The Normal Fire Environment

Modeling Large Wildfire Suitability using Past, Present, and Future Climate Normals

Zhiqiang Yang - Co-Director Lab. For Applications of Remote Sensing in Ecology
Raymond Davis - Monitoring Lead - Older Forests & Spotted Owls. USFS R6
Andrew Yost - Forest Ecologist, Oregon Department of Forestry
Cole Belongie - GIS Specialist USFS R6
Presentation Outline

• Describe process for modeling the probability of large wildfires in Oregon and Washington

• Explain how the baseline models were projected through 2100 using downsampled climate data

• Display preliminary results in graphical and mapped format

• Future possibilities
The Fire Environment

Countryman 1972 – The Fire Environment Concept
The role of models in this context is to help:

- Identify plausible future conditions,
- highlight regional vulnerability to large wildfire
- provide insight into the range and variability of potential climate change effects,
- examine general ecological principles rather than predict the behavior of a specific ecosystem,
- inform strategic decision making processes and policy development.
Spatial Distribution Modeling

Occurrence data *aka* the Response Variable

Environmental data *aka* Predictor Variables

*GIS layers*

Statistical Model

Model evaluation

*Test data*

Estimate relative probability of occurrence across a landscape

...and future landscapes
Building The Baseline Model

- Maxent modeling algorithm
- Modeling resolution was 800m
- Response variable was sampled from fire perimeters >40 ha (100 acres) (1971-2000)
Spatial Distribution Modeling

Fire Perimeters as Response Variable

- **Fire Perimeters 1971 to 2000**
  - subsampled: \( \frac{\text{area burned}}{\text{smallest perimeter}}^{0.5} \)

- **Forest Area**
Temperature and Precipitation

The Fire Environment Model

- Max temperature (Jul – Aug)
- Precipitation (May – Sep)

Slope (percent)

Elevation (m)

Forested areas
Temperature and Precipitation

- Max temperature (Jul – Aug): 38.9%
- Precipitation (May – Sep): 22.2%

Slope and Elevation

- Slope (percent): 10.7%
- Elevation (m): 28.2%

The Fire Environment Model

Forested areas
Temperature and Precipitation

Max temperature (Jul – Aug)

Precipitation (May – Sep)

Slope (percent)

Elevation (m)

The Fire Environment Model

Slope and Elevation

Forests

Baseline

LWS Model
Model Classification and Evaluation

Bootstrap Test
Random 50% of large wildfire locations (1971-2000) for 50 replicates

AUC = .77

Independent Test
All large wildfire locations (2001-2013)
Future Climate Normals

The Greenhouse Effect

Some solar radiation is reflected by the Earth and the atmosphere. Some of the infrared radiation passes through the atmosphere. Some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth’s surface and the lower atmosphere.

Most radiation is absorbed by the Earth’s surface and warms it.

Infrared radiation is emitted by the Earth’s surface.

Climate Change Indicators

- Sea Level
- Temperature: Air & Ocean
- Water Vapor
- Ocean Acidity
- Snow Cover
- Glaciers and Ice Sheets
- Permafrost
- Arctic Sea Ice
Latest \( \text{CO}_2 \) reading
December 09, 2014
398.48 ppm

Carbon dioxide concentration at Mauna Loa Observatory
Average Global Temperature Change
Large Forest Wildfires
Pacific Northwest Region (Oregon and Washington)
Trend in numbers of large forest wildfire and total area burned (1970-2015)
Representative Concentration Pathway
GHG Emissions Scenarios

**RCP 2.6** Peak and decline

**RCP 4.5** Stabilization

**RCP 6** Stabilization

**RCP 8.5** High Emissions
## Global Circulation Models and RCP’s

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### Variables available NEX-DCP30

- Precipitation,
- Maximum temperature
- Minimum temperature
Climate Change and LWS Modeling

Representative Concentration Pathways

Forest LWS Class Distribution Trend – RCP 4.5
Climate Change and LWS Modeling
Representative Concentration Pathways

Forest LWS Class Distribution Trend – RCP 6.0
Climate Change and LWS Modeling

Representative Concentration Pathways

Forest LWS Class Distribution Trend – RCP 8.5
Douglas County, OR
2009 Fire Season
Douglas County, OR
Large Wildfire Suitability – Climate Normal (1981-2010)
Douglas County, OR
Large Wildfire Suitability – Climate Normal (2011-2040)
Douglas County, OR
Large Wildfire Suitability – Climate Normal (2061-2090)
Douglas County, OR
Large Wildfire Suitability – Climate Normal (2071-2100)