

PRE- and POST-SETTLEMENT FIRE RETURN INTERVALS ON INTERMOUNTAIN SAGEBRUSH STEPPE

Rick Miller and Jeff Rose

We are currently documenting the fire history for mountain big sagebrush, aspen, and old-growth juniper communities across central and southeastern Oregon, and northeastern California. The recent expansion of juniper into sagebrush steppe communities throughout the semi-arid Intermountain West is most frequently attributed to the reduced role of fire, introduction and overstocking of domestic livestock in the late 1800s, and climate. However, limited fire history studies in sagebrush communities, and the absence of studies that examine the timing of changes in mean fire intervals, introduction of livestock, and climatic conditions with juniper expansion have made this hypothesis difficult to test.

We recently completed a study in eastern Oregon testing the hypothesis that post-settlement western juniper (*Juniperus occidentalis*) expansion was synchronous with the introduction of domestic livestock, reduction in fire frequency, and optimal climate conditions for plant growth. We documented the fire history and western juniper woodland chronology for a sagebrush steppe in a 12,000-acre watershed in south central Oregon. The results of this study, briefly described below, have been submitted to the American Midland Naturalist.

Tree ring data, collected in the region, were used as proxy data for pre-settlement climatic conditions. Western juniper chronology was determined by coring trees across the study area. Fire history was constructed from several small clusters of presettlement ponderosa pine (*Pinus ponderosa*) scattered across the study area. Samples were cross-dated to determine fire occurrence to the calendar year. Mean fire intervals were computed for each site based on cumulative fire history of each tree sampled within the site. Fire events in low sagebrush (*A. arbuscula*) were documented by determining death dates of fire killed western juniper trees. Records dating the introduction and buildup of livestock during the late 1800s and dates of initial fire suppression were summarized.

Western juniper expansion began between 1875 and 1885, with peak expansion rates occurring between 1905 and 1925. Between 1875 and 1915 tree ring widths exceeded average growth in 70 percent of the years. The fire record spans from 1650 to 1996. Prior to 1897, mean fire intervals within individual clusters ranged from 12 to 15 years, with years between fire occurrences varying between 3 to 28 (Fig. 1). Nearly one third of the fires in the basin were large and were usually preceded by one year of above-average tree ring growth. Two fire events were recorded in the sparsely vegetated low sagebrush site, 1717 and 1855. Age structure of aspen stands sampled in the study area indicated they last burned in the fire of 1855. The 1855 fire was preceded by 5 years of above average growing conditions. The last large fire occurred in the study area in 1870, and the last fire event in 1897. The time sequence of wet climatic conditions between 1870 and 1915, introduction of livestock, and the reduced role of fire support the paradigm that these factors contributed to the postsettlement expansion of western juniper.

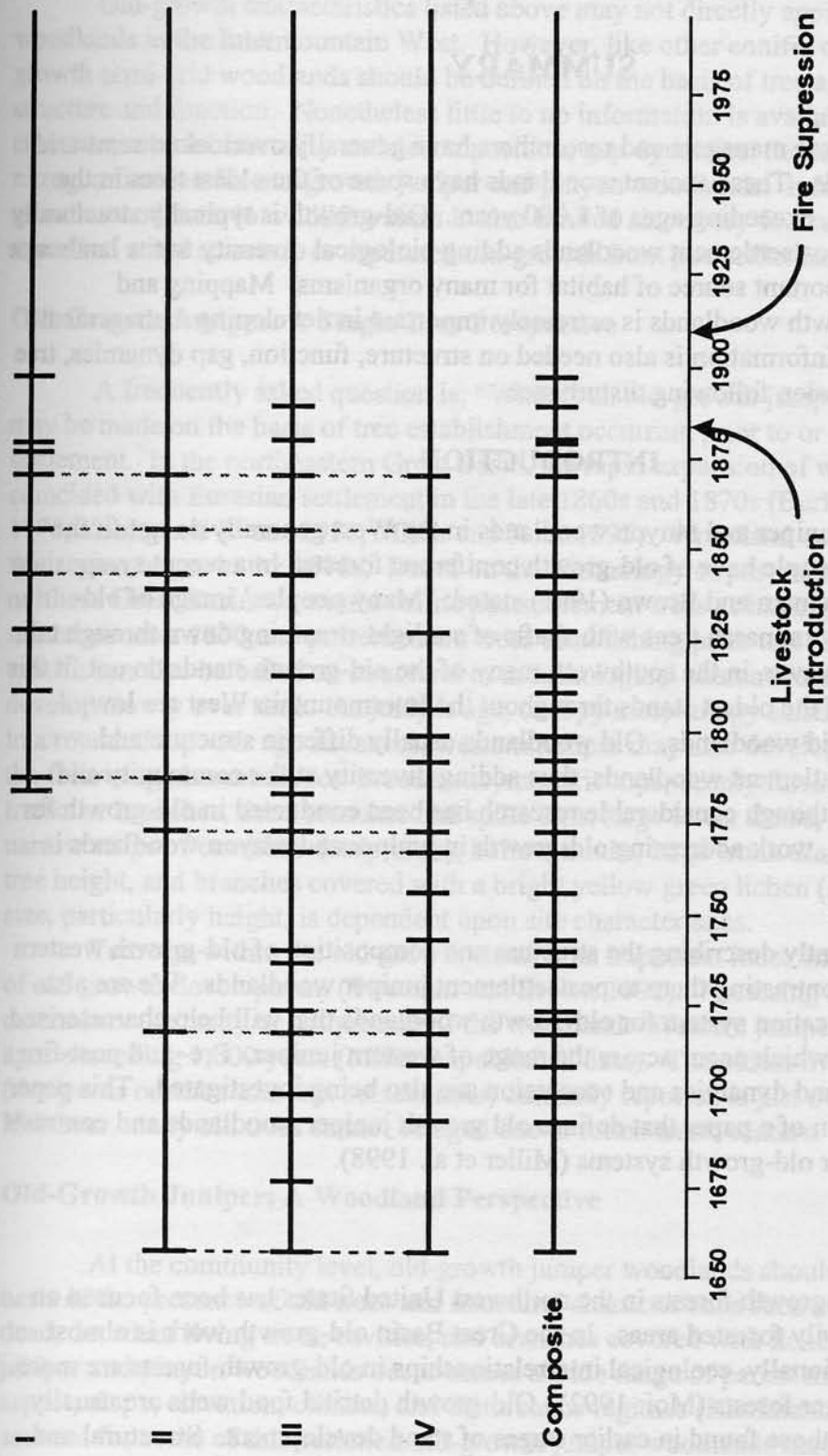


Figure 1. Master fire chronology for the *A. tridentata* ssp. *vaseyana* community type in the upper Chequamegon River basin. Fire history extends from 1650 to 1996. Each horizontal line represents a sample composite for each collection site with the bottom line being a composite for all fire scar samples across the four sites. Each vertical line designates a fire occurrence. Dashed lines connect collection sites where fires occurred across two or more sites in the same year.