Foundations of Forest Wildlife Habitat Management
Habitat through Disturbance and Silviculture

Guest Lecturer: Dr. Brenda McComb, Oregon State University.

Series Description The Forest Ecology Working Group (FEWG) and NCTC are pleased to offer this 5-part focused lecture series to introduce fundamental principles of forest habitat management. Please contact Jeff_horan@fws.gov
if you want more information about FEWG or this webinar series.

July 14 - Habitat Selection by Forest-Associated Species: Abiotic factors

July 28 - Saving all the Pieces: Forest structure and Composition

August 11 - Forest Disturbance and Stand Dynamics

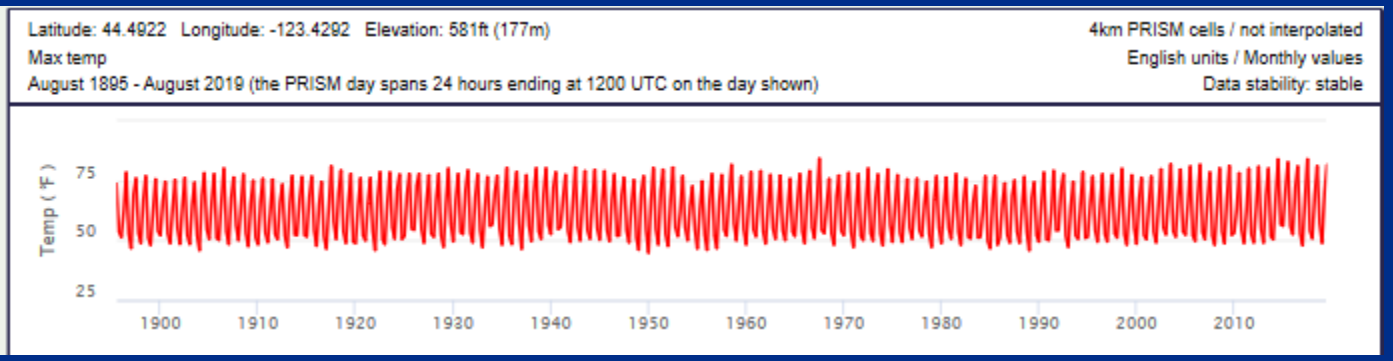
August 25 - Silviculture as a Forest Disturbance

September 15 - Habitat Considerations: Dead wood and Riparian Areas

Foundations of Forest Wildlife Habitat Management:

Habitat Through Disturbance and Silviculture

Week 1: Introduction and Habitat Selection by Forest Associated Species: Abiotic Factors



https://prism.oregonstate.edu/

Photo by Hankyu Kim

Objectives of this Lecture Series

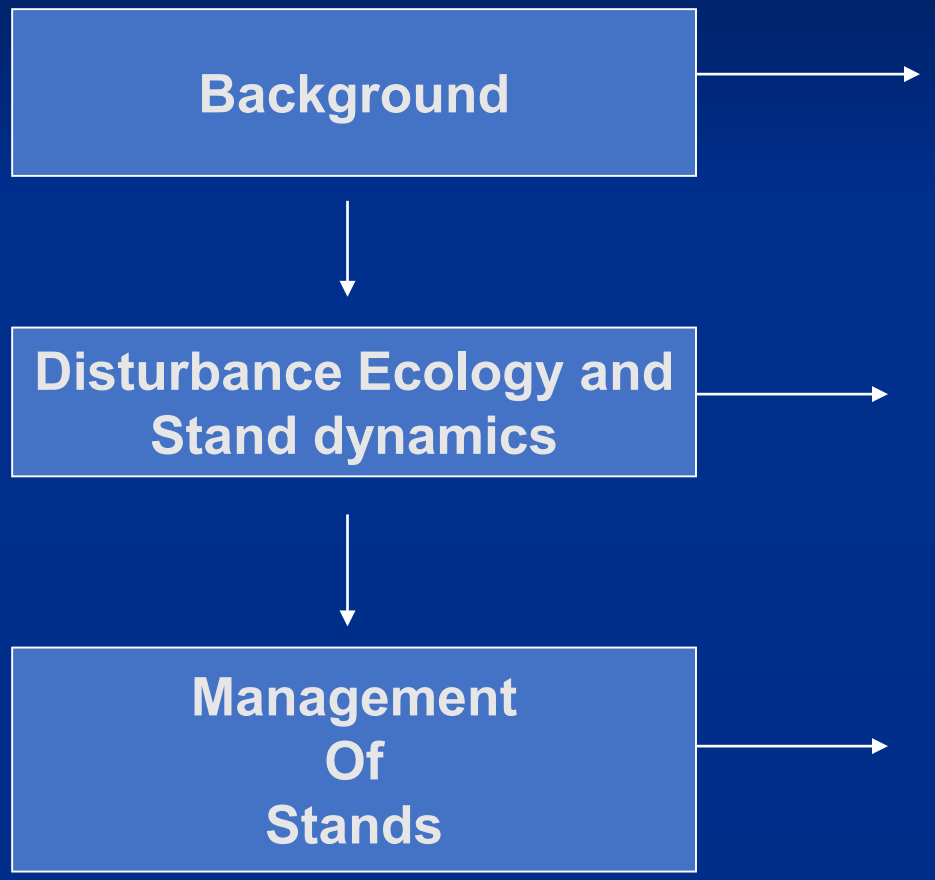
- Provide foundational information to find a **common ground** when approaching management of forests for multiple values.
- Use disturbance ecology as a foundational framework for active stand management
- Introduce management stands to achieve desired habitat conditions for selected species or conservation of biological diversity

Information provided is a component of:

NCTC Course: “Forest Ecology and Management”

FW/FES 552: “Forest Wildlife Habitat Management” (OSU)

Lecture Schedule



Principles of forest habitat ecology, habitat function, and habitat selection; introduce abiotic & biotic factors (Lectures 1 & 2)

Disturbances and stressors that influence forest structure, composition, and function as habitat for selected species (Lecture 3)

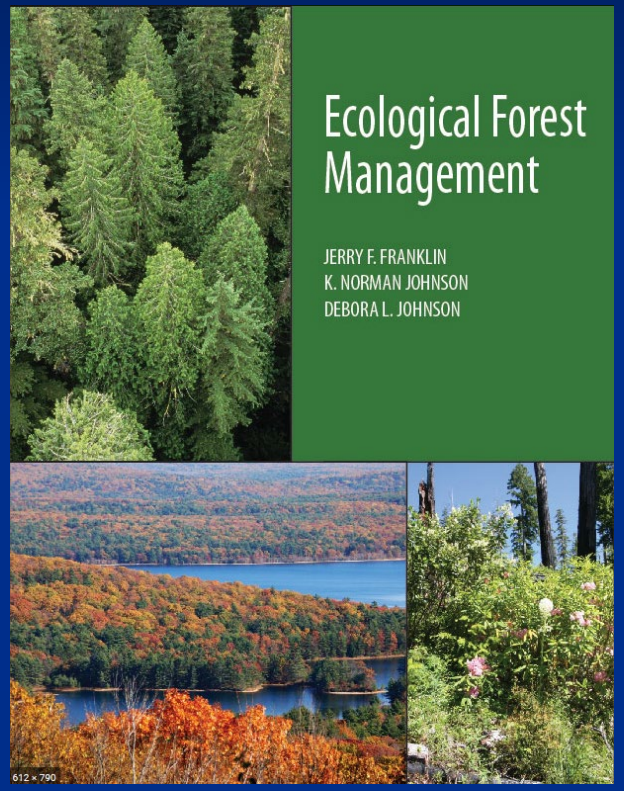
Applying silvicultural approaches to achieve habitat objectives (Lectures 4 & 5)

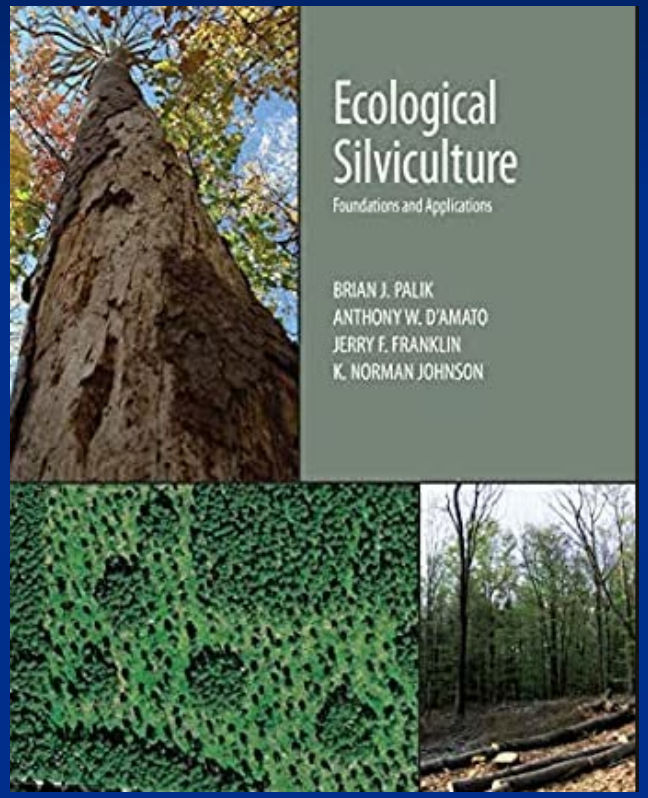
Conceptual Framework

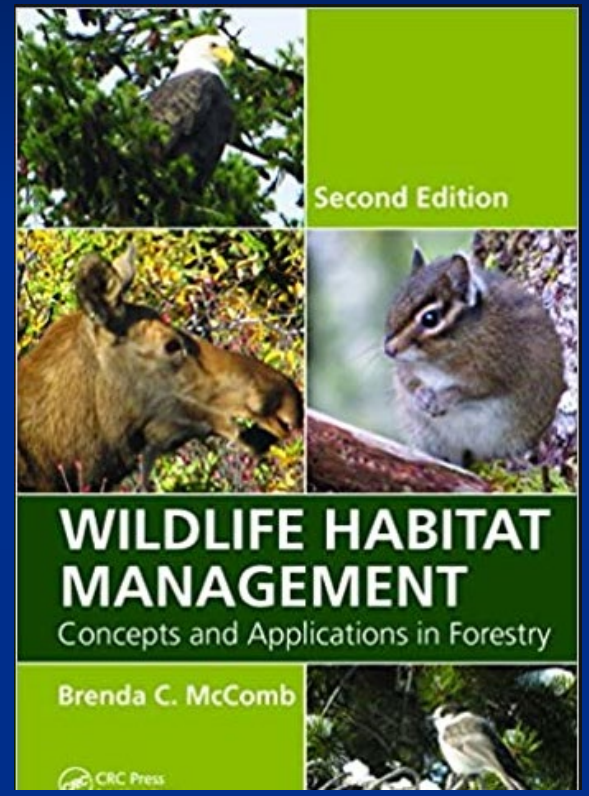
Active management with a forest products focus

Active management with habitat or multiple products focus

Passive management to allow natural disturbances to achieve goals







Value of Forests

- Forests managed primarily for forest products provide habitat for many species.
- Forests managed to consider habitat structure and function can support a wide variety of species with forest products as one outcome

Saving all the pieces

- “The first rule of intelligent tinkering is to save all the pieces” (Aldo Leopold)
- What are the pieces?

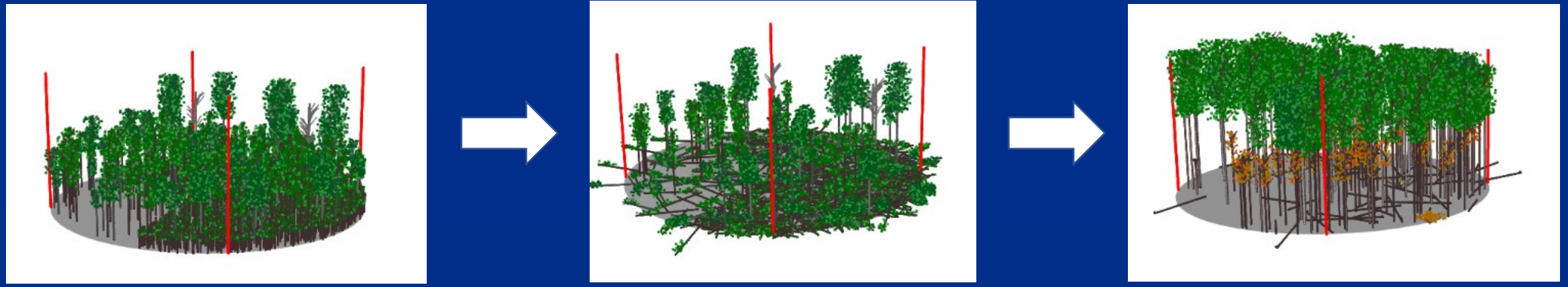
Habitat elements: Those parts of the environment important to a species when present in the correct sizes, amounts and distributions

Defining Goals: Species, wildlife, biodiversity?

- **Manage for a species such as deer, woodpeckers, owls, snakes, wood ducks, etc. – which of the 1.7 million described species would you like?**
- Manage for a group of species such as game, songbirds, native fish, etc.
- Manage to conserve biodiversity (both known and unknown): genetic representation, populations, ecosystems

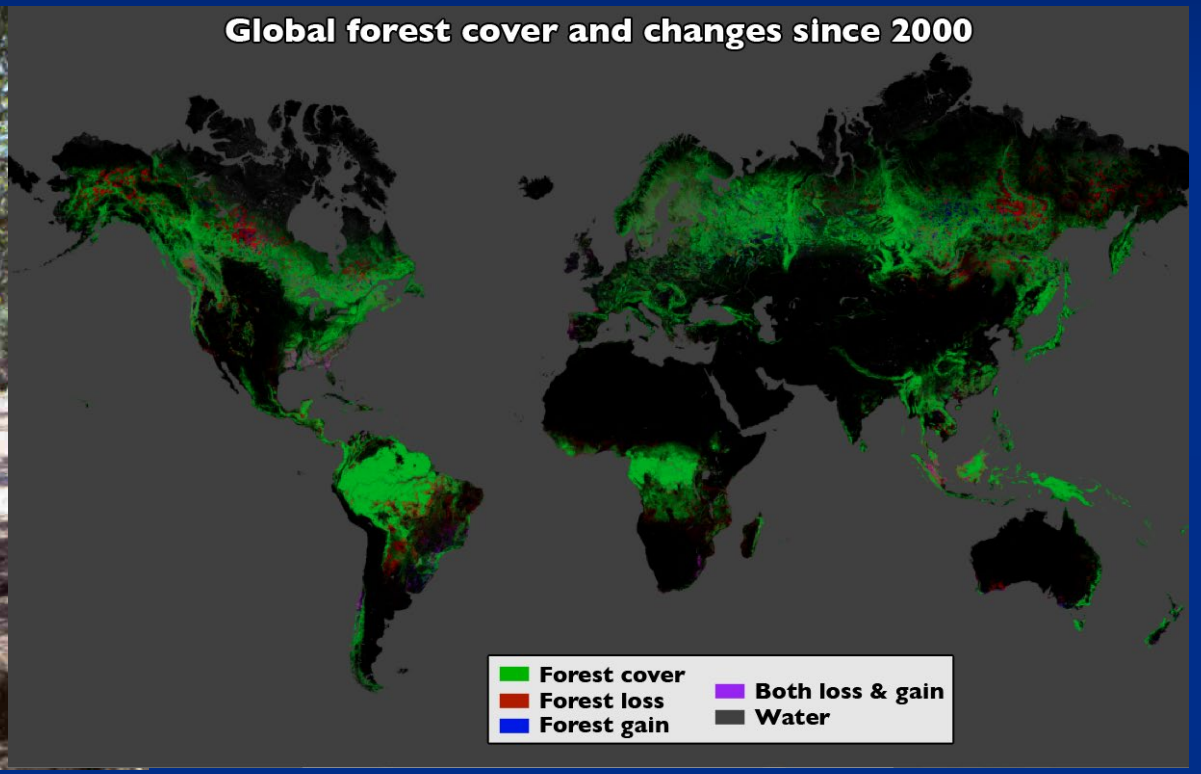
We have information to manage forests

- We understand plant dynamics, disturbance ecology, habitat selection, and population dynamics.
- We can develop reasonable stand and forest management plans
- Need to monitor the effectiveness of the plans



The Biggest Challenge

Meeting habitat goals with increasing demands on natural resources on a decreasing available land base.



https://www.nasa.gov/sites/default/files/forest-cover-global.png?itok=SzC6cclf

Questions?

Photo by Hankyu Kim

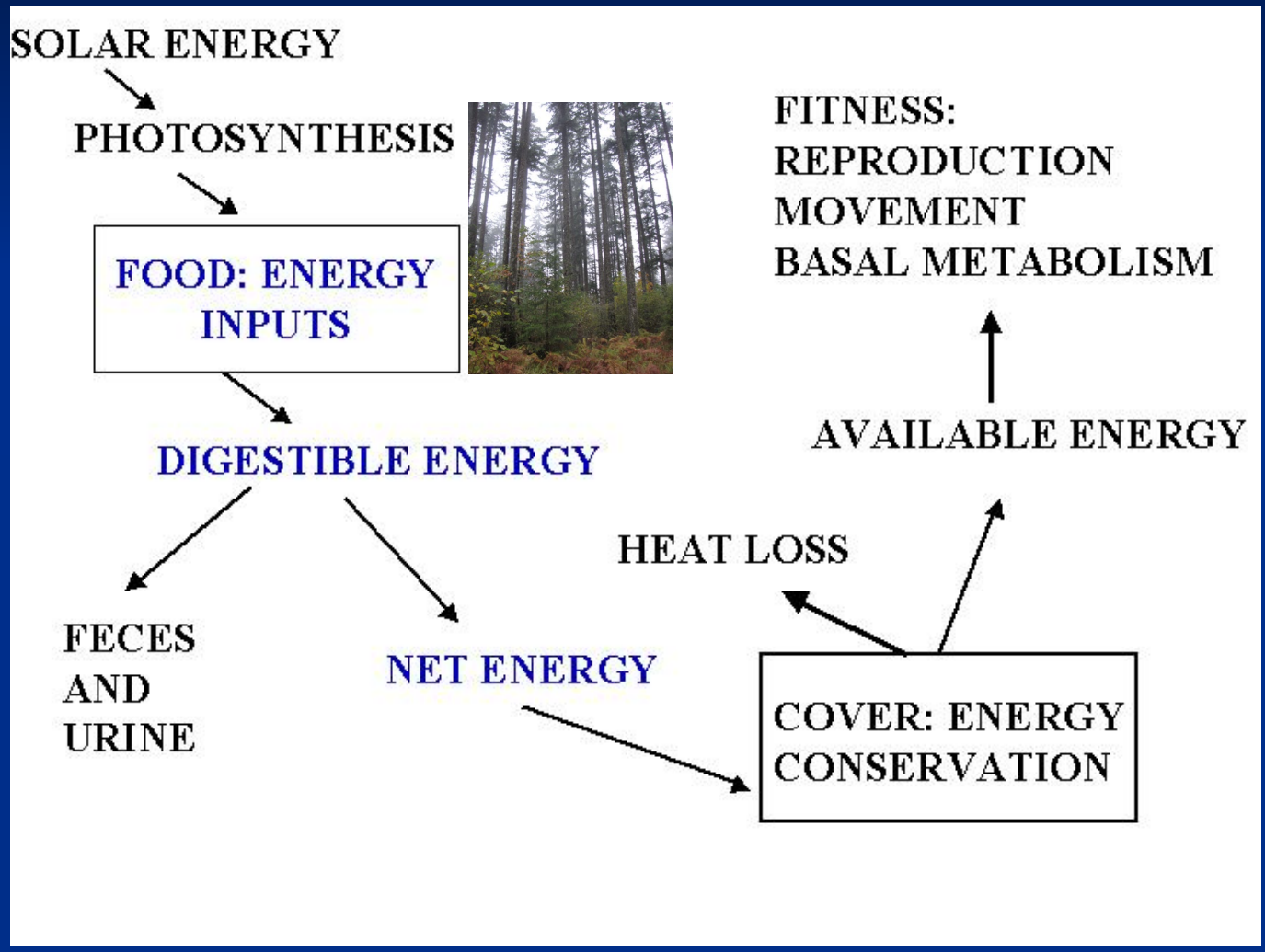
Habitat Selection by Vertebrates

Habitat is defined as the resources necessary to support a population over space and through time

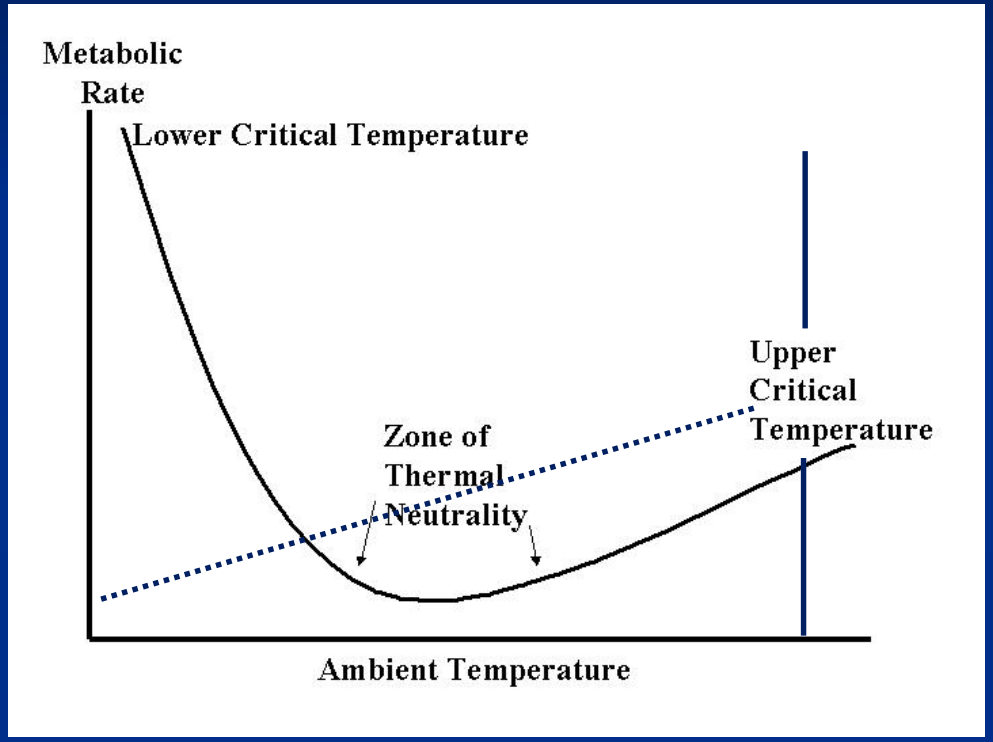
Learning outcomes for this lecture

- Identify levels of selection for a species of vertebrate
- Understand limitations of studies designed to detect habitat selection
- Recognize the importance of fitness as a response variable when detecting habitat selection

Food – Energy input



Cover provides a mechanism for conserving energy



Energy Conservation = closer to the TNZ for endotherms

Question: how does this concept relate to ectotherms?

Cover

- And escape from predators
- And a place to nest or den

Water

- Essential but highly variable from species to species

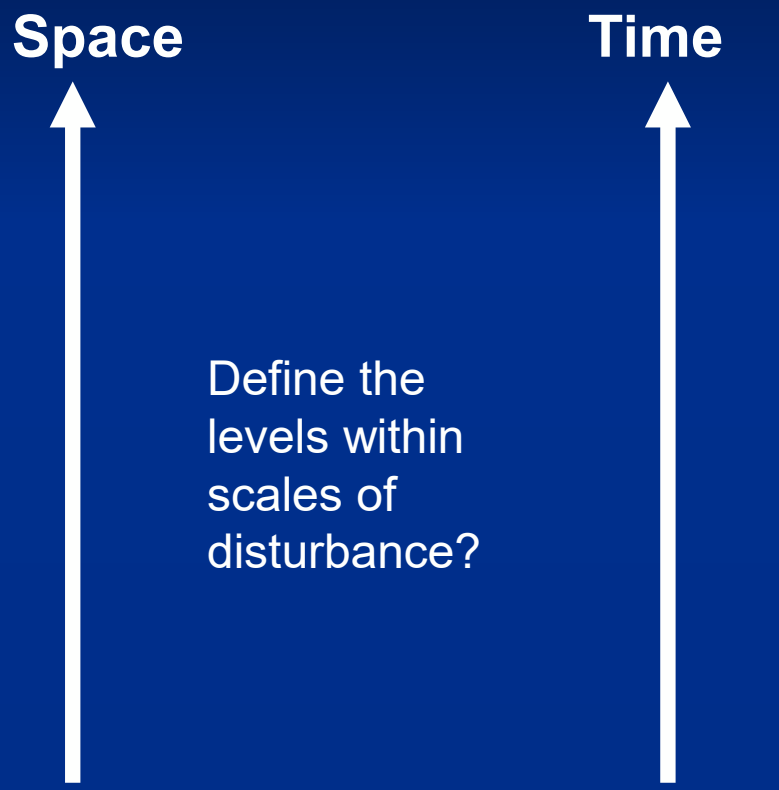
Habitat Selection

Levels of Habitat Selection

- ***First order selection*** = occurrence within a **geographic range** "where in the world the species occurs"
    - Establishment of subpopulations within the geographic range
- ***Second-order selection*** = establishment of a **home range** "the area used to acquire resources"
- ***Third order selection*** = use of **resource patches** within the home range where resources are found
- ***Fourth order selection*** = use of specific food and cover resources acquired in the resource patches.

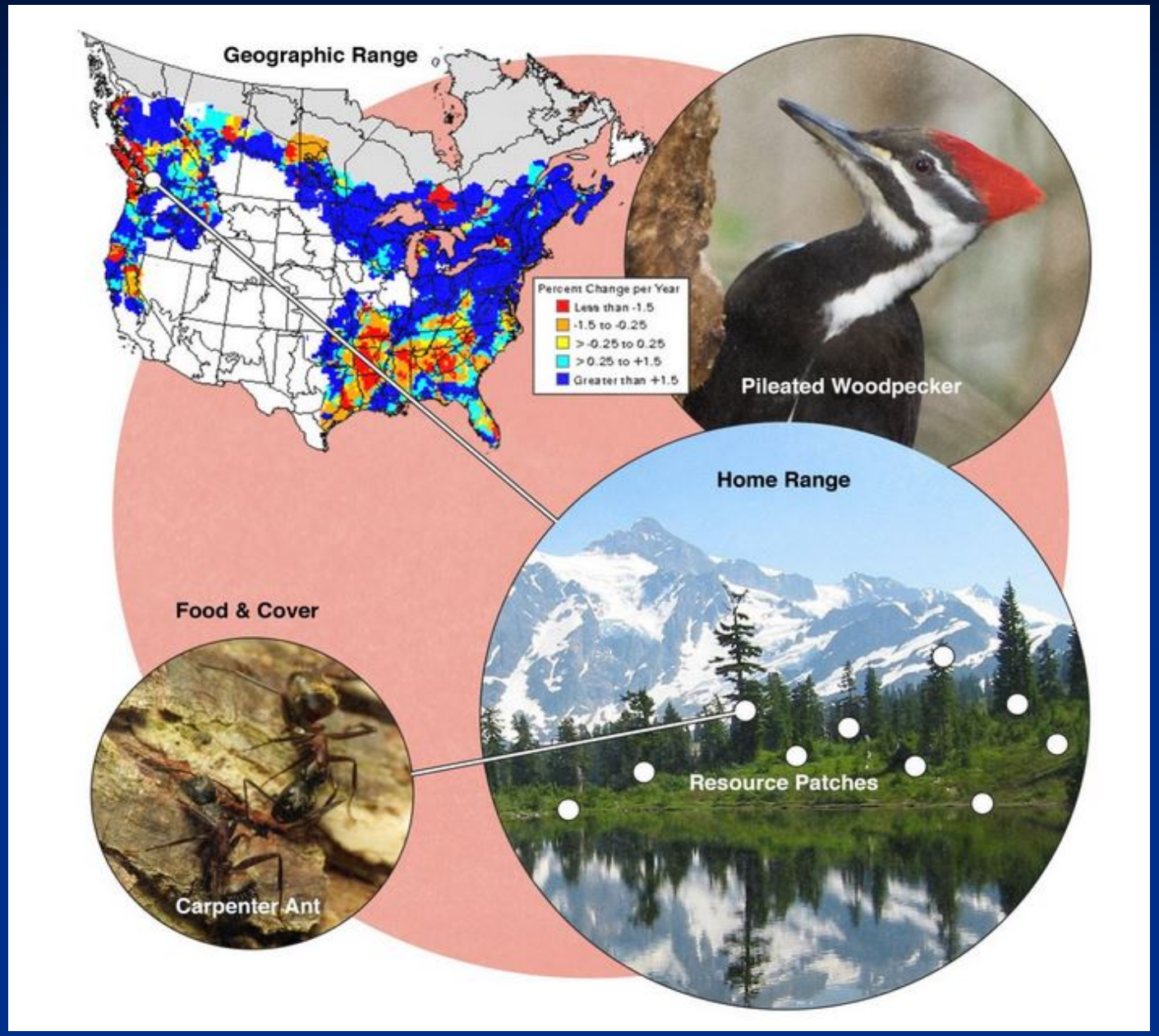
Johnson, D.H. 1980. The Comparison of Usage and Availability Measurements for Evaluating Resource Preference Ecology 61: 65-71

Scales of Habitat Selection



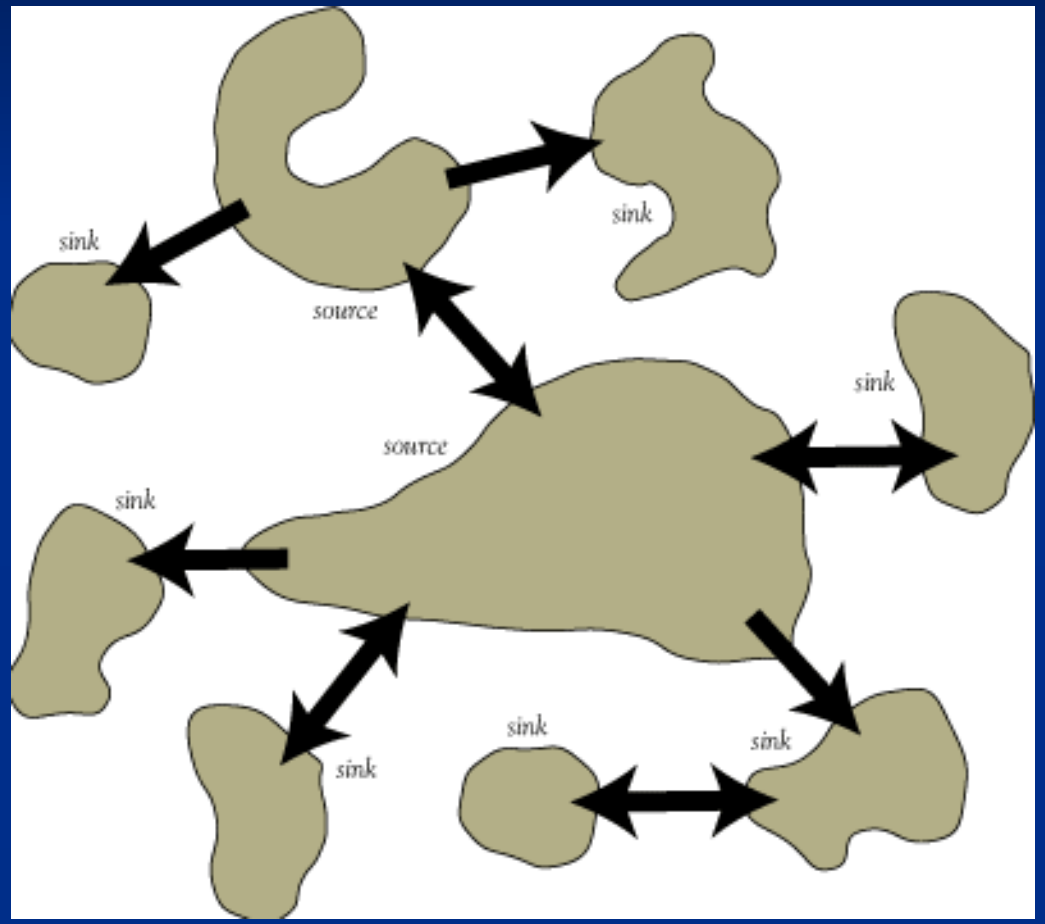
McGarigal et al. 2016. Multi-scale habitat selection modeling: a review and outlook . Landscape Ecology.

Hierarchical Levels of Habitat Selection



Johnson, D.H. 1980. The Comparison of Usage and Availability Measurements for Evaluating Resource Preference Ecology 61: 65-71

Metapopulation Structure



https://seaspout.files.wordpress.com/2011/08/source_sink.gif

https://www.fs.fed.us/pnw/olympia/wet/team-research/owl-res/index.shtml

Habitat Structure and Composition

- Animals often use proximal cues to select habitat that can provide ultimate resources
- Ultimate resources = food, cover, water

We tend to think of structure and composition as visual proximate cues to ultimate resources, but is that too anthropocentric?

Aural social cues – Betts et al. & black-throated blue warblers
Olfactory cues – Scent marking by mammals
Tactile? – Soil compaction?
Other?

Betts et al. 2008. Social information trumps vegetation structure in breeding-site selection by a migrant songbird. Proc. R. Soc. B 275: 2257–2263

https://www.fs.usda.gov/detail/okawen/landmanagement/?cid=STELPRDB5319349

Assessing habitat use

- An example of classic habitat selection research using radio telemetry:
  - Potvin et al. 2000. Marten Habitat Selection in a Clearcut Boreal Landscape. Conservation Biology 14: 844–857.
  - "…Regenerating stands (<20 years), mostly 1992–1994 clearcuts, are white."
- What does this tell us about selection?
- What level of selection is addressed?
- What spatial scale is addressed?
- What information is needed to assess habitat preference?
- What information is needed to assess habitat quality?

Photo by Mike Jones

Figure from Potvin et al. 2000

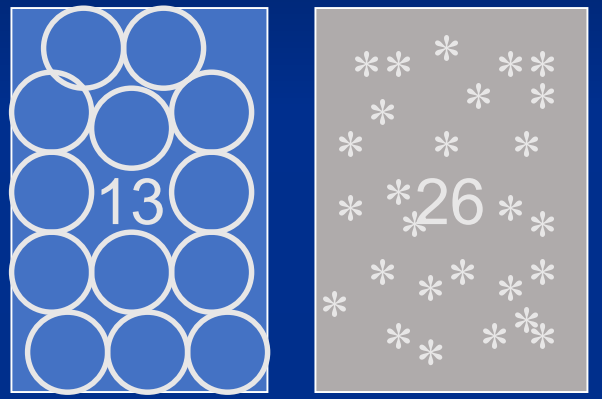
Habitat Quality = Animal fitness

Ideal Free Distribution

More animals in better habitat

Is density a useful index of habitat quality?

Ideal Despotic Distribution



Territoriality influences distribution and fitness

What demographic parameters do we need to know to understand fitness?

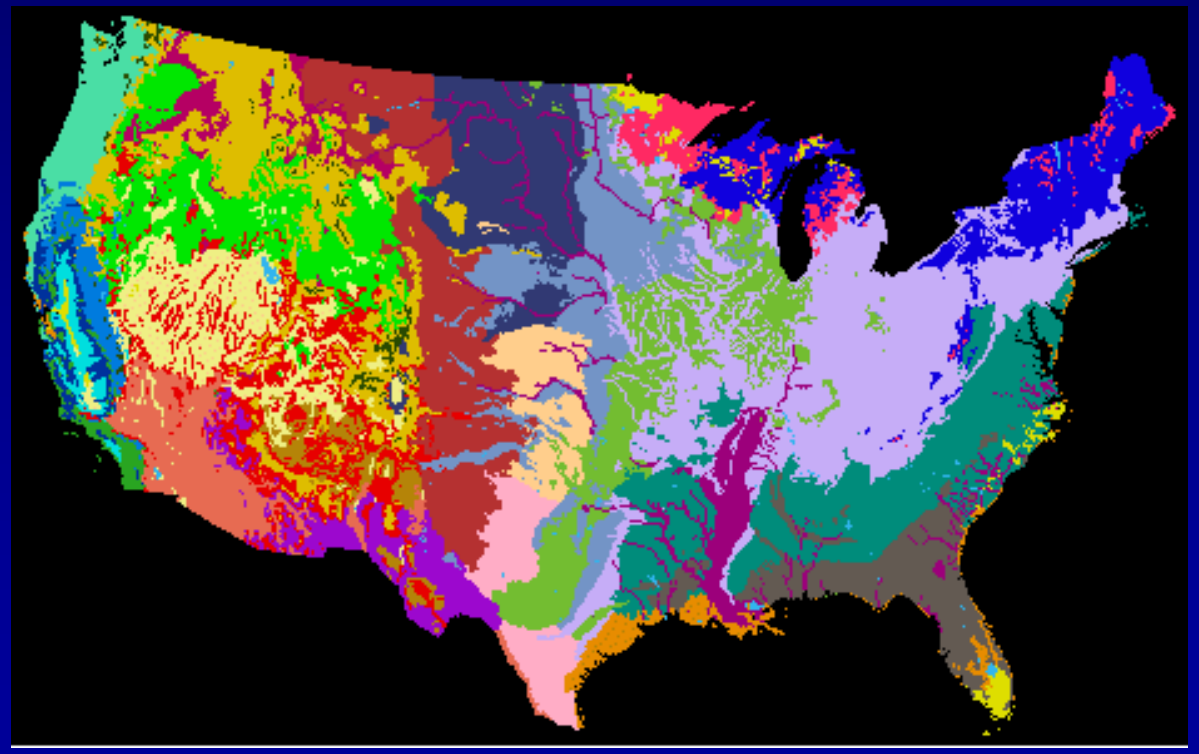
- Survival
- Reproduction
- Movement

Questions?

Photo by Mike Jones

Abiotic factors influencing habitat elements

- Geology
- Topography
- Soils
- Climate



- Limits on habitat elements and organism physiology
- Drives distribution of potential vegetation
- Provides the template for biotic interactions
- Influences tree occurrence and tree growth

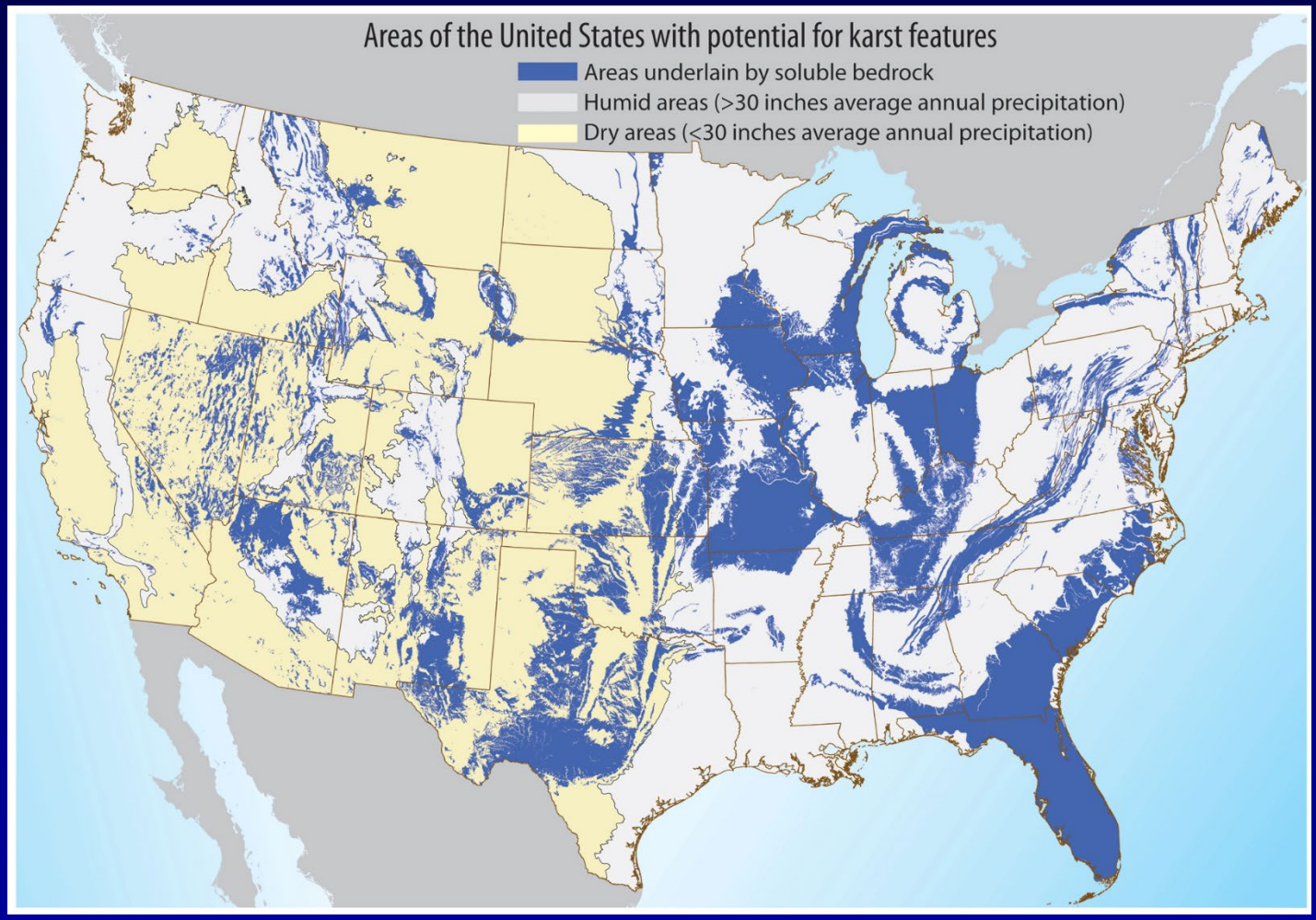
Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States, American Geographical Society, Special Publication No. 36.

Abiotic factors influencing production of habitat elements

Learning Outcomes

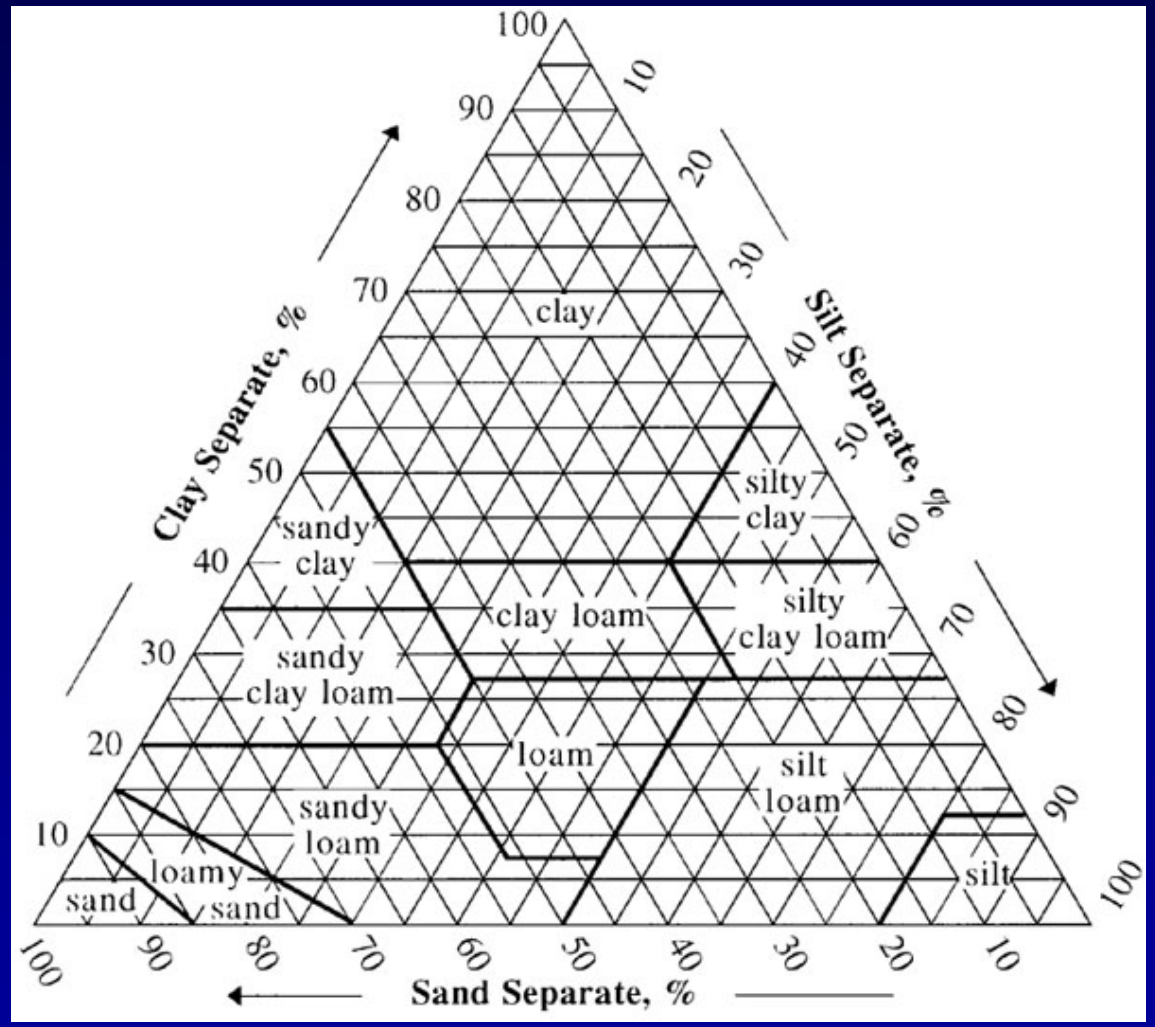
- Identify the key abiotic factors influencing forest species composition and structure on a site
- Understand how the site can limit the ability to achieve habitat goals

Geology



http://geology.er.usgs.gov/egpsc/graphics/06_karst_studies_weary.jpg

Soils

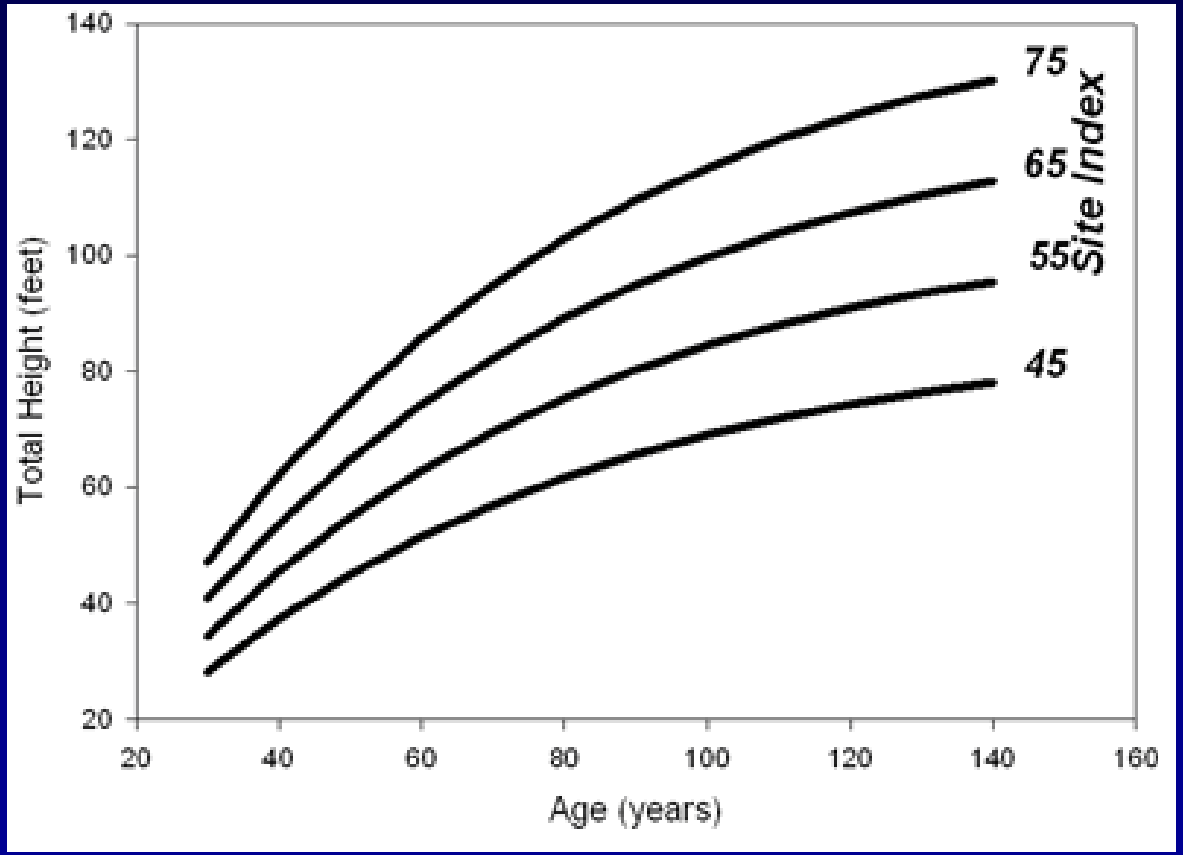


https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167

- Texture
- Depth
- pH
- Micronutrients (e.g., Serpentine)
- Moisture (hydric, xeric, mesic)

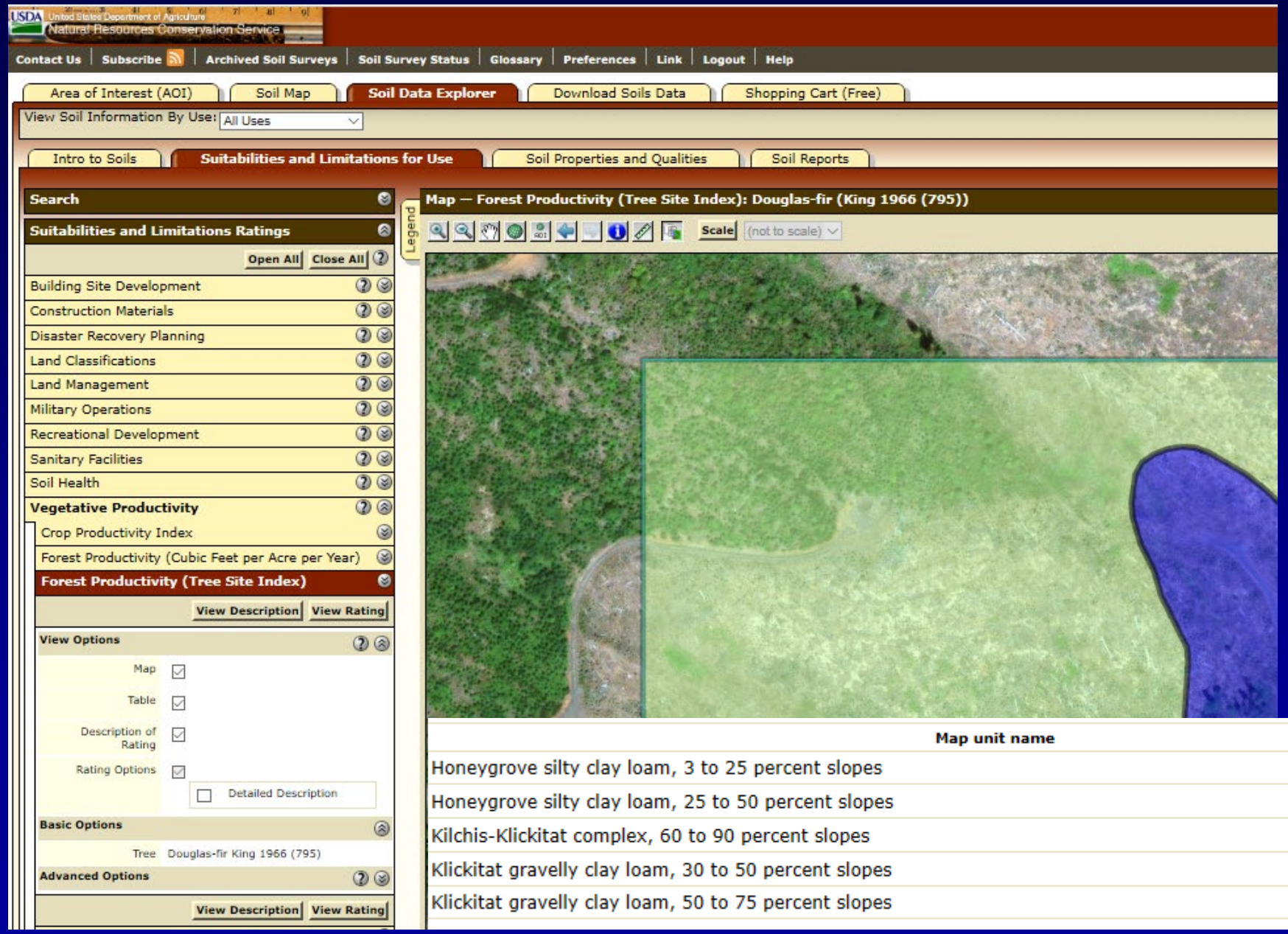
Site quality

- Site index=Height of the dominant and co-dominant trees at a specified age
- Tree presence, and growth rates are a function of available sunlight, moisture, nutrients, in addition to competition
- Why tree height?



https://www.nrs.fs.fed.us/fmg/nfmg/rp/silv/sitequality/p2_siteindex.html

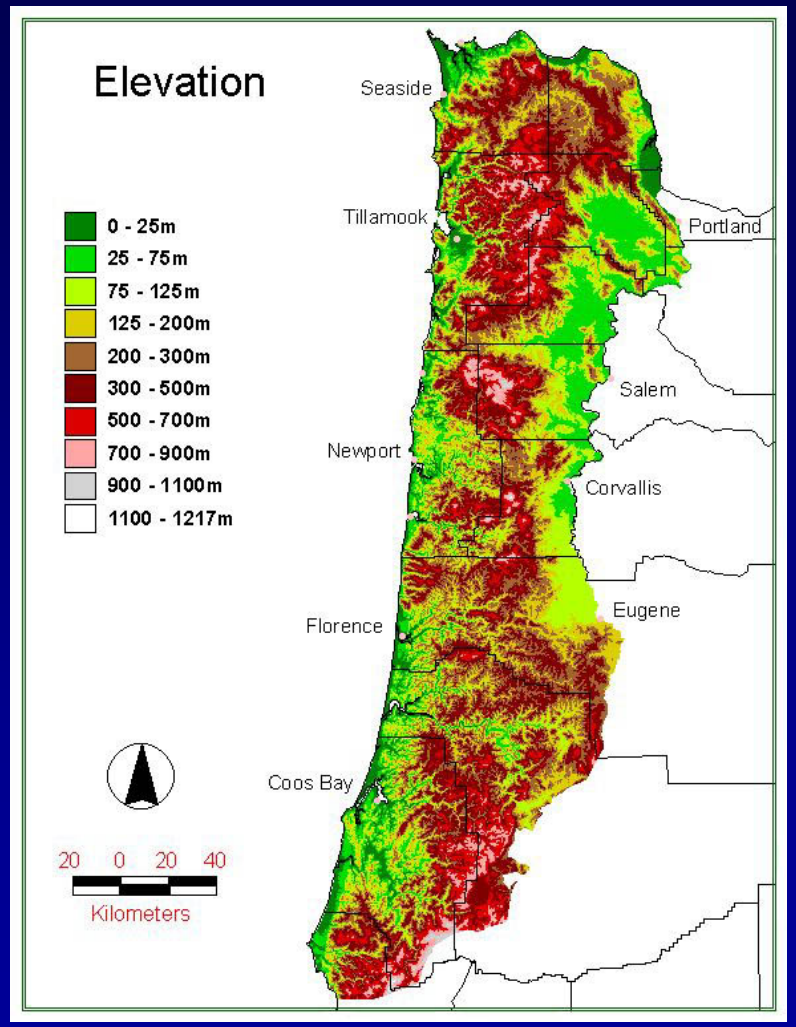
Soils



Map unit name	Rating (feet)
Honeygrove silty clay loam, 3 to 25 percent slopes	122
Honeygrove silty clay loam, 25 to 50 percent slopes	122
Kilchis-Klickitat complex, 60 to 90 percent slopes	90
Klickitat gravelly clay loam, 30 to 50 percent slopes	112
Klickitat gravelly clay loam, 50 to 75 percent slopes	112

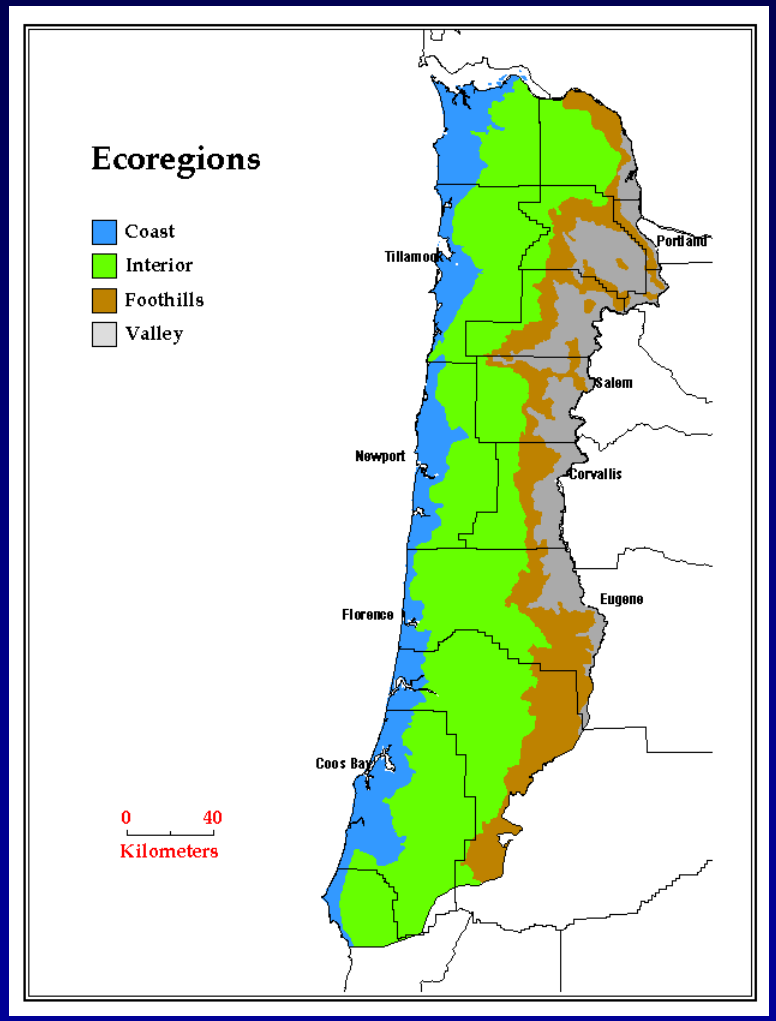
Find a soil survey for your area https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Changes over Space: Topography



http://www.fsl.orst.edu/clams/map_index.html#elevation

https://catalog.data.gov/dataset/usgs-national-elevation-dataset-ned-1-meter-downloadable-data-collection-from-the-national-map-

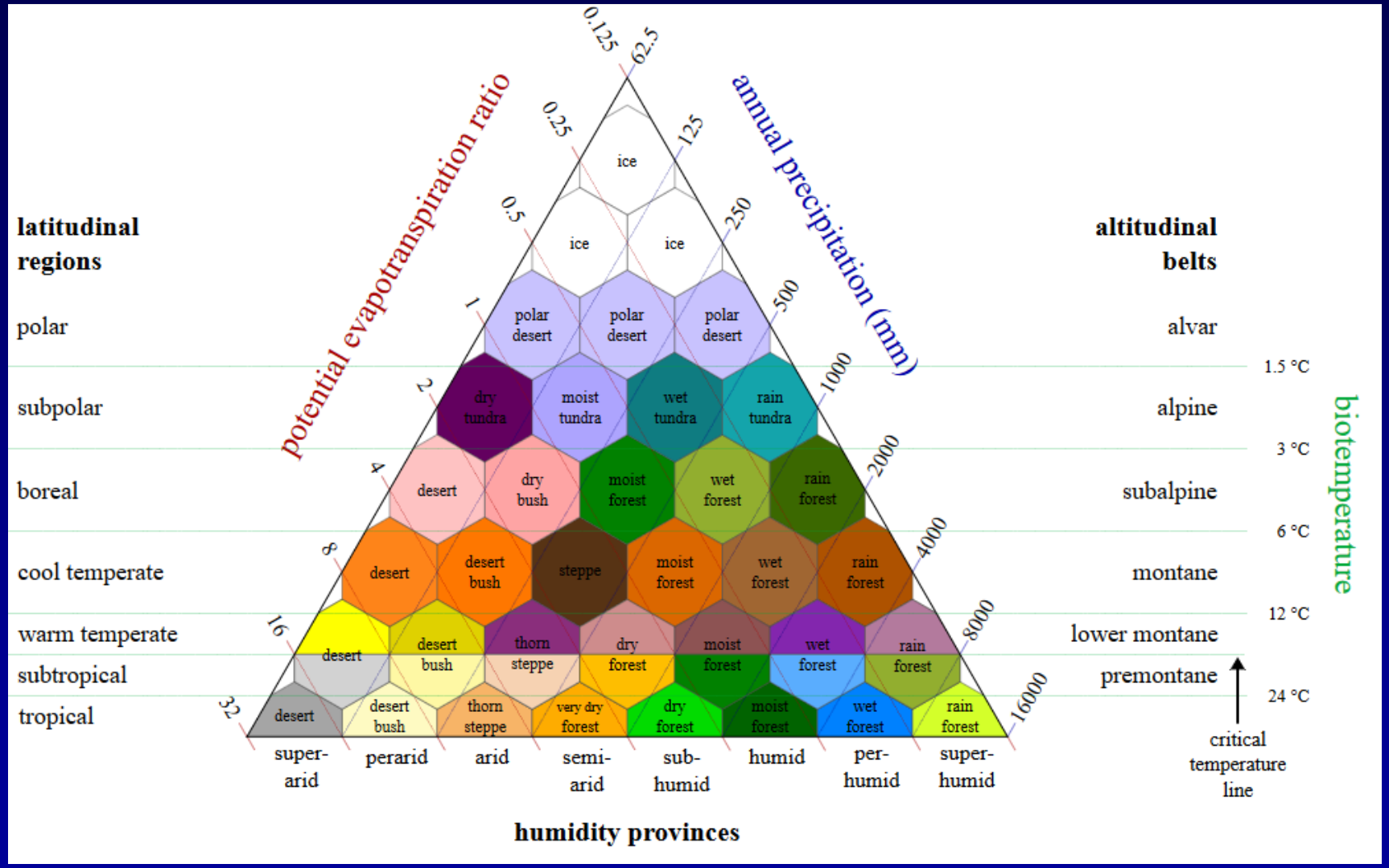


http://www.fsl.orst.edu/clams/map_index.html#ecoregions

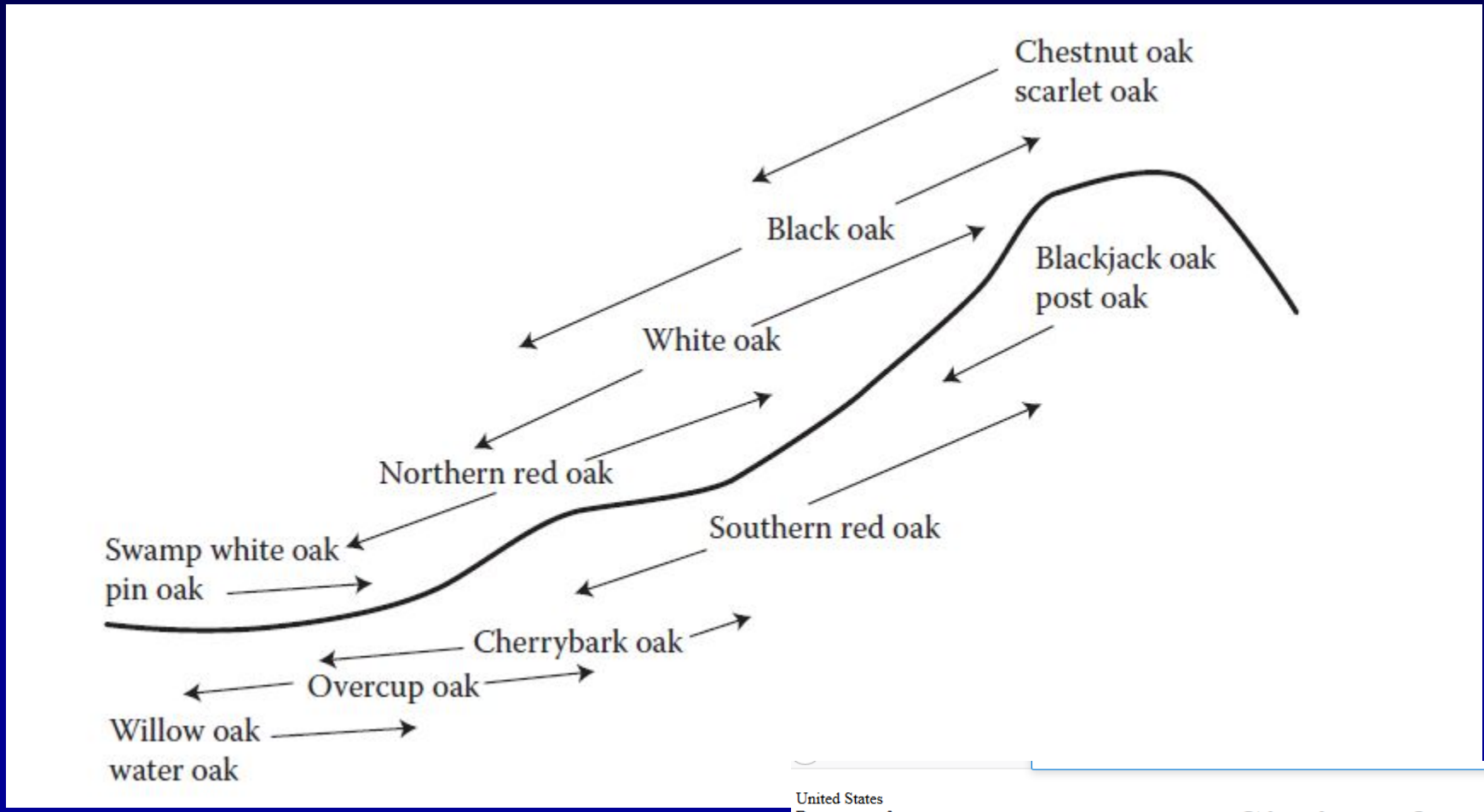
Elevation and Latitude Effects

Holdridge Life Zones

https://commons.wikimedia.org/wiki/File:Lifezones_Pengo,_FAO.svg



Moisture gradients



United States Department of Agriculture

Forest Service

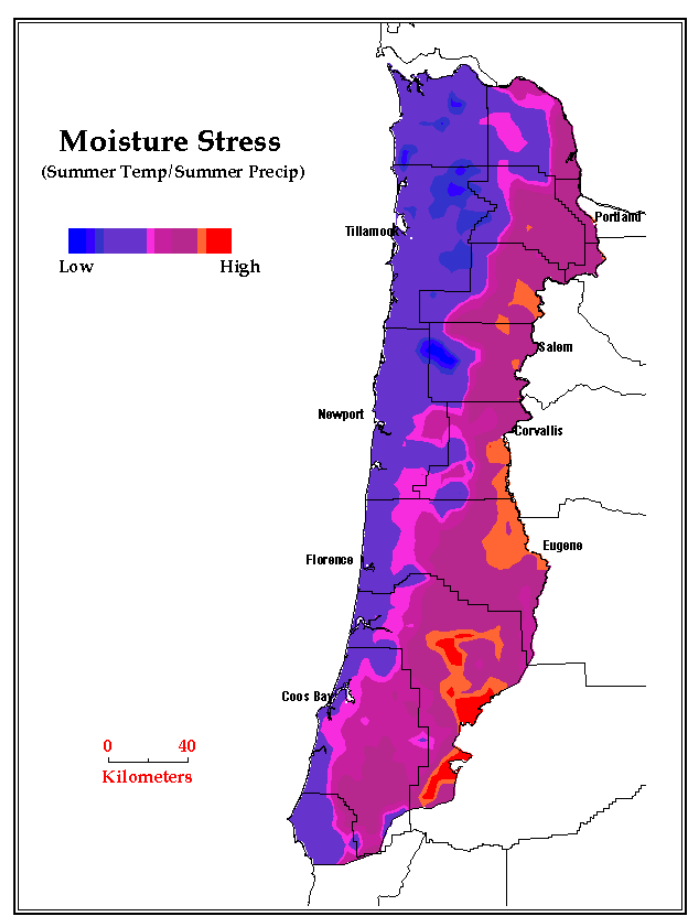
Agriculture Handbook 654

Silvics of North America

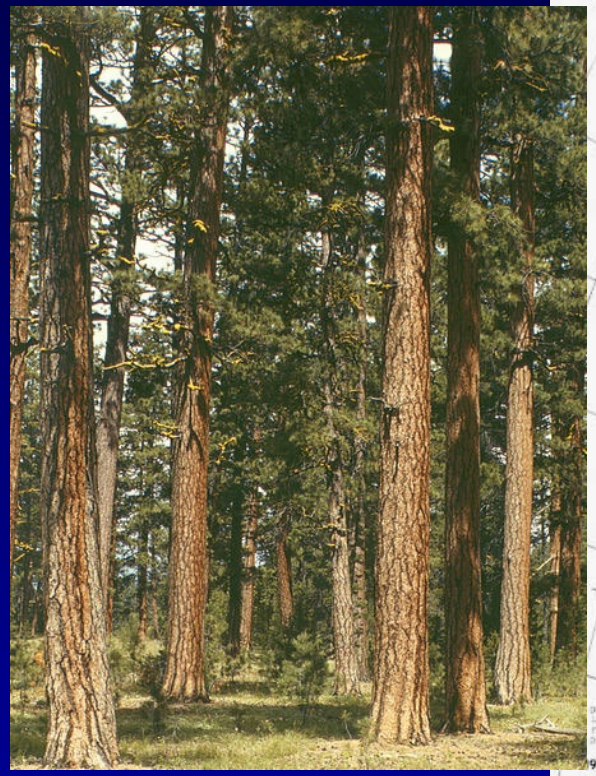
https://www.srs.fs.usda.gov/pubs/misc/ag_654/table_of_contents.htm

Climate Effects

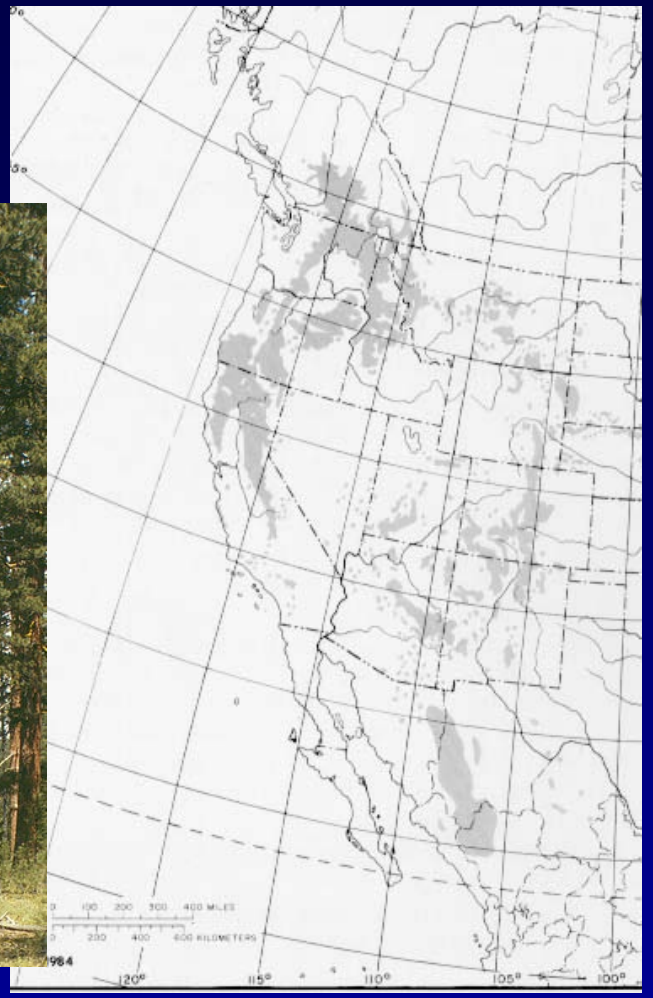
Temperature and precipitation can limit the distribution of some species.



http://www.fsl.orst.edu/clams/map_index.html#climate

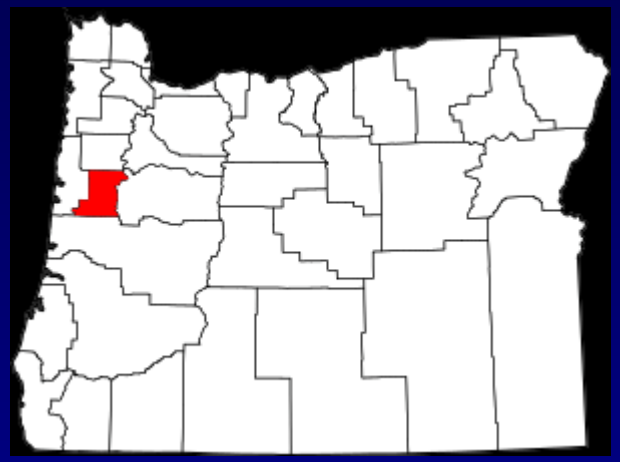


Source: WikiMedia Common: from Farm Services Administration (1942) Public Domain

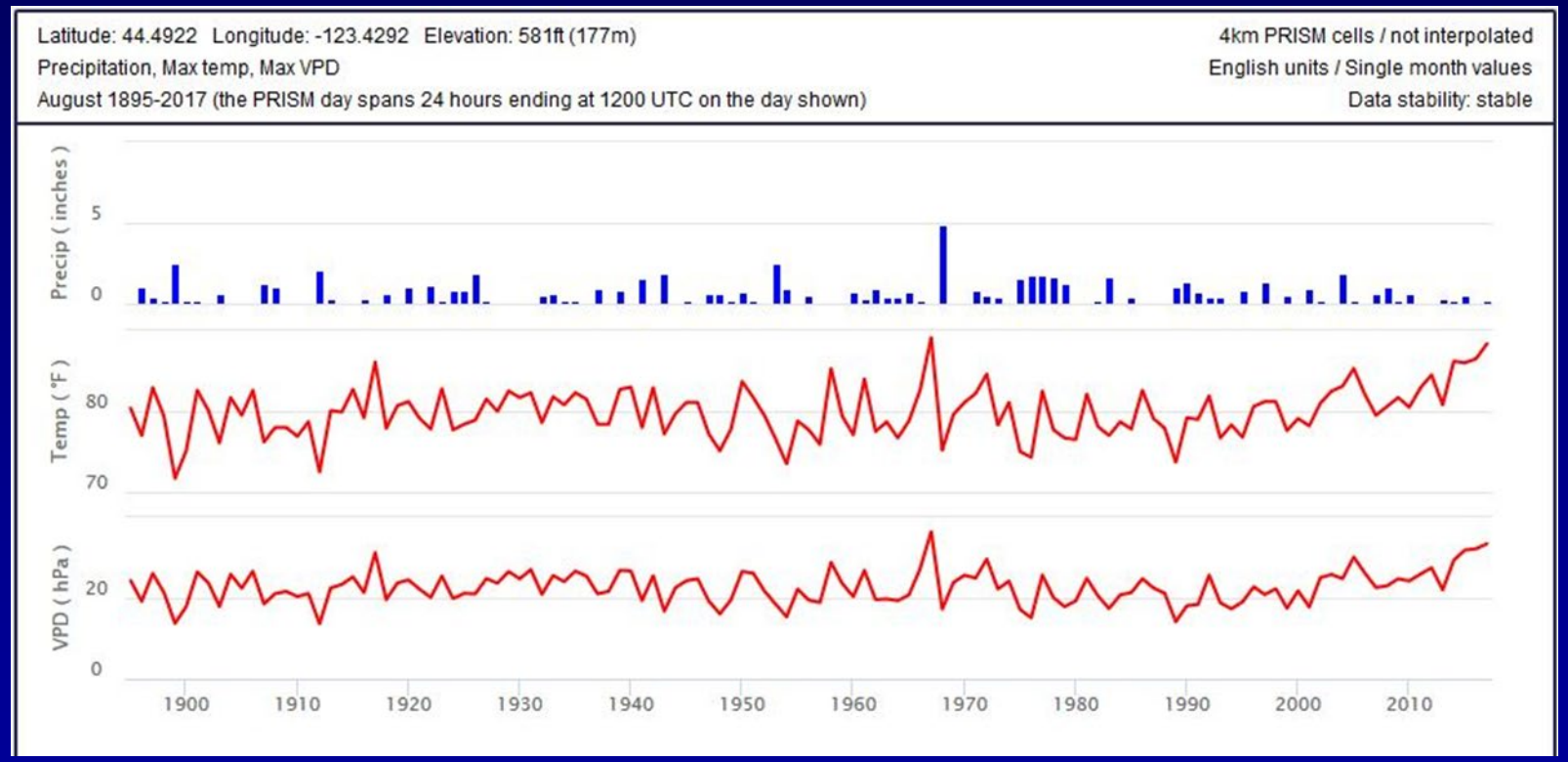


https://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_1/silvics_vol1.pdf

Long term trends in temperature, precipitation and vapor pressure deficit

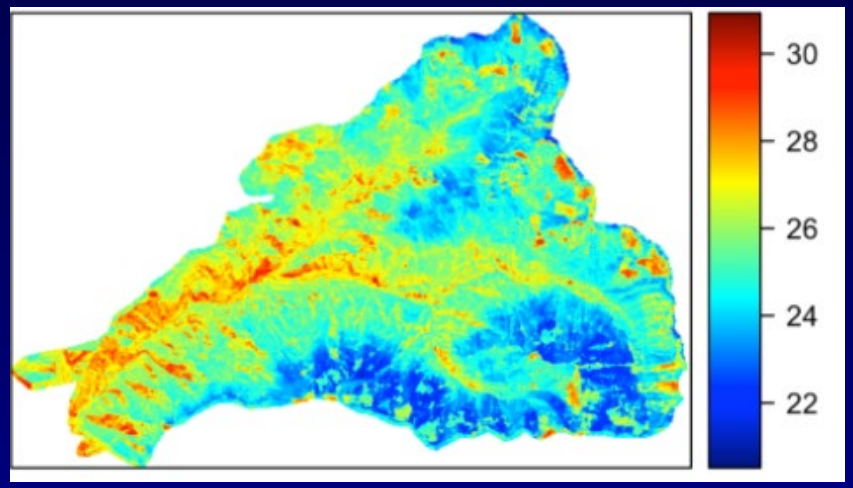


https://en.wikipedia.org/wiki/Benton_County,_Oregon



https://prism.oregonstate.edu/

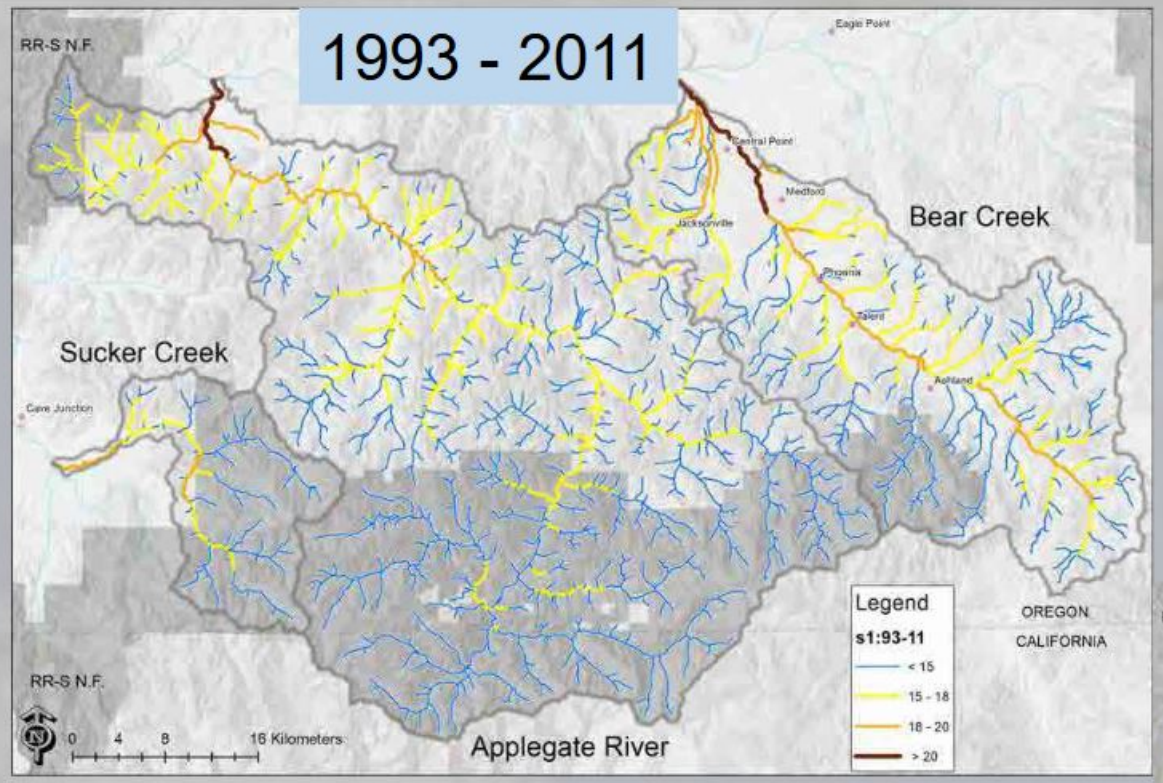
Below canopy trends in temperature and birds



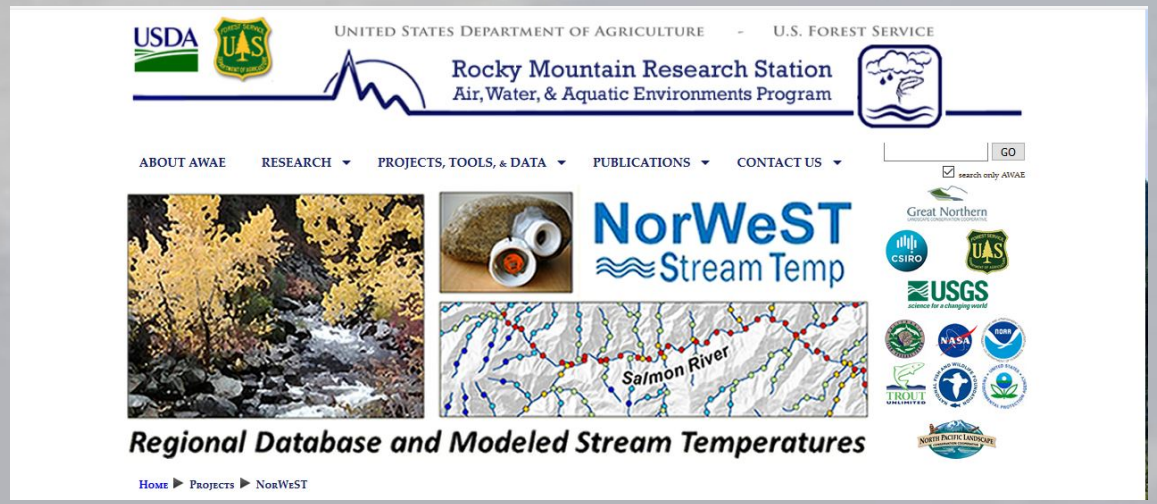
Frey, S. J. K. et al. 2016. Spatial models reveal the microclimatic buffering capacity of old-growth forests. – Sci. Adv. 2: e1501392.

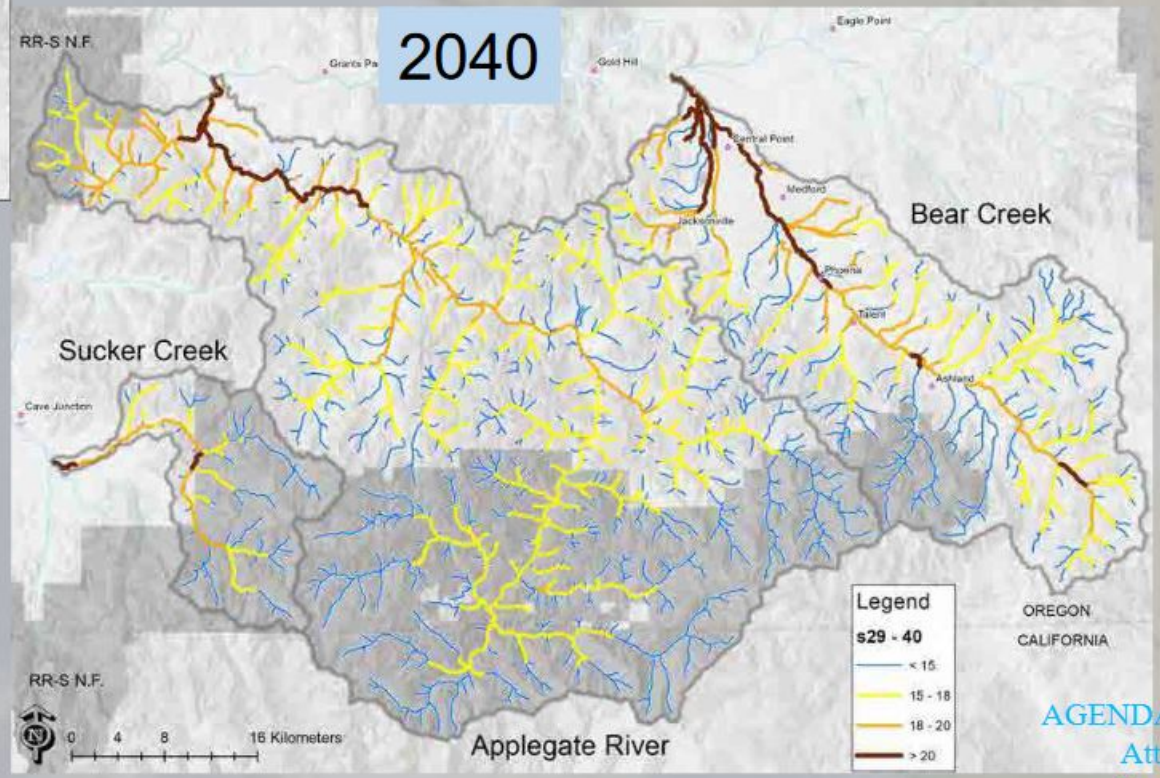
Photos by Hankyu Kim

NorWeST Modeled Mean August Water Temperatures (°C)

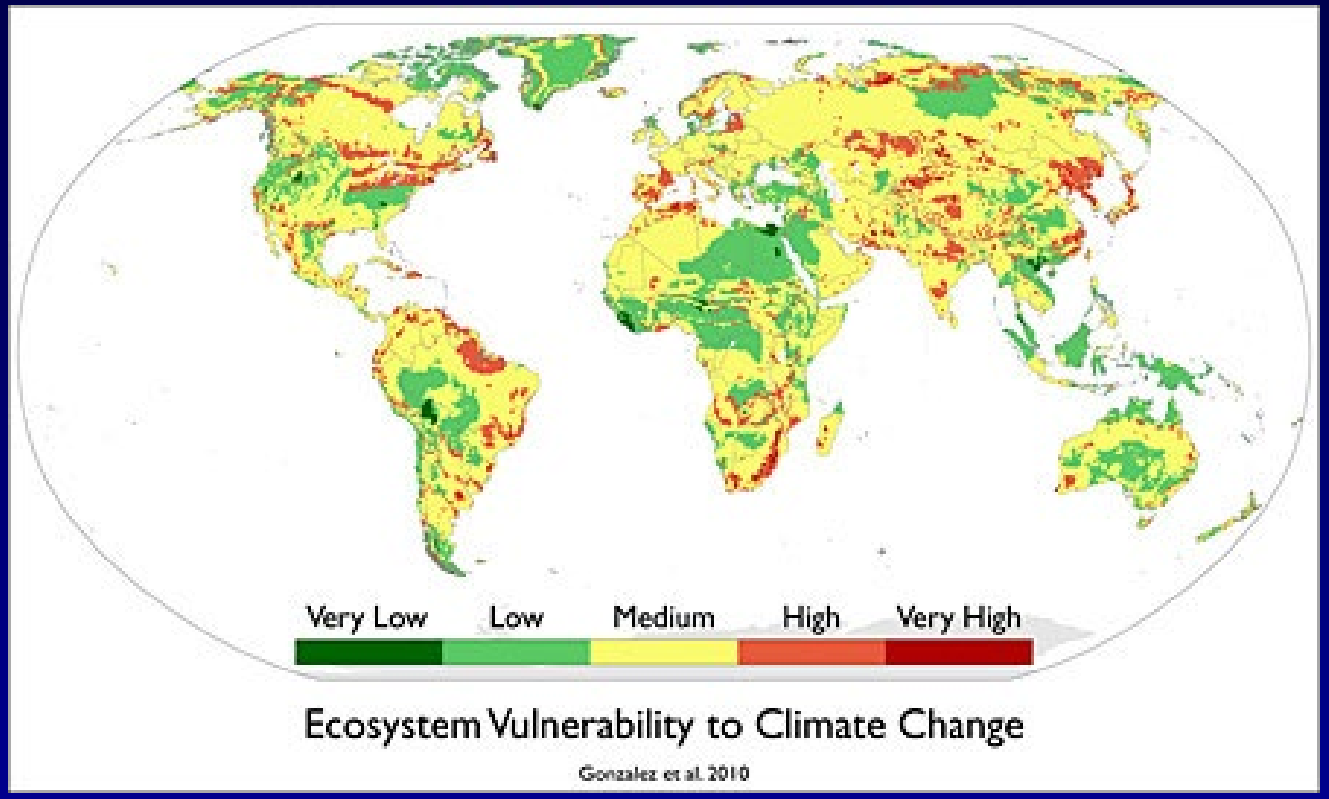


Projecting climate change effects forward in time (G. Reeves Presentation to the Oregon Board of Forestry, June 3, 2020).





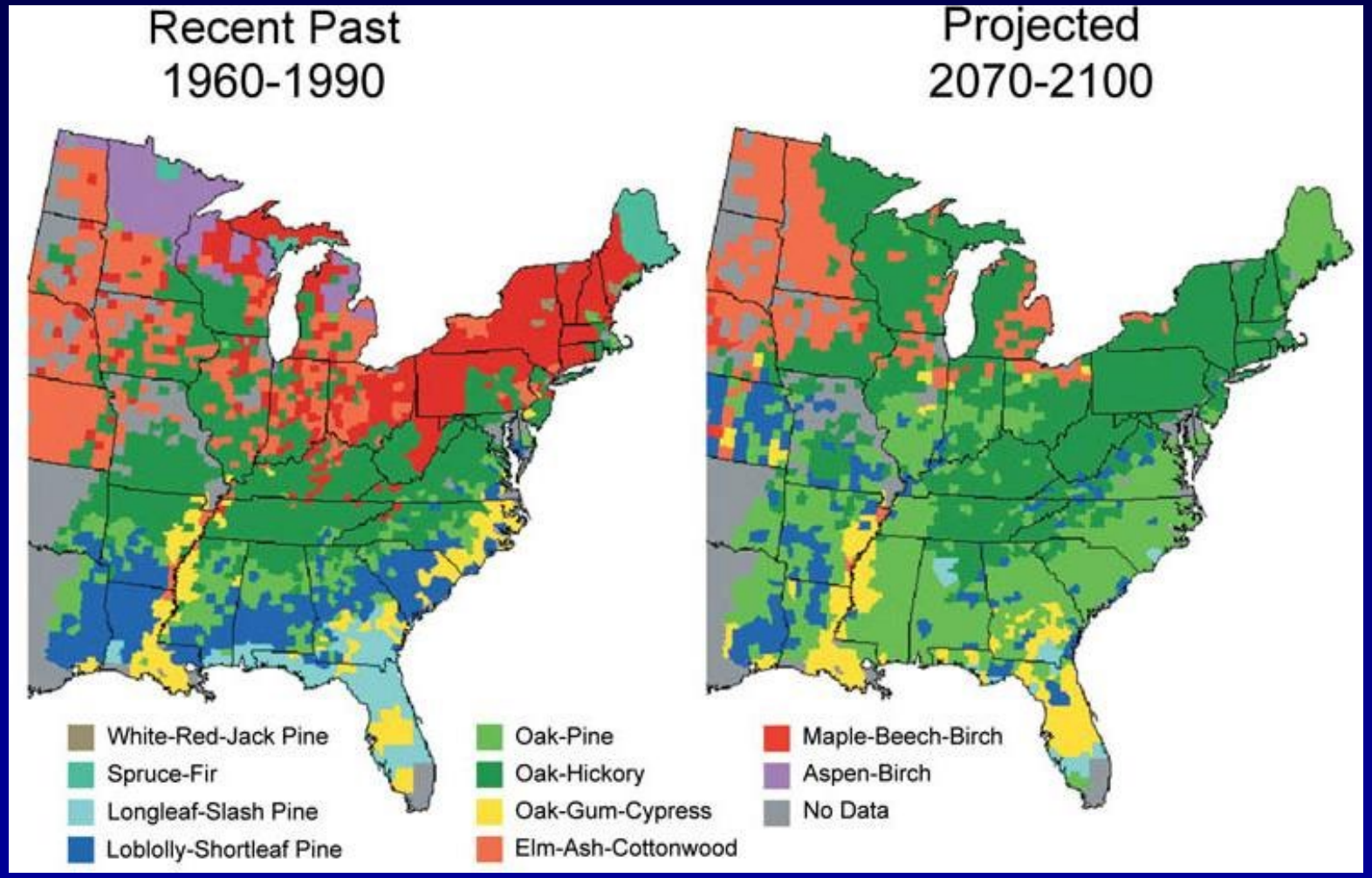
Vegetation patterns will likely continue to change



http://news.berkeley.edu/2010/06/04/climate/

"…many invasive species share traits that will allow them to capitalize on the various elements of global change. Increases in the prevalence of some of these biological invaders would alter basic ecosystem properties in ways that feed back to affect many components of global change..."(Dukes and Mooney 2000)

Forest Types

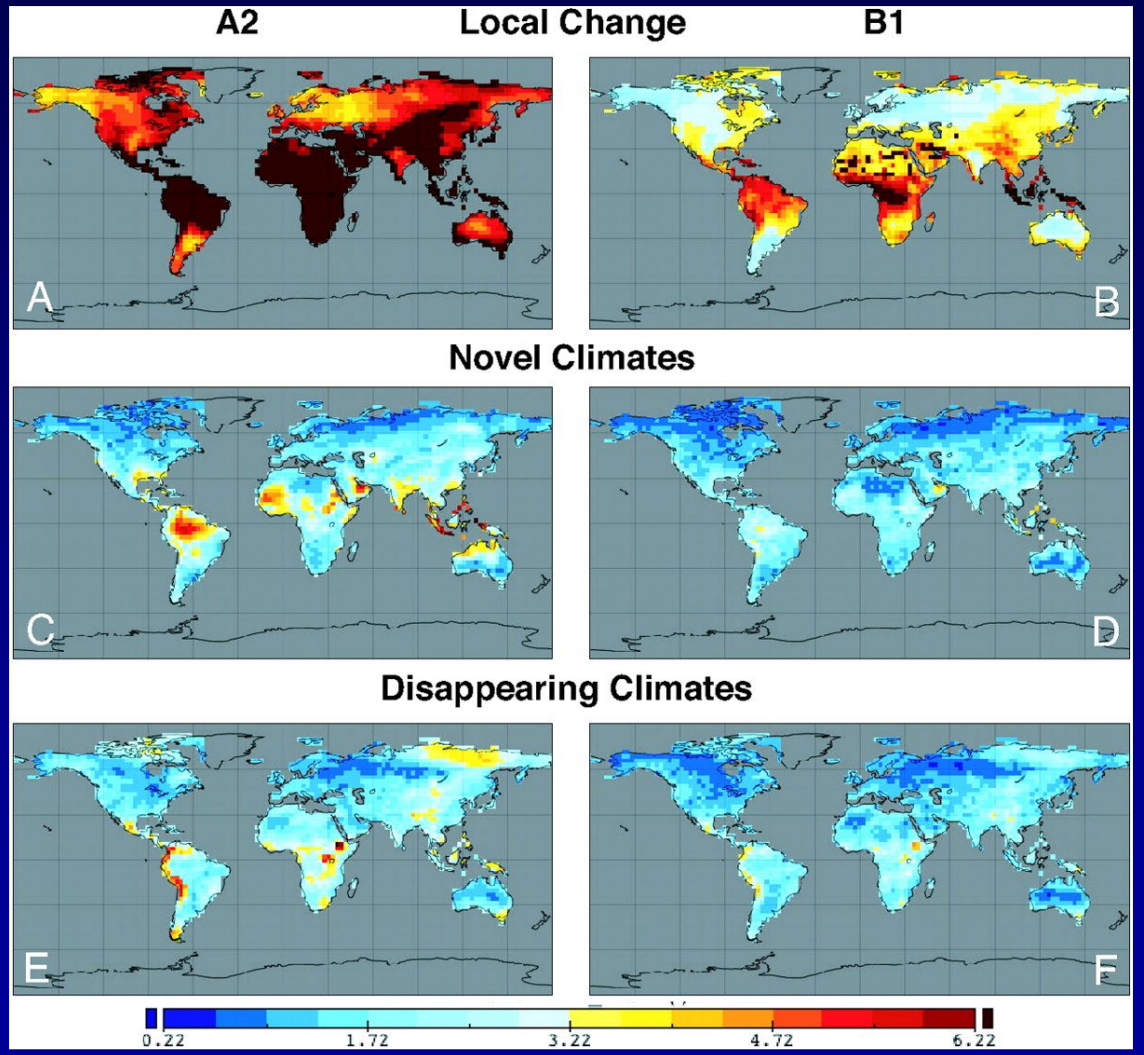


https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-forests_.html

https://data.fs.usda.gov/geodata/rastergateway/forest_type/conus_forest_type_metadata.php

Climates will disappear and new ones will develop

"There is a close correspondence between regions with globally disappearing climates and previously identified biodiversity hotspots; for these regions, standard conservation solutions (e.g., assisted migration and networked reserves) may be insufficient to preserve biodiversity."
(Williams et al. 2007)
http://www.pnas.org/content/104/14/5738.abstract



http://www.pnas.org/content/104/14/5738/F2.large.jpg

Site limitations to providing habitat elements

- Is the site capable of meeting your objectives for a stand?
  - What is the capability of the soil to grow trees of desired species? Shrubs? Herbaceous plants?
  - Is soil moisture adequate during the growing season?
  - How might slope or aspect influence growth and survival of desired species?
  - What are the climatic limits to growth and survival of the desired species?
  - How might climate change influence growth and survival of the desired species?

Questions?

For questions, comments and ongoing discussions to the group for all 5 Forest Wildlife Habitat Management webinars:

forestwildlifehabitatseminars@doimspp.onmicrosoft.com

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