Ecoregion Sensitivity to Future Climate Change in the Pacific Northwest

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Abstract
Many conservation and natural resource organizations have begun using ecosystems as the basis for their management planning activities. Accompanying this trend is the definition of ecoregions, large areas consisting of distinct assemblages of ecosystems, as geographical units within which to plan conservation reserve networks. This study examines the relative sensitivity of ecoregions to climate change by simulating the potential response of the vegetation within ecoregion boundaries to changes in climate. The study area consists of a large region of western North America represented on a 2.5-minute grid. The future climate scenario is from a coupled atmosphere-ocean general circulation model (HADCM3). Vegetation response to climate change is simulated using a modified version of BIOM5, a terrestrial biogeochemistry model that includes the physiological response of vegetation to increased atmospheric CO2 concentrations. The changes to the vegetation within ecoregion boundaries are used to identify ecoregions that may be highly sensitive to climate change, and ecoregions that may be more resilient to changing climate.

Elevational Gradients
Elevation combined with existing vegetation determines an ecoregion's sensitivity to future climate change. Low-elevation ecoregions dominated by forest (e.g. West Cascades and Coastal Forests) are less sensitive than high-elevation ecoregions dominated by shrubland and steppe (e.g. Wyoming Basins).}

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Patterns of Biome Change
78% of the grid cells in the study area experience significant changes in vegetation under future climate. Ecoregions dominated by grasslands, steppe, and shrubland habitats are invaded by trees. Subalpine forest and tundra conditions, for example, contract under future climate, and expand under present climate. Ecoregions dominated by forest (e.g., West Cascades and Coastal Forests) are less sensitive than high-elevation ecoregions dominated by shrubland and steppe (e.g. Wyoming Basins).