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Research Brief for Resource Managers

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Structure, fuels and fire behavior in Sierran riparian and upland forest: past and present.

Van de Water, K., & North, Malcolm. (2011). Stand structure, fuel loads, and fire behavior in riparian and upland forests, Sierra Nevada Mountains, USA; a comparison of current and reconstructed conditions. Forest Ecology and Management, 262(2), 215-228.

Fire suppression and altered management regimes have led to an increased density of smaller-sized trees, increased fuel loading and a depauparate understory. Despite policy changes supporting the use of fire on the landscape, wildfire suppression has remained the common protocol. In addition, the use of prescribed fire and mechanical fuels reduction are usually excluded from sensitive landscapes such as riparian conservation areas. This policy is often based on little to no knowledge of stand structure in riparian areas under an active fire regime. Van de Water et al. presents quantitative information on the differences in stand structure, fuel loading, and fire behavior in current and reconstructed riparian and upland areas in the Sierra Nevada.

Sampling occurred in four areas throughout the Sierra Nevada on plots in upland and riparian areas taking care to account for variation in historic fire movement and dominant microclimate. Forest structure, fuel loading and species composition were recorded for current conditions.

Management Implications

- Riparian and upland Sierran mixed conifer forests under an active fire regime (reconstructed conditions) had similar forest composition, structure, fuel loading and fire behavior.
- Riparian and upland Sierran mixed conifer forests are more susceptible to high severity fires in their current state, with riparian areas more so.
- Management should focus on the reintroduction of an active fire regime. To facilitate this, fuels treatments focused on removal of small fire-sensitive trees and reduction of surface fuels, particularly in the duff layer, may first be necessary.

Forest conditions were reconstructed for the time of the last fire, which ranged from 1848 to 1990 across the study sites. The last fire was determined from a coordinated fire history study at the same sites. Diameter at breast height (DBH) at the time of the last fire was derived from tree cores using radial increment calculations. Tree height and canopy base height were calculated from DBH. These metrics were then scaled up to stand level basal area, stem density, and quadratic mean diameter. Snags, stumps and logs were reconstructed based on level of decay

and equations predicting transition from live tree to snag to log. Reconstructed structure and composition were then used to quantify fuel loading.

Potential fire behavior in current and reconstructed riparian and upland plots was determined using the Fire and Fuels Extension in the Forest Vegetation Simulator.

Three hypotheses were tested in this study: 1) Current riparian and upland areas are more susceptible to high intensity fire than reconstructed riparian and upland stands, 2) Current riparian stands have a structure more conducive to high intensity fire than current upland stands, and 3) Reconstructed riparian stands have similar structure to reconstructed upland stands.

Results show that current riparian stands have greater basal area, higher density, and higher total fuel loads as compared to the reconstructed riparian areas. This was also true of current uplands stands. In addition, canopy and duff fuels were greater and snag densities have increased, most likely due to the lack of an active fire regime. As a result, the potential for torching has increased and the crowning index has decreased indicating a greater propensity to high-intensity fires.

Current riparian stands had higher stem density, lower quadratic mean diameter, lower height to live crown and a lower percentage of fire tolerant species as compared to the upland areas. This higher percentage of dense fire-intolerant riparian species coupled with continuous horizontal and vertical fuels may leave the current riparian areas at a greater risk to high-intensity fire than upland areas. Under these current stand conditions, modeled fire behavior shows an increase in predicted mortality in both the riparian and upland areas.

In comparison, reconstructed riparian and upland stands were similar in structure and fuel loading. Understanding the processes whereby ecosystems evolved may be more important for managing current forest stands than restoring to historical conditions.

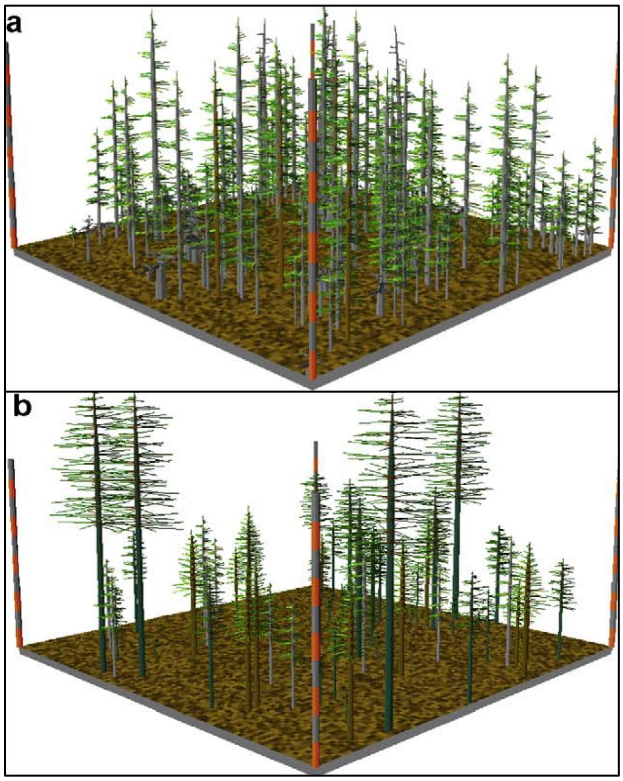

Fig. 2. Stand visualization simulation of typical conditions for (a) current riparian forest (Dollar Creek, 2009), and (b) reconstructed riparian forest (West Branch Feather River, 1886).

Suggestions for further reading:

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