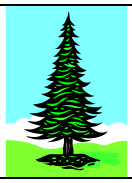
Forest Succession Illustrated

A *highly* simplified look at forest dynamics in the Puget Lowlands

I. The Stage

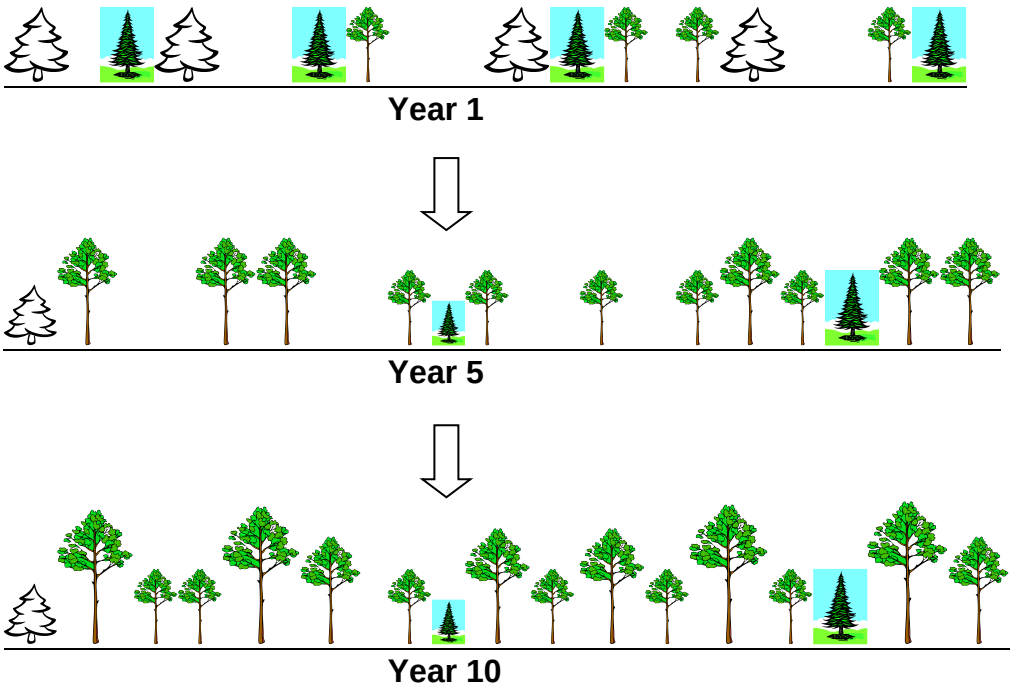
Low elevation Western hemlock zone in western Washington & the Puget Lowlands.

II. The Major Actors (Recently, hardwoods such as Red alder & Bigleaf maple, brush species & invasive plants have joined the cast as major actors, but will not be considered here.)

	Douglas-fir	Western Hemlock	Western Red Cedar
Life Span (years)	800 - 1000	500	800 - 1200
Seedling shade tolerance	Poor	Good	Good
Seedling survival & growth in forest clearings	Good	Poor	Poor
Symbol			

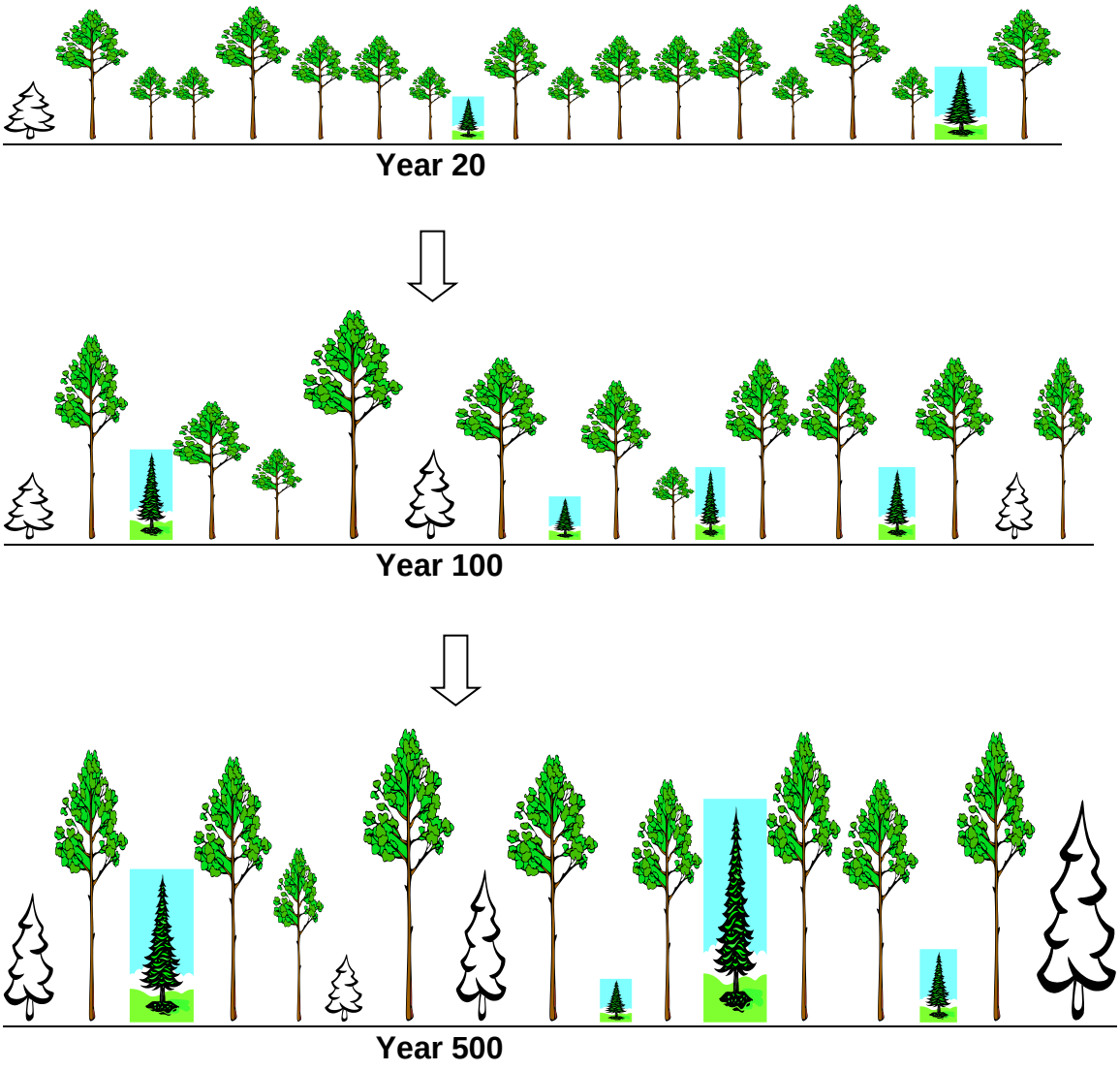
Act 1 (Pioneer Stages)

A volcano explodes and devastates a mature forested area. Nothing living is left – except the soil. *Forest Succession* (the evolution of a biological community) begins again. Seeds from all three tree species are blown into the area. Seeds sprout. Shade- tolerant hemlock and cedar seedlings die or grow poorly because of the hot, dry conditions. Douglas-fir seedlings are relatively happy in such conditions. An open forest dominated by Douglas-fir develops. With the open canopy seedlings are still exposed to mostly hot, dry conditions and Douglas-fir seedlings and alder flourish; other species do not. A few hemlock and cedar seedlings hang in there (gasp, gasp).



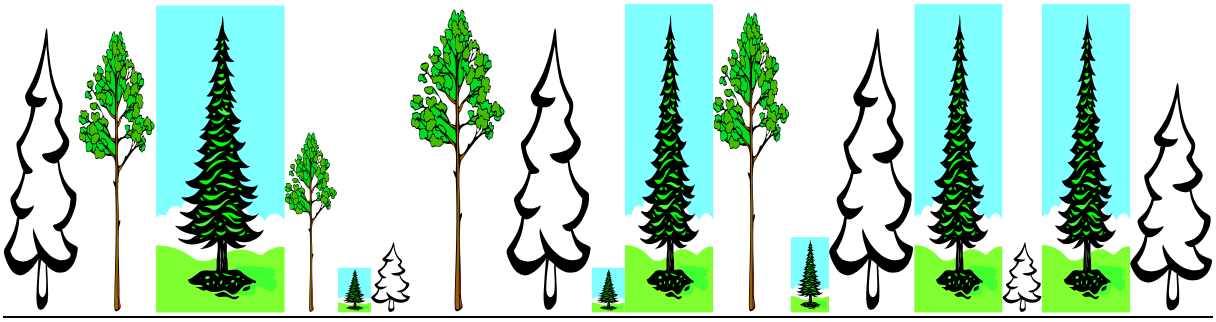
Act 2 (Seral Stages)

As the Douglas-fir forest develops further, the trees get denser and the ground is more shaded. This makes Douglas-fir seedlings unhappy because Douglas-fir does not successfully reproduce well under its own canopy. Hemlock and cedar seedlings are now happy and they begin to accumulate and grow in the understory of the Douglas-fir forest. However, Douglas-fir has a head start and is a fast grower in the sunlight of the upper canopy. Douglas-firs continue to grow fast and become large and dominant during its life span (a looong time!). In the meanwhile, cedar and hemlock (and Pacific yew!) putter along growing slowly beneath the Douglas-fir canopy for hundreds of years. Now that's patience! Occasionally some hemlock and cedar get big where a few Douglas-fir have died early due to wind throw, insects, disease, competition mortality, or other causes.

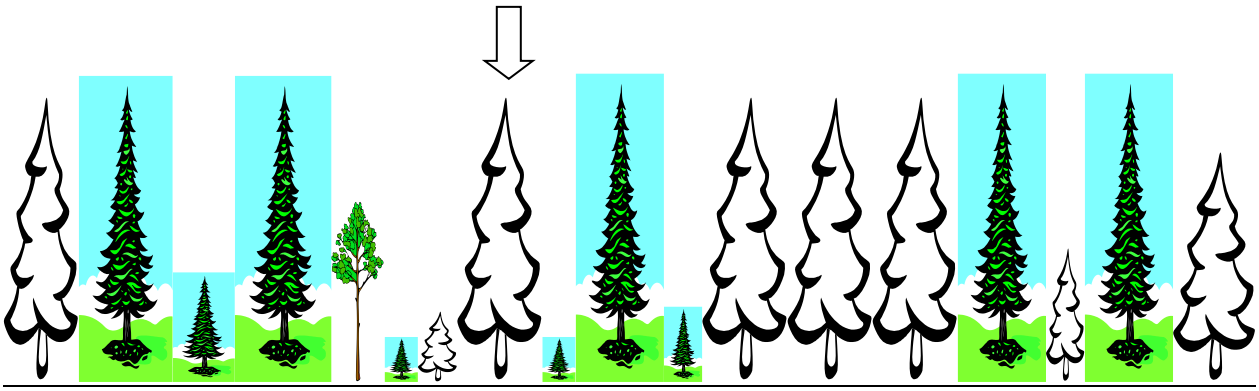


Act 3 (Climax Stages)

Between 600-1,000 years after the first Douglas-fir have germinated they begin to die from old age (the tragedy part of the play). Now the forest becomes dominated by the hemlock and cedar that were patiently waiting their turn. Slow-growing Pacific yew persist as understory trees. No Douglas-fir seedlings can make it in the shady understory of the mature forest. Hemlock and cedar seedlings grow fine and are there to replace old hemlock and cedar that die after hundreds of years. Thus, the hemlock and cedar replace themselves in a stable, long-term community -- a "climax" community. *NOTE: Climax conditions are seldom actually achieved due to natural and human-caused disturbances.*



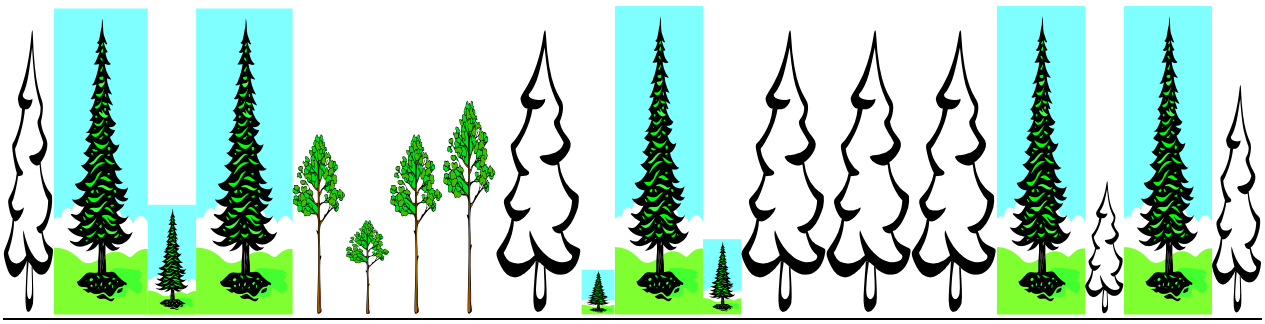
Year 1000



Year 1500

Act 4 (The Mosaic Forms)

A fire sweeps through part of the forest and creates a big gap. Now Douglas-fir seeds that are blown in find a happy spot and succession proceeds all over again in that patch. Other unburned patches of forest continue along as climax hemlock-cedar forests (except for small patches where trees fall over due to wind, insects, disease, old age, etc where Douglas-fir establishment might be successful).



Year 1600 (post fire)

The Theater Critic's Bottom Line

1. **Our Forests as Mosaics**

   Lowland Pacific Northwest forests are mosaics of patches dominated by different successional stages and thus by different species. This is a result of disturbances that affect only some parts of the landscape and not others AND because the forest is so different at different stages of succession following these disturbances.

   Variability in soil types and topography -- and in the existence of landscape features such as rivers, wetlands, lakes, and ravines -- also contribute to the creation of varied environments and ecologically diverse plant communities within the forest.

2. **Forest Development (Succession)**

   The speed and nature of succession is determined by two major characteristics: the long life span of the trees involved and the different shade tolerance of young trees of different species. The pioneers (Douglas-fir & Red alder) make the environment more stressful (decreased light) for establishment of their own progeny and thus their seedlings are not successful.

   This is very different than the situation after the last glacier retreated. There was no soil after the glacier scoured the landscape. Before plant life could become established again after the passage of the last glacier, bare sediment and rock first had to weather. Eventually the first primitive species, such as certain lichens, became established -- adding nutrients and slowly forming soil. *Primary succession* is a long, long process. In both primary and secondary succession, the pioneer species change the conditions such that their young cannot survive.

   However in the post-volcanic forest example above, the faster growers (Douglas-fir, Red alder) come first and make conditions more favorable for the more shade-tolerant species (hemlock, cedar) while in the post-glacier example the stress tolerators come first and make the conditions better (favoring the fast growers).

3. **How a Non-Climax Tree can still be Common in our Forests**

   Although it is not a climax species, Douglas-fir was very common in our old-growth forests. Douglas-fir can maintain itself in our forests because it is long-lived relative to the frequency of disturbance that it requires. It lives for a thousand years or so. There was a good chance that some of its seeds produced in those thousand years would encounter a forest opening created by an insect outbreak, disease pocket, lightning strike, as a result of fire, or due to natural shade-caused mortality of suppressed Douglas-fir which may have lost the race for canopy dominance.

Some other species common to Puget Lowland forests include:

Overstory Trees – Grand fir, Sitka spruce, Western white pine, Lodgepole/Shore pine, Red alder, Bigleaf maple, Bitter cherry, Black cottonwood, Pacific madrone, Cascara, Pacific dogwood.
Understory Trees – Pacific yew, Oregon ash, Pacific crabapple, Willows, Black hawthorn.
Tall Shrubs – Evergreen huckleberry, Red elderberry, Western hazel, Vine maple, Oceanspray, Pacific ninebark, Red-flowering currant, Gooseberry, Twinberry, Salmonberry, Rose species, Indian plum, Mock orange, Thimbleberry, Snowberry.
Understory & Groundcover Species – Salal, Oregon grape, Orange Honeysuckle, Sword Fern, Lady Fern, Deer Fern, Solomon's seal, Piggyback plant, Pacific bleeding heart, Trailing blackberry, False-lilly-of-the-valley, Wild ginger, Mosses, Lichens.

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