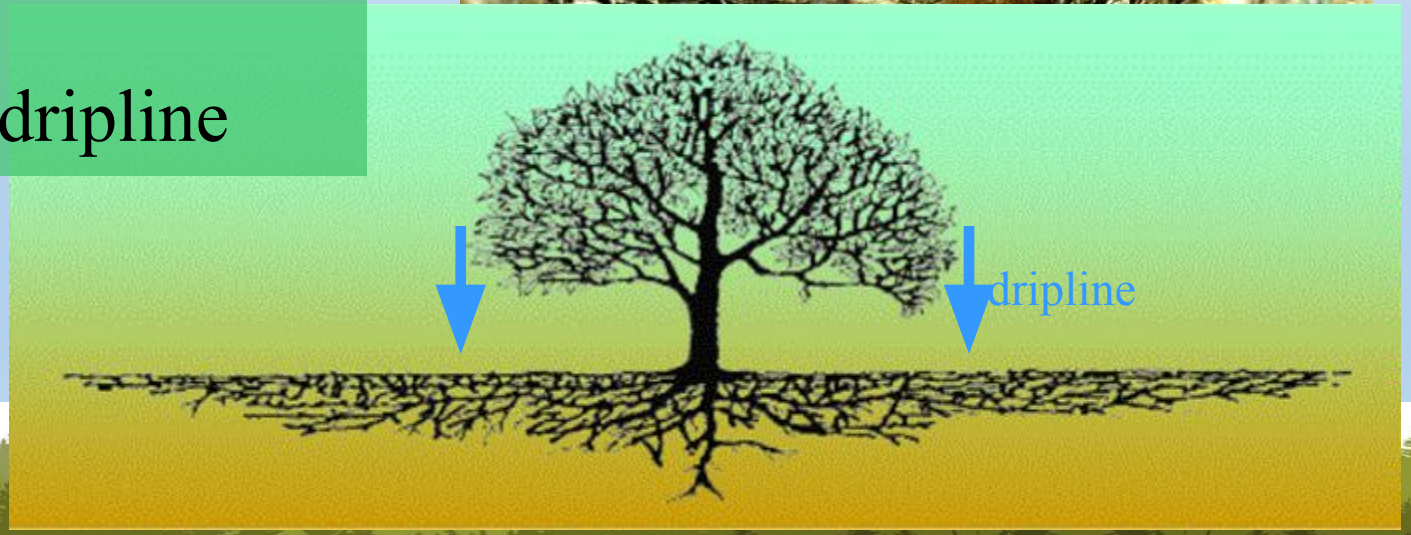
Look down !

- What is your soil type?
  - USDA Web Soil Service
- Is there water?
  - All the time, some of the time, too much, to little (more later)
- What type of plants are growing under the trees?
  - Invasives, shrubs, grasses, NONE
  - How many different kinds of plants
  - Are there mushrooms growing around the tree(s)?

Side Note:

Roots Grow Out Not Down

Roots are usually in the top 16” to 30” of soil.
Roots are not protected by soil.
Tree roots are not woody and tough.
Roots grow beyond the dripline



What to look for:

Roots and Root Crown

- Hard to see - Look for signs above ground
- Root uplift? - extent, direction
- Root rot? – dead tops, thinning crown, off color &/or smaller foliage
- Decay at point of lean?
- Roots exposed, undermined, wounded?
- Circling, kinked, or girdling roots?

Armillaria root disease

Species & Synonyms	Relative Pathogenicity	Primary Hosts
A. solidipes = A. ostoyae	High	Conifers
A. mellea	High	Hardwoods
A. gemina	Moderate?	Hardwoods
A. calvescens	Low	Mixed
A. sinapina	Low	Mixed
A. gallica = A. bulbosa	Low	Mixed
A. alitmontana (NABS X)	Low	Mixed
A. cepistipes	Low	Mixed
A. nabsnona	Low	Hardwoods
A. socialis = A. tabescens	Variable	Hardwoods

WASHINGTON STATE DEPARTMENT OF Natural Resources

Root Diseases in Oregon and Washington Conifers

R6-FPM-250-86

James S. Hadfield, Donald J. Goheen , Gregory M. Filip, Craig L. Schmitt , Robert D. Harvey

U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Forest Pest Management, Portland, Oregon

Hosts	Laminated root rot	Armillaria root disease	Annosus root disease	Black stain root disease	Port-Orford-cedar root disease
Douglas-fir (westside)	1*	2**	3	1	4
Douglas-fir (eastside)	1	1	3	3	4
Ponderosa pine	3	2	2	3	4
Lodgepole pine	3	2	2	3	4
Western white pine	3	2	3	4	4
Sugar pine	3	2	3	4	4
Grand fir	1	1	1	4	4
White fir	1	1	1	4	4
Pacific silver fir	2	2	1	4	4
Noble fir	2	2	2	4	4
Subalpine fir	2	2	2	4	4
California red fir	2	2	2	4	4
Western hemlock	2	2	2***	3	4
Mountain hemlock	1	2	1	3	4
Larch	2	3	3	4	4
Engelmann spruce	2	2	3	4	4
Sitka spruce	3	2	3	4	4
Western redcedar	4****	2	3	4	4
Incense cedar	4	3	3	4	4
Port-Orford-cedar	4	3	3	4	1

* 1 = severely damaged
2 = moderately damaged
3 = seldom damaged
4 = not damaged

** Westside DF is moderately damaged up to age 25, susceptibility then decreases

*** Western hemlock is not severely damaged until it exceeds 150 years

**** Western redcedar east of the Cascade Range may have butt rot caused by laminated root rot

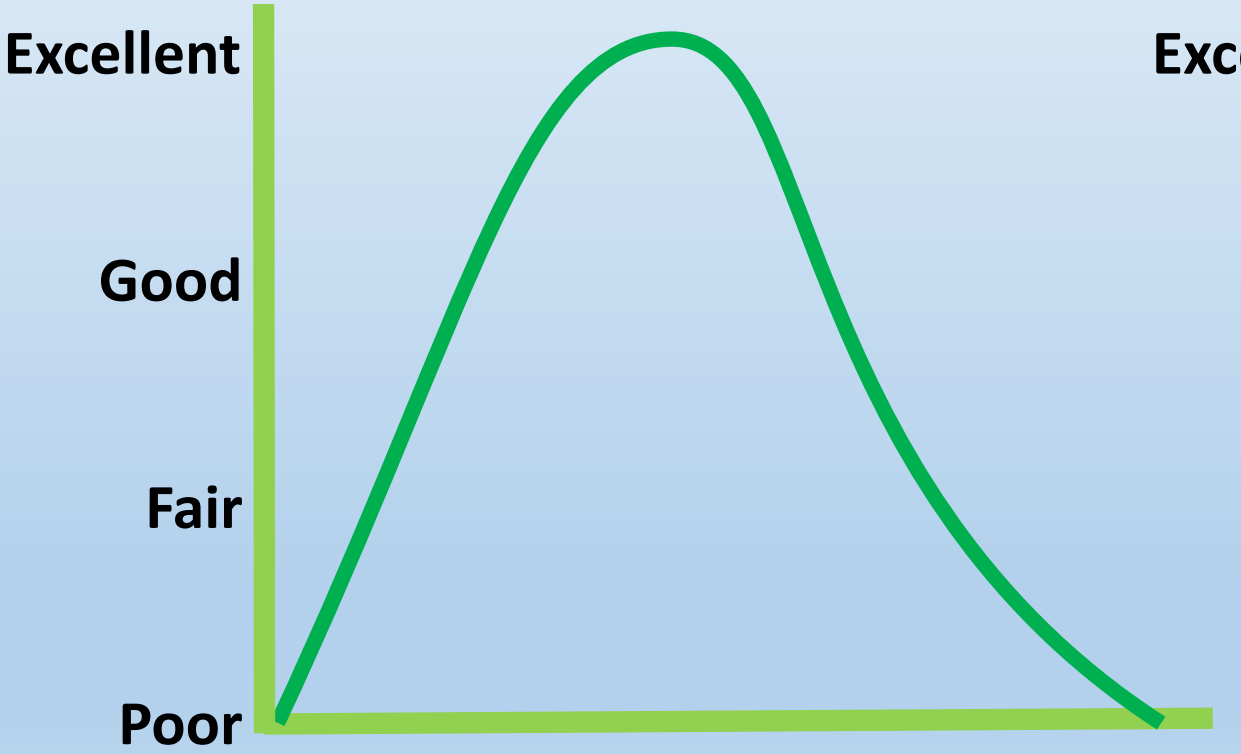
Symptoms & Signs	Laminated root rot	Armillaria root disease	Annosus root disease	Black stain root disease	Port-Orford-cedar root disease
Reduced height growth	X	X	X	X	
Yellow foliage	X	X	X	X	X
Slow loss of foliage	X	X	X	X	
Distress cones	X	X	X	X	
Slow crown decline	X	X	X	X	
Rapid tree death		X		X	X
Dead tree, no foliage loss		X			X
Abundant basal resin flow		X			
Cinnamon stain in inner bark					X
Black stain in sapwood				X	
Roots rotted	X		X		
Windthrown live trees	X		X		
Insect galleries under bark	X	X	X	X	X
Fleshy golden-yellow mushrooms .....on tree base		X			
Mycelial fans		X			
Rhizomorphs		X			
Leathery conks			X		
Setal hyphae	X				
Ectotrophic mycelium	X				
Creamy leathery pustules on roots			X		
Advanced Decay:					
Laminated decay with pits on both ..... sides of sheets	X				
Laminated decay with pits on only .... one side of sheets			X		
Yellow, stringy decay with black ..... zone lines		X			
White, stringy decay with black ..... specks			X		

Look all around!

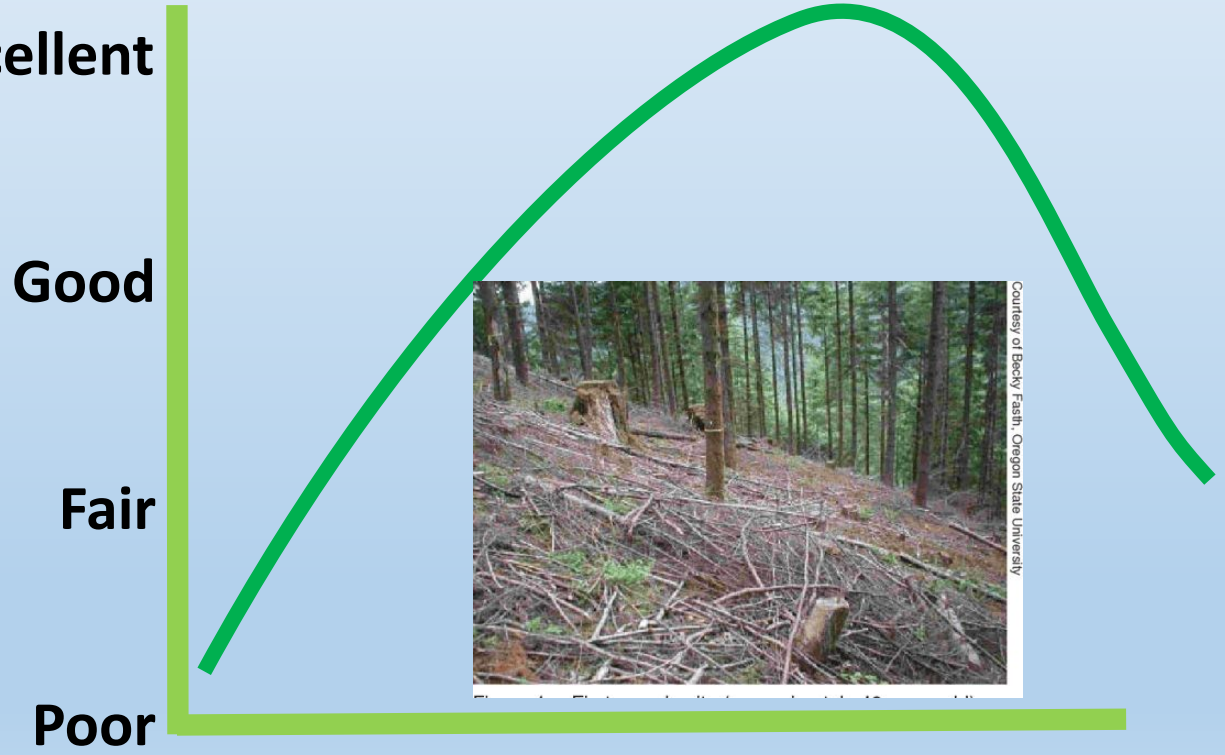
- Trunk defects
- Decay spots
- Tree spacing (more later)
- Insects/Disease
  - Sap
  - Small holes
  - Fungus/Mushrooms growing from the tree
- Anything new?
  - Construction
  - Roads

DEAD IS HEALTHY?

% Trees are Dead



% Coarse Woody Debris



Courtesy of Becky Fasth, Oregon State University

What to Look For:

- Poor Tree Architecture
- Cankers
- Cracks
- Decay
- Dead Wood
- Weak Unions

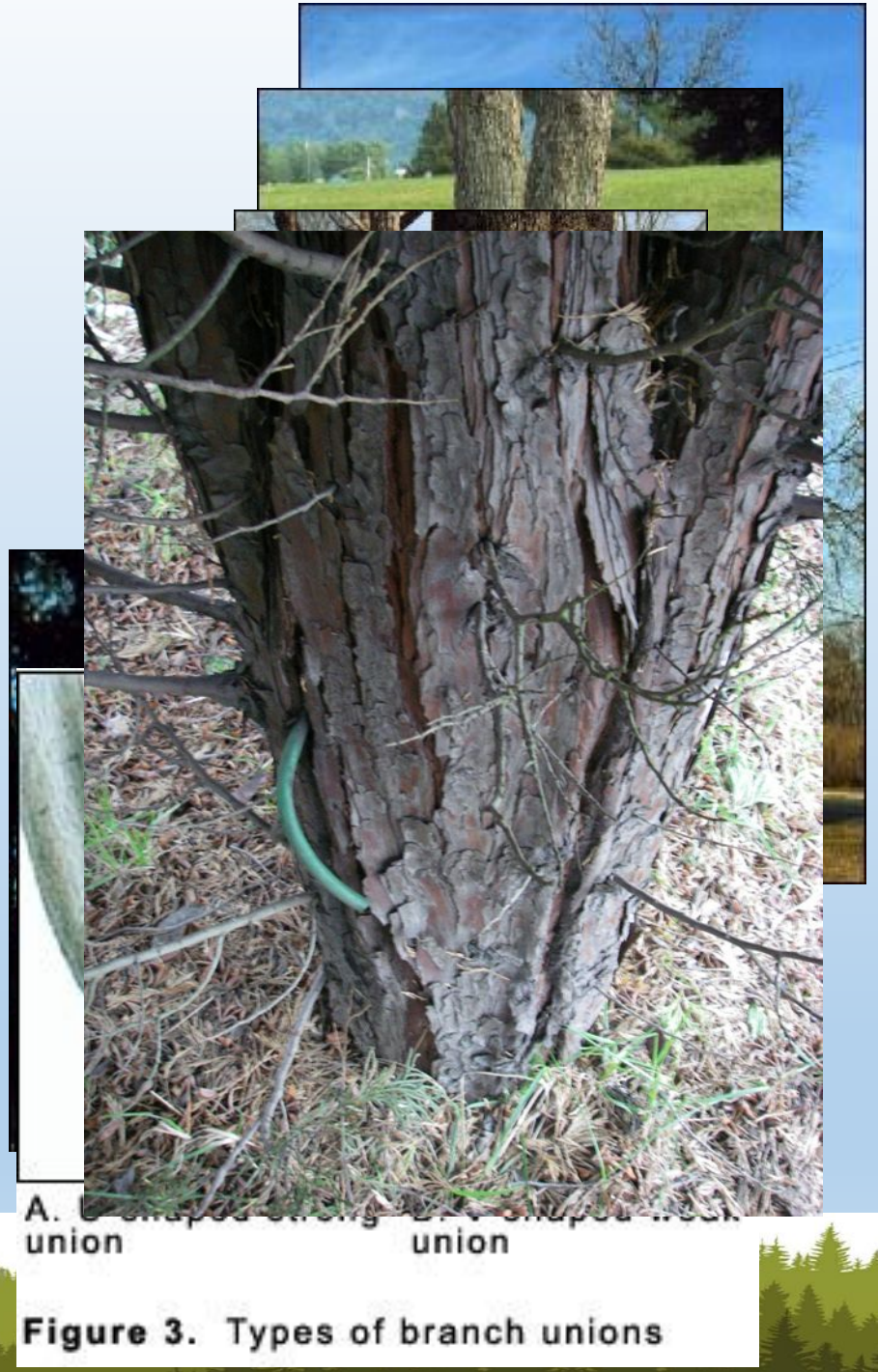


Figure 3. Types of branch unions

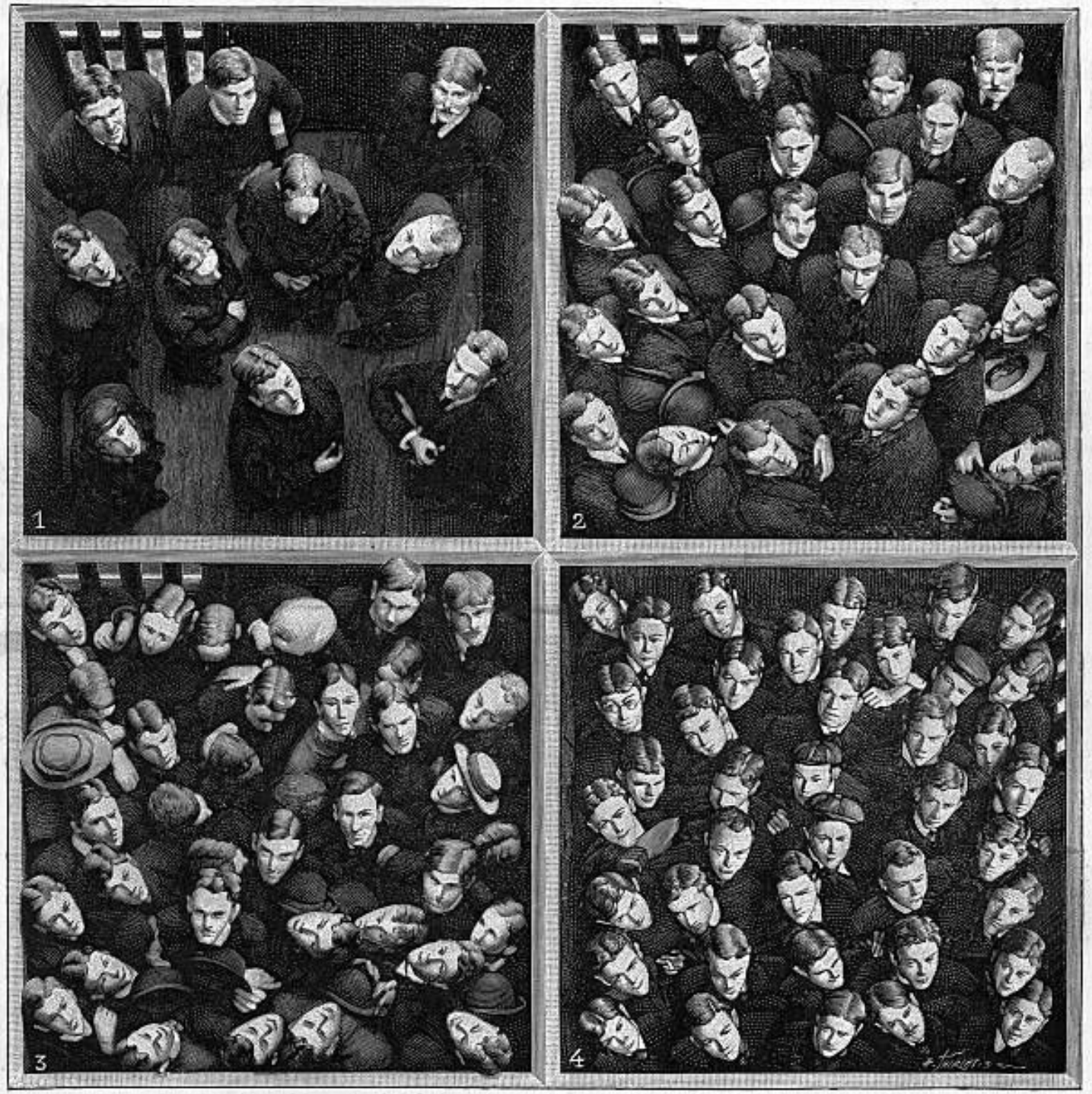

1
2
3
4

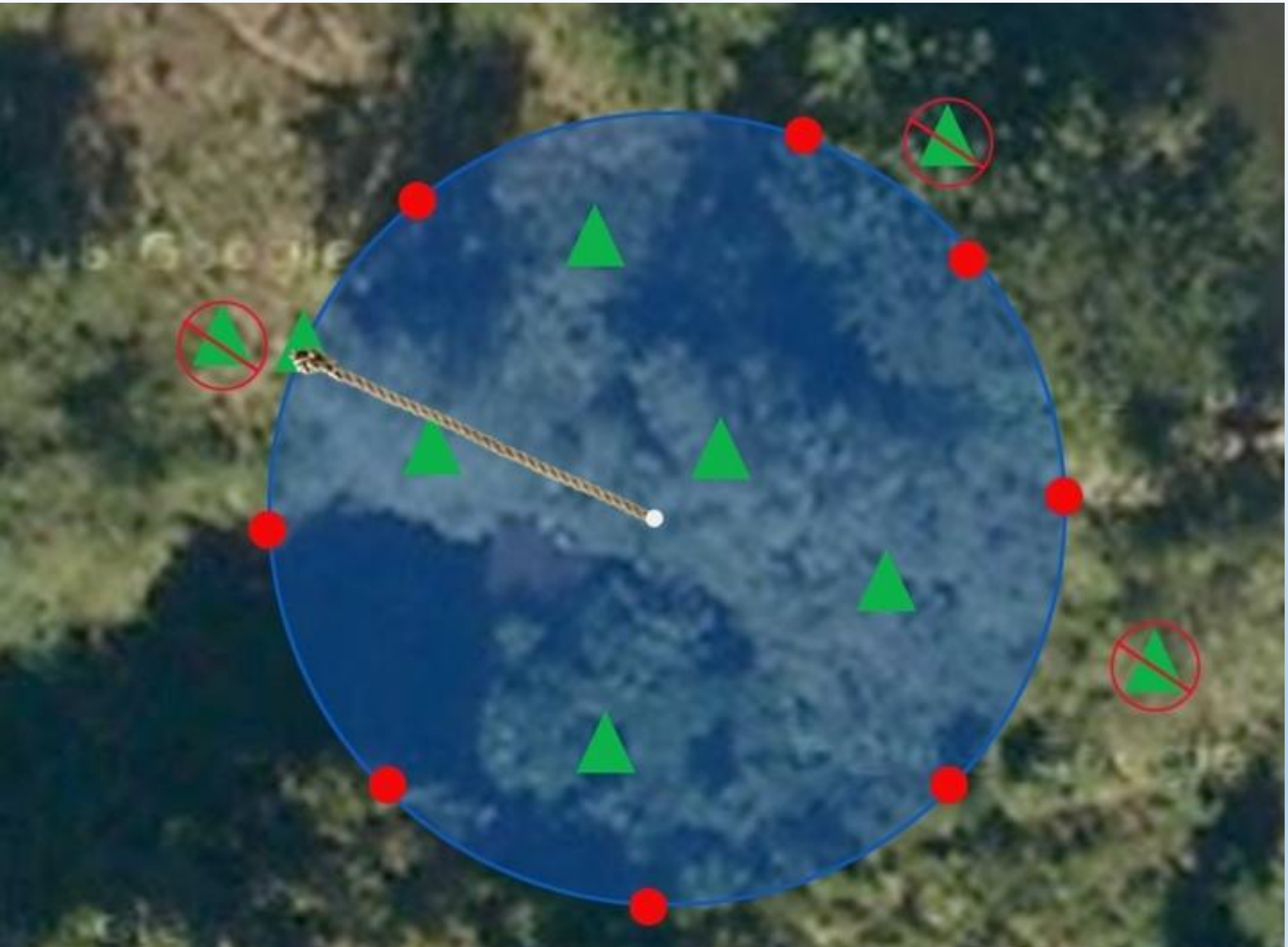
Figure 5.5. An illustration of crown classes. “D” = Dominant; “C” = Codominant; “I” = Intermediate and “S” = Suppressed.

Figure 1a. Basal area of ~30 square feet per acre.

Figure 1b. Basal area of ~60 square feet per acre.

Figure 1c. Basal area of ~90 square feet per acre.

Figure 1d. Basal area of ~120 square feet per acre.



THE FIX:
Stand Improvement

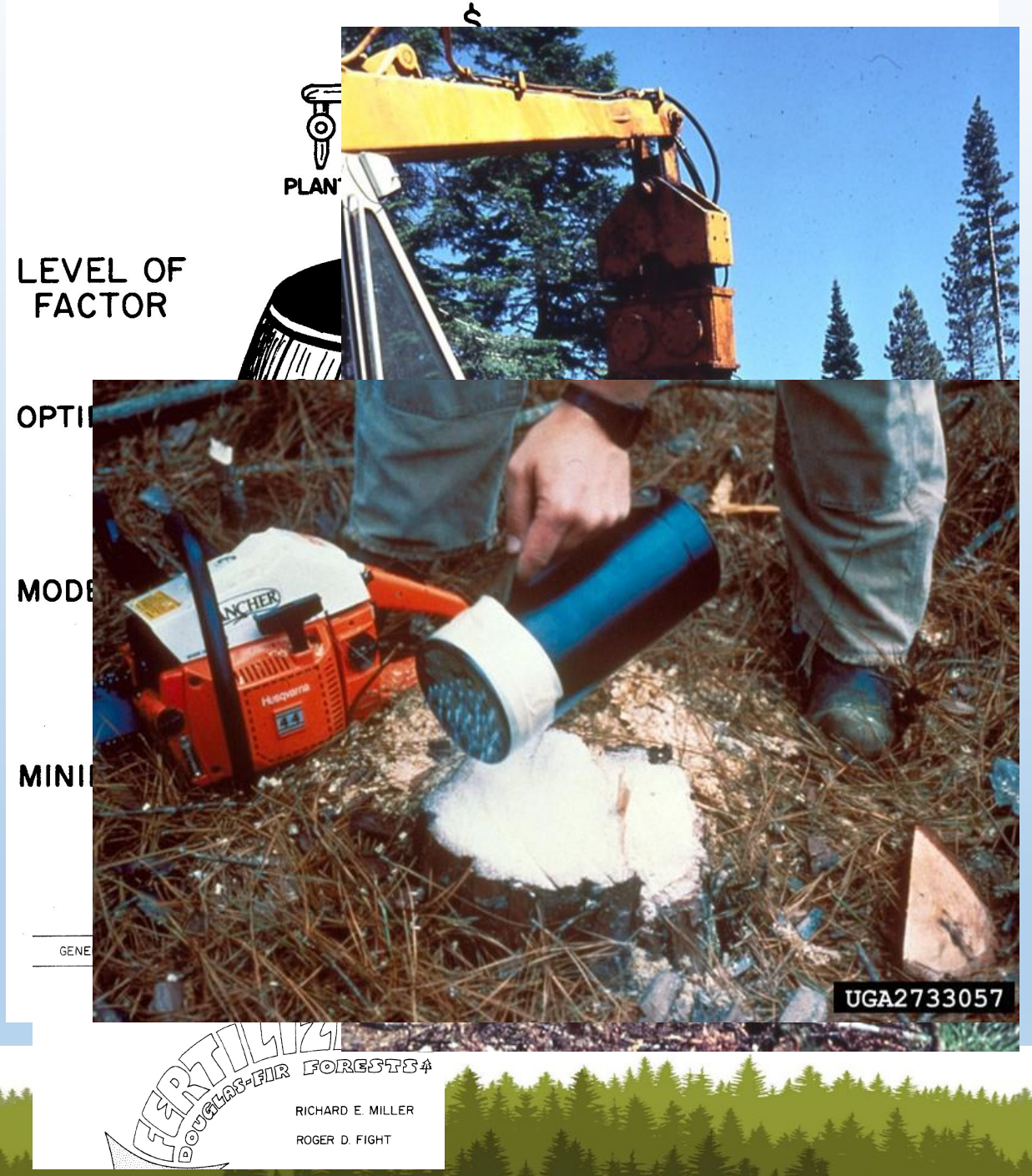
Source: NNRG

THE FIX:
Stand Replacement

- Replace species
- Rotate species
- Cut earlier
- Develop resistant cultivars

THE FIX:
Stand Treatment

- Treat trees
- Treat soils
- Treat stumps
- Remove stumps



Basic Tree Needs and Cost to Fix - Forest

Plant Need	Easy Fix	Cost
Water	No	High
Light	Yes	Moderate
Nutrients – Soil	Yes/No	Moderate-High
Air	?	?
Temperature	Maybe	?
Time	No	High
Room to Grow	Yes	Low-High

Risk Tree Management

It is impossible to maintain trees free of risk; some level of risk must be accepted to experience the benefits that trees provide.

What is risky?

Willingness to accept risk varies widely

There is no defined threshold

What is at risk?

TARGET TYPES:

Static - Cannot be moved

- ***House near tree***

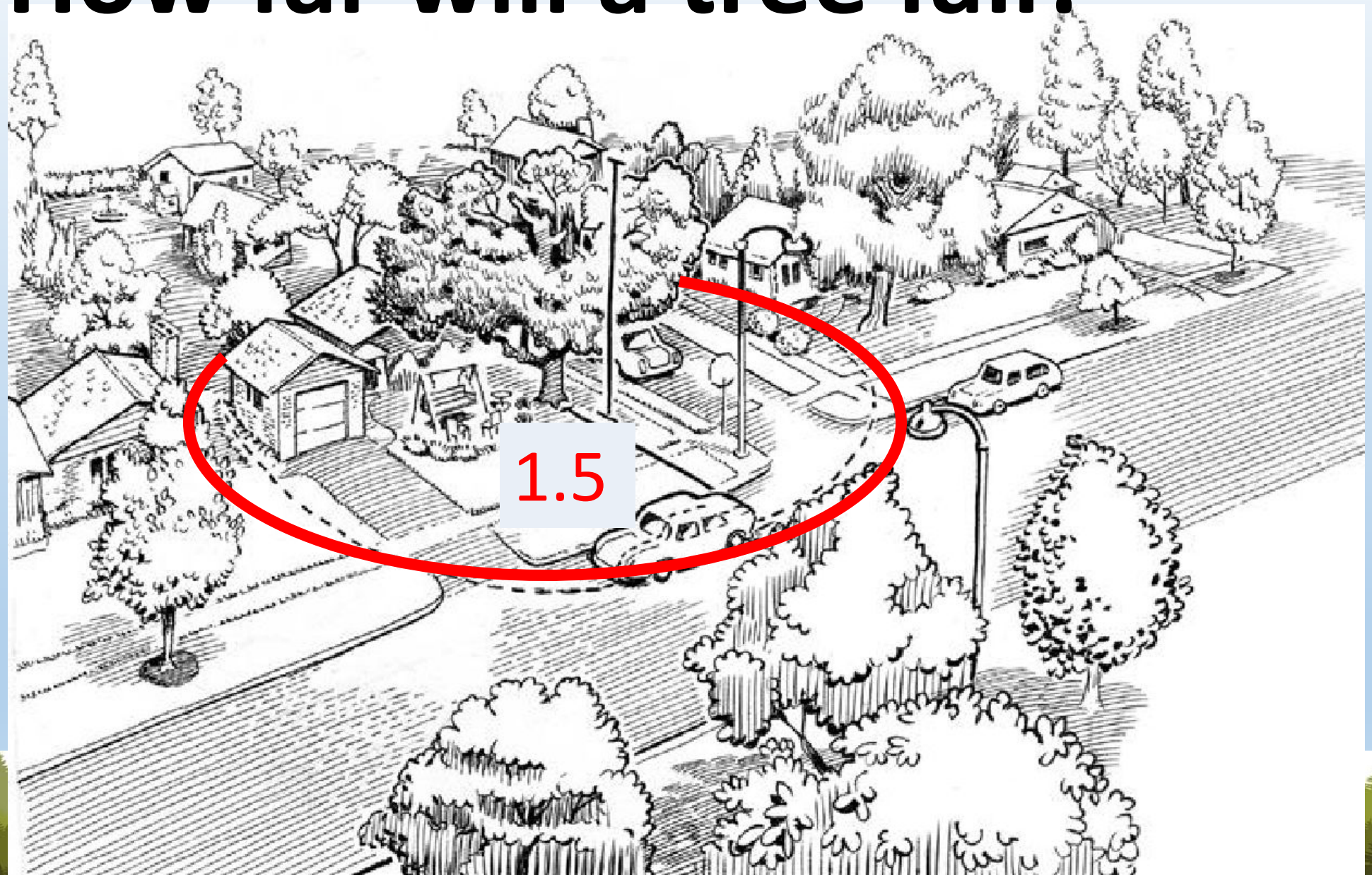
Moveable – Can be moved

- ***Bench under tree***

Mobile – Is moving

- ***Car on road, people on trail***

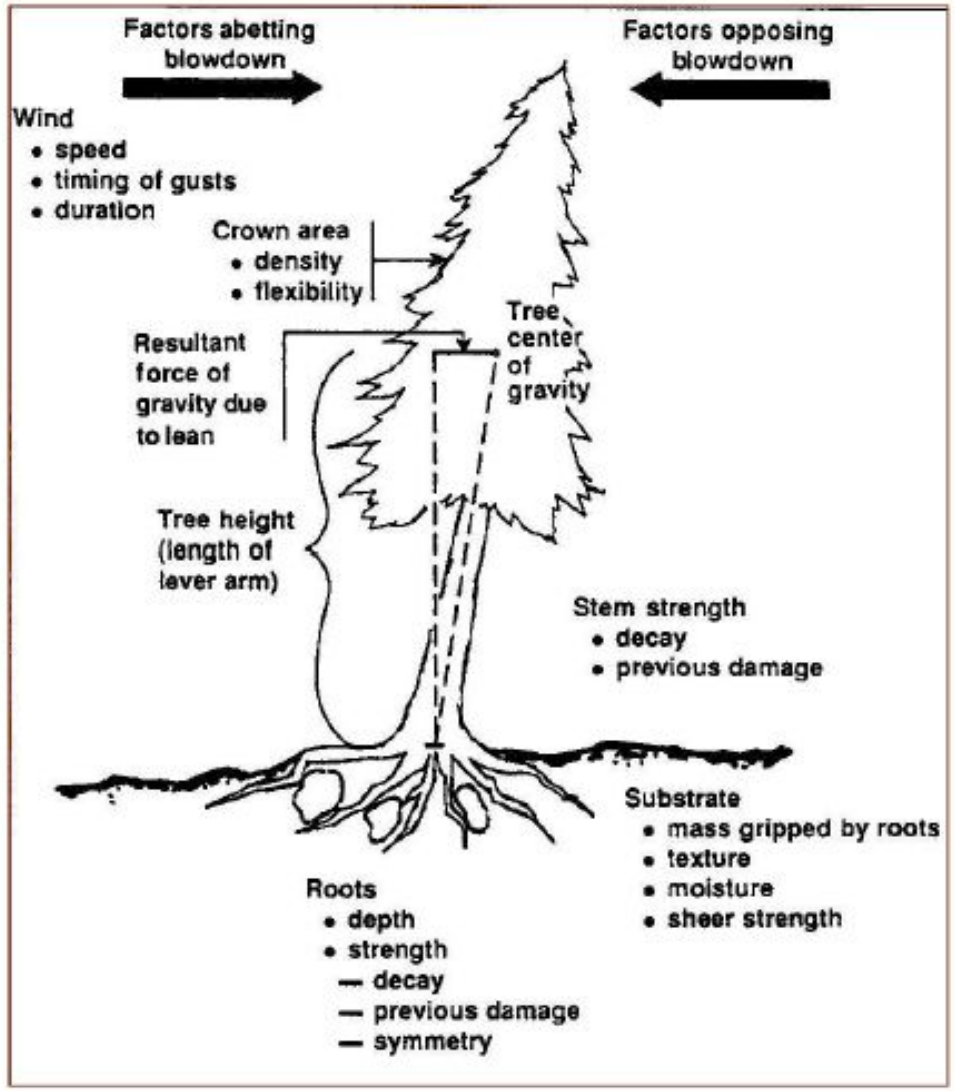
How far will a tree fall?



Tree/Branch Failure	Cause
At the Tree	Tree defects.
	Improper pruning.
	Pest and/or disease issues.
	Landscape trees planted too deep.
	Root structure.
At the Site	Saturated soils.
	Land disturbance.
	Exposure.
During a Storm	Wind Speed.
	Wind Direction.
	Rain, snow, and ice.

Trees can only take so much:

- Wind
  - speed, timing, gusts, duration
- Crown
  - area, density, flexibility
  - height
- Stem
  - diameter, strength
- Roots
  - depth, spread, strength
- Soil
  - texture, sheer strength, moisture, depth



Nelda Matheny & Jim Clark
HortScience, Inc.

Harris 1998

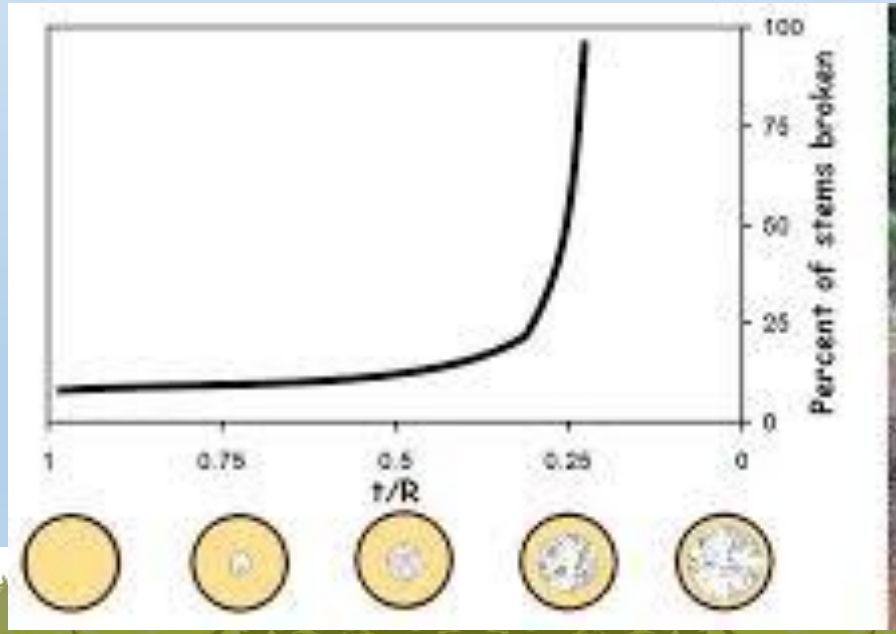
What you can not see

Decay column

Rutgers Ocpe,Feb 15, 2013

ttps://gristwoodandtoms.co.uk/consltancy/tree-decay-detection/

Depending upon species up to 2/3 of stem can be decayed and still stand.



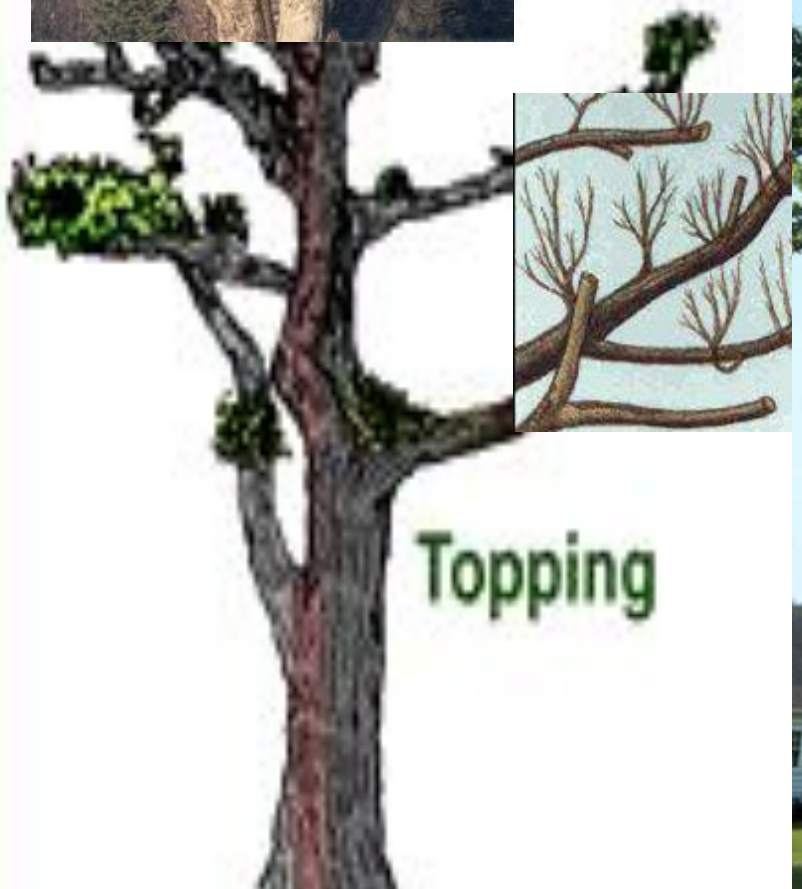
LIKELIHOOD RATING

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	*Low*	*Medium*	*High*
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

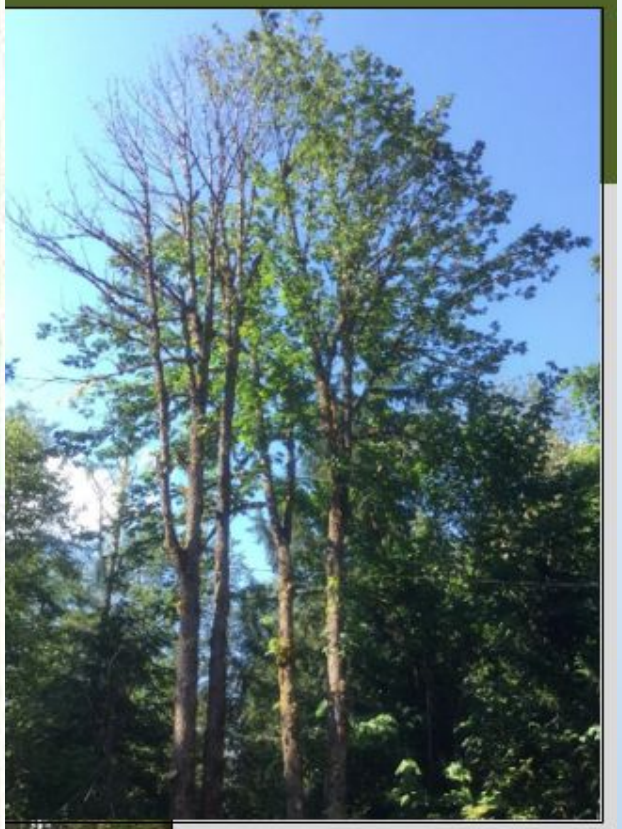
RISK RATING MATRIX

Likelihood of Failure and Impact	Consequence of Failure			
	Very Low	*Low*	*Medium*	*High*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Low	Moderate	High
Somewhat Likely	Low	Low	Low	Moderate
Unlikely	Low	Low	Low	Low

Creating hazard trees



Bigleaf Maple Decline



Sudden Branch Drop: Cottonwood – Species Specific

Response to hot, dry day where transpiration exceeds vascular capabilities.

Side Note:

Trees don’t need to be pruned

Pruning is done for human:

- **Safety**
- **Aesthetics**
- **Value**
- **Created problems**

How To Avoid Making Hazard Trees

Good pruning methods achieve a safer and healthier tree

Before | **Crown Cleaning** | **Crown Thinning** | **Crown Raising** | **Crown Reduction**

The FIX :

Hazard Tree Abatement

Remove tree or remove target

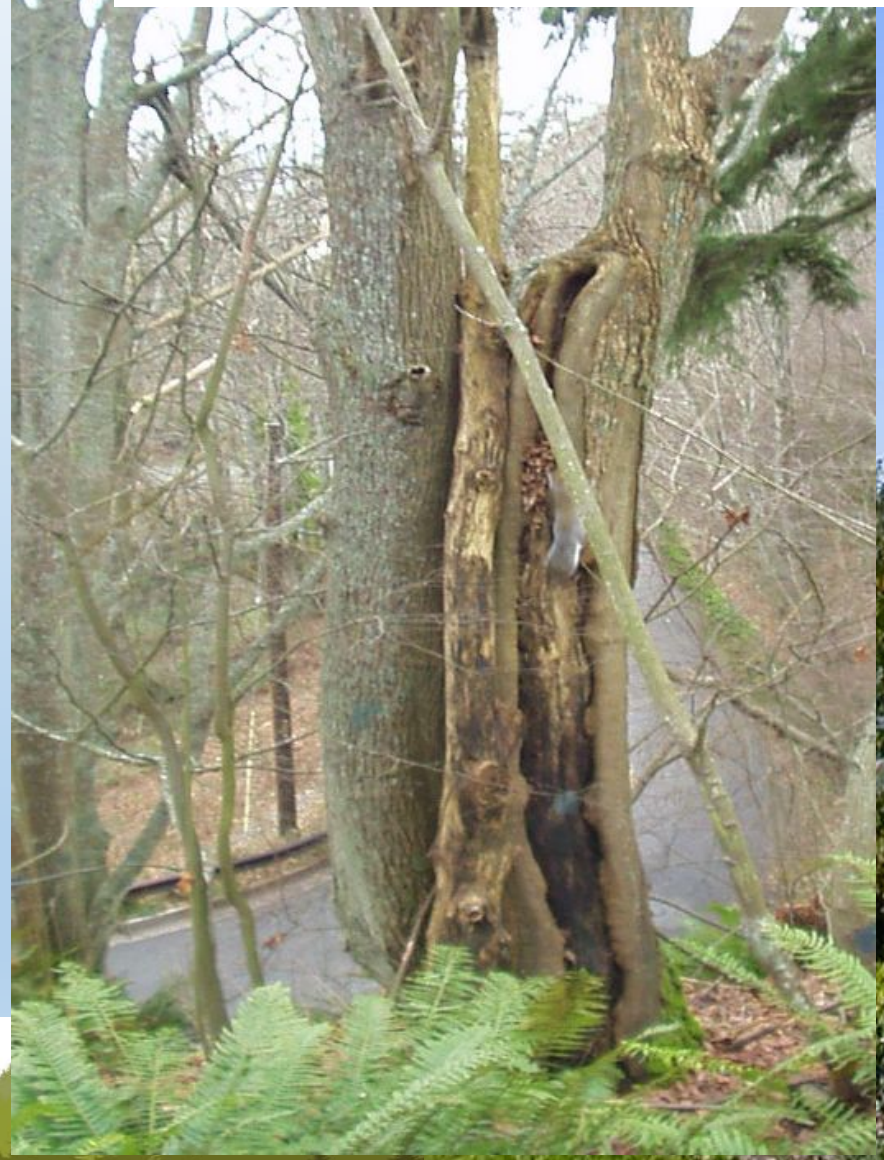
Prune it – reduce hazard

Cable it – tree value?

Make it a habitat tree

Leave it – accept the risk and LOOK UP!

Wildlife Habitat (Snags)



Basic Tree Needs and Cost to Fix - Urban

Plant Need	Easy Fix	Cost
Water	Yes	Low-High
Light	Yes	Moderate
Nutrients – Soil	Yes	Moderate-High
Air	?	Low-High
Temperature	Maybe	?
Time	Yes	High
Room to Grow	No	High

The FIX:

What's common, What's not

Foliar diseases increase in wetter springs

Tree stress increases with warmer, drier summers

= increase in root disease

Expect the unexpected moving forward

Get help:

Identification

Specific management options

The FIX:

Right tree in the right place

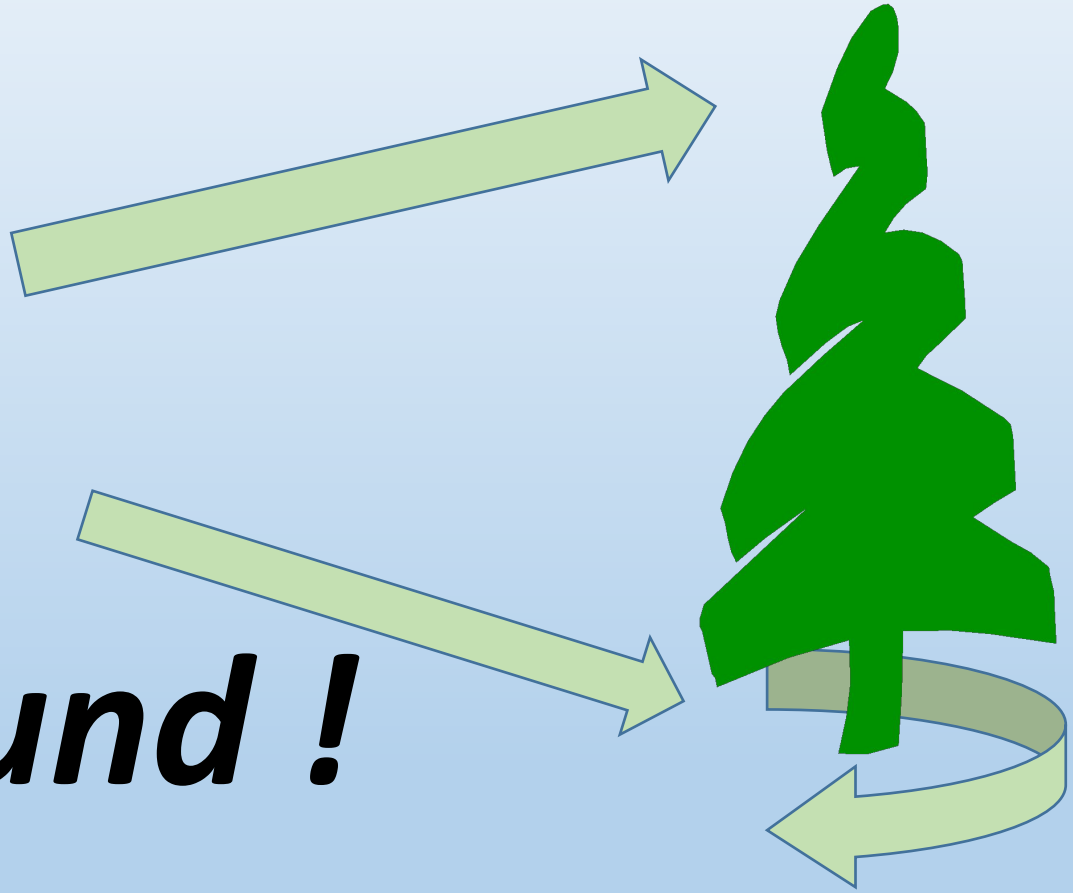
Make a forest management plan

And,

Look up !

Look down !

Look all around !



"We'd been more gardeners than foresters. Gardening is putting the human imprint on the environment. Forestry is more understanding that the forest has its own life cycle. You're there to support it in its life cycle"

Jim Davies
Granite Falls Forest Landowner
From HearldNet
By Noah Haglund
Sunday, June 2, 2019

Kitsap Conservation District

Mason Conservation District

Pierce Conservation District
Over 70 Years of Conservation
Since 1949

Thurston Conservation District
EST 1948