

Western Ecological Research Center

Publication Brief for Resource Managers

Release:
November 2006

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Simulating the Effects of Frequent Fire on Southern California Shrublands

Fire frequency has been steadily increasing in coastal regions of California due to ignitions at the growing wildland-urban interface. Although chaparral and sage scrub are resilient to a range of fire frequencies, successively short intervals between fires can threaten the persistence of some species, and the effects differ according to plant functional type. New tools are needed to predict future landscape changes, and one such tool that has been recently applied to this problem is the spatially explicit simulation model of landscape disturbance and succession known as LANDIS. San Diego State University researchers Alexandra Syphard and Janet Franklin and USGS research scientist Dr. Jon Keeley have modified this forest model to predict fire effects on 60,000 ha of shrubland landscapes within the Santa Monica Mountains National Recreation Area (SMMNRA), administered by the National Park Service. Their study was published in a recent issue of *Ecological Applications*.

LANDIS is a raster-based, stochastic, spatially explicit model that simulates forest landscape dynamics, including multiple disturbances where successional dynamics result from interactions between fire regimes, plant life history behaviors, and site conditions, and are simulated over broad spatial extents and long time periods. Life history parameters of the simulated species include longevity, maturity, dispersal distance, ability to resprout, and relative shade and fire tolerance. Three fire regime scenarios — short, medium, and long fire return intervals — were calibrated using historical data that varied according to landscape. Model simulations were consistent with functional type responses documented from empirical studies. Shrubs dependent on fire-cued seed germination were most sensitive to frequent fire and lost proportionately more

Management Implications:

- The forest succession model LANDIS has been modified to provide reasonable simulations of fire effects in chaparral shrublands.
- Model simulations demonstrate that some native shrub life forms are particularly vulnerable to projected future fire regimes.
- Current fire frequencies have pushed some portions of the landscape to the threshold of tolerance, and model simulations suggest caution should be exercised in the additional use of fire through prescription burning.

cover to other functional types, including subshrubs that typify coastal sage scrub and nonnative annual grasses. Shrubs that resprout were favored by higher fire frequencies and gained in extent under these scenarios.

Model simulations predicted broad-scale differential impacts of repeated fire similar in nature to those that have been observed in localized field studies, strongly suggesting that there may be serious ecological consequences from altered fire regimes in southern California. In particular, increasing fire frequency could result in substantial declines in obligate and facultative seeding native shrubs and replacement by nonnative grass. Due to this potential for vegetation change, in particular the expansion of nonnative grassland, caution is advised against the widespread use of prescribed fire in this region.

Syphard, A. D., J. Franklin, and J. E. Keeley. 2006. Simulating the effects of frequent fire on southern California coastal shrublands. Ecological Applications 16:1744–1756.