

# Forestry: Day 3:
# Conifers

Co instructors: Tatiana Liang, Hayley Tang, Ellen Tang

# QOTD:

Is cheesecake a cake or a pie?



# Conifers

- Largest group in gymnosperms
- Evolved ~310 mya
- Have cones - reproductive organs (most of the time)
- Are evergreen - do not drop leaves in the winter (most of the time)
- Include Redwoods (Taxodiaceae), Cypresses (Cupressaceae), Pines (Pinaceae), Yews (Taxaceae)







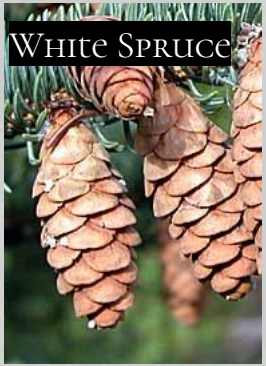





# Cones

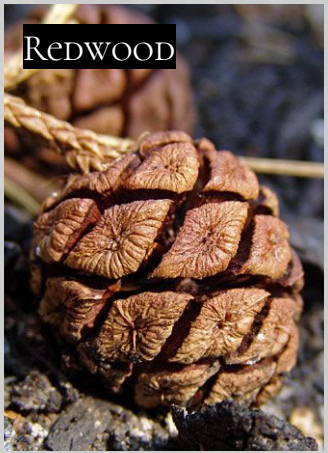
- Known formally as “strobilus” (singular), “strobili” (plural)
- Male cone - microstrobilus: produces pollen, herbaceous (does not have woody parts)
- Female cone - megastrobilus: woody, produces seeds
    - Contains ovules: structure that contains female reproductive cells


Balsam Fir


White Spruce


Bald Cypress


Male + Female pine cones


Redwood

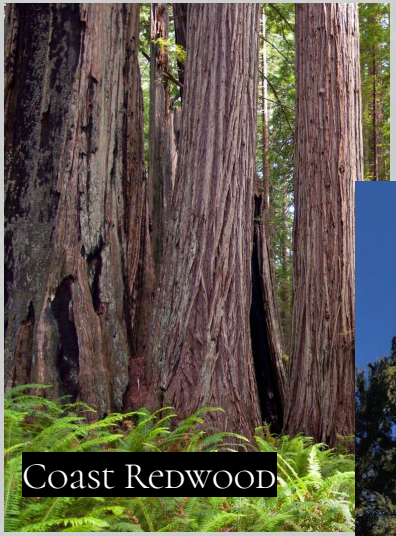
# Spot the Difference!





# Taxodiaceae

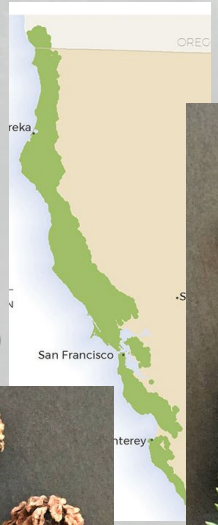
- Outdated term now that they have been discovered to be a part of Cupressaceae
- We will focus on one group: the Sequoioideae
  - Coast Redwood (Sequoia sempervirens), Giant Sequoia (Sequoiadendron Giganteum), Dawn Redwood (Metasequoia)
- Characteristics: the wood is red and fibrous. That's all you need to know to ID them


Coast Redwood


Giant Sequoia

# Coast Redwood - Sequoia sempervirens

- “Sempervirens” means “everlasting”
- Can live 2000+ years
- Only known coniferous hexaploid: 6 sets of chromosomes!
- Appearance:
  - Conical
  - 60-100m tall, up to 9m dbh (diameter at breast height)
  - Roots: shallow, wide spreading, lateral
  - Bark can be up to 30 cm thick, soft and fibrous
- Distribution: Pacific coast of North America
  - From Southwest Oregon to Monterey County
  - 30-750m above sea level








# Coast Redwood - Sequoia sempervirens

- Ecology:
  - Terpenoids and tannic acid = bug, fungus, and rot resistant
  - Fire resistance:
    - Bark grows a foot thick and does not have much flammable pitch or resin
    - New buds can sprout from the parent tree's base
  - Floods:
    - Extra sediment piles on top of roots
    - Roots grow upwards and new roots grow from the newly buried stem





# Coast Redwood - Sequoia sempervirens

- Ecology:
  - Fog:
    - As height increases, it becomes harder to transport water to the leaves at the crown
    - Fog is absorbed directly through leaves, bypassing the xylem
    - Water is also absorbed directly through bark
    - Fog collects on leaves and drips down to the roots, forming 30% of total water used by tree



# Coast Redwood - Sequoia sempervirens

- Reproduction:
  - Sexually:
    - Cones





  - Asexually:
    - Lignotuber: woody swelling of root crown
      - Developed from axils of cotyledons
      - Buds can sprout new shoots and roots, or become an entirely new tree
    - Can sprout from root crown, stump, fallen branches
      - “Fairy ring”: ring of sprouts around parent tree





# Giant Sequoia - Sequoiadendron giganteum






- Oldest specimen = 3,200+ years old
- Appearance:
  - Height: 50-85m, some as tall as 94.8m
  - Trunk diameter: 6-8m
  - Trunk does not taper with height as with Coast Redwood
- Distribution:
  - limited area of Sierra Nevada, California
  - Dry summers, snowy winters
- Ecology:
  - pioneer species: first to colonize barren environments
  - Rely on fire to clear leaf litter, competing species, open cones
  - Longhorn beetle/Douglas squirrel: damages cones to allow them to open



# Spot the Difference!





# Pines - Pinaceae





- Subfamilies:
  - Pinus (Pine):
    - cones are biennial (every other year)
  - Picea (Spruce):
    - cones are annual
    - Needles are 4-sided and attach singly to small peg-like structures on branches
    - Cones hang downwards
  - Laricoideae (Larix, Pseudotsuga, Cathaya) (Larch, Douglas Fir, Cathaya):
    - cones are annual
  - Abietoideae (Abies, Cedrus, Pseudolarix, Keteleeria, Nothotsuga, Tsuga):
    - cones are annual
    - Firs, Cedars, Hemlocks

# Firs - Abies

## Key Features of Fir Trees:



- Needles:
  - Flattened
  - Two whitish lines on bottom: wax covered stomatal bands
  - Attached to twig with suction cup like base
  - Tips are often notched
- Cones:
  - Stand upright on branch, like candles



# Balsam Fir - Abies balsamea

- Appearance:
  - Height: 14-20m, occasionally 27m
  - Dark green leaves
  - Bark: smooth and grey on young trees, rough and fissured on old trees
  - conical
- Distribution:
  - Eastern - Central Canada, Northeastern US
  - Cool climates: annual temp of 4C (40F)
  - Like swamps, dry swamps, hardwood slopes, mountain tops
- Ecology:
  - Very cold-hardy: can survive temps up to -45C (-49F), and can even be immersed in liquid nitrogen

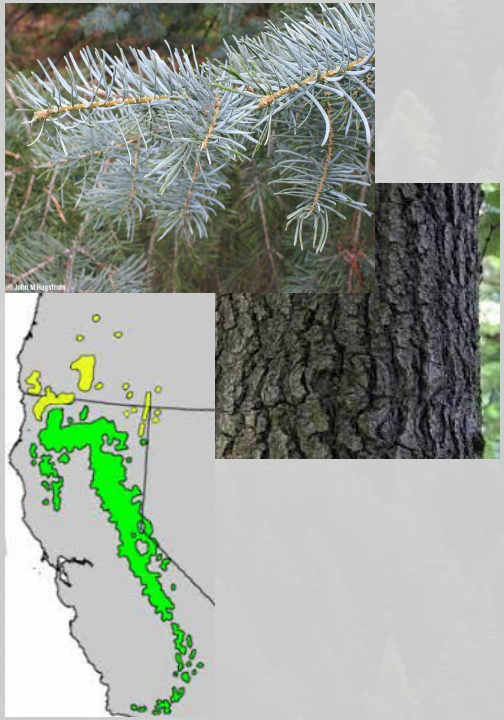






# White Fir - Abies Concolor

- Appearance:
  - Height: 25-60m, max 74.9m
  - Diameter: 2.7m, max 4.6m
  - Gray bark is 10cm thick and brown on the inside
  - Leaves are needle-like and flattened, green to blue-green
- Distribution:
  - Mountains of western North America
- Two subspecies: Abies concolor subsp. Concolor / Abies concolor subsp. Lowiana
- Ecology:
  - Climax species: can grow with limited resources

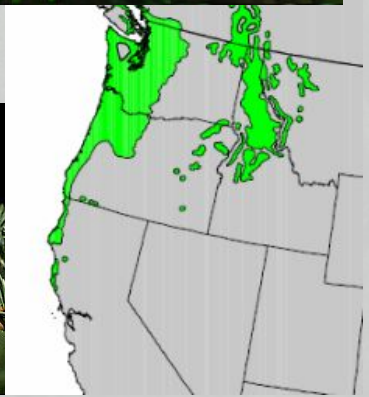


# Grand Fir - Abies grandis

- Aka. giant fir, Oregon fir, Vancouver fir, great silver fir, western white fir
- Appearance:
  - Height: 40-70m, may be tallest Fir in the world
  - Diameter: up to 2m
  - Bark: 5cm thick, reddish to gray, plates
  - Needles: flattened, dark green
  - Cones: green to reddish
- Distribution:
  - Pacific Northwest, Northern CA
  - Cascade range
  - 1,700m above sea level
- Varieties:
  - Coast grand fir, interior grand fir







# Subalpine Fir - Abies Lasiocarpa

- Aka. Rocky Mountain Fir
- Appearance:
  - Height: 20m
  - Trunk: 1m
  - Bark: smooth, grey, resin blisters
  - Leaves: flat, glossy green







- Distribution:
  - Central to West North America
  - High altitudes, 300-900m in the north and 2,400-3,650m in the south
- Ecology:
  - Act as snow fence: blocks windblown snow and directs it
    - Leads to creation of meadows from extra moisture
  - Shade tolerant, short-lived, slow growing
  - Layering: branch touches ground, makes roots, separates and becomes new plant

# What is Weird about this Conifer?







# Larch - Larix

## Key Features of Larch Trees:

- The only Conifers that are Deciduous: drop their leaves in the autumn
- Needles in clusters
- Wood is Bicolor:
  - Heartwood is salmon pink
  - Sapwood is yellowish white
- Cold, humid climates
  - Siberia, Canada, anywhere cold and north
  - Lowlands and temperate zones
- Pioneer species





# Tamarack (Eastern Larch) - Larix laricina

- Aka. hackmatack, red larch, American larch
- Appearance:
  - Height: 10-20m
  - Trunk: 60cm
  - Bark: tight and flaky
  - Needles: light blue green, yellow in the fall
- Distribution:
  - Canada, Minnesota to West Virginia, some in Alaska
  - Swamps, fens, bogs, lowlands
  - Temps up to -65C (-85F)







# Western Larch - Larix occidentalis

- Can live up to 1000 years
- Appearance:
  - Height: 30-60m
  - Trunk: 1.5m
  - Bark: orangish, purplish-brown
  - Crown: narrow and conical
  - Upswept branches
- Distribution:
  - Mountains of North America, Canada, drainage of Columbia River
  - Moist slopes up to 1,800m above sea level
  - Temps up to -50C (-58F)
- Ecology:
  - Very fire resistant







# Spruce - Picea

## Key Features of Spruce Trees:

- Needles: four sided, attached to peg-like structures
- Cones: do not have protruding bracts and hang downwards
- Whorled branches
- Temperate and Boreal (Taiga) regions





# Engelmann Spruce - Picea engelmannii

- Aka. white spruce, mountain spruce, silver spruce
- Appearance:
  - Height: 25-40m
  - Trunk: 1.5m
  - Bark: Reddish, thin and scaly, flakes off in plates
  - Narrow conic when young, cylindric when old
  - Leaves: blue green above, blue white below
  - Cones: purple, 1cm, cylindrical
- Distribution:
  - Western North America, Rocky Mountains, Cascade Range
  - High altitude: 520-3650m
- Ecology:
  - Water uptake and storage = critical for winter survival
  - Spruce bark beetles: attack spruce trees







# White Spruce - Picea Glauca

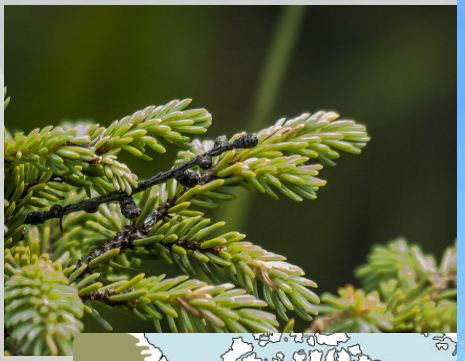
- Aka. Canadian spruce, skunk spruce, western white spruce
- Appearance:
  - Height: 15-30m
  - Trunk: 1m
  - Bark: grey, thin, scaly, flakes in plates
  - Conical when young, cylindrical when old
- Distribution:
  - All of Canada, Northeast US states
  - Between sea level and 1,520m
  - Temps as low as -56.5C (-69.7F)
- Ecology:
  - Climax canopy tree
  - Can live in acidic soils (pH 4.7- 7.0)





# Black Spruce - Picea Mariana

- “Mariana” meaning “of the Virgin Mary”
- Appearance:
  - Height: 5-15m
  - Trunk: 15-20cm, does not taper
  - Branches droop and tips are upturned
  - Bark: thin, scaly, grayish-brown
  - Needles: dark green on top, pale green on bottom
  - Roots: shallow and wide spreading
- Distribution:
  - All over Canada, Northeast US, Alaska



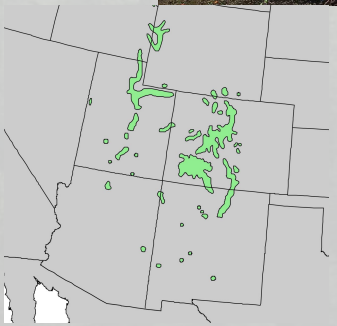




# Blue Spruce - Picea pungens

- Aka. green spruce, colorado spruce
- Appearance:
  - Height: 23m in wild, 15m in captivity
  - Branches are yellow brown, dense, horizontal
  - Bark: scaly, grey
  - Leaves: gray-green, waxy
  - Male cones on entire tree, female cones on top of tree
- Distribution:
  - Arizona, Colorado, Idaho, New Mexico, Utah, Wyoming
  - Southwest US
  - Likes moisture but is drought tolerant
  - Temps as low as -40C

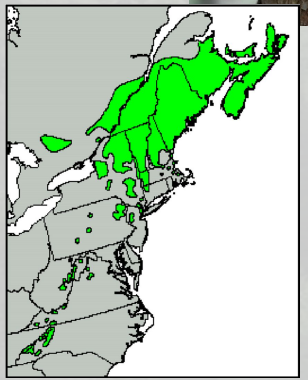




# Red Spruce - Picea Rubens

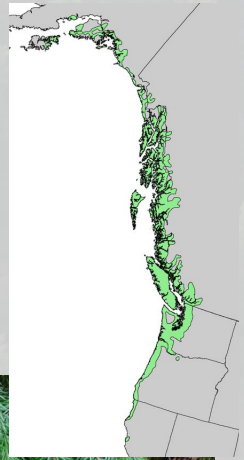
- Aka. yellow spruce, West Virginia spruce, Eastern spruce
- Appearance:
  - Height: 18-40m
  - Trunk: 60cm
  - Narrow, conical crown
  - Leaves: yellow green, curved, sharp point
  - Bark: gray brown on surface, red brown on inside, thin, caly
- Distribution:
  - Northeastern US: Maine, Vermont, New Hampshire, NY





# Sitka Spruce - Picea sitchensis

- Largest spruce, 5th largest conifer
- Appearance:
  - Height: up to 100m
  - Trunk: 5m+
  - Crown: broad conic when young, cylindric when old
  - Needles: stiff, sharp, dark blue green from top and blue white from bottom
- Distribution:
  - West coast of North America, Alaska to NorCal
  - Temperate rainforests
  - Can only extend 80kn (50mi) from ocean
- Ecology:
  - Not fire resistant





# Pines - Pinus

## Key Features of Pine Trees:

- Largest conifer family
- Needles:
  - Long needles in bundles



# Whitebark Pine - Pinus albicaulis

- Aka. white pine, scrub pine
- Appearance:
  - Needles in bundles of 5
  - Bark is white
  - Female cones are dark purple, male cones are red
  - Krummholz: when trees look funky because of fierce wind
- Distribution:
  - Mountains of Western US and Canada
  - Sierra Nevada, Cascade Range, Pacific Coast Ranges, Rocky Mountains
  - Highest elevation pine tree found in mountain ranges
- Ecology:
  - Harmful species: Mountain pine beetle, White pine blister rust

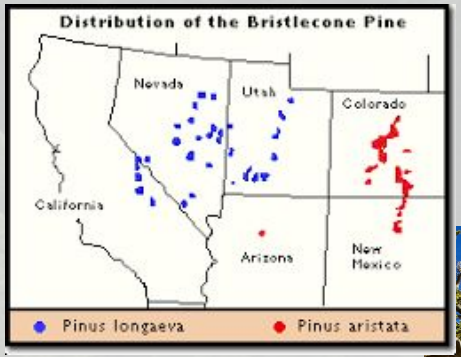






# Bristlecone Pine - Pinus aristata

- Can live up to 2,500 years
- Aka. Rocky Mountain bristlecone pine, Colorado Bristlecone Pine
- Appearance:
  - Height: 2-6m
  - Trunk: 3-4.5m
  - Bark: grey-brown, thin, scaly
  - Needles: bundles of 5, deep green
- Distribution:
  - Rocky Mountains in colorado and New Mexico
  - High altitudes: 2,100-4,000m
  - Cold, dry conditions








# Knobcone Pine - Pinus attenuata

- Can also be a shrub if conditions are harsh enough
- Appearance:
  - Height: 8-24m
  - Bark: thin, smooth, flaky when young, gray-red-brown, furrowed into scaly ridges when old
  - Wood is knotty
  - Cones: irregularly shaped
- Distribution:
  - Mountains of Southern Oregon to Baja California
  - Mild climates, poor soils





# Jack Pine - Pinus banksiana

- Can become shrub is conditions are harsh enough
- Aka. grey pine, scrub pine
- Appearance:
  - Height; 9-22m
  - Do not grow perfectly straight
  - Bark: thin, reddish-brown to gray when young, dark brown and flaky when old
- Distribution:
  - East of Rocky Mountains in Canada, Minnesota to Maine
  - Sandy, rocky soil

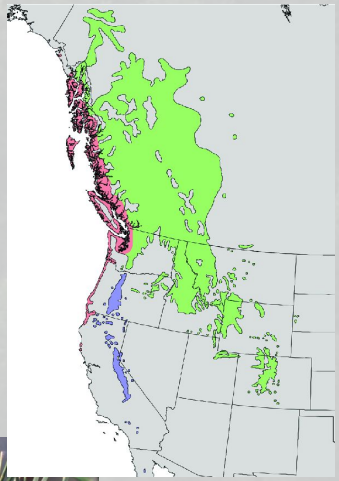




# Lodgepole Pine - Pinus contorta

- Aka. shore pine, twisted pine, contorta pine
- Appearance:
  - Height: 40-50m
  - Needles are twisted
  - Bark: thin, scaly, grey brown, can be corky
- Distribution:
  - Western North America, Cascades
  - Ocean shore, dry forests
- Ecology:
  - Fire dependent: fire opens cones
- Uses:
  - Log cabins, teepees







# Your Homework:

You're going to put together a **graphic** about an angiosperm and present it to the class! A couple things:

- Choose any tree from this list (first-come, first-serve basis)
- You can use Google Slides, Canva, or any other website/app
- Information to include:
  - Common name, scientific name, appearance
  - Ways to ID this tree/plant (leaf shape/arrangement, bark, anything that makes this tree/plant easy to identify)
  - A picture of the tree
    - Try to find individual pictures of the bark/leaves/flowers too!
  - Distribution: Where is it mostly found?

More info on next slide!

# Your Homework (cont.):

You're going to put together a **graphic** about an angiosperm and present it to the class! A couple things:

- We will put all your graphics into a PDF and send it to the Google Classroom
- Examples: all of the previous slides lol
- If you cannot fit all of the information on 1 page, you can use 2 **but no more than 2**
- Keep it short: it should last no longer than 2 minutes!
- Presentation day: Wednesday, July 20th