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What We Know about Climate Change Effects on Forests and Rangelands

Climate change effects on vegetation eventually will be direct and important, but for the near-term, largely indirect processes are dominating responses to climate change.

- Currently, climate change has had relatively minor direct effects on forest condition.
- But climate change and variability are affecting wildfires and pathogen populations over large areas.
- The magnitude and effects of climate change and its impacts now, and in future will vary in different regions of the country.

Destructive insect populations in the western US, Alaska and Canada are increasing to unprecedented densities, as a result of changing climate extremes.

- Climate directly increases insect populations as longer, warmer growing seasons permit more annual insect generations, and warmer winters permit insects to expand upward in elevation and far north of their historic ranges.
- Insects, not drought stress alone, killed most of pines that died in a recent western drought.

Severity and size of wildfires in the western US, Alaska and Canada are increasing with longer, warmer growing seasons.

- Many areas of the US have warmed significantly over the last 40 years, with the greatest changes occurring in the northern latitudes and in the West.
- Much of the recent increase in fire in the western US can be correlated with increasing temperatures, changes in precipitation patterns, and longer fire seasons since the mid-1980s.
- Changing seasonal temperatures combined with shifting precipitation and snowmelt patterns and predicted increases in the density of vegetation are expected to lead to increased stress and mortality from insects and diseases, which in turn can increase susceptibility to fire.

In the eastern US where water supplies are more plentiful, invasive insects combine with air pollutants to amplify increasing climate stresses.

- Ground level ozone reduces or eliminates growth advantages conferred upon trees by added warmth and atmospheric CO₂.
- Acid rain continues to reduce forest tree growth while nitrate deposition is saturating forests, reducing growth, and increasing nitrate pollution of streams and estuaries.
- As a result, the health of large older trees and seedlings is vulnerable to climate extremes.

Changing climate is responsible for substantial shifts in distribution and timing of reproduction in plant, wildlife and fish populations.

- Wildlife and fish responses to climate change depend on feedbacks among climate, land use, land cover, hydrology, and fire.
- Tree species and forest ecosystems will take decades to centuries to redistribute, while invasive pests and annuals can become established in distant new regions quickly.
- We can expect large changes in the structure and species composition of plant communities.

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