Future Climate Change Projections to Support County Natural Hazard Mitigation Planning in Oregon

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Outline

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• Climate Change in NHMPs (Tricia)
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• County-Level Future Climate Change Projections (Meghan)
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OCCRI-DLCD Scope of Work
OCCRI-DLDCD Scope of Work

Perform analysis of the influence of climate change on natural hazards and provide county-specific data, graphics, and text.

8 counties

81 climate-related natural hazards

- Heat waves
- Cold waves
- Heavy rains
- River flooding
- Drought
- Wildfire
- Air quality
- Windstorms
- Dust storms
- Increased invasive species & pests
- Loss of wetland ecosystems
Climate Change in NHMPs
Hazard Mitigation Planning

- Conditions of concern:
  - Non-climate hazards, i.e. earthquakes
  - Man-made/technological hazards, i.e. oil spill

- Response type:
  - Planned policies, projects, programs

- Goal:
  - Long-term risk reduction

Climate Adaptation Planning

- Conditions of concern:
  - Climate-related natural hazards, i.e. wildfires
  - Incremental or slow-onset climatic changes, i.e. seasonal shifts

- Response type:
  - Spontaneous or unplanned adjustments

Figure 5: The intersection of Hazard Mitigation and Climate Adaptation Planning

What is a Natural Hazard?

• A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event.

• Examples: drought, flood, wildfire, landslides, earthquakes, volcanic event, severe weather (rain storms, snow storms, hot and cold temperatures), dust storms, and air quality
Hazard Mitigation

• **Hazard mitigation** is defined at 44 CFR 201.2 as *any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.*

• **Benefits of hazard mitigation actions:** fewer injuries and deaths; less damage to buildings, critical facilities, and infrastructure; diminished interruption in essential services; reduced economic hardship; minimized environmental harm; and quicker, lower-cost recovery.
Summary of NHMP Requirements

Is Climate Change Information Required?

- **Local NHMPs** (County, City, Special District) – Not required. Encouraged. “Probability of future events for each identified hazard.”

- **State NHMPs** – Required. “Effect of long-term changes in weather patterns and climate on identified hazards.”

- **Tribal NHMPs** – Required. “Effect of long-term changes in weather patterns on identified hazards.”
Overview of Climate Change
Oregon’s Average Temperature

Source: NOAA NCEI Climate at a Glance, https://www.ncdc.noaa.gov/cag/
Carbon Dioxide Emissions

Source: NCA4, Vol 1: https://science2017.globalchange.gov/chapter/2#fig-2-7
Climate change expected to increase climate-related natural hazards

- Heat Waves
- Heavy Rains
- Flooding
- Drought
- Wildfire
- Air Quality
County-Level Future Climate Change Projections
Oregon Annual Mean Temperature
Future Projections & Observations

Annual mean temperature
- RCP4.5
- RCP8.5

Source: David Rupp, Oregon Climate Change Research Institute
Future Scenarios

Higher Emissions Scenario (RCP 8.5)

Lower Emissions Scenario (RCP 4.5)

Source: NCA4, Vol 1: https://science2017.globalchange.gov/chapter/4#fig-4-1
Downscaling Climate Models

Source: NCA4, Vol 1: https://science2017.globalchange.gov/chapter/4#fig-4-4
Historical Baseline: 1971–2000
Early 21st Century “2020s”: 2010–2039
Mid 21st Century “2050s”: 2040–2069

Annual Average Temperature Projections
Harney County

- Historical
- Lower (RCP 4.5)
- Higher (RCP 8.5)

2020s: +2.8 °F
2050s: +5.8 °F
2020s: +2.5 °F
2050s: +4.4 °F
### Climate Metrics

#### Table 1: Natural hazards and related climate metrics evaluated in this project.

<table>
<thead>
<tr>
<th>Heavy Rains</th>
<th>Heat Waves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wettest Day • Wettest Five Days • Landslide Threshold Exceedance</td>
<td>Hottest Day • Warmest Night • “Hot” Days • “Warm” Nights</td>
</tr>
<tr>
<td>River Flooding</td>
<td>Cold Waves</td>
</tr>
<tr>
<td>Annual maximum daily flows</td>
<td>Coldest Day • Coldest Night • “Cold” Days • “Cold” Nights</td>
</tr>
<tr>
<td>Drought</td>
<td>Air Quality</td>
</tr>
<tr>
<td>Summer Flow • Spring Snow</td>
<td>Unhealthy Smoke Days</td>
</tr>
<tr>
<td>Summer Soil Moisture</td>
<td></td>
</tr>
<tr>
<td>Wildfire</td>
<td>Windstorms • Dust Storms • Increased Invasive Species &amp; Pests • Loss of Wetland Ecosystems</td>
</tr>
<tr>
<td>Fire Danger Days</td>
<td></td>
</tr>
</tbody>
</table>
Heat Waves

*Extreme heat events are expected to increase in frequency, duration, and intensity.*

Malheur County

# Days w/ Max Temp $\geq$ 90°F

Annual Maximum of Max Temp
Cold Waves

Cold extremes are still expected to occur from time to time, but with much less frequency and intensity as the climate warms.

Lake County

# Days w/ Max Temp ≤ 32°F

Annual Minimum of Max Temp
As the atmosphere warms and is able to hold more water vapor, the frequency and intensity of extreme precipitation events is expected to increase.
Flooding

Mid- to low-elevation tributaries that are near freezing level in winter, receiving a mix of rain and snow, may experience an increase in winter flood risk due to warmer winter temperatures causing precipitation to fall more as rain and less as snow, as well as more intense precipitation events.
Drought

Drought Metrics for Hood River County

- Historical
- Lower (RCP 4.5)
- Higher (RCP 8.5)

Drought Frequency (%)

- Low Summer Soil Moisture
- Low Spring Snowpack
- Low Summer Runoff
Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change.
Air Quality

Under future climate change, the risk of wildfire smoke exposure is projected to increase.
Other Climate-Related Hazards

**Windstorms.** Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

**Dust Storms.** Limited research suggests that the risk of dust storms in summer would decrease under climate change in parts of eastern Oregon that experience an increase in vegetation cover from the carbon dioxide fertilization effect.

**Increased Invasive Species.** Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species, insect and plant pests for forest and rangeland vegetation, and cropping systems.

**Loss of Wetland Ecosystems.** Freshwater wetland ecosystems are sensitive to warming temperatures and altered hydrological patterns, such as changes in precipitation seasonality and snowpack reduction.
# Summary of Projected Changes

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Low Confidence</th>
<th>Medium Confidence</th>
<th>High Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Increasing</td>
<td>⬆</td>
<td>![Low Confidence Weather Symbols] Poor Air Quality</td>
<td></td>
</tr>
<tr>
<td>Risk Unchanging</td>
<td>=</td>
<td>Windstorms</td>
<td></td>
</tr>
<tr>
<td>Risk Decreasing</td>
<td>⬇</td>
<td>Dust storms</td>
<td></td>
</tr>
</tbody>
</table>

- **Low Confidence:** Poor Air Quality
- **Medium Confidence:** Heavy Rains, Flooding, Drought, Wildfire, Increased Invasive Species, Loss of Wetland Ecosystems
- **High Confidence:** Heat Waves, Cold Waves
How to Use this Information

• Explore a range of plausible future outcomes taking into consideration the climate system’s complex response to increasing greenhouse gases
• These are NOT weather predictions
• Envision how current systems may respond under climate conditions different from those the systems were designed to operate under
• Evaluate potential mitigation actions to accommodate future conditions (e.g., NHMP, CWPP)
• Should NOT be used for engineering/design
• Influence the assessment of likelihood of a particular climate-related hazard risk
Contact Us

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