Rocky Mountains Cooperative Ecosystem Studies Unit (RM-CESU)
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CSURM-208

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TITLE OF PROJECT: Regeneration Status and Dynamics of Rare Ponderosa Pine (*Pinus Ponderosa*) Stands in Western Rocky Mountain National Park

NAME OF PARK/NPS UNIT: Rocky Mountain National Park

NAME OF UNIVERSITY PARTNER: Colorado State University

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Over the past three months we have focus on processing the tree-ring samples, and preliminary analyses of stand dynamics. We completed dating all of the tree-ring samples including samples collected to date ponderosa pine establishment, fire events, and spruce budworm outbreaks.

Preliminary Results:

Disturbance history: Three fire years, 1667, 1732, and 1851, were recorded at the site. The mean fire return interval at the site was 92 years with a range from 65 to 119 years and 159 years from the last fire event (1851) to present. More significant spruce budworm (SBW) outbreaks (recorded by >25% of Douglas-fir core samples) occurred at various severities for several decades in the second half of the 1600s, 1820s-1840s, 1900-1909, 1941-1949, and 1967-1988 (Fig. 1).

Ponderosa pine establishment: Ponderosa pine establishment dates in the North Inlet are temporally clustered in pulses lasting from 30 to 60 years (Fig. 1).Visibly apparent pulses of establishment occurred in 1560-1610, 1680-1710, 1740-1770, 1850-1910, and 2000-present. While the 1560-1610 pulse predates the disturbance history for the site, the 1680-1710, 1740-1770 and 1850-1910 pulses follow fires in 1667, 1732, and 1851 respectively. The tail end of the relatively long post-fire establishment period following the 1851 fire corresponds to a SBW outbreak from 1900-1909. The recent pulse in seedlings from ca. 1990 to present corresponds to the recent high-severity MPB outbreak. Other known MPB outbreaks in the region (1930s, late 1970s) do not correspond to pulses of establishment; however, we did not detect that these previous outbreaks resulted in ponderosa pine mortality in the North Inlet.

Current Status of Ponderosa Pine: Of the 467 ponderosa pine trees recorded at the site 378 (81%) are dead as a result of the recent MPB outbreak. MPB preferentially killed larger diameter trees (Fig. 2 and 3) with very few larger individuals (>30 cm dbh) surviving. The majority of surviving trees are <20 cm dbh. In contrast to tree diameter, tree age did not

influence mortality patterns (Fig. 3). Larger-diameter trees in all age classes were killed at higher rates than smaller-diameter trees of similar age. While this pattern is apparent across all age classes, mortality among the post-1851 fire cohort clearly demonstrates that larger trees in similar age ranges were killed at much higher rates (Fig. 3).

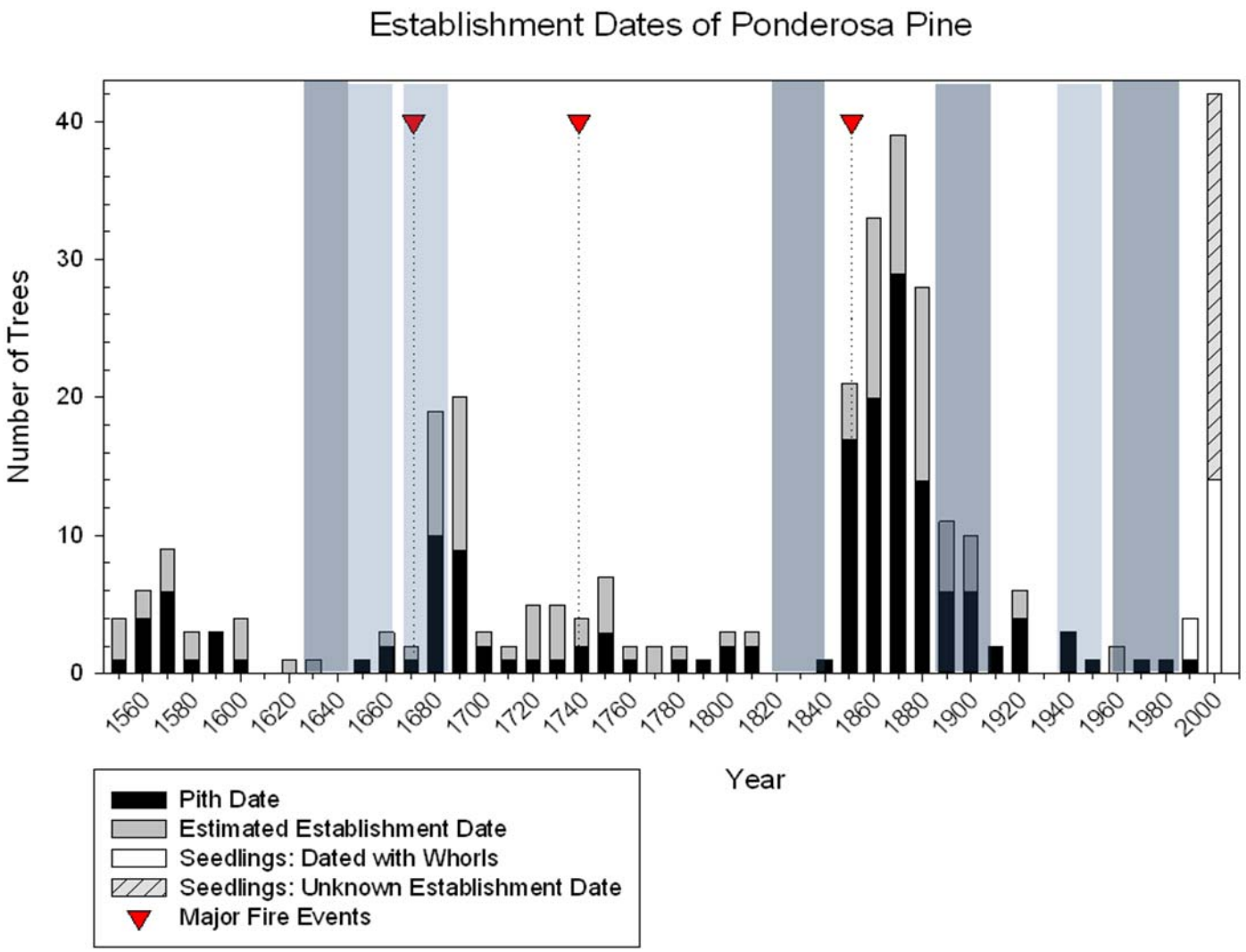

Figure 1. Ponderosa pine establishment dates (in ten-year bins; note that decadal bins are centered on the first year of the 10-year period) in the context of fires and spruce budworm outbreaks in the North Inlet of ROMO. Shaded areas represent spruce budworm outbreaks. Darker areas = outbreak recorded by >50% of trees, lighter areas = outbreak recorded by>25% of trees.

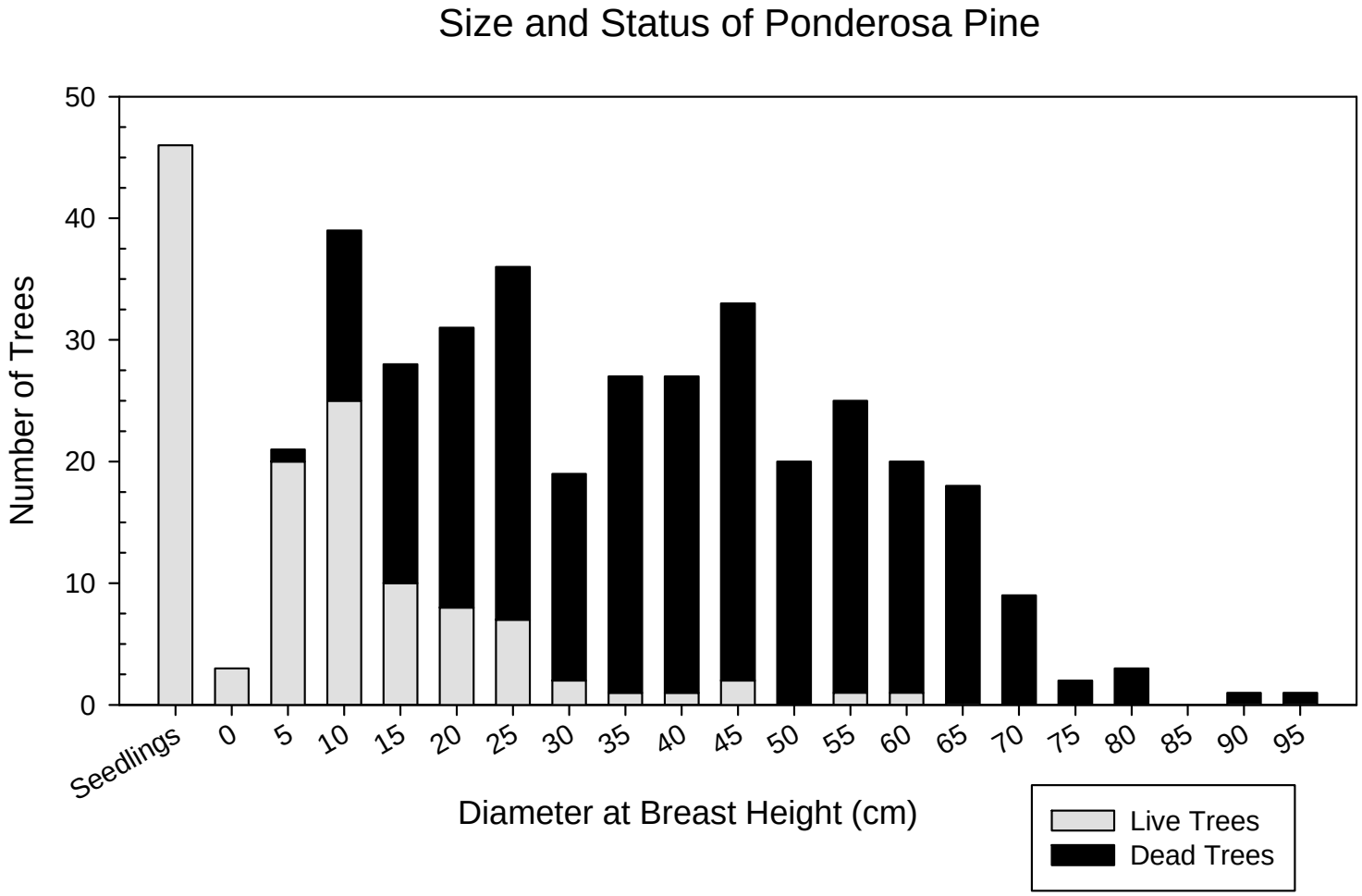

Figure 2. Number of live and dead ponderosa pine in 5 cm diameter at breast height size categories.

Figure 3. Patterns of ponderosa pine mortality in the context of tree age (x axis) and diameter (y axis).