ECOLOGY OF PACIFIC NW COASTAL FORESTS

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Natural Disturbance Regime

Wind is the primary disturbance in coastal forests of the Pacific Northwest (Edmonds et al. 2000, . Wind affects forests through major, stand replacing storms that re-start forest development as well as chronic, small-scale blowdown events. Storms with hurricane force winds—potential stand replacing events—have swept the western Washington coast approximately once every 20 years in the last 200 years . Of these events, the "21 Blow" of 1921 and the Columbus Day Storm of 1962 were the most significant, with estimated 7 and 11 billion board feet of timber volume blow down in the storms, respectively. However, these major events strike different areas and typically recur in a specific stand only every few centuries (Edmonds et al. 2000, Harcombe 1986). At the landscape scale, additional complexity is introduced by feedbacks between wind-created edges along canopy gaps and blowdown areas, which expose additional trees to wind disturbance . As a consequence, blowdown patches can be seen to grow and migrate across coastal forest landscapes at annual to decadal time scales in wave like patterns . As forest establishment is generally rapid after windstorms in this forest type (Edmonds et al. 2000), initial blowdown patches recover as the outer edges of the "waves" continue to be affected. Smaller windstorms blow down or damage individual trees or groups of trees on a much more frequent basis. Due to competition from moss and shrubs on the forest floor, downed logs provide an important substrate for regeneration and establishment of sitka spruce and western hemlock . At the stand scale, period recruitment of downed logs from windthrow leads to the development of complex, patchy, multi-aged stands (Edmonds et al. 2000). The net effect of this variable-intensity wind disturbance regime is a complex landscape mosaic of different patch types and sizes, often with high within-patch heterogeneity. This shifting mosaic allows for a diversity of ages classes, species, and habitat types across the landscape, and greater overall resiliency.

Fires, while rare, also perturb coastal Zone forests. The incidence of fire in these forests is low because ignition sources are infrequent and ignitions rarely coincide with fuel moisture levels conducive to carrying wildfire. The limited available fire history data for these forests indicates that stand replacement fires occur only during extreme weather conditions associated with dry east winds (Agee 1993). Long and Whitlock estimated a fire return interval of 240 ± 30 years over the past 2700 years in coastal northwest Oregon. In the Sitka spruce Zone forests of the Olympic Peninsula fires have burned with a return interval of approximately 900 years (Henderson et al. 1989). A major stand-replacing fire event—the Nestucca Fire— burned Sitka spruce Zone forests at what is now the Cascade Head Experimental Forest in northwest Oregon sometime between 1845 and 1849 . The Nestucca fire started in the Willamette Valley and was pushed over the Coast Range by strong east winds. It is unknown if this significant fire was of natural or human origin. In any case, stand replacement fire events are certainly possible in Coastal PNW forests, although the probability of occurrence is quite low.

Long term studies of forest development following stand replacement fire at Cascade Head Experimental Forest provide insight into forest structural development after major disturbances in this forest type. Following fire, natural regeneration established quickly and forest development proceeded along the sequence described by Franklin et al. (2002) up to the end of the competitive exclusion stage and beginning of the maturation stage . Permanent plot studies then demonstrate accelerating mortality and biomass loss in maturing forests from a complex pattern of wind disturbance (blowdown). Harcombe et al. used aerial photographs to characterize this wave like pattern as it advanced through Cascade Head over a 40 year period.

Many stands that initiated after the "21 Blow" event on the Olympic Peninsula also appear to have followed this same development pathway and are now nearing maturation. Understory trees that survived the windstorm, as well as new regeneration, led to rapid stand establishment often at moderate to high densities (Edmonds et al. 2000). Many of these stands are now becoming more susceptible to windthrow events.

Responding to Disturbances in Coastal Forests

From a timber production viewpoint, wind, fire, insects, and other natural disturbances are viewed as threats that must be controlled and contained to reduce losses to timber value. Quickly salvaging downed wood after disturbances is done to recover timber value, prevent further mortality from beetle attacks or fire, and ensure rapid establishment of the next forest through planting. Leaving downed wood on the forest floor is viewed as wasteful and aesthetically appears messy to most casual observers.

As described above, however, coastal forests are well adapted to natural disturbances and have recovered from major windstorms and fires in the past without human intervention. While downed logs from windstorms can lead to a build up of bark beetles and subsequent attacks on remaining live trees, this scenario is not likely in these coastal forest due to diversity of tree species and relatively low abundance of Douglas-fir . Dead branches, tops, and needles from a major windthrow event will increase fine fuel loading and the ability of these stands to carry a ground fire. However, major fires in this zone are driven by extreme weather events, especially dry east winds and drought conditions, and occur very infrequently . During normal summer weather, moisture levels in the soil and downed logs are too high to support a major, uncontrollable crown fire. The addition of fine fuels from a windthrow event is will only slightly increase the risk of a major fire, which is very low to begin with. These fine fuels will decompose quickly and thus the increase in fire risk will be short term.

From an ecological perspective, snags and downed logs maintain soil health and provide critical habitat elements for many wildlife species Windstorms provide important pulses of larger dead wood to these systems, likely more so than from competition related mortality . This wood is then available for landslides to deliver it into stream systems . Landslides, occurring at natural rates, have been shown to be essential in delivering pulses of the basic habitat elements –downed wood and sediment -required for streams to develop optimal habitat function . Salvaging large amounts of downed wood, cleaning sites up, and then re-planting may lead to somewhat faster recovery of forest cover, but it will likely create more simplified forests with less habitat value over time. Indeed, the major goal of thinning on the Olympic National Forest is to add complexity to previously managed stands. In addition, the more open, early stand establishment phase of forest development is important for many species of wildlife and in relatively short supply on the Olympic NF. While downed logs may look messy and leaving them to decompose may seem wasteful, there is simply no ecological or "restoration" rationale for salvaging wood from these forests.

The decision of whether to salvage or not depends on the management goals for particular area. If wood production is a major goal, then salvage is clearly appropriate. If wildlife habitat, watershed health, and complexity across the forest are the goals, then salvage is likely not appropriate. If protecting homes from ground fires is a goal, then limited, strategic salvage around homesites and roads should occur. Can some salvage occur to generate economic return and wood volume, reduce fire risk to homes, without compromising ecological functions? Possibly, but significant amounts of the larger downed wood will need to be left behind. Where road access does not exist, the negative impacts from new road construction will likely be too great to warrant salvage.