1. **Past:**
   - fire history and regimes
   - landscape pattern
   - Forest developmental trajectories

2. **Present:**
   - Fire activity
   - Fire management

3. **Future:**
   - Climate change
   - Fire effects
Climatic Variation on the Westside
Westside Biophysical Environments
Fire History Record: Variability in Time

- Mean fire return intervals varied (~50-500 years)
- Variable fire expression in space—stand replacement, mixed severity
<table>
<thead>
<tr>
<th>Regime</th>
<th>Return interval</th>
<th>Severity Characteristics</th>
<th>Landfire group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrequent, high severity</td>
<td>&gt; 200 years</td>
<td>Very large patches of high severity, with moderate and low severity</td>
<td>V</td>
</tr>
</tbody>
</table>

Spies et al., in press.  Northwest Forest Plan Synthesis
Fire Effects: Variability in Space

- Variability in severity patch sizes/shapes
- High severity patches large and small
Infrequent High Severity Pattern

Data from Thompson and Johnson 1900 and Plummer 1902

<table>
<thead>
<tr>
<th>Fire regime</th>
<th>Number of burned patches</th>
<th>Median patch size (ac)</th>
<th>Largest patch size (ac)</th>
<th>Percentage of area in patches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrequent - high severity</td>
<td>331</td>
<td>968</td>
<td>1,022,700</td>
<td>29</td>
</tr>
<tr>
<td>Moderate frequency - mixed severity</td>
<td>103</td>
<td>2,146</td>
<td>128,163</td>
<td>11</td>
</tr>
<tr>
<td>Frequent - mixed severity</td>
<td>132</td>
<td>556</td>
<td>51,302</td>
<td>5</td>
</tr>
<tr>
<td>Frequent - low severity</td>
<td>51</td>
<td>398</td>
<td>6,579</td>
<td>1</td>
</tr>
</tbody>
</table>

Data from Thompson and Johnson 1900 and Plummer 1902
## Mixed Severity Pattern

Data from Thompson and Johnson 1900 and Plummer 1902

<table>
<thead>
<tr>
<th>Fire regime</th>
<th>Number of burned patches</th>
<th>Median patch size (ac)</th>
<th>Largest patch size (ac)</th>
<th>Percentage of area in patches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrequent - high severity</td>
<td>331</td>
<td>968</td>
<td>1,022,700</td>
<td>29</td>
</tr>
<tr>
<td>Moderate frequency - mixed severity</td>
<td>103</td>
<td>2,146</td>
<td>128,163</td>
<td>11</td>
</tr>
<tr>
<td>Frequent - mixed severity</td>
<td>132</td>
<td>356</td>
<td>51,302</td>
<td>5</td>
</tr>
<tr>
<td>Frequent - low severity</td>
<td>51</td>
<td>398</td>
<td>6,579</td>
<td>1</td>
</tr>
</tbody>
</table>

Data from Thompson and Johnson 1900 and Plummer 1902
Single Successional Pathway ?????

The gradual and orderly process of change brought about by the progressive replacement of one structural stage by another until a stable climax stage is established.

Stand replacement, long interval between fires

Successional Pathways--It's Complicated!

Tepley et al. 2013
Recent Fire Regimes
Lightning Fire Starts in NWFP Area and Large recent fires
Suppression Effects on Westside Fire Regimes

Suppressed Lightning Fire Starts 1992-2013

<table>
<thead>
<tr>
<th>Fire Regime</th>
<th>Number of starts suppressed</th>
<th>Starts suppressed per 25,000 acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrequent-high severity</td>
<td>4271</td>
<td>12.2</td>
</tr>
<tr>
<td>Moderately frequent-mixed severity</td>
<td>2350</td>
<td>13.4</td>
</tr>
<tr>
<td>Frequent-mixed severity</td>
<td>2511</td>
<td>15.2</td>
</tr>
<tr>
<td>Very frequent-low severity</td>
<td>4240</td>
<td>17.4</td>
</tr>
</tbody>
</table>

Tony Patten, Columbia Helicopters
# Recent Fire Regimes 1985-2010

<table>
<thead>
<tr>
<th>Zone</th>
<th>High Severity Extent (ha)</th>
<th>All Fires Extent (ha)</th>
<th>High Severity Rotation (yrs)</th>
<th>All fire Rotation (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Hemlock</td>
<td>10,242</td>
<td>50,083</td>
<td>18,594</td>
<td>3,802</td>
</tr>
</tbody>
</table>
Fire Severity in PNW (1985-2010)
Current Effects and Pattern: Stand Replacing Regime

Charlton 1996

Shadow Lake 2011
Fire Severity in PNW (1985-2010)

Reilly et al. 2017
Current Fire Effects and Pattern:
Mixed Severity Regime

Warner 1991
Tumblebug 2009
Deception Complex 2014
Potential Future Fire Suitability

Large Fire suitability model
Trained on past fires
Used climate models to predict future

Davis et al. 2017
Potential Future Fire Suitability
Summary

1. Variation in historical fire regimes of westside forests
   - Infrequent, high severity fire, very large HS fire patches
   - Moderately frequent, mixed severity fire with variable patch sizes (some large HS fire patches)
2. Climate variation affected fire occurrence
3. Multiple successional pathways across region
4. Variability in landscape pattern
Summary

1. Despite increase in fire in western U.S.
   - Fires have been relatively rare in westside forests
     - Except subalpine forests
   - Thousands of fires have been suppressed
   - Probably less landscape variability than historical for current climate

2. Increases in fire under climate change but amount of increase is uncertain

3. Challenge for fire-related biodiversity on westside
   1. Although fire suppression still needed in some areas, may have opportunities to manage wildfires in others
   2. How to provide for landscape diversity (including early seral)
Questions?