Insights into the vegetational development of Headwaters Forest Reserve

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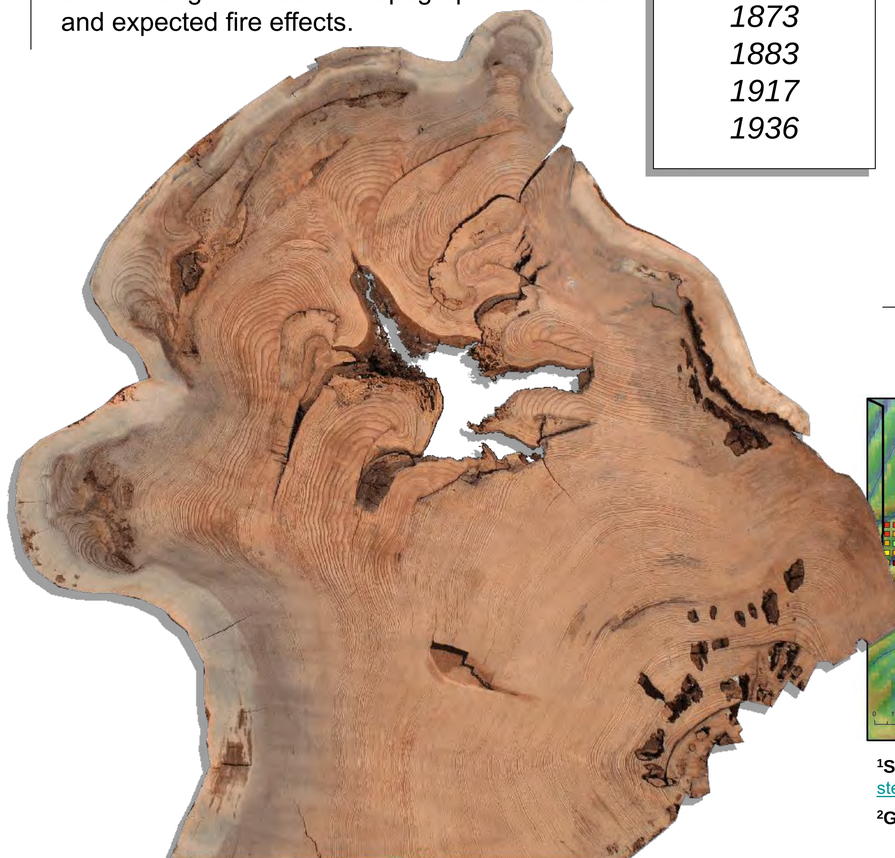
Introduction

Headwaters Reserve occurs along a transitional climate and ecological gradient from the dryer forests of Humboldt Redwoods State Park in the south to the wetter forests of coastal Humboldt and Del Norte Counties, California. Given the extensive area of the Reserve that was logged prior to 1999 and the agency goal of forest restoration, we sought to better understand the natural gradients of vegetation and disturbance during characterized recent centuries.

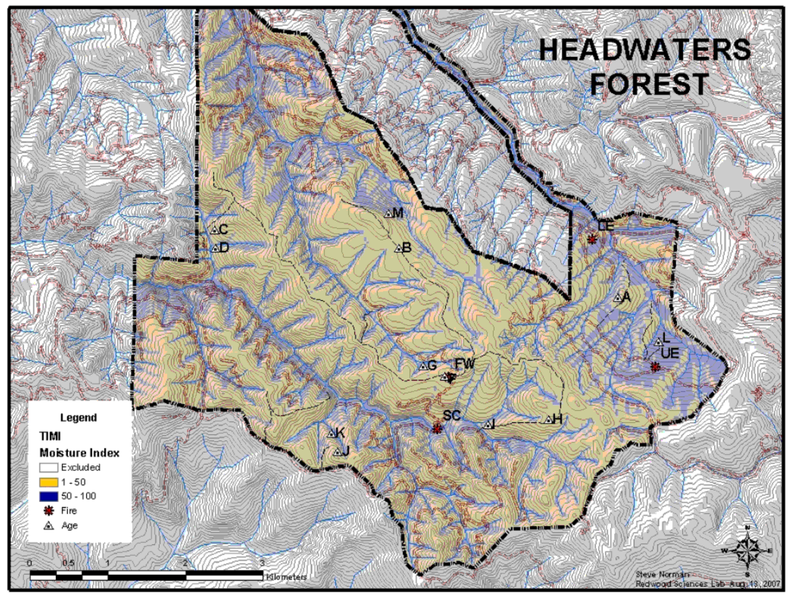
Discoveries

Frequent to moderately frequent fire occurred in the Reserve at least since the 1760s at intervals from 10 to 42 years. Earlier fires were documented, but they were not datable. Fire appears to have increased after 1850 and it ended in 1936 (72 years prior to a 2008 lightning ignition event that was suppressed). Fires from stump section scars were linked to cohorts and/or growth suppressions in Douglas fir. This provides insights into the historically moderate severities of past fires. Vegetation patterns documented by pre-1999 gridded cruise data show strong affinities with topographic moisture and expected fire effects.



Extensive Fires in Headwaters Reserve

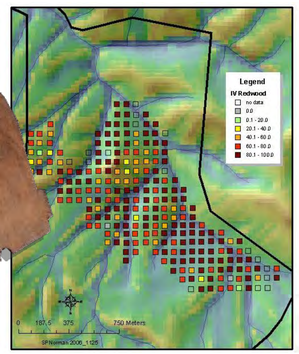
1764/6
1774
1808
1834
1850
1873
1883
1917
1936



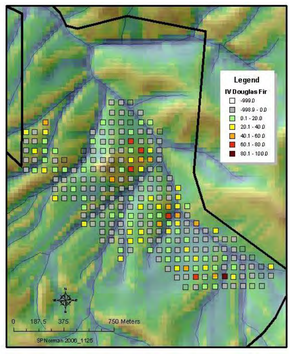
Location of fire history sites and Douglas fir coring sites

Cruise Plot Importance Values (Elk Head Springs)

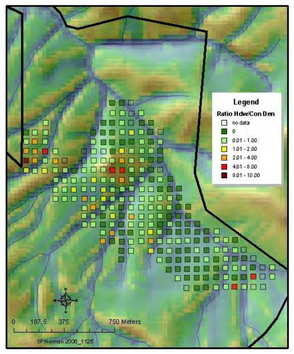
Coast redwood



Douglas fir



Conifer/Hardwood ratio



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Prior to 1936, fire was a key but variable contributor to old forest complexity and diversity at stand and landscape scales. Cohorts of Douglas fir established in pulses during the 18th through 20th centuries following nine identified fire events. Fires were of low to moderate severity based on frequent tree survival and limited fire-related suppressions in the growth rings of survivors. Pulses of Douglas fir establishment were patchy and linked to topography. Converging insights into past disturbance and vegetation responses were obtained from the distribution of hardwoods and conifers in 1992 cruise data. Such a low to mixed severity fire regime is consistent with that of Humboldt Redwood and Del Norte Coast Redwoods State Parks where other fire history research was conducted. This suggests that certain structural and compositional attributes of the north coast redwood forest may be dependent on fire and that fire exclusion may have long term successional and wildlife consequences. The recurrence of lightning events in the last decade and increasing live and surface fuels further suggests that the potential for future wildfire in the Reserve is substantive. If wildfire and drought stress become more intense or frequent in coming decades due to climate change, restoration efforts may be set back in the absence of a program of active prescribed fire management.

Under extreme fire weather, wildfire can be lethal to old redwood, so both old and second growth may be at risk. However, fire use can also increase the risk of future fire and it increases tree mortality. This presents difficult tradeoffs for forest managers. “Restoration” may be less desirable than maximizing the resilience of specific forest attributes, given ancient and novel stressors.