



Forest Ecology of the Pacific Northwest

Lecture 1 - Introduction

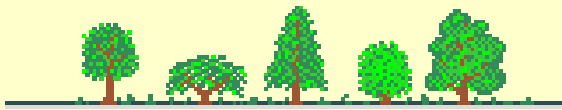
What is a Forest?

■ NOT JUST THE TREES!

“Complex, functional system of interacting and often interdependent

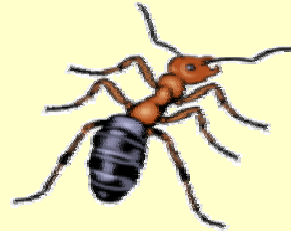
- Biological (e.g. trees, wildlife, microorganisms),
- Physical (e.g. substrate, climate), and
- Chemical Components (e.g. carbon, nitrogen)

The biological part of which has evolved to perpetuate itself through the production of new organic matter”



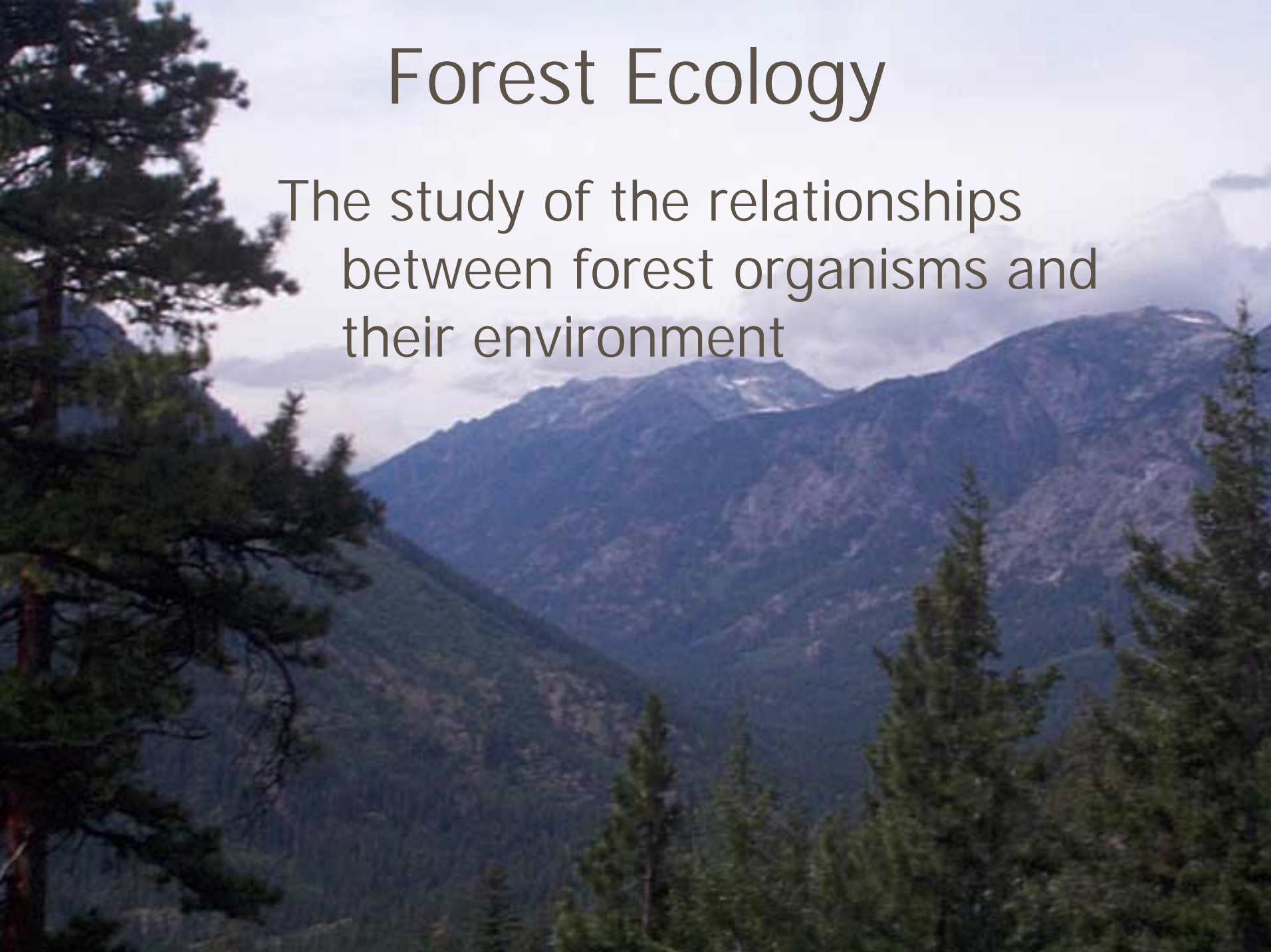


Forest Component



Forest Ecology

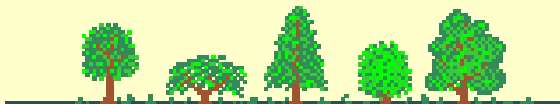
The study of the relationships
between forest organisms and
their environment



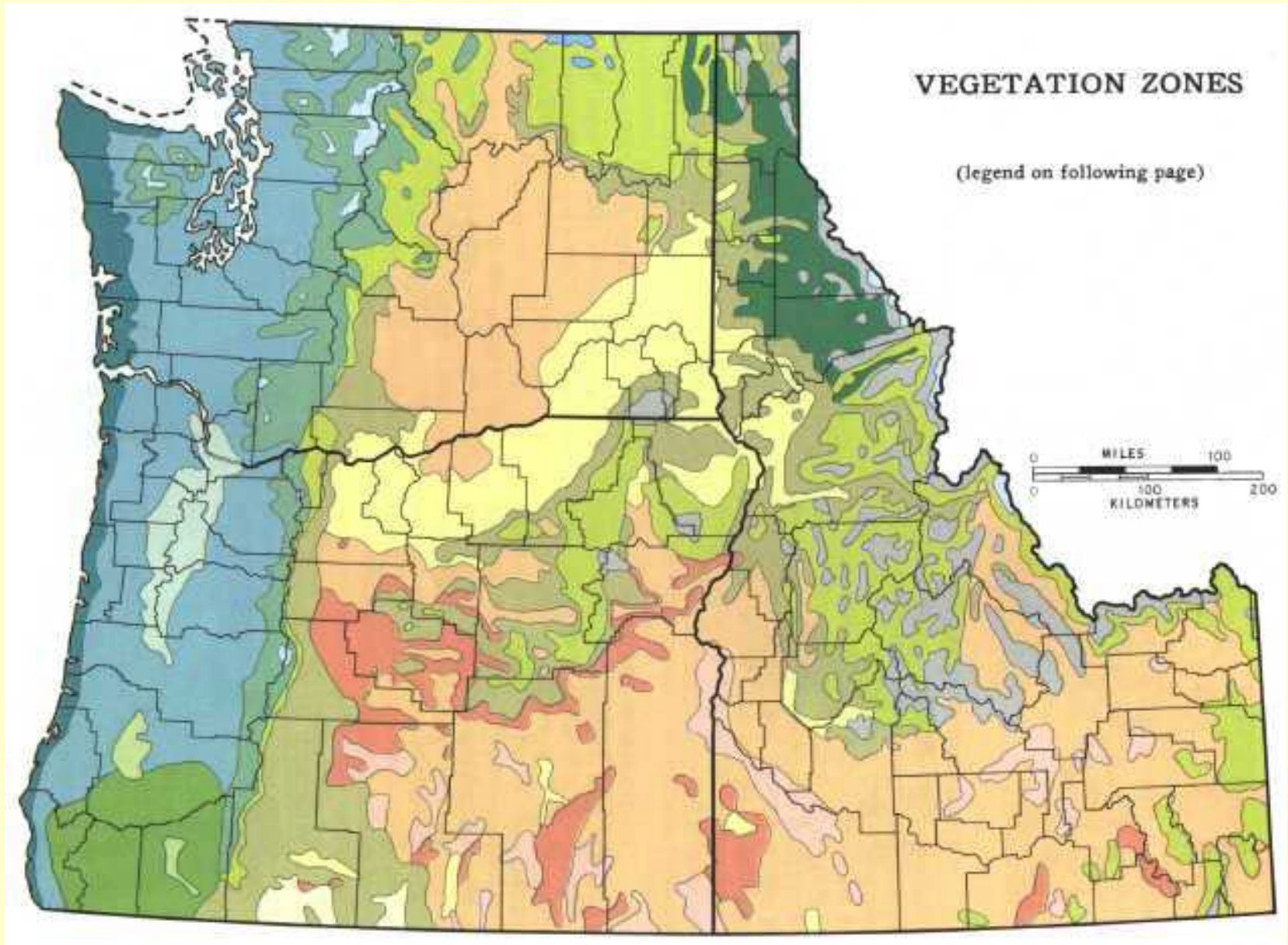
Role of Forest Ecology

(to provide a knowledge of...)

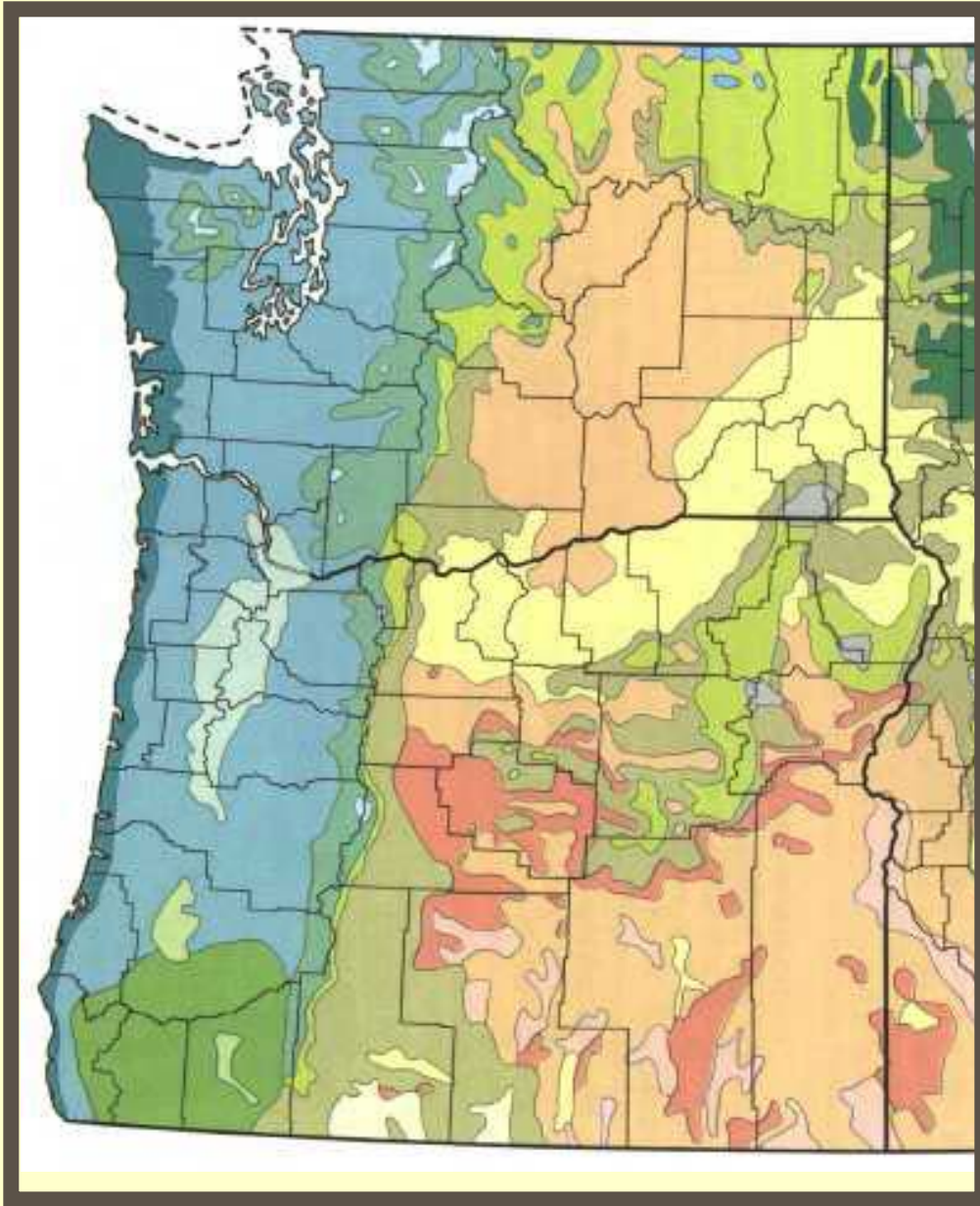
- Ecosystem components, functional processes and change over time
- Systems by which to describe the ecological variability of forested landscape.
- Systems by which we can predict the response of ecosystems to natural and human-caused disturbance.



The Pacific Northwest



The Pacific Northwest – This Course

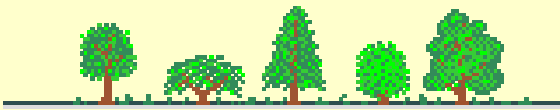


■ Washington

■ Oregon

Humans and Forest Ecology

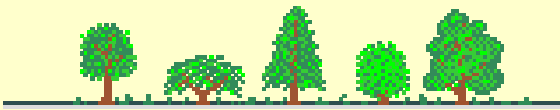
- Why Study Forest Ecology?
 - Humans, like other organisms are ultimately resource limited. (Malthus 1798).
- Present Consumption Rate:
 - 4.7 billion m³ per year (0.7 m³ per person) out of 340 billion m³ growing stock.
- With Population Growth:
 - 5.5 billion people today, 8 billion by 2030.
 - By 2025, 6.6 billion m³ consumed per year.



Human's Dependence on Forests

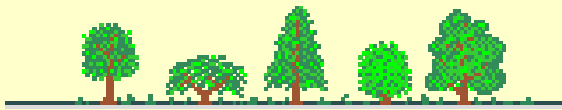
- Historic

- Human ancestors: tree dependent: food, shelter, protection.
- On the ground: tools, **fire**, shelter.
- Agricultural conversion of forest: beginning 8,000 yrs ago.
- Transportation needs: wooden carts, ships.
- Early wars based on wooden technology (e.g. naval warfare).
- Industrial Revolution required wood supplies – building, machinery, power.



Human's Dependence on Forests - Indirect

- Regulation of stream discharge
- Maintenance of water quality
- Stabilization of steep hillsides
- Protection from high winds and avalanches
- Provision of wildlife habitat and food for hunting
- Provision of food for domestic livestock



Prediction of Future Growth

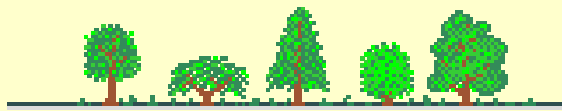
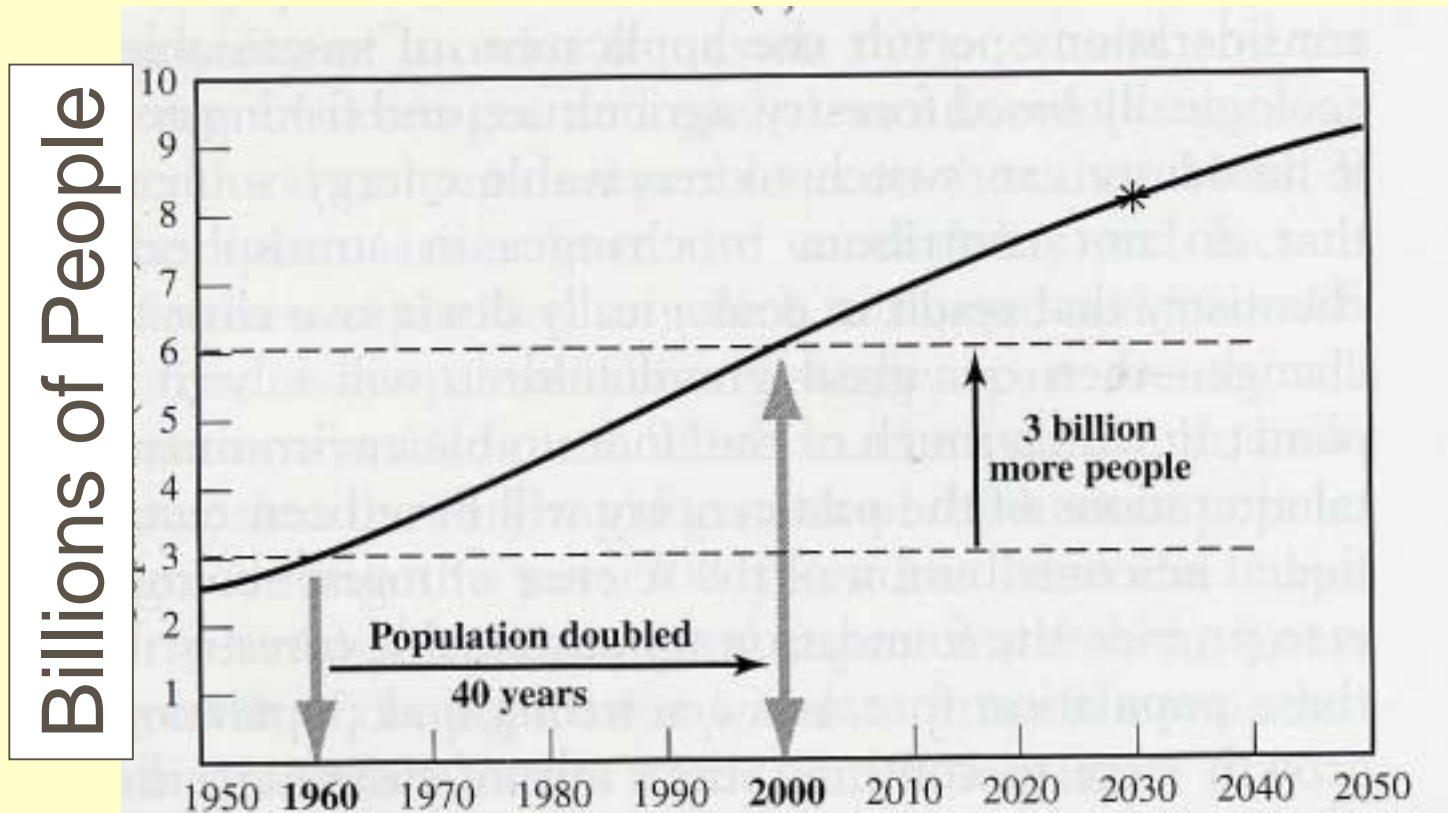
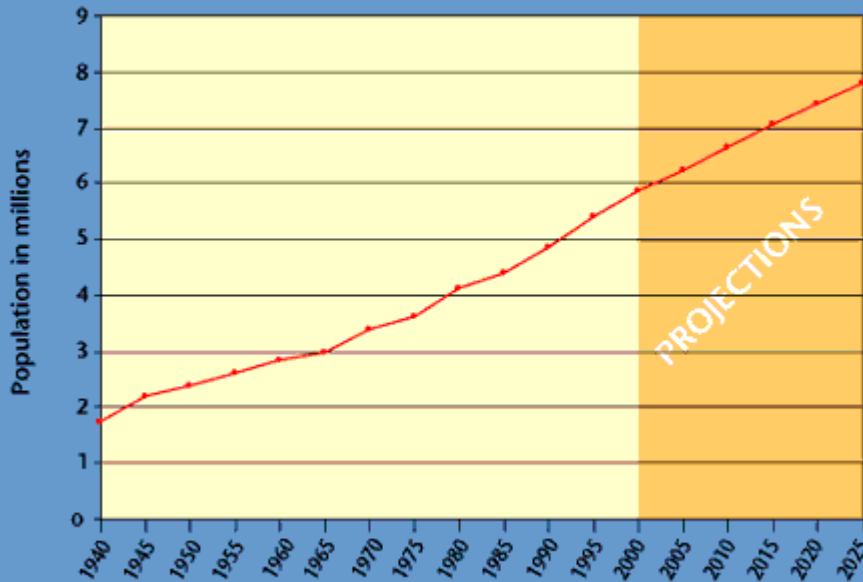


Fig 1.1b

Humans and Ecology - PNW

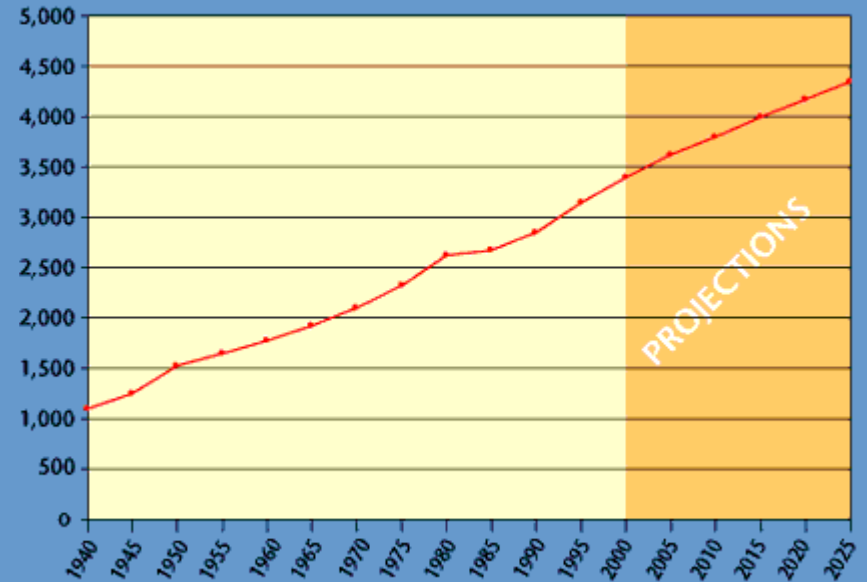
- 2000 \simeq 9.3 million people

Washington Population, 1940 to 2025



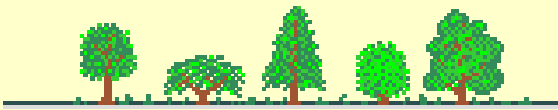
Source: U.S. Census Bureau, March 2001

Oregon Population, 1940 to 2025

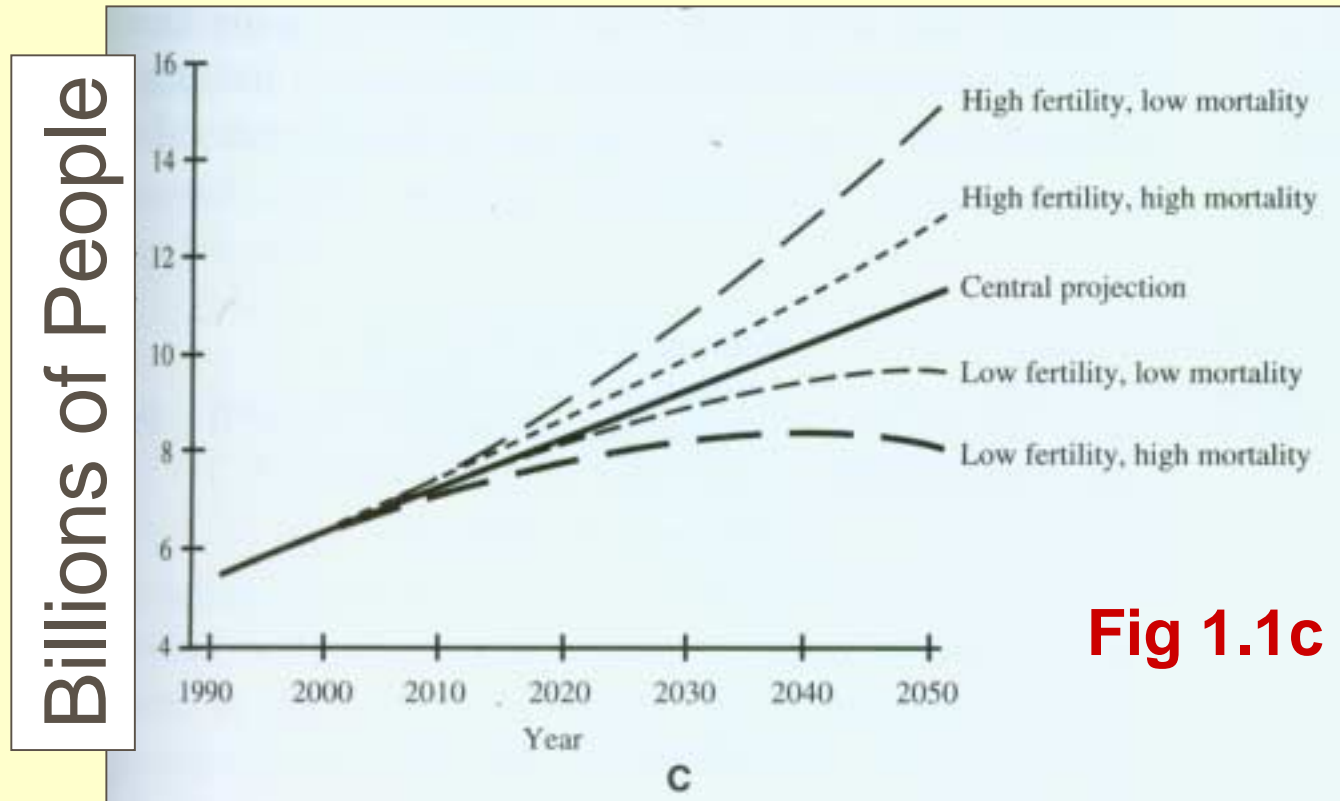


Source: U.S. Census Bureau, March 2001

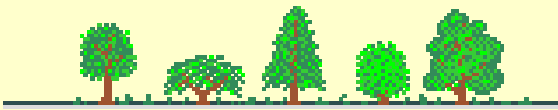
- 2025 – projected to be \simeq 12.5 million



When and at What Population Size Will Stability be Reached?



- Depends on when replacement fertility is reached. (average family size has enough children to replace the parents).



Exponential Growth:

- Doubling took 35,000 years in prehistoric times.
- Only 40 years presently.

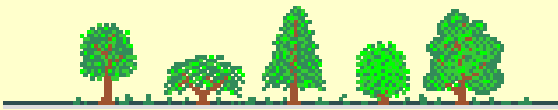
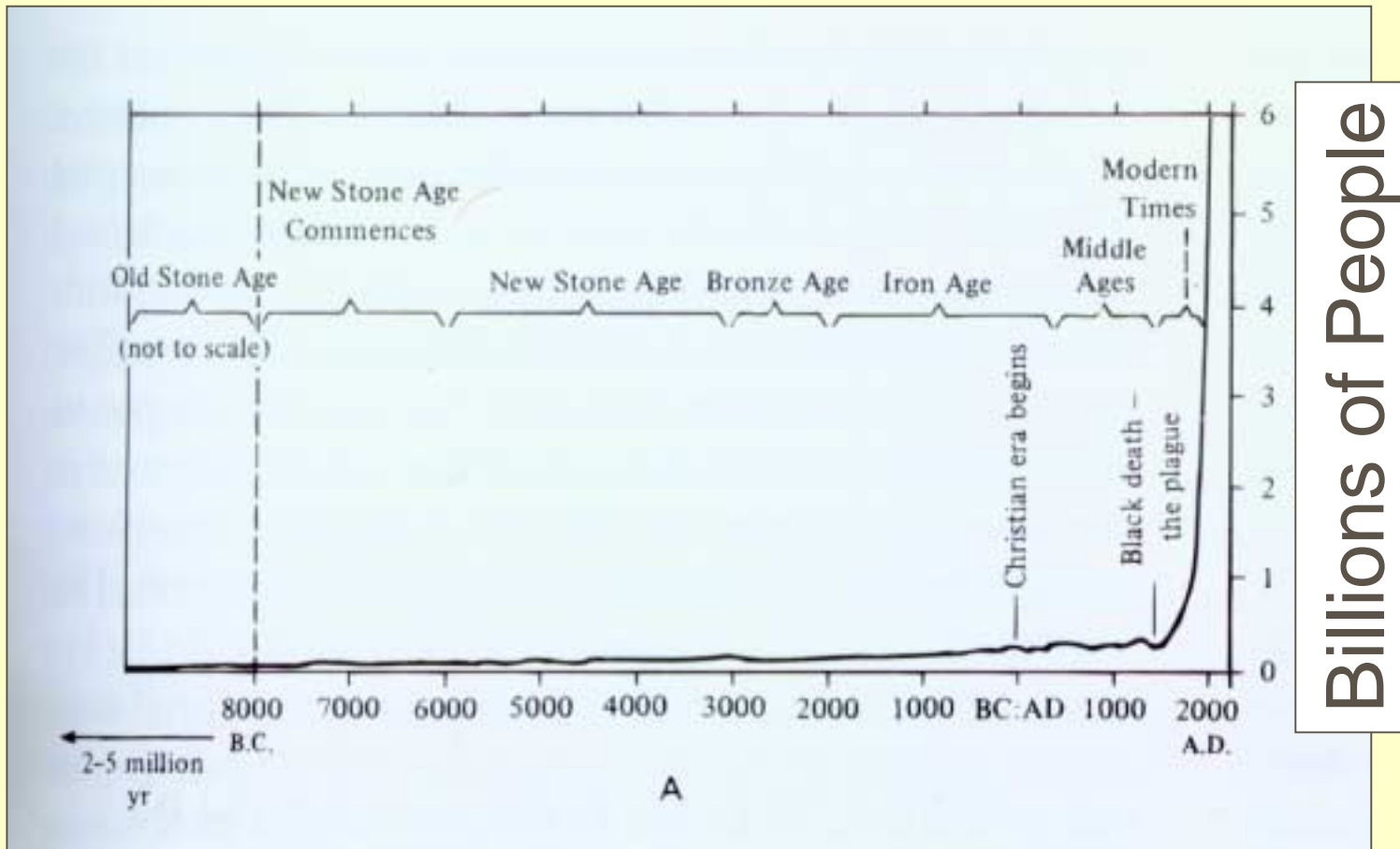
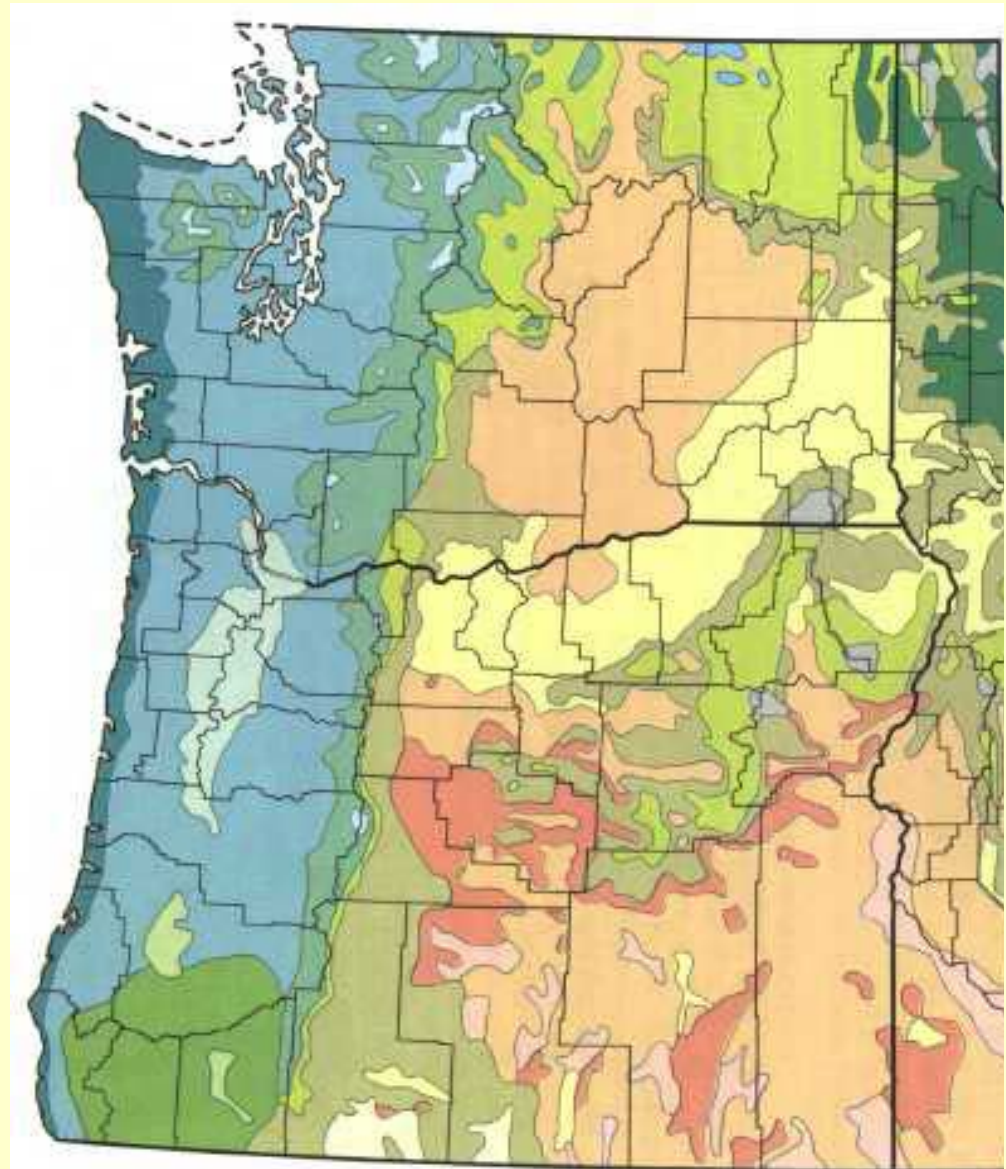


Fig 1.1a

West-Side Vs. East-Side

- Division is generally the Crest of the Cascade Range
- Climate Distinction
 - West = wet
 - East = drier



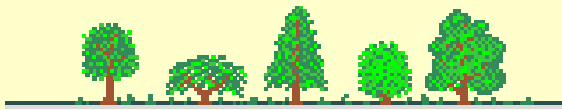
West-Side



Human Impact on PNW Forest - Historic

West-Side

- Pre-European Settlement: Complex history of disturbances from natural and Native American-induced fires.
- Most presettlement forests included diverse mixtures of conifers of different age and size classes, with each class occurring in large patches.
- Infrequent High Intensity Stand Replacement Fires
- 50+ yrs even-age clear-cut logging and replanting greatly altered the structure of forests in the region.



Human Impact on PNW Forest - Recent West-Side

- Primarily intermixed patches of stands < 50 yrs with small trees, and older stands with much larger trees.
- Scientists estimate that \approx 17% of the old-growth Douglas-fir forests from the early 1800's remained in 1988 (Spies and Franklin 1988; [Marcot et al. 1991](#));
- 96% of original coastal rain forests in OR and 75% in WA logged by 1988 ([Kellogg 1992](#)).
- About 51% (2.4 M ha) of federal lands in OR & WA currently support older forests (mean dbh > 51 cm (FEMAT 1993))
- About 56% (1,3 M ha) of these older stands (28% of total federal forest lands) classified as old-growth (Bolsinger and Waddell 1993).



East-Side



UGA0806085

Human Impact on PNW Forest - Historic

East-Side

- Low and moderate elevations: Open, parklike, old-growth stands of ponderosa pine, western larch, and lodgepole pine **with grassy understories**.
- Frequent, low-intensity fires maintained these forests, as well as pathogens, and periodic droughts.
- Fine-scale mosaic of stands of varying ages and stages of development, with young stands a result of infrequent, stand-replacing fires.
- History of selective harvesting of mature pines and larches, intensive grazing, and fire suppression greatly altered this forest landscape.
- 60 years ago: 74% of the commercial forests in the region was classified as ponderosa pine timber, much of which was old-growth ([Cowlin et al. 1942](#)).



Human Impact on PNW Forest - Recent

East-Side

- Recent estimates suggest that 92%-98% of the old-growth ponderosa pine that once existed in the Deschutes, Fremont, and Winema national forests has been logged or lost ([Henjum et al. 1994](#)).
- Stands classified as mixed-conifer timber, frequently overstocked with second-growth pines and firs tolerant of crowding, now cover most of the eastside forest landscape (Mason and Wickman 1994).
- Outside HRV – Historical Range of Variability



Exponential growth of human populations will have to be curbed and a sustainable relationship with forests and other ecosystems will have to be established.

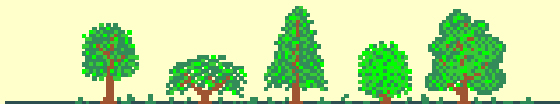


Sustainability

“Resources should be developed and used to meet the needs of the present generation in a way that does not compromise the ability of future generations to satisfy their needs”

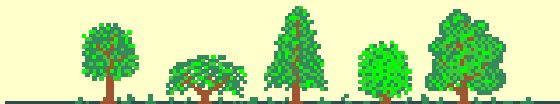
(adapted from WCED 1987)

- Economic
- Environmental
- Social



Forestry

“The science, business, and practice of conserving and managing forests to provide a sustained supply of forest products, forest conditions, or other values desired by forest owners (Ford-Robertson 1971)



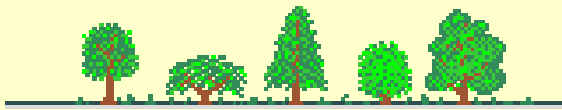
Development of Forestry

	Stage of Development	Result
Pre-forestry	Exploitation	Resource depletion
Stage 1	Administrative Forestry	Failure to achieve conservation and sustainability goals
Stage 2	Ecologically Based Forestry	Sustained production of timber and other conventional forest products
Stage 3	Social Forestry	Ecologically based forestry that sustains a wide range of forest conditions and values desired by society

(Table 2.1)

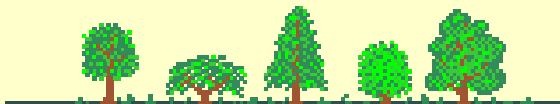
Dangers of Skipping Steps

- By-passing ecologically based forestry
- “Green Religion” or Deep Ecology
- Faith based forestry
- Why won't it work? What should the paradigm be?



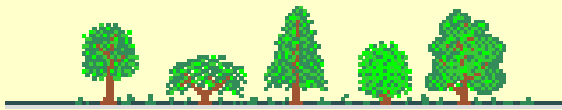
Environmentalism: Origins of Forestry & Conservation

- Balancing Social Demands
- Sustain Function and Integrity
- Preserve Life-Support System for Diversity



History of US Forestry

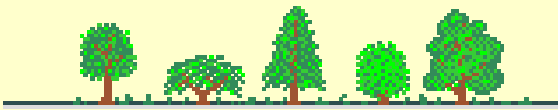
- Native Americans were the first 'managers' of America's forests - using fire to alter the landscape and the ecology of many tree and plant communities.
- Post-European settlement - Volume of timber cut >> forest growth without reforestation programs
 - Only the best part of the tree was used and large volumes of wood were left in the woods, and massive clearing of timberland continued to gain land for agriculture.
- No real policy effort to manage trees, practice forestry or conserve the American forest took place until midway through the 19th Century.



History of US Forestry – Cont'd.

~ 1880-1920: Conservation and Reservation –

- People no longer viewed natural resources as boundless and infinite
- They demanded the government intervene to protect forests and wildlife species.
- Forest Reserve Act – 1891 - Protected nation's forests from timber thieves and profiteers – granted presidential authority to reserve forest.
- It's goals were outlined in the Organic Act in 1897:
 - To preserve and protect forest
 - To secure favorable conditions of **water** flow
 - To furnish a **continuous** supply of timber for use and necessities of the US people.
- Gifford Pinchot - appointed chief of Division of Forestry, Dept of Agriculture - in 1898 began crusade to convert the public and forest industry to support scientific forest management. Went on to establish the U.S. Forest Service.



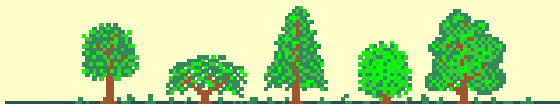
History of US Forestry – Cont'd.

~ 1920 – 1940: “Custodial” Management Period

- Focused on the consolidation and protection of national forests.

~ 1940-1970: Intensive Multiple-Use Management Era

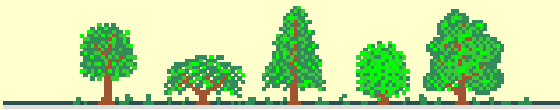
- High demand for wood during WWII and postwar baby boom
- Forest Service shifted from custodial approach to - supplying the public with natural resources such as timber when the need arose.
- Increased access to the land for camping, fishing, swimming, and other recreational activities.



History of US Forestry – Cont'd.

≈ 1970 – present: Era of Conflict and Consultation

- Environmental movement - Earth Day in 1970
- Subsequent policy change:
 - National Environmental Policy Act (NEPA)– 1969 – EIS for major federal actions signif. affecting quality of human environment.
 - Endangered Species Act – 1973
 - National Forest Management Act - 1976
 - Clean Water Act – 1977 – regulating water pollution
- Forest Service adopted a more holistic approach to manage the forest. - promoting efficient use of products from the forest, while simultaneously protecting wildlife, fish, outdoor recreation, and the aesthetics of the landscape.



Distribution of Forest Land and Timber Production

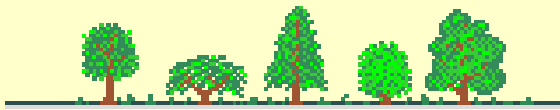
WA

- 43 million acres
- 53% forested (23 million acres)

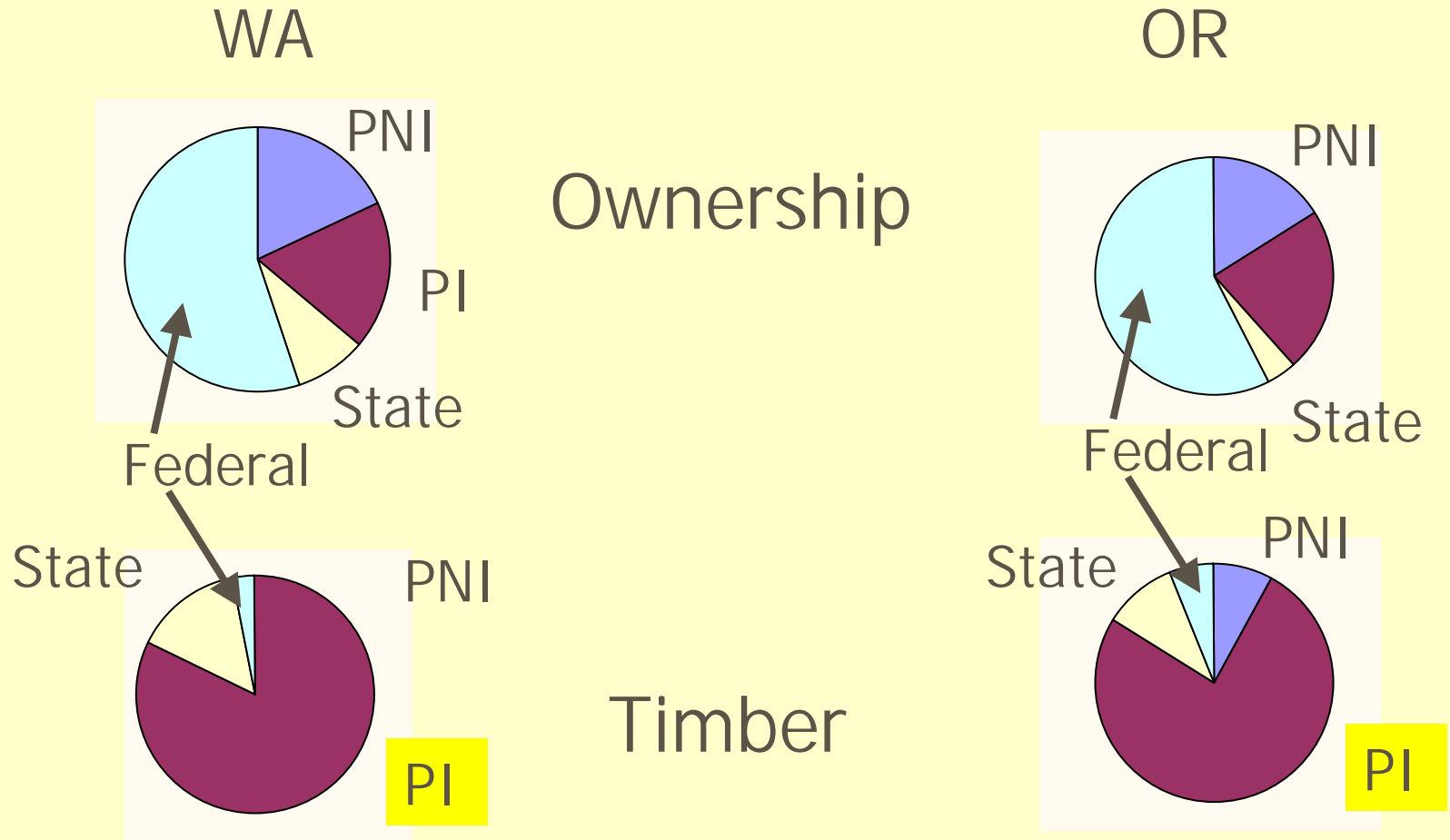
OR

- 62 million acres
- 45% Forested (28 million acres)

- Nearly same amount of forest as 4 centuries ago prior to European settlement
- Only 8% lost to human use:
 - agriculture,
 - cities and towns,
 - industrial development,
 - highways and electric transmission lines.



Current Distribution of Forest Land and Timber Production



* Primarily Private Industrial (PI) Timber Harvest



PNW Forestry

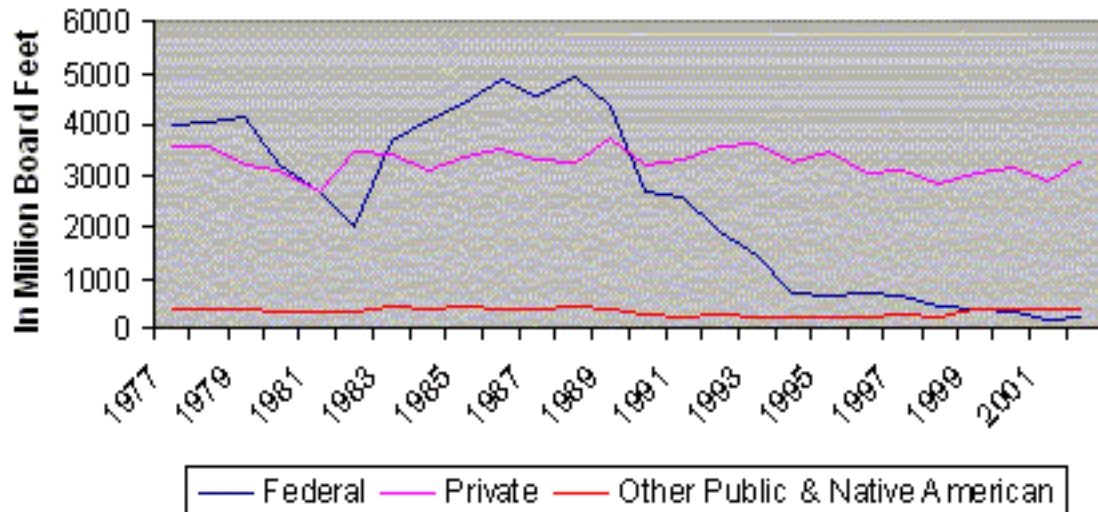


NWFP: Northwest Forest Plan – 1994

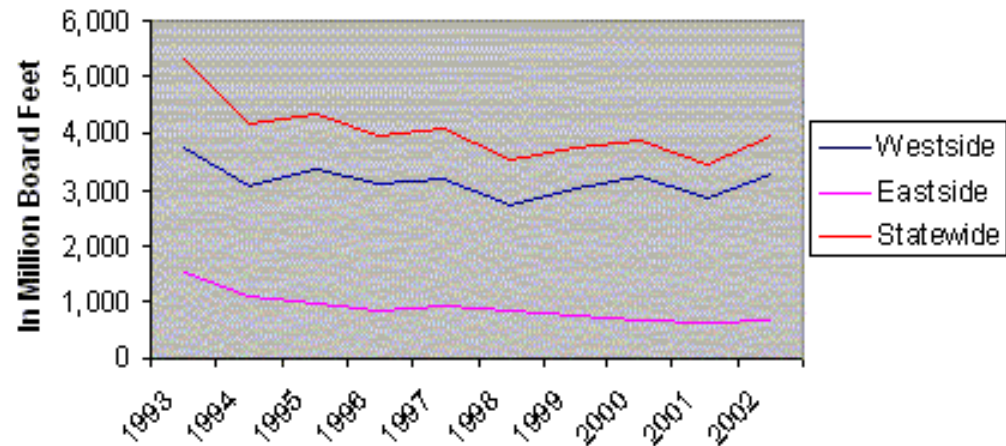
- Initiated to end the impasse over management of **Federal** forest lands in the PNW within the range of the northern spotted owl.
- Goals:
 - Be mindful and responsive to **human and economic** dimensions of issues
 - Protect **long-term health** of forests, wildlife, and waterways*
 - Management is to be **scientifically sound, ecologically credible, and legally responsible**
 - Produce a **predictable and sustainable level of timber sales and non-timber resources** that will not degrade or destroy the environment
 - Reflect a **coordinated, interagency approach** to the issues to the extent practicable.

Example – Oregon Harvest

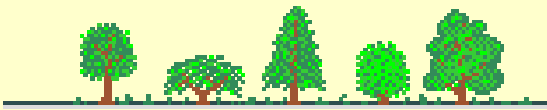
State Timber Harvest by Ownership 1977-2002



Statewide and Eastside/Westside Harvest 1993-2003



Source: Oregon Forest Resources Institute





Picture by John
McColgan

The Healthy Forests Restoration Act

- On December 3, 2003, President Bush signed into law the Healthy Forests Restoration Act of 2003
 - “Expedites the environmental review process for projects that restore forests to ‘good health’.
 - Directs courts to consider the long-term risks that could result if thinning projects are delayed.
 - Prioritizes focus on woodlands closest to communities and where risk to wildlife and the environment is the greatest.
 - It enforces high standards of stewardship so that we can ensure that we're returning our forests to more natural conditions and maintaining a full range of forest types. “

Source:<http://www.whitehouse.gov/news/releases/2003/12/20031203-4.html>

More info: <http://www.healthyforests.gov/>



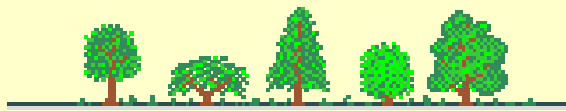
State-Level Forest Rules – Forest Practices Acts

WA

- WA Forest Practices Act – 1974
- Defines a plan to protect public resources while assuring that WA continues to be a productive timber growing area.
- Regulates activities related to growing, harvesting or processing timber on all local government, state and private forest lands.
- <http://www.dnr.wa.gov/forestpractices/>

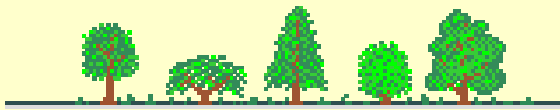
OR

- The OR Forest Practices Act – 1971 - 1st of its kind in US.
- Set standards for ALL harvesting of trees - whether by large commercial or family forest owner - e.g.:
 - Restrict size of clearcut,
 - Require reforestation,
 - Provide for protection of streams and habitat for fish and wildlife
- http://www.odf.state.or.us/divisions/protection/forest_practices/default.asp



Forests are Complex!

- Complex biological and physical systems with interaction and interdependency among parts.
- Events or conditions are multiply determined, and there can be uncertainty associated with which factors are determining the forest composition and function.
- For Example....



Example of Clearcutting and Prediction of Landslides

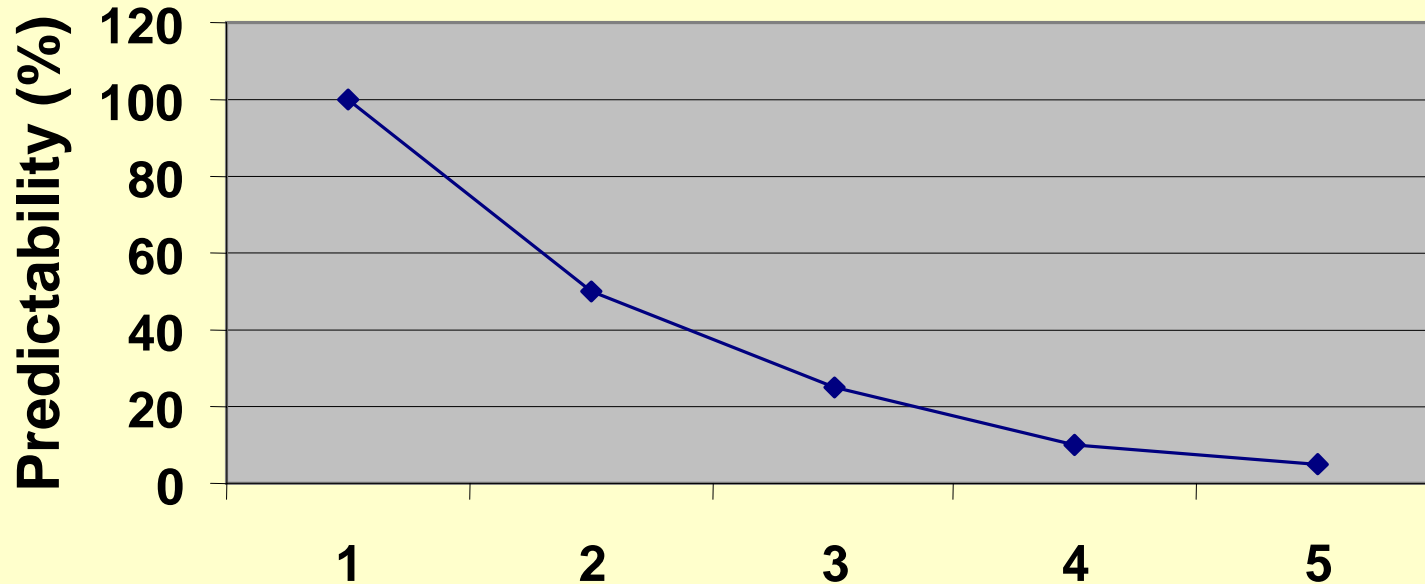


Fig 2.2c

**Degree of Complexity/
of Unknown Parameters**

- 1. Steep Land**
- 2. + Flat Land**
- 3. + Volcanic and Till soil**
- 4. + Wet and Dry Climate**
- 5. + Deep and Shallow Roots**



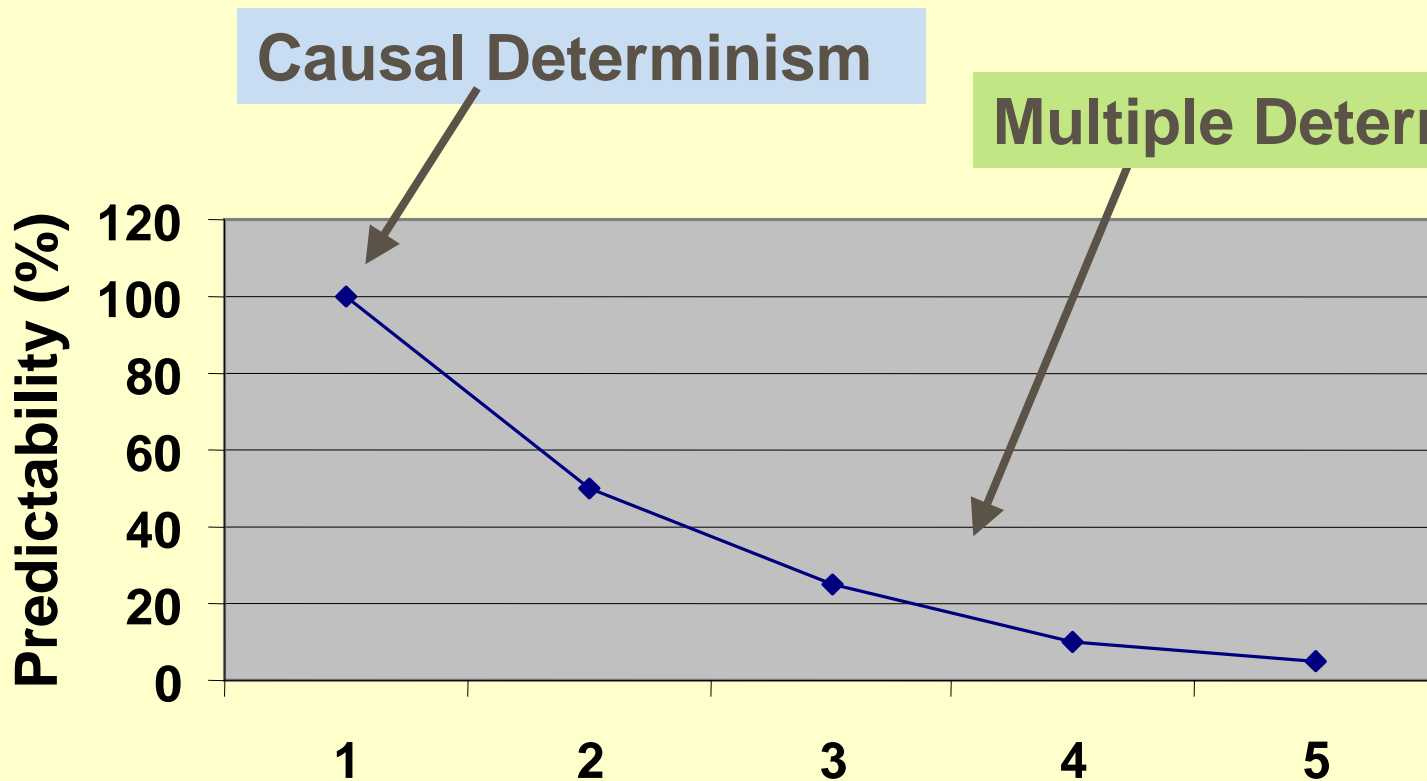
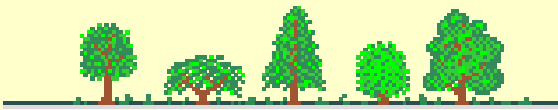


Fig 2.2c

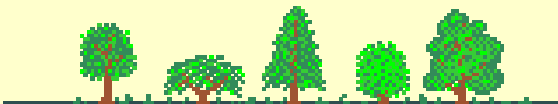
**Degree of Complexity/
of Unknown Parameters**

- 1. Steep Land**
- 2. + Flat Land**
- 3. + Volcanic and Till soil**
- 4. + Wet and Dry Climate**
- 5. + Deep and Shallow Roots**



Predicting Components

- Vegetation = $f(\text{soil, climate, parent material, topography, biota, time})$
- And...
- Soil = $f(\text{vegetation, climate, parent material, topography, biota, time})$



Establishing Management Objectives

- Predict consequences of scenarios.
- Knowledge of structure, function, and spatial variability of the forest.
- Understand interactions of components.
- Growth / productivity of crop trees.
- Effects of clear-cutting, slash burning



Important Role of Forest Ecology

- Provides forest managers with a basic understanding of the way in which the forest ecosystem works
 - Acquaint them with the major determinants of the system

