

Habitat Characterization and Fish Usage of Remnant Picea sitchensis Tidal Freshwater Wetlands on the Columbia River Estuary

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The loss of virtually all brackish and most freshwater Sitka spruce (*Picea sitchensis*) wetlands in the Columbia River estuary (CRE) since 1870 was documented by the Columbia River Estuary Data Development Program in the 1980s, however, only cursory descriptions of these swamp ecosystems and their habitat functions have been published. Our intensive physical and biological sampling data from 2005-2010, from four of the largest tidal freshwater remnants, indicate that spruce swamps occur at 1-4 m NAVD88 in the CRE. Analysis of LiDAR data quantifies the hummocky microtopography, and shows that total channel length and watershed area are correlated with surveyed channel cross-sectional area at the mouth. In-channel fluxes are moderated by large woody debris (LWD) and beaver dams, with morphology classified as a forced step-pool channel type. Channel substrates are fines (TOC 3.1%) dense with nematodes and oligochaetes; floodplains also contain coarse sands/gravels (TOC 5.2%) and sediment stake data show that most swamp sites are vertically accreting (mean rate 0.53 cm/yr). Spruces attain large statures, rooting on LWD hummocks in association with salal (*Gaultheria shallon*) and red huckleberry (*Vaccinium parvifolium*). Subdominant trees are red alder (*Alnus rubra*) and western redcedar (*Thuja plicata*), with a well-developed shrub layer. The observed plant species richness was 74. Mean quarterly litterfall was highest October-January (342 g/m²) and lowest April-July (43 g/m²). Preliminary analysis of electrofishing data indicates the presence of Pacific lamprey (*Lampetra tridentata*) as well as juvenile coho salmon (*Oncorhynchus kisutch*) and chum salmon (*Oncorhynchus keta*) in the swamps during the spring months; spawning-run eulachon (*Thaleichthys pacificus*) were observed in winter. Fallout traps deployed in the spring months contained 58 taxa (half present in juvenile salmon diets), and small neuston samples 46 taxa. The flood regime and water properties are also described.