Forest Research Advisory Council meeting

Dialogue on Forest Composition change after disturbance or resetting events (fire, wind, water extremes)

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Processes affecting vegetation Dynamics

Disturbances
- Catastrophic
  - Natural
    - Earthquakes, Fire, Snow storms, Hurricanes, Land slides, Tornados, Insect and disease attack, Floods
  - Man made
    - Fire, Mining, Grazing
- Non-Catastrophic
  - Natural (Same as above, but a lower scale)
  - Man made

Intensity
- Frequency

Climate Change has strong influence on these disturbances

Factors affecting tree growth

Tree species intrinsic characteristics: tolerance, genetic pool

Climatic conditions:
- Precipitation
- Solar radiation
- Day length
- Temperature
- Wind
- Number of days with light

Soil:
- Depth
- Organic matter
- Water availability
- Texture
- Ph
- Nutrient content

Orography:
- Topography
- Altitude
- Aspect

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Climate Change

- Mean annual global surface temps. increased ~0.74ºC from 1906-2005, with the change over the last 50 years twice that of the last 100 years.
- Since 1995, 11 of the warmest years on record have occurred.
- By the end of the century, mean annual increases of 1.8 to 4.0ºC are expected (relative to 1980-1999).

Results from different methods agree

- Holocene lake-sediment records -- increased fire activity in warmer drier climates.

- Fire-scar records -- drought and warmer temperatures increase fire occurrence and extent.

- Recent fire (1977-2003) also directly associated with drought except for arid systems, which need priming and curing of fuels.
Climate Change and Disturbances

- **Fire regimes**
  - Increased severity
  - Possible changes in size, seasonality

- **Drought**
  - Increase in frequency

- **Insects and diseases**
  - Changes in distributions

- **Hurricanes, landslides, ice storms, windstorms**
  - Alterations are possible

Disturbances

- Natural
- Anthropogenic

Climate Change

Ecosystems

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Forest disturbances

- Drought
- Wildland fire
- Pests and diseases
Global warming

Higher temperatures & more severe and extended droughts

Stand-replacing fire regime

Bark beetles and defoliators

Extensive mature cohorts (70-80 yrs)

Lodgepole pine mortality

Large severe fires

Fuel accumulation

Salvage logging

Changes in species composition (including exotics)

Interior lodgepole pine

Stand-replacing fire has multiple causes.
Extended warm period, insects, vulnerable age classes, pines die, fuels accumulate, large fires.
High Elevation Pines

- >1.4 million acres affected by mountain pine beetle
- e.g., whitebark pine serves as keystone species vital to the survival of Clark’s nutcracker, bears and others.

By the end of the century, ~50% of the West is predicted to experience climates that are incompatible with the vegetation occurring there today.
Flows of carbon from the atmosphere to the forest and back. Carbon is stored mostly in live and dead wood as forests grow (adapted from Ryan and Law 2005).
Carbon Dioxide

- 45% of the dry weight of plants is Carbon, which comes from atmospheric CO₂ converted into carbohydrates by the process of photosynthesis.
- The atmosphere contains 350 ppm of CO₂ and this low concentration limits the rate of photosynthesis.
- The increase in concentration of atmospheric CO₂ should be welcomed by farmers and foresters, because of its direct “fertilization” effects on plants, but this increase in CO₂ causes an increase in temperature known as the greenhouse effect, and a change in rainfall patterns that indirectly will affect plant growth and human activities unfavorably.

Given that the plant species that are established today are going to be affected by climate change, extreme events and new pests and diseases, and other disturbances. Then,

**Some suggested questions for discussion**
- How the ecosystems composition would be in the future?
- What we should maintain what we have of start replacing it?
- Should we plan having lower productivity and less ecosystems services?
- What would be the science needs under this environment?
- How to select the best management practices?
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Questions?
Thank you