Western Washington wildfires: Managing the risk

Daniel Donato and Joshua Halofsky
Washington State Department of Natural Resources
November 2019
Increasing fire activity

Wildfires between 1984-2015
Wildfires between 1984-2015

Westside firewall?
Characteristic fire (historical)

- Infrequent – high severity
- Moderately frequent – mixed severity
- Frequent – mixed severity
- Very frequent – low severity

Spies et al. 2018
1902 Yacolt Burn

Figure 11 Tillamook Fire, August 25, 1933  Courtesy of National Archives

1933 Tillamook Burn
Characteristic fire (historical)

- Infrequent – high severity
- Moderately frequent – mixed severity
- Frequent – mixed severity
- Very frequent – low severity
Fire Regimes

Figure 3.5—Conceptual diagram characterizing the proportions of low-, moderate-, and high-severity fires in three major fire regime classes. Inset panels represent idealized landscape dynamics associated with each regime based on proportions and size class distributions of patches at each of the three levels of severity. From Reilly et al. 2017, who modified it slightly from Ager (1993, 1998).
The Bioclimatic Setting

Summer Temperature

Summer Precipitation

Summer Drought
Characteristic fire (historical)

- **Infrequent – high severity**
- **Moderately frequent – mixed severity**
- **Frequent – mixed severity**
- **Very frequent – low severity**

Spies et al. 2018
Characteristic fire (historical)

Infrequent – high severity
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Spies et al. 2018
Life & times of a Doug-fir/hemlock forest

~200-600 years

Van Pelt (2007)
How big were the largest fire episodes?
How big were the largest fire episodes?

~7 million acres
How big were the largest fire episodes?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
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<tbody>
<tr>
<td>1,730,000</td>
<td>3,500,000</td>
<td>4,700,000</td>
</tr>
<tr>
<td>870,000</td>
<td>1,700,000</td>
<td>2,200,000</td>
</tr>
<tr>
<td>590,000</td>
<td>1,200,000</td>
<td>1,500,000</td>
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~7 million acres
Consistent with evidence

- Year ~1700 fire episode:
  - >1 million acres on Olympic Peninsula,
  - 3 to 10 million acres in western Washington

- Henderson et al. 1989
• Year ~1700 fire episode:
  ⇒ >1 million acres on Olympic Peninsula,
  ⇒ 3 to 10 million acres in western Washington
    - Henderson et al. 1989

• Yacolt complex
  ⇒ >1 million acres
    - Natl. Int. Fire Center [nifc.gov]

• Tillamook burn
  ⇒ 350,000 acres
    - Kemp 1960

Consistent with evidence
Early land surveys

Spies et al. 2018 (summarizing Plummer 1902, etc.)
Spies et al. 2018 (summarizing Plummer 1902, etc.)
Early land surveys

Spies et al. 2018 (summarizing Plummer 1902, etc.)
The M.O. of large westside fires

Three factors coincide:

1) 

2) 

3)
The M.O. of large westside fires

Three factors coincide:

1) Dry, late summer conditions

2) 

3) 

The M.O. of large westside fires

Three factors coincide:

1) Dry, late summer conditions

2) Ignition source

3)
Causes of western Washington fires

- DNR Wildfire Division
The M.O. of large westside fires

Three factors coincide:

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3) Synoptic east wind event
The M.O. of large westside fires

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Tillamook Burn: 200,000 acres in 24 hrs

Yacolt Complex: 30 miles in 36 hrs
The M.O. of large westside fires

The largest westside fires are not so much a fire event...

...They are a wind event with fire in it
• Not just a historic thing
• Not just climate change
• Not forest mis-management
• Not just a historic thing
• Not just climate change
• Not forest mis-management

• Big events are part of the system
• Built-in resilience
Some parallels:
Cascadia Subduction Earthquakes

Last event:
1700
“Cascadia Subduction Fires”
Characteristic fire (historical)

- **Infrequent – high severity**
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Characteristic fire (historical)

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Spies et al. 2018
Mixed severity regimes (e.g. Puget Lowlands)
Fire Regimes

Figure 3-5—Conceptual diagram characterizing the proportions of low-, moderate-, and high-severity fires in three major fire regime classes. Inset panels represent idealized landscape dynamics associated with each regime based on proportions and size class distributions of patches at each of the three levels of severity. From Reilly et al. 2007, who modified it slightly from Ager (1993, 1998).
Mixed severity regimes: Fine and Coarse Scale Mosaic

• Fuels and topography become more important

• Occasional large patches of high severity in weather-driven fires

• Small to moderate events more common (i.e. more manageable)

• East side principles more applicable
Climate change and westside fire

Projected Increase in Area Burned
- 600% to 700%
- 500% to 600%
- 400% to 500%
- 300% to 400%
- 200% to 300%
- 100% to 200%
- Not modeled

Mote et al.
Littell et al.
Rogers et al.
BUT...

- This is relative to modern era
  - 8000+ year fire rotation (mean return interval)
  - <2000 acres burned per year

- 400% increase still means
  - 2000+ year fire rotation (mean return interval)
  - <8000 acres burned per year

Climate change and westside fire

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Summer droughts will 
Ignitions will likely
Major wind events will ?
So, what do we do *before* a fire?
So, what do we do **before** a fire?

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<thead>
<tr>
<th>Pre-fire management options</th>
<th>Puget Lowlands (mixed severity)</th>
<th>West Cascades (high severity)</th>
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<tr>
<td></td>
<td><strong>Small fire events</strong></td>
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</tr>
<tr>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>✓</td>
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<td>✓</td>
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</tr>
<tr>
<td>Promote species diversity within and across stands, include hardwoods</td>
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<td>✓</td>
<td>?</td>
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<tr>
<td>Promote structural diversity within and across stands when feasible</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>?</td>
</tr>
<tr>
<td>Fire-wise principles around high value resources (thinning, fuel breaks)</td>
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<td>Fire-wise principles around high value resources (thinning, fuel breaks)</td>
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<tr>
<td>Reduce other ecosystem stressors (invasives, fragmentation)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coordinate with adjacent landowners on fire management plans</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Limit human ignitions</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Aggressive wildfire detection</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Develop post-fire response strategies</td>
<td>✓</td>
<td>✓</td>
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So, what do we do **before** a fire?
So, what do we do *during* a fire?

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<tr>
<td></td>
<td>Small fire events</td>
<td>Large fire events</td>
</tr>
<tr>
<td>Aggressive suppression of wildfires while event is still small</td>
<td>?</td>
<td>✓</td>
</tr>
<tr>
<td>Permit wildfire when risk to other values is low</td>
<td>✓</td>
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So, what do we do *after* a fire?

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<tr>
<td>Assess fire impacts relative to management objectives (can be + or -)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Leverage natural regeneration - inexpensive, diverse, can't replant everywhere</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Planting: promote species diversity within and across stands, consider hardwoods</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Promote structural diversity within and across stands when feasible</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coordinate post-fire activities with adjacent landowners</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Use events as learning opportunities (research, monitoring, trials, adaptive mgt.)</td>
<td>✓</td>
<td>✓</td>
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Thanks!
Large fires couldn’t happen today, right?

Fire suppression?

Modern infrastructure?

Fuels management?
Large fires couldn’t happen today, right?
The M.O. of large westside fires

Three factors coincide:

1) Dry, late summer conditions

2) Ignition source

3) Synoptic east wind event

Tillamook Burn: 200,000 acres in 24 hrs
Yacolt Complex: 30 miles in 36 hrs
Large fires couldn’t happen today, right?

- Fire suppression?
  - During wind event, a non-factor
- Modern infrastructure?
- Fuels management?
Large fires couldn’t happen today, right?
Large fires couldn’t happen today, right?
During wind event, a non-factor

Largest events burn through
Large fires couldn’t happen today, right?

Fire suppression?

Modern infrastructure?

Fuels management?
During wind events, a non-factor.

Largest events burn through fire suppression? Modern infrastructure? Fuels management? Large fires couldn’t happen today, right?
Not a fuel-limited system
Large fires couldn’t happen today, right?

Fire suppression? → During wind event, a non-factor

Modern infrastructure? → Largest events burn through

Fuels management? → Less relevant on west side
The future: Climate change
The future: Climate change

Three factors coincide:

1) Dry, late summer conditions

2) Ignition source

3) Synoptic east wind event
Three factors coincide:

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The future: Climate change
Population increase of ~2.5 million between 2010-2040 across Washington

-WA State Office of Financial Management, 2017
The future: Climate change

Three factors coincide:
1) Dry, late summer conditions
2) Ignition source
3) Synoptic east wind event

24-72 hours
Three factors coincide:

1) Dry, late summer conditions
2) Ignition source
3) Synoptic east wind event

The future: Climate change