A Summary of Forest Succession in the Pacific Northwest

CHANGES IN FOREST VEGETATION

The amount, variety, age, and size mix of trees on a site determine the extent and severity of damage by disturbance agents. Changes in forest vegetation affect erosion rates, landslide extent and severity, and other environmental conditions.

About thirteen thousand years ago, glaciers still covered much of Puget Sound. As the continent warmed, about 10,000 years ago, glaciers receded and coniferous forests expanded their range. Fossils from Mount Rainier suggest that the period from 6,000 to 3,400 years ago was actually warmer and drier than the current climate. Subalpine fir, Douglas-fir, ponderosa pine, noble fir, and lodgepole pine were common. California chaparral vegetation extended as far north as Vancouver Island. Fires were probably very frequent. The current cooler, wetter period began about 3,500 years ago, and fire frequency declined.

FOREST SUCCESSION

Forest succession is the change in species composition as plants grow, die, and are replaced over time. A tree that thrives in a sunny opening created by fire may not be able to reproduce in the shady environment of a mature forest. It will be replaced by a more shade-tolerant species, such as Western Hemlock. In the absence of disturbances that create openings, shade-tolerant climax species eventually dominate. Type, diversity, and frequency of disturbances interact with site factors such as soil type, topography, weather, climate, and surrounding vegetation to influence which plants invade a site after disturbance and how communities develop. People can affect plant succession by altering the type, severity, and frequency of disturbances (eg. logging, conversion of wooded acreage to developed uses).

AMERICAN INDIAN AND PIONEER INFLUENCES

Native people modified the vegetation of the Pacific Northwest – both accidentally and deliberately. Fires set on sites such as Puget Sound's Whidbey Island enhanced the growing of bracken, camas, huckleberries and attracted browsing animals like deer and elk.

Millions of logs were moving out of the Northwest by the turn of the century. Photo courtesy of Oregon Historical Society (neg.45791)

Early non-native visitors and settlers also modified the forest environment throughout Washington. In many places, the virtual elimination of beaver by trapping for their pelts drastically altered riparian systems. Settlers copied the American Indians' technique of attracting grazing animals by setting many, sometimes devastating, fires. Settlers also brought new species to the area: sheep, cattle, cheat grass, wheat, potatoes. Use of forests was initially limited to local demands for construction materials, firewood, and fencing. Some forest lands were converted to agriculture, town sites, and residential areas so, in some places, forest depletion became an issue.

LOGGING AND TREE FARMING

Logging of old-growth forests in the Pacific Northwest created many changes in forest vegetation. The shorelines of Puget Sound were logged early due to their proximity to water and easy transport, result-

ing in slope instability and accelerated erosion of coastal slopes. The forest industry gained momentum in Washington and Oregon in the late 1800s. The Puget Sound area had major shipping ports. Lumber was sent to San Francisco and helped build many West Coast cities. Logs were dragged out of the woods by oxen, horses, and mules and floated to steam-powered mills. By the turn of the century, narrow-gauge railways provided access to remote, rugged areas. Steam-donkey engines on skids and high-lead cables pulling logs above the forest floor made log removal easier and reduced soil compaction. Railroads allowed efficient transport of material to markets in the East. Low shipping rates allowed Puget Sound producers to compete with interior markets, as well as continue to supply worldwide customers.

Beginning in the early 1900s, mechanized equipment was used extensively. From about 1910 to 1940, the lumber market was glutted. Land owners suffering major economic hardships during this period were forced to liquidate stumpage to pay for the land or other investments. They extracted only the most valuable logs as quickly as possible, leaving "weed" trees standing and high volumes of fuels lying on the ground. Sparks from steam engines and railroads started many fires, and burns through logging debris were hot and damaged the soil, seedlings, and remaining trees. Fire-scarred old-growth stumps and cull sections of downed trees are still common sights in many undisturbed shoreline areas such as state parks.

After World War II, the logging industry struggled to keep up with demand for wood products. Gas-powered chain saws and diesel and gasoline-powered trucks and tractors improved logging efficiency and reduced fire hazard. Removal of all wood within reach of cable settings (clearcutting) increased because of operational efficiency and ease of regenerating new forests in the Douglas-fir region. Slash burning was standard.

By the 1950s, the most productive portions of Pacific Northwest forests were being managed to maximize timber production. When cutover sites were replanted, Douglas-fir was usually the only species planted on the west side of the Cascades. Although the prevalence and distribution of species changed somewhat after logging and replanting, the planted seedlings did not always thrive, and native species often partly or completely revegetated harvested areas.

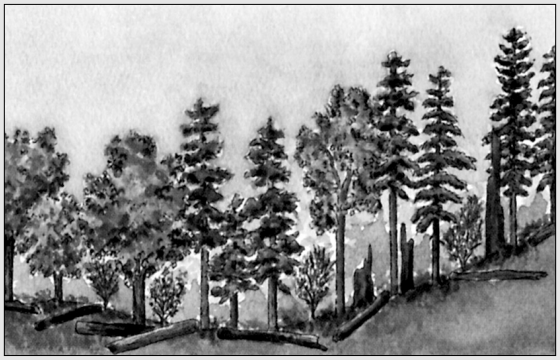
FIRE SUPPRESSION

Fire fighting gained momentum after huge fires at the turn of the century. For example, the Yacolt fire in 1902 burned nearly 239,000 acres in Clark and Skamania counties (Washington) and killed 38 people. Several fires, including the Columbia fire near Mount Hood, burned more than 170,000 acres in Oregon the same year.

Society demanded that the forests be protected. Laws regulating slash and slash-burning to protect forests were passed in 1911. Permits were required for burning slash in summer, and all snags over 25 feet had to be cut. A highly efficient and coordinated forest fire-fighting force was developed nationwide to aggressively attack and quickly control all wildfires. Fire-fighting efficiency increased dramatically after World War II when airplanes became available for detecting and suppressing fires. Campaigns such as "Smokey Bear" encouraged all citizens to help prevent forest fires. The legacy of fire suppression efforts throughout the west has actually increased the severity of recent fires, especially in dry east-side areas of Washington. Fire danger west of the Cascades, especially in the cooler maritime region of Puget Sound, is significantly less of a threat than elsewhere in the west. However, urbanized "pockets" in rural areas can increase the danger from fire.

VEGETATION, PAST AND PRESENT

Today's forests are different in composition and structure from the presettlement period. Pacific Northwest forests have always been affected by disturbances (such as fires, wind storms, volcanic eruptions, and landslides.) Disturbances west of the Cascades – predominantly wind storms and wildfire – rarely removed all large woody debris. Fires usually only burned during periods of extremely dry weather, and generally several fires were required to consume the wood. Snags, large trees, and unburned patches survived. Wide age ranges in natural Doug-



Vegetation change west of the Cascades. Western Oregon and Washington have had large changes in forest vegetation over the past century. Before European settlement (above), trees and tree species were more numerous; valleys contained many hardwoods; snags were common; and abundant woody material contributed to periodic widespread fires. In the last 100 years (below), much of the forest in the Puget Sound area and Willamette Valley has been converted to cities, suburbs, and farms; on slopes and mountains of the Coast and Cascade ranges, many forests are younger, less diverse, and more fragmented as the result of years of timber harvesting and replanting. *Artwork by Beverly Swanson.*

las-fir forests suggest slow recolonization because seed sources were absent after large disturbances.

The activities of the increasingly intensified timber industry also disturbed the forests, but they did not mimic the natural disturbances. Today's commercial forests are younger, artificially dominated by even-aged Douglas-fir, have few snags and logs, and are more fragmented than less intensively managed forests or wilderness. Erosion and soil loss are chronic problems associated with roads and annual logging operations rather than periodic problems associated with natural fires.

EXOTIC PESTS

Trees have coevolved with their native pests for thousands of years. Forest health can be greatly affected when exotic pests are introduced and upset the balance.

Exotic plants and animals – those introduced from places outside of their native range – can be harmful to native species. Many introduced organisms are beneficial, were deliberately introduced, and are essential to commerce and society in the Pacific Northwest. The exotics that cause the most damage to forest trees are accidentally introduced insects and fungi. Introduced weeds are also destructive, competing with native forest vegetation for space, nutrients, and water. Many ornamental plants, such as English ivy, were planted extensively, only to cause widespread problems decades later. They now threaten the productivity of thousands of acres of commercial timberland as well as our National, State and local parks.

PROBLEMS WITH EXOTICS

English Ivy in forested area.

Without natural checks, the population of an introduced pest can grow rapidly and wreak havoc on the host organism. For example, a fungus disease – white pine blister rust, was introduced in 1910. As a result of the introduction of this disease; the range of the host tree (Western white pine) has been significantly reduced.

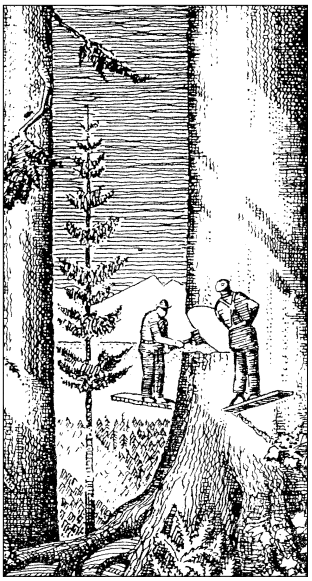
Exotic pests seriously affect Northwest forests. Damaged trees diminish

the value of property and recreation experiences. Revenue is lost from recreation, forest products, and real estate. Quarantines to prevent pest spread disrupt and affect the costs of transporting local forest products. Control efforts, such as pesticide treatments or resistance breeding programs, are expensive, and additional money must be spent to replace killed or damaged trees. Control efforts also increase the use of pesticides, which can adversely affect water quality and damage natural control agents such as beneficial insect and bird populations.

Most important, undesirable exotics change forest ecosystems. Potential effects range from slight decreases in native populations to permanent alteration of biological communities. Although much attention is directed at introduced insects and disease, the current and potential effect of introduced plant species on forests is huge. Not only do exotic plants compete with native vegetation but they can also change the physical and biological environment. Changes have been noted in moisture and nutrient status, microbial populations, and soil characteristics where exotic plants have become established. Organisms dependent on native plants and adapted to a particular environment are also affected.

Removing or thinning trees during home construction can cause remaining trees to be unstable and prone to windthrow.

FOREST CONVERSION AND URBANIZATION



Around 30,000 acres of forest land a year is being converted from forest management to developed uses in the Puget Sound region. This is a more profound and final disturbance than the logging of the original old-growth forest. It is also more detrimental to water, wildlife and fisheries resources. Accelerated erosion, more severe and frequent landslides, and other types of environmental degradation are occurring as a result of urbanization. The costs of mitigating these cumulative impacts is increasing and must be borne by local communities and public agencies.

Over the last 30 years, more than 2.3 million acres of forest land have been converted to other uses. "It could cost as much as $2.4 billion to build a stormwater system equivalent to that provided by forests converted to other uses in only the last decade." (Our Changing Nature: Natural Resource Trends in Washington State. 1988. Washington State Department of Natural Resources)

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