Module 7. WOOD IN STREAMS

[Fred Swanson]

Wood in streams has been an important theme of Andrews Forest research since the early 1970s, beginning with inventory of wood as part of stream-ecology studies (Froehlich, 1973) and then mapping of wood to assess structure and dynamics (Swanson et al., 1976; Lienkaemper and Swanson, 1987). Initial emphasis was on ecologic and geomorphic functions of static wood pieces and accumulations in streams. Studies in part of the River Continuum project (Vannote et al., 1980), which occurred in the Andrews Forest and four other sites across the country, placed emphasis on variation in wood conditions and processes down through a stream network (Keller and Swanson, 1979). Later modeling studies (Braudrick et al., 1997; Braudrick and Grant, 2000) and the experience of the 1996 flood (Swanson et al., 1998; Johnson et al., 2000) led to interest in the ecologic functions of mobile wood. Static wood can protect patches of riparian vegetation from flood disturbance, but once the wood begins to move can it serve as tools for riparian disturbance.

Amount, arrangement, dynamics, and functions of wood vary with stream size. Small (first- and second-order) streams flowing through old-growth Douglas fir forest contain large amounts of wood (500 to >1000 m^3/ha, Harmon et al., 1986) generally randomly located where it fell from the adjacent stand. In channels subject to periodic debris flows this material and associated sediment deposits may undergo cycles of gradual filling and abrupt evacuation. The third-order Mack Creek flowing through old growth contains about 600 m^3/ha of wood that is somewhat clumped around large "key" pieces which anchor jams. Long-term observations indicate that wood pieces longer than channel width tend to remain in place, but smaller pieces can be moved during high flows (Lienkameper and Swanson, 1987). Lower Lookout Creek (fifth order) contained about 200 m^3/ha in the late 1970s, but the amount and arrangement varied rather dramatically with gradual accumulation over the 1964-1996 interflood period and then substantial flushing in the 1996 flood (Fig. 4.4). In progressively larger channels the relative importance of wood-delivery processes shifts, and a higher proportion of pieces is mobile. This results in attendant shifts in patterns of structures (more aggregation) and functions (reduced sediment-storage function) (Keller and Swanson, 1979).

Forest-stand conditions, such as size distribution of trees, species, stocking levels, and disturbance history affect past, present, and future conditions of wood in streams. More massive and productive forests with wood of slow decay rates and tendency to topple as fresh wood (vs. dying and decaying while standing) are conditions that favor accumulation of high levels of wood in streams (Harmon et al., 1986).

Wood pieces have been placed in streams throughout the Pacific Northwest with the intent of improving fish habitat. However, few experiments have been conducted to assess effects of these practices. Two studies are underway in the Andrews Forest and vicinity: the Quartz Creek (South) Study with wood structures placed in a single reach and the Pool Complexity Study with installations of three levels of wood complexity in pools with treatments replicated at three study reaches. Three of four sets of structures survived the 1996 flood well. In the fourth case, sediment deposition in pools and lateral channel change rendered many structures ineffective. Fish response to the structures has been nil to slightly positive—more wood equals more fish. The Quartz Creek Study demonstrated that placement of the largest part of the size distribution of wood found in an old-growth reach (Mack Creek used as reference) resulted in recruitment of the full old-growth size distribution of wood pieces in about 5 yr, as a result of input from upstream and the adjacent riparian stand (Figs. 7.1, 7.2).

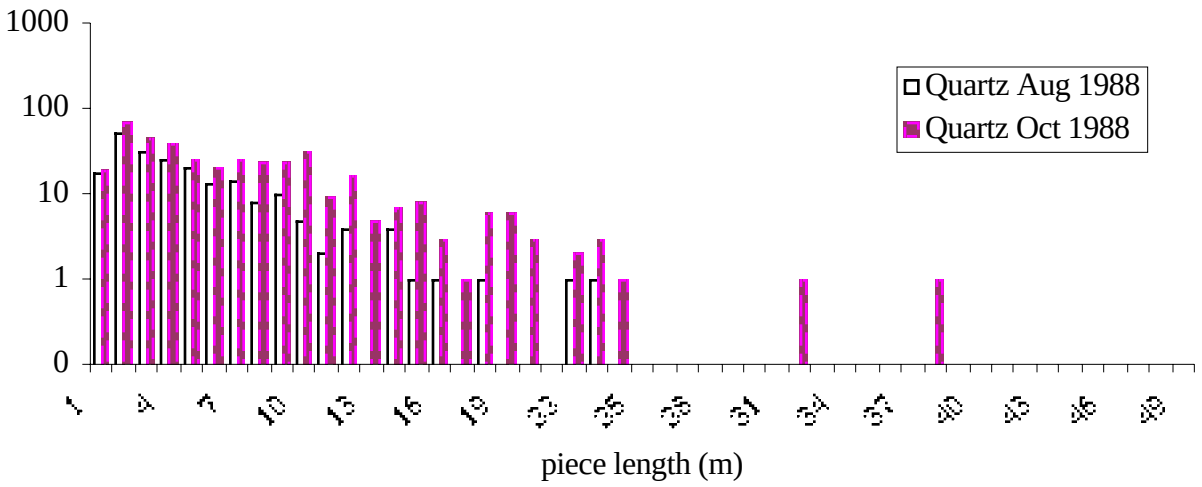

Figure 7.1. Quartz Creek (South) wood piece size distributions in stream before and after placement of 30-40+ m pieces in 1988 (from Randy Wildman, Oregon State University).

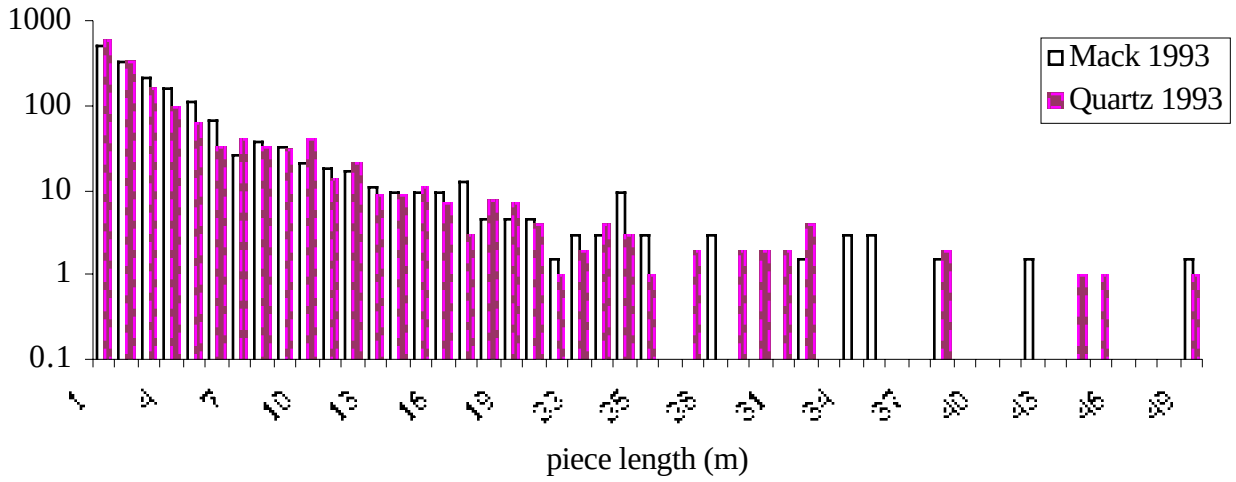

Figure 7.2. Quartz Creek (South) wood piece size distribution at year 5 after wood input (1993), relative to wood distribution in old-growth stream at Mack Creek in 1993 (from Randy Wildman, Oregon State University).