SIMULATING FIRE SPREAD AND SHRUBLAND DYNAMICS IN A SEMIARID RANGELAND OF SOUTHWESTERN IDAHO USING GIS AND REMOTELY SENSED DATA

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ABSTRACT

We developed a computer simulation of fire spread and vegetation regeneration in rangeland habitats as part of a study of long-term spatial and temporal landscape dynamics. Shrubland loss due to fire is an important management concern in the Snake River Birds of Prey National Conservation Area, southwestern Idaho; approximately half of the shrublands have been lost since 1979. Our objectives were to project future habitat conditions under alternate management plans for fire control and shrubland restoration. The simulations were based on a raster GIS map of dominant habitats classified from Landsat Thematic Mapper satellite imagery (resampled into 150-m cells), which had an 80% accuracy in separating shrubland and grassland habitats. We estimated the composition and biomass of understory vegetation using gradient modeling from field sampling sites. Similarly, average wind speed and direction were determined from field sites. We then used BEHAVE to determine habitat specific fuel loads and rates of spread. Fire propagation from an ignition point was based on percolation dynamics and depended on within- and among-cell attributes of habitat class, understory, fuel load, and rates of spread modified by external weather variables. The size distribution of 1,000 simulated fires was similar to actual fires (n=446) that burned in the Snake River Birds of Prey National Conservation Area between 1950 through 1995. Increases in area dominated by cheatgrass (Bromus tectorum) resulted in significant declines in total area of shrub cover at equilibrium conditions, and also in increased fire frequency and size. Under current conditions of climate, fire size and frequency, we predicted almost total loss of shrublands in the Snake River Birds of Prey National Conservation Area within 50-80 years. Given optimum climate conditions for shrub regeneration and no fire, complete restoration to historical shrub cover in some regions still was not possible within 100 years. Climatic conditions, including longer droughts that contributed to lower rates of shrub regeneration significantly delayed the rate at which shrublands could recover. Approximately 60-80 years of optimum conditions for shrub regeneration and fire suppression were required to replace losses in the 15 years between 1979 and 1994. Without significant efforts for fire control and shrubland regeneration, the conversion of native shrublands to a system dominated by exotic annual grasslands may be irreversible.