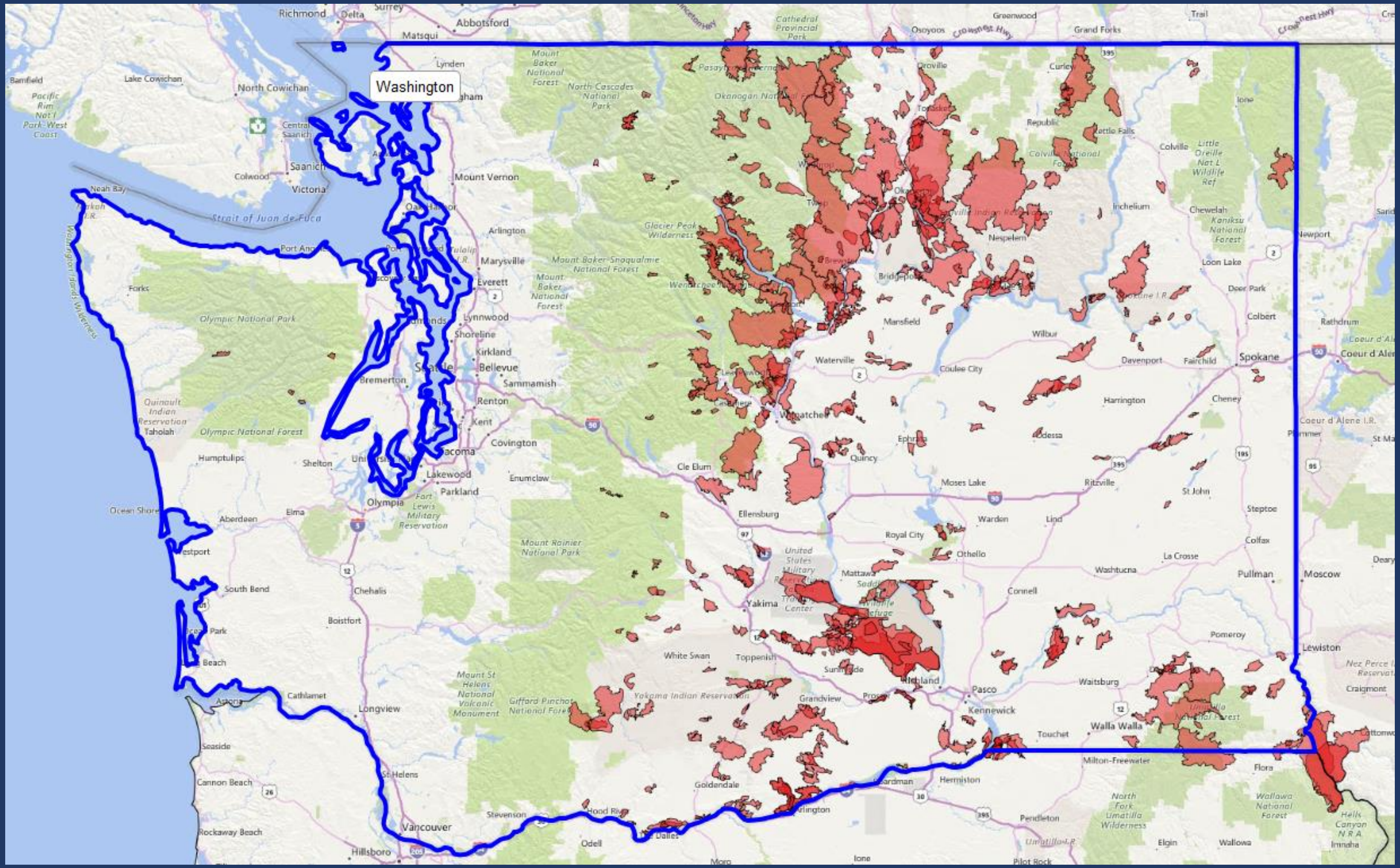
Western Washington wildfires: Managing the risk

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

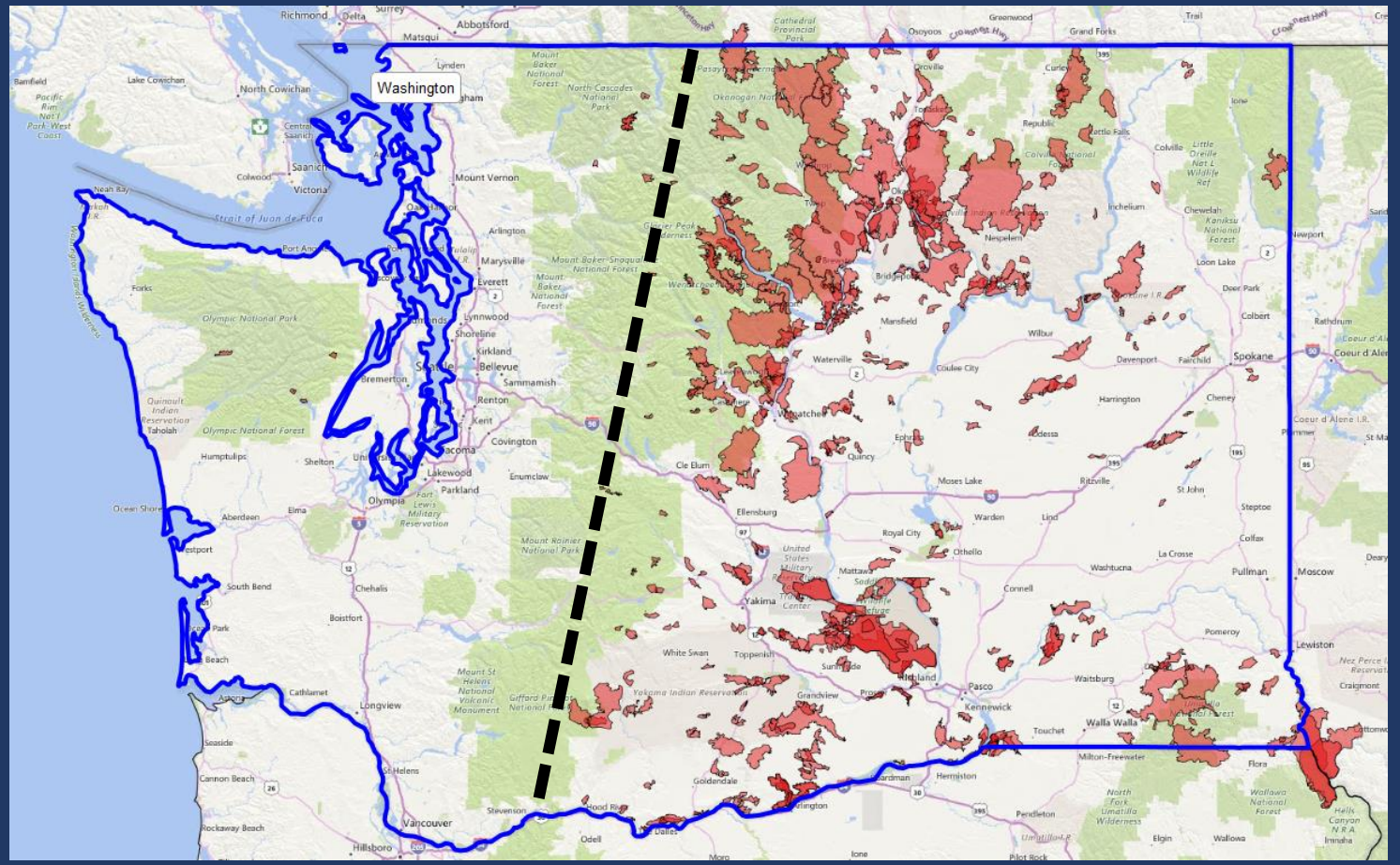
Increasing fire activity

Wildfires between 1984-2015

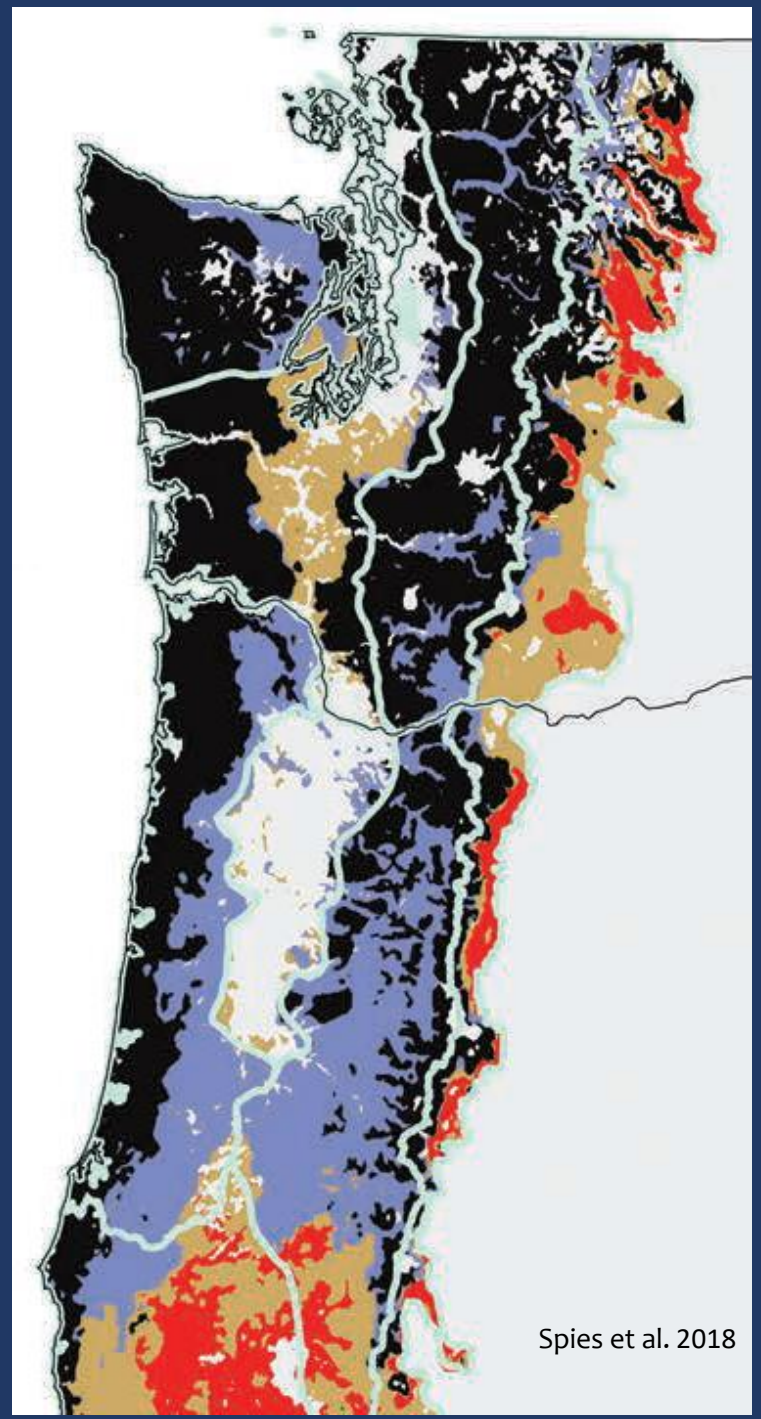


Westside firewall ?

Wildfires between 1984-2015



Characteristic fire (historical)



Infrequent – high severity

Moderately frequent – mixed severity

Frequent – mixed severity

Very frequent – low severity

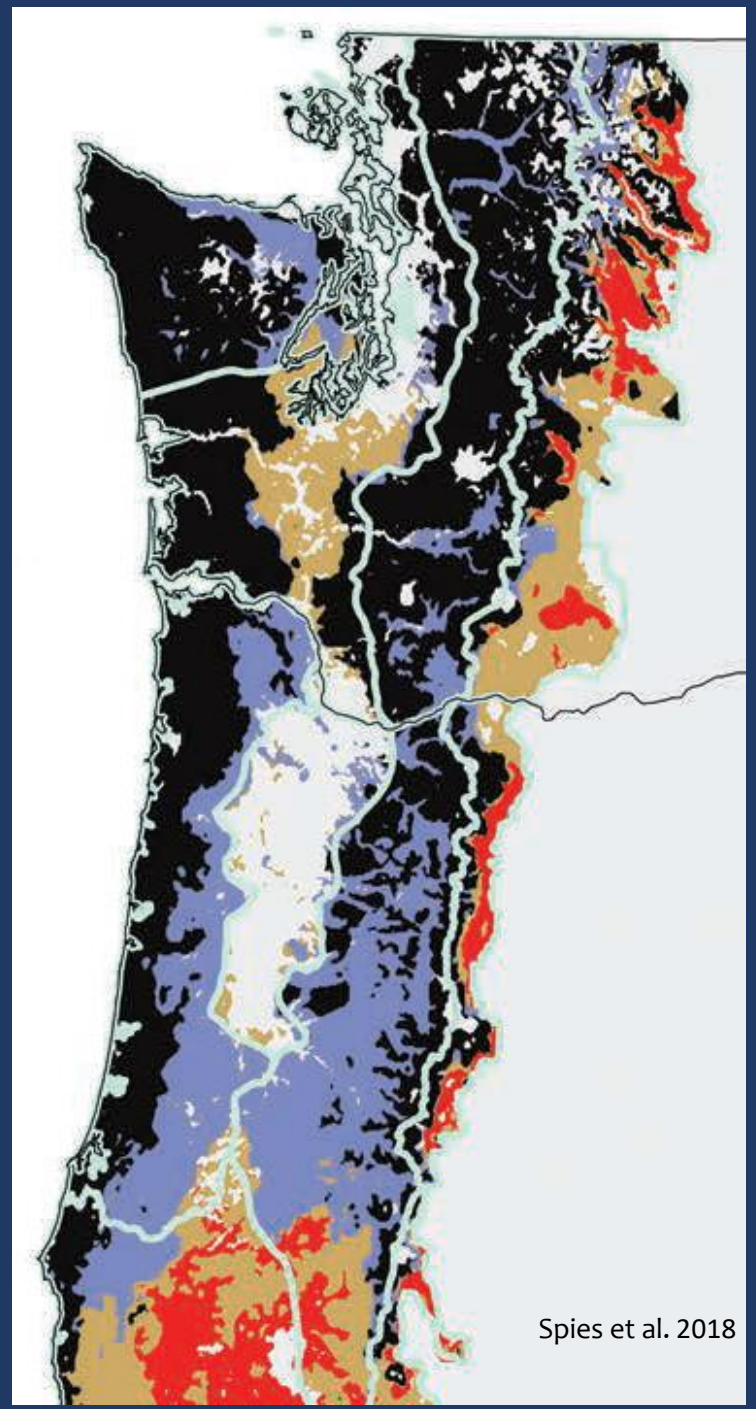

Camp Fire
Paradise
San Francisco
CALIFORNIA
Smoke
Hill and Woolsey Fires
Los Angeles
100 km

1902 Yacolt Burn

Figure 11 Tillimook Fire, August 25, 1933 *Courtesy of National Archives*

1933 Tillamook Burn

Characteristic fire (historical)



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Fire Regimes

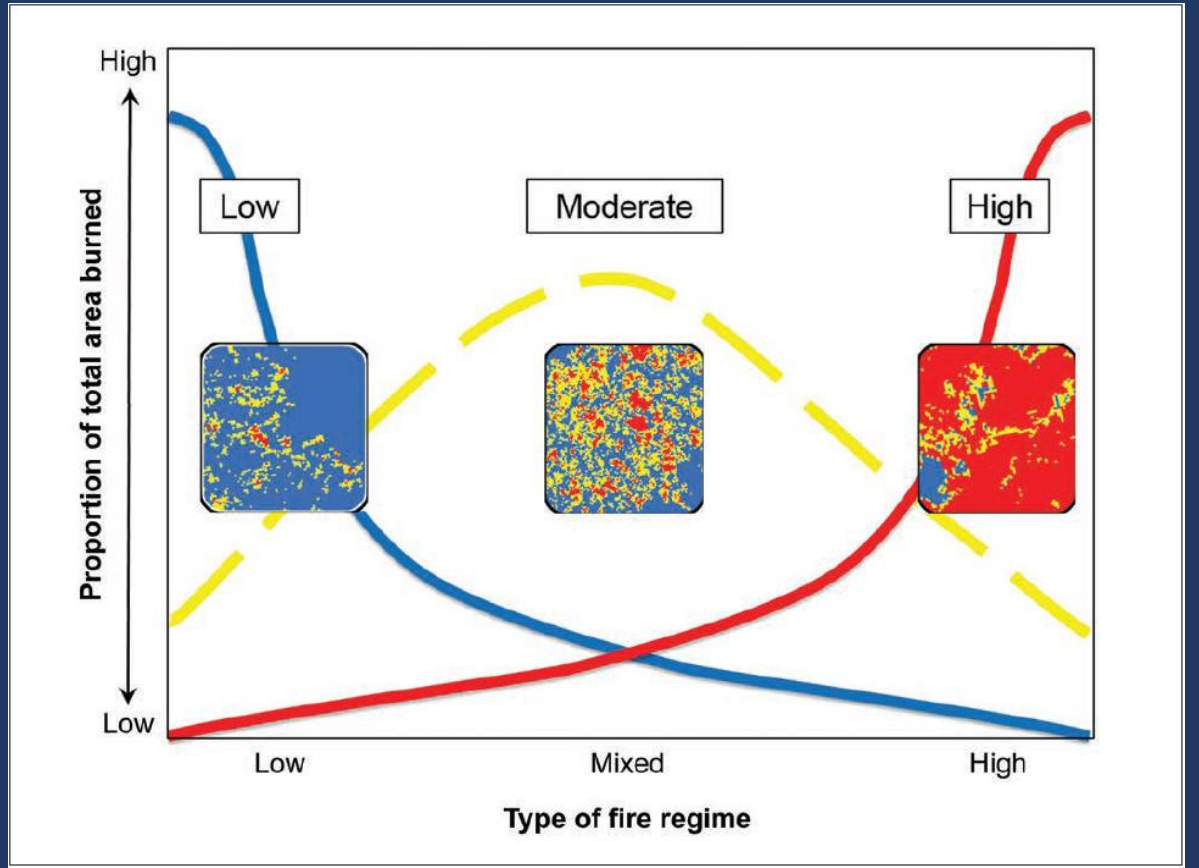


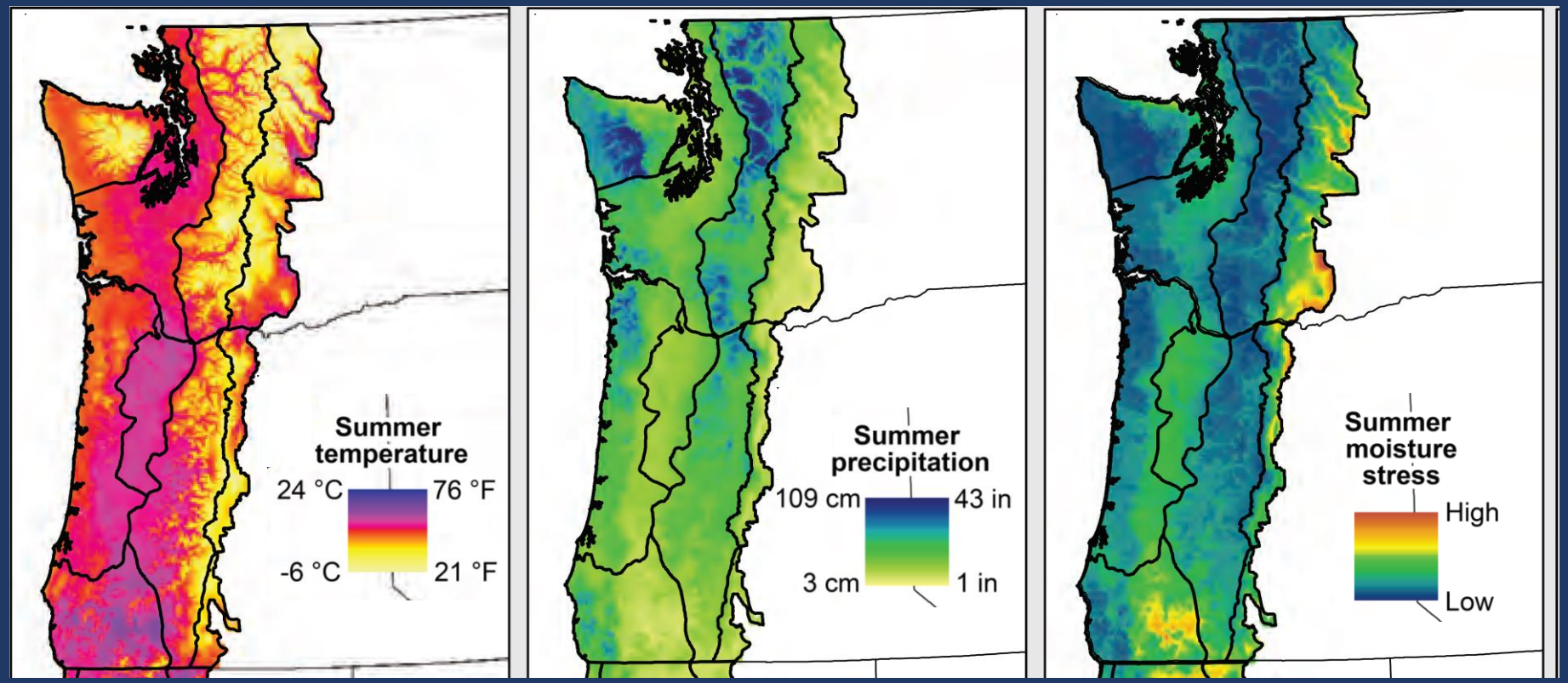
Figure 3-5—Conceptual diagram characterizing the proportions of low-, moderate-, and high-severity fires in three major fire regime classes. Inset panels represent idealized landscape dynamics associated with each regime based on proportions and size class distributions of patches at each of the three levels of severity. From Reilly et al. 2017, who modified it slightly from Agee (1993, 1998).

The Bioclimatic Setting

Summer Temperature

Summer Precipitation

Summer Drought



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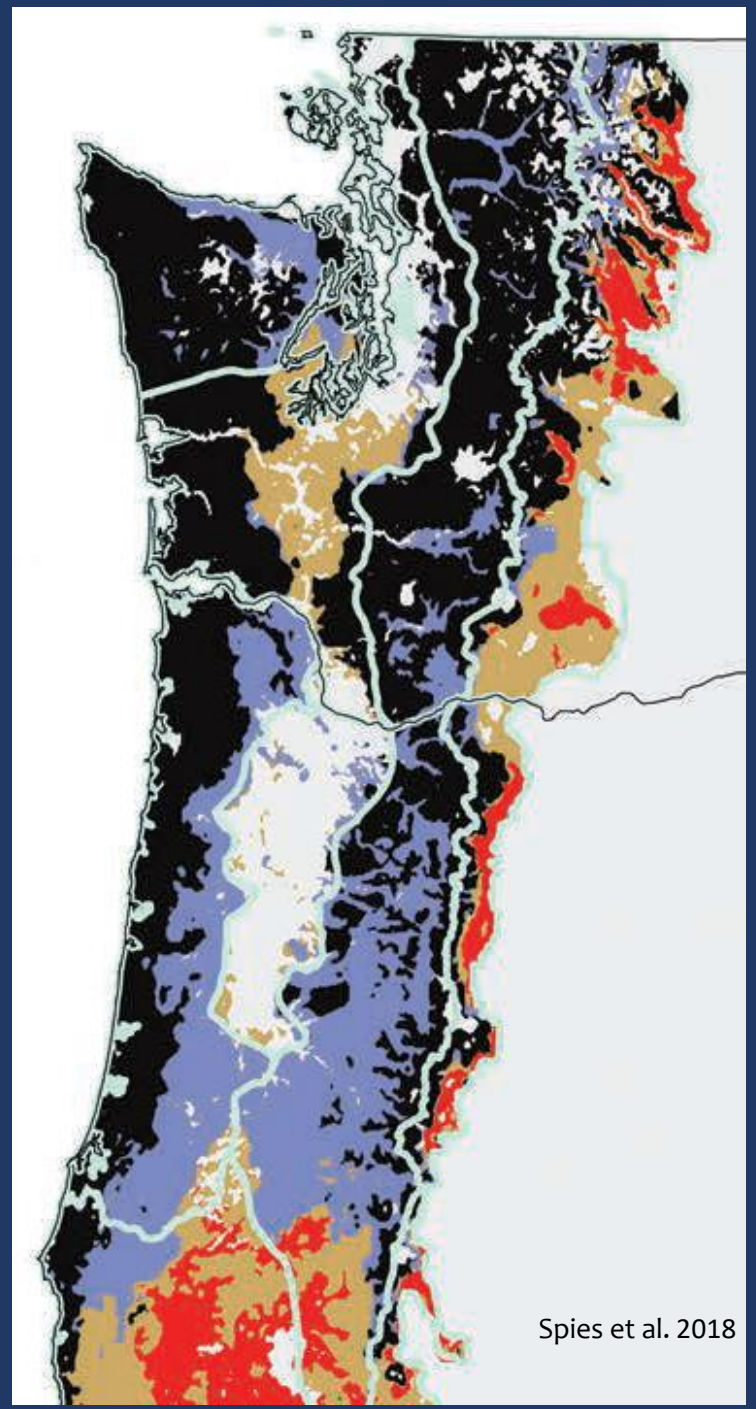

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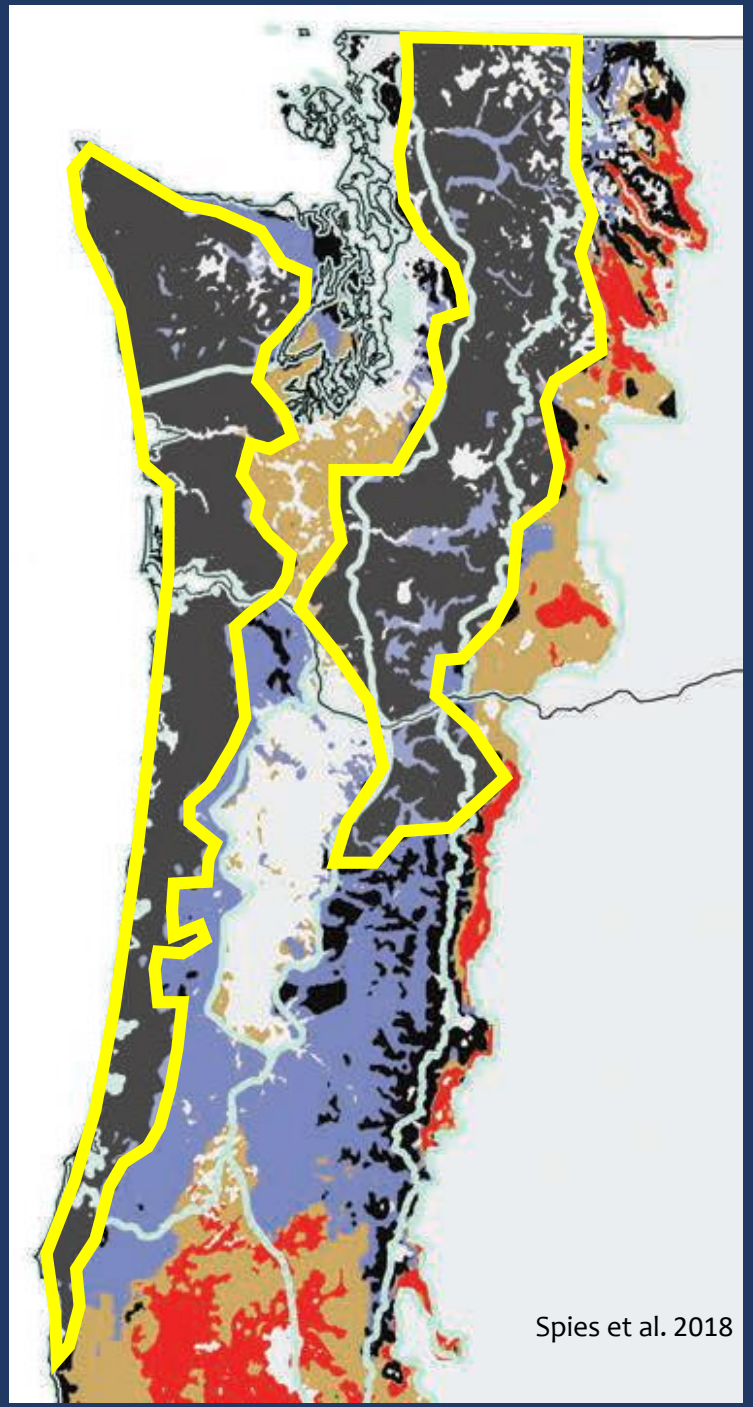

Characteristic fire (historical)

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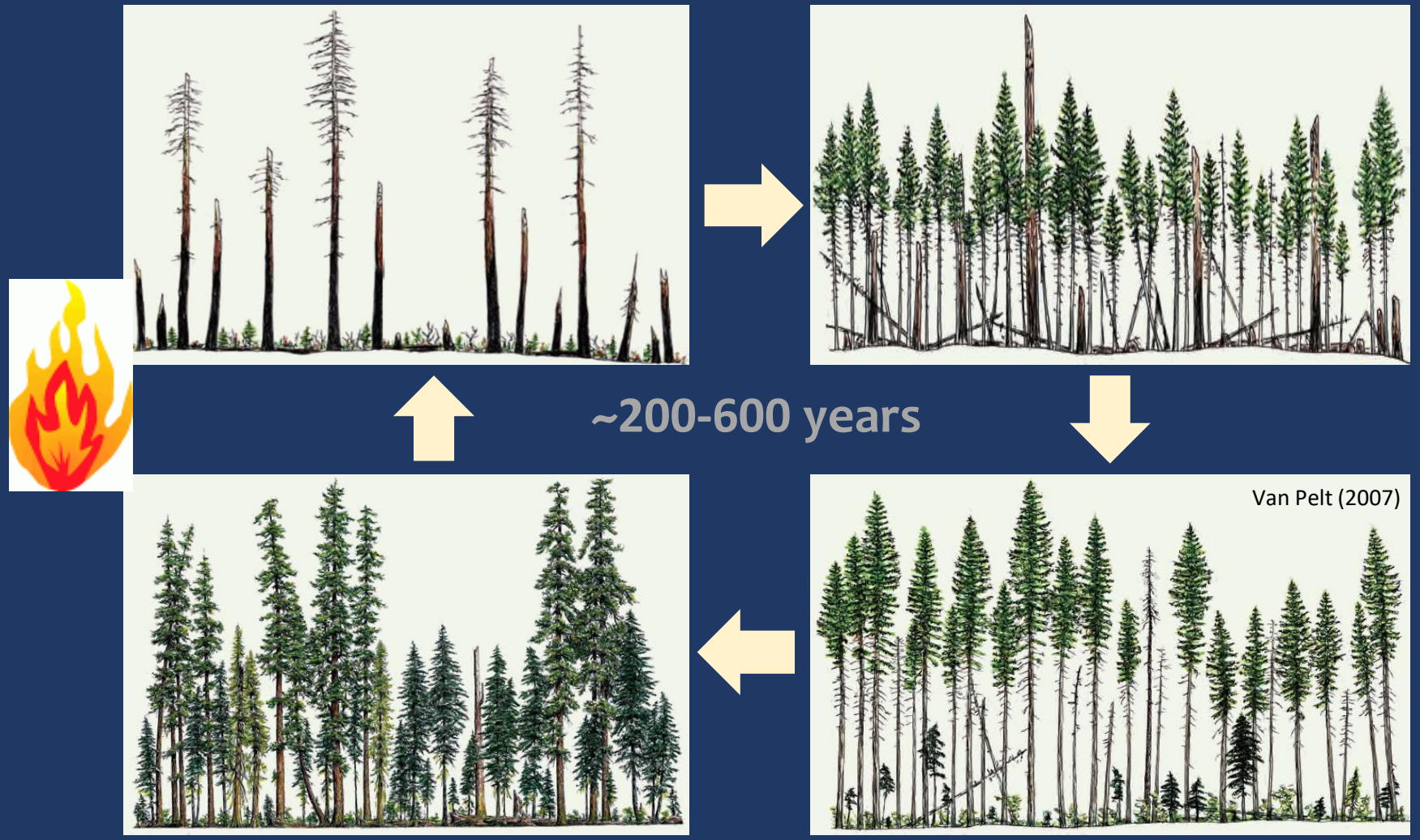
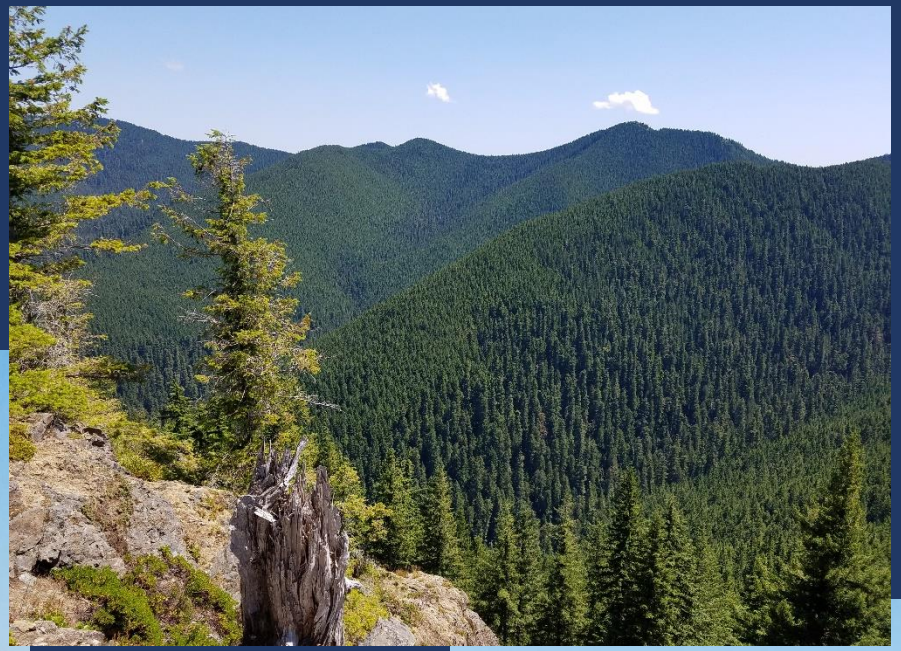
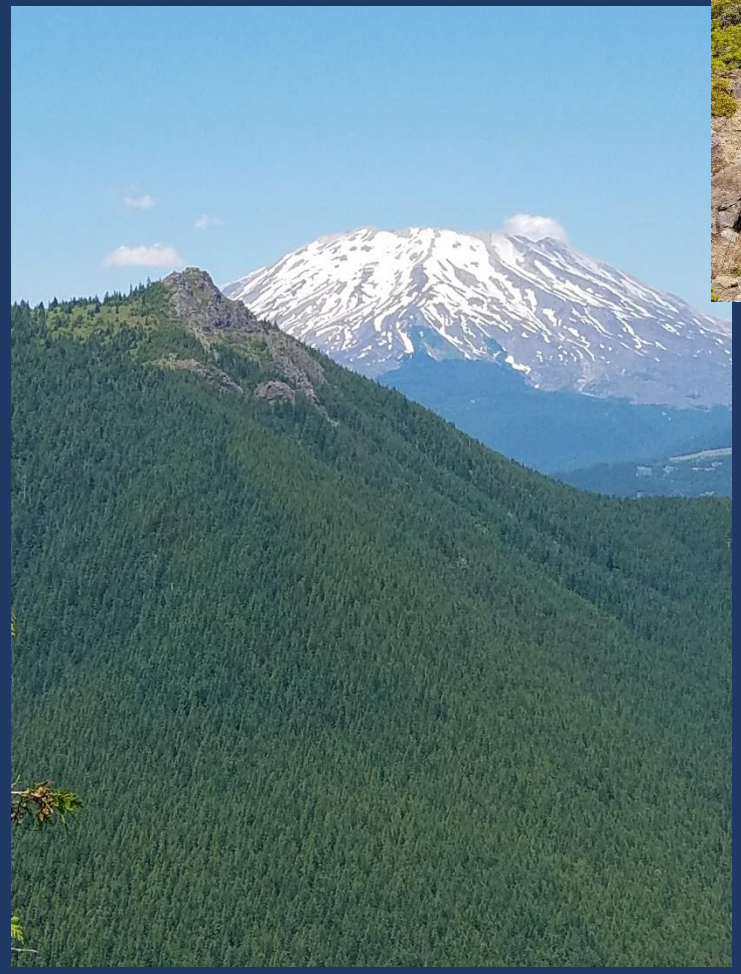
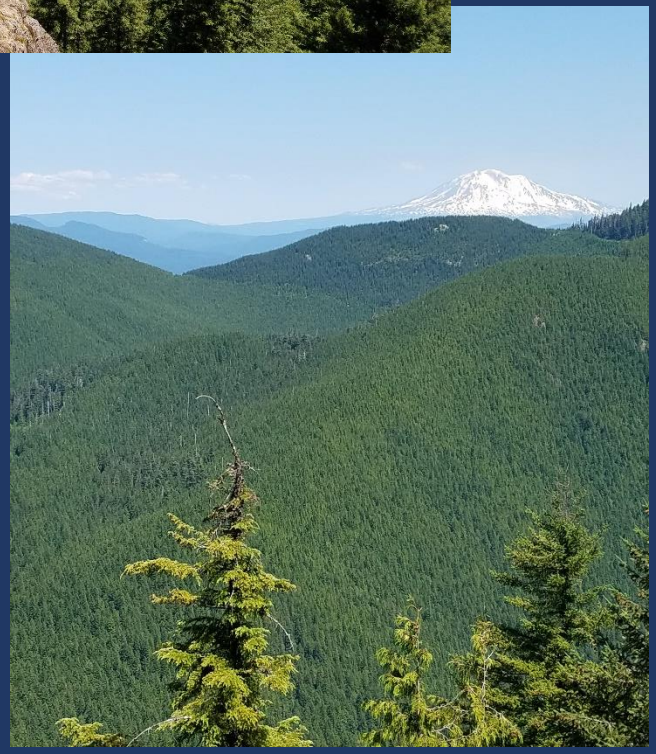
Life & times of a Doug-fir/hemlock forest









How big were the largest fire episodes?

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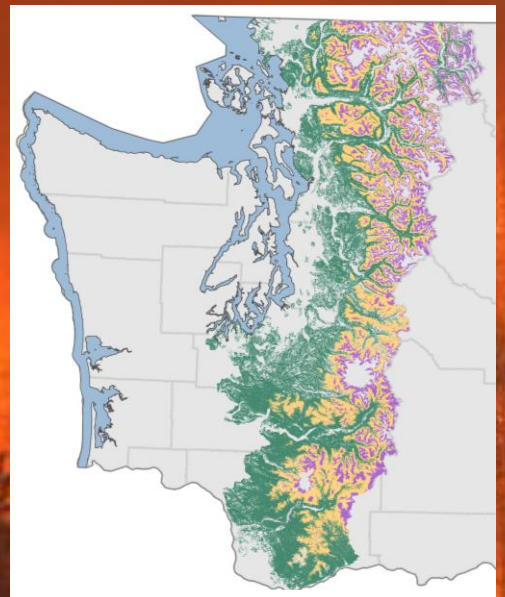
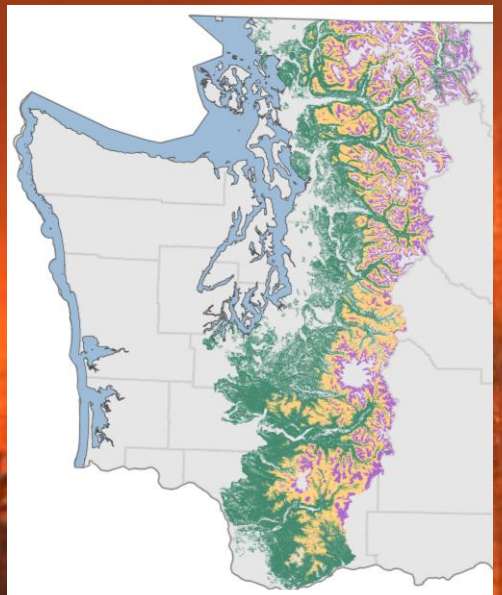


~7 million acres

How big were the largest fire episodes?

1,730,000	3,500,000	4,700,000
870,000	1,700,000	2,200,000
590,000	1,200,000	1,500,000



~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

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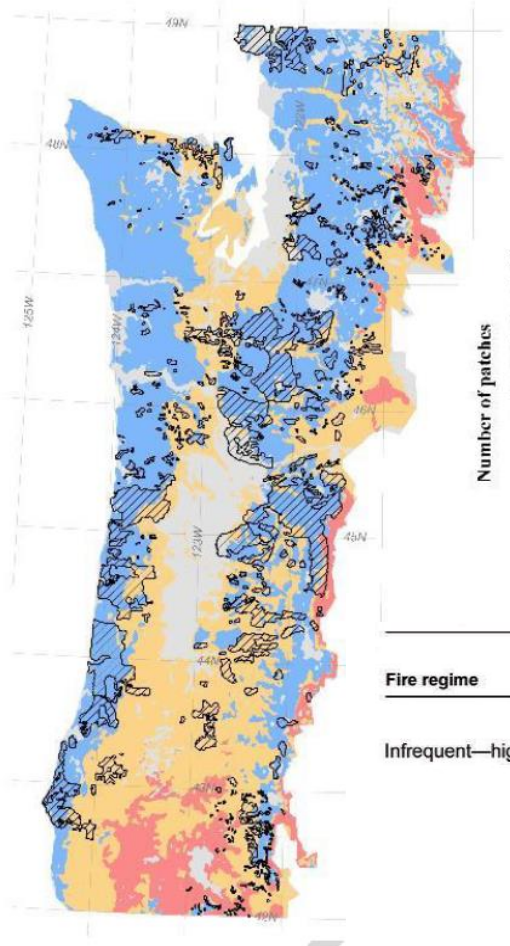
- Yacolt complex
  - → >1 million acres

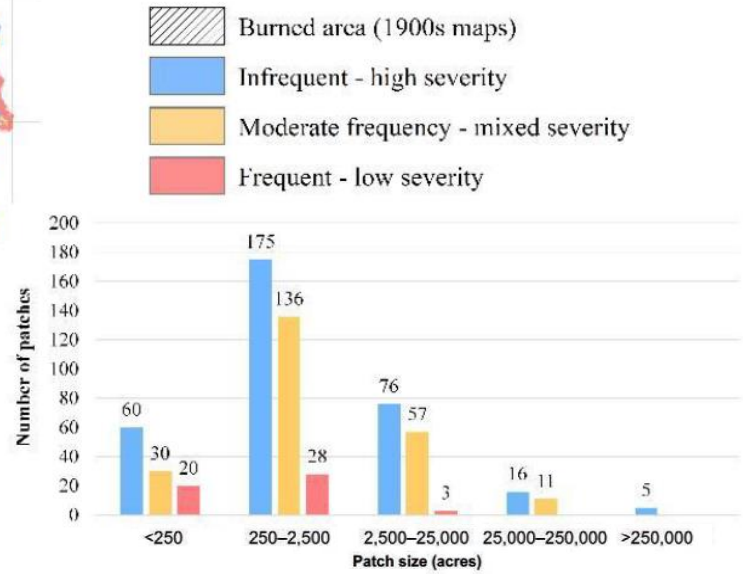
  - Natl. Int. Fire Center [nifc.gov]

- Tillamook burn
  - → 350,000 acres

  - Kemp 1960

Early land surveys

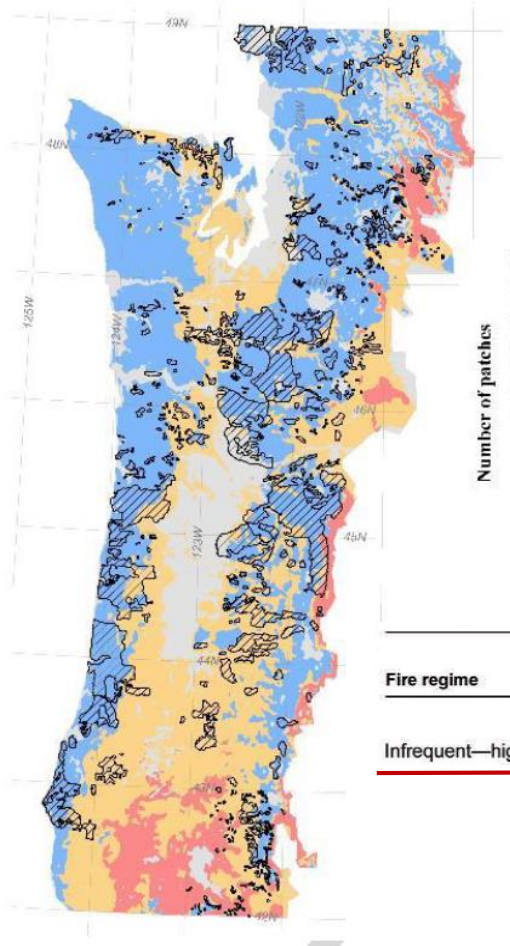


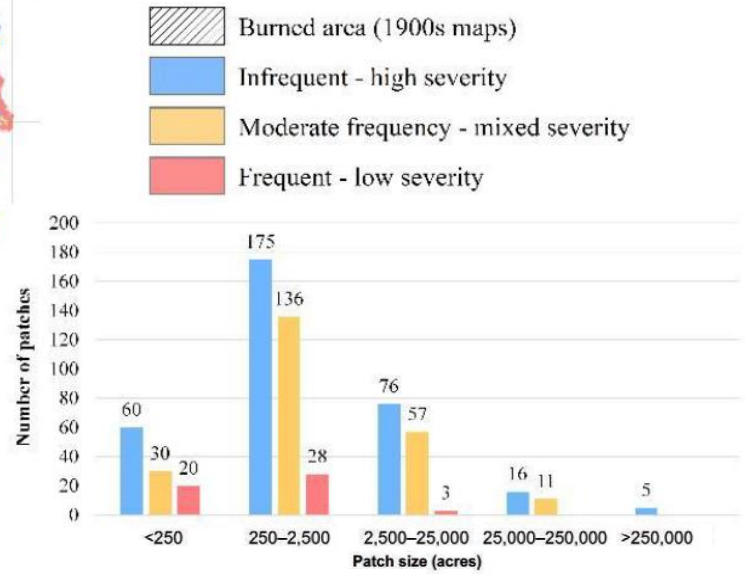


Fire regime	Number of burned patches	Median patch size	Largest patch size	Percentage of area in patches
		------ *Acres* ------		
Infrequent—high severity	331	968	1,022,700	29

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

Early land surveys





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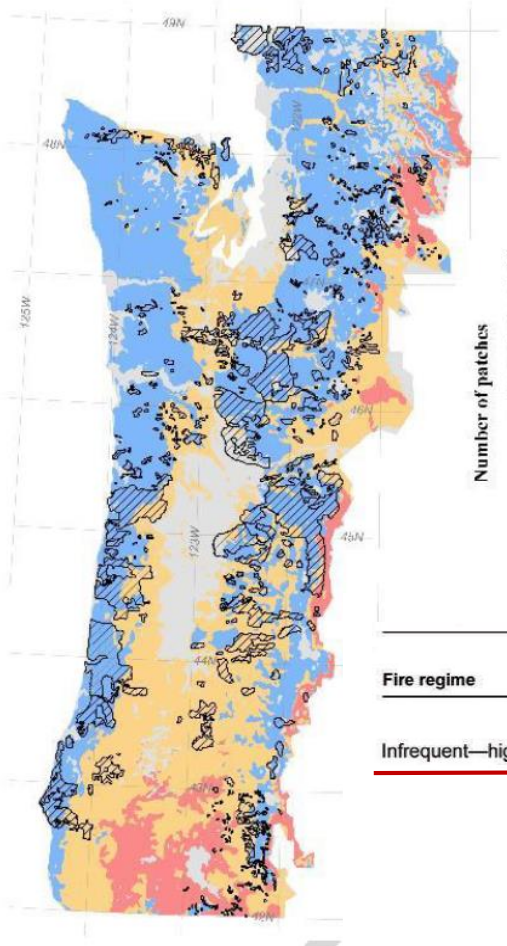

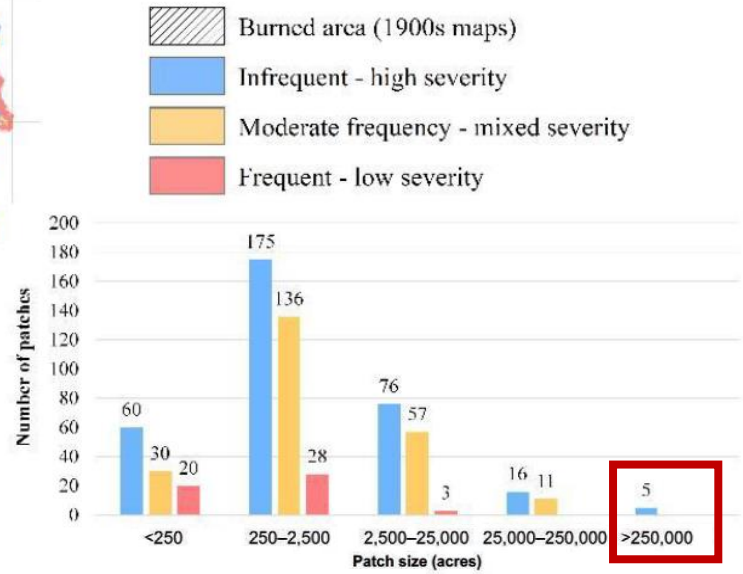

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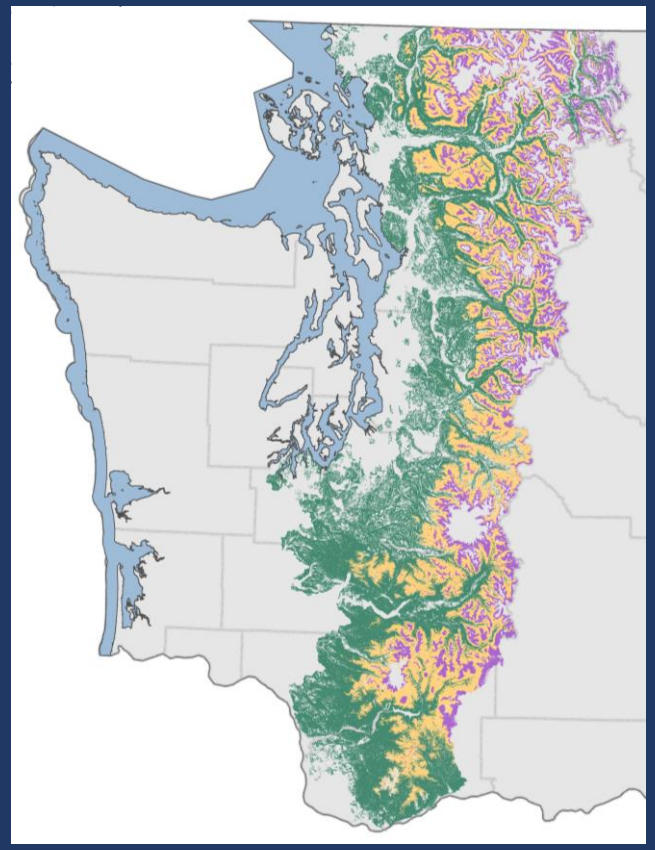
The M.O. of large westside fires



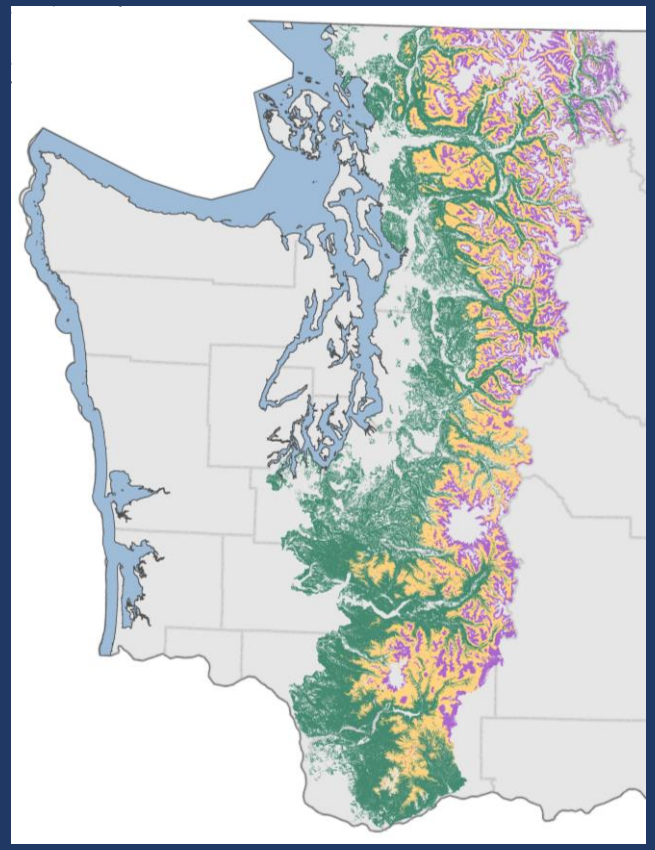
Three factors coincide:

1)

2)

3)

The M.O. of large westside fires



Three factors coincide:

1) Dry, late summer conditions

2)

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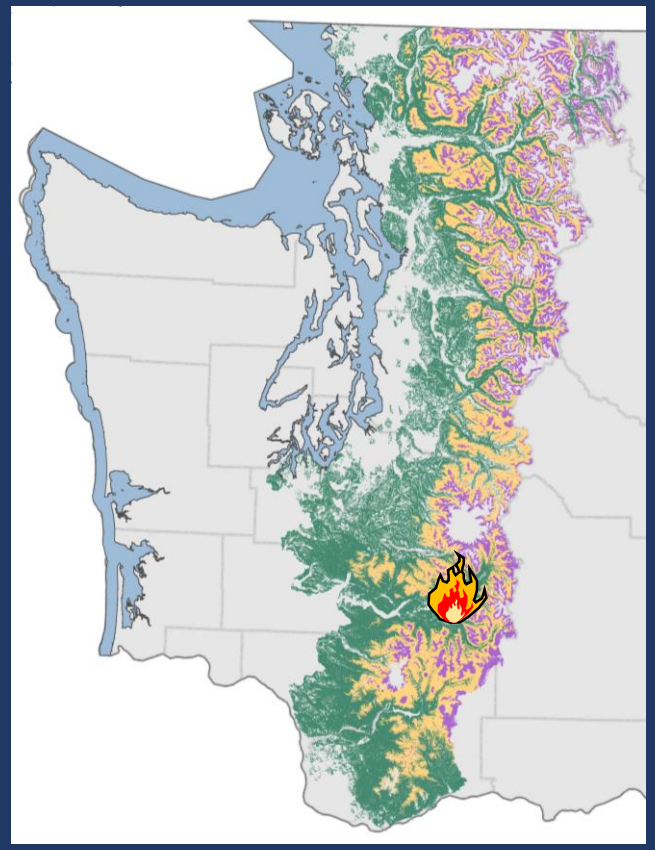
The M.O. of large westside fires



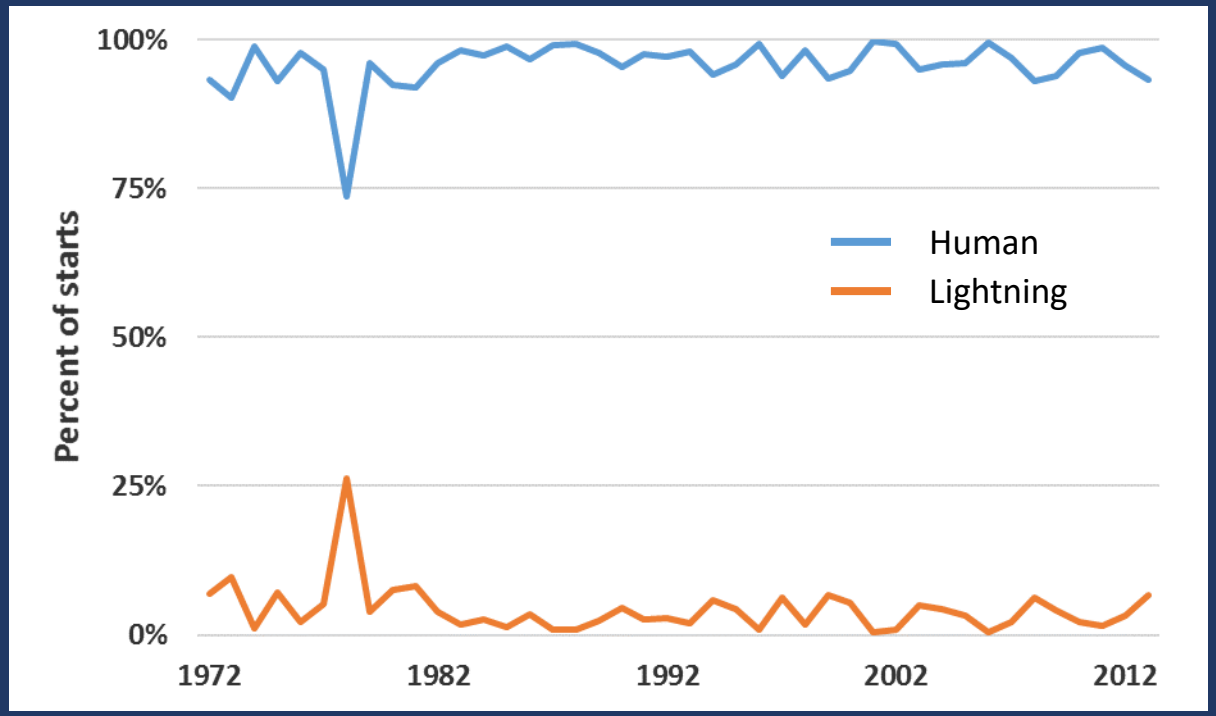
Three factors coincide:

1) Dry, late summer conditions

2) Ignition source

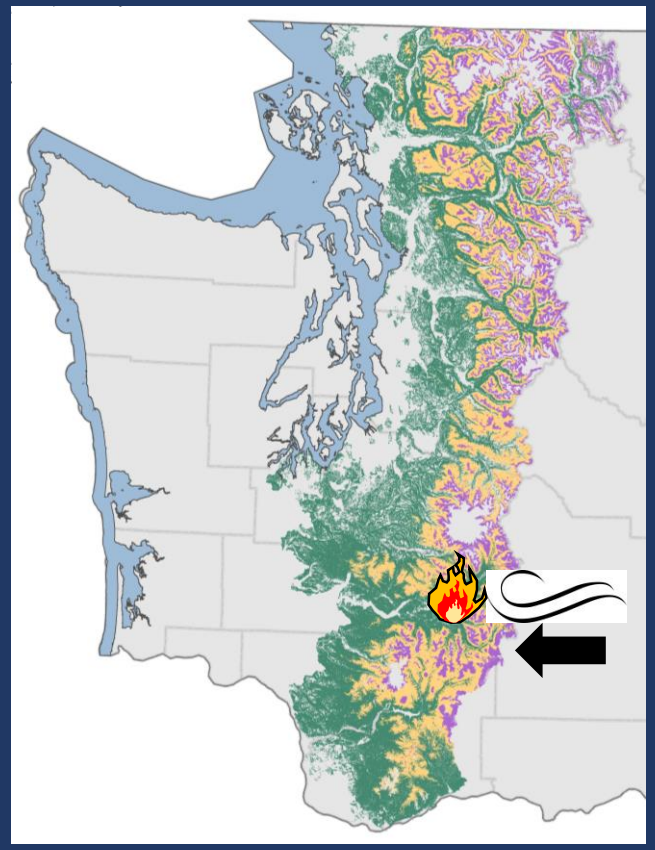
3)

Causes of western Washington fires



-DNR Wildfire Division

The M.O. of large westside fires



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3) Synoptic east wind event

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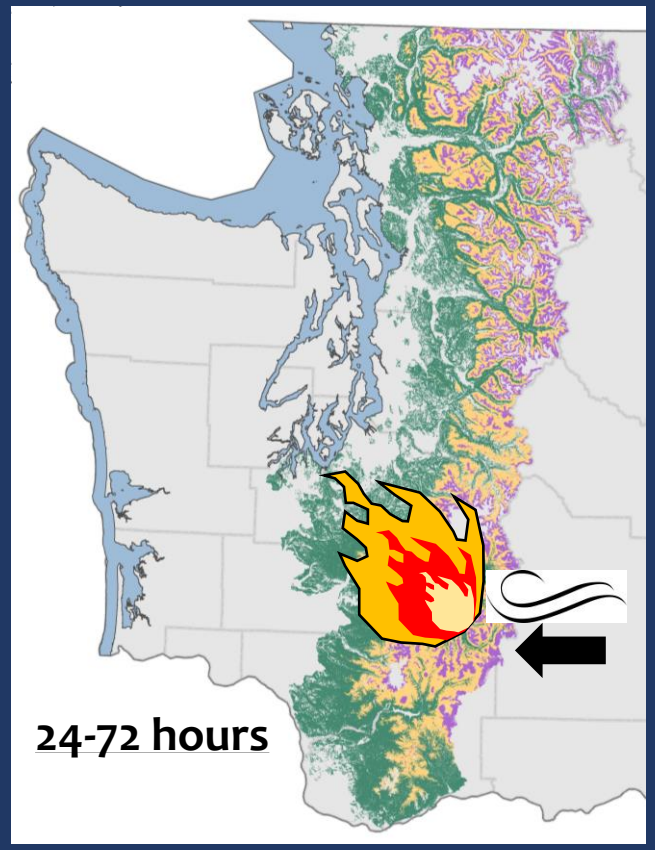

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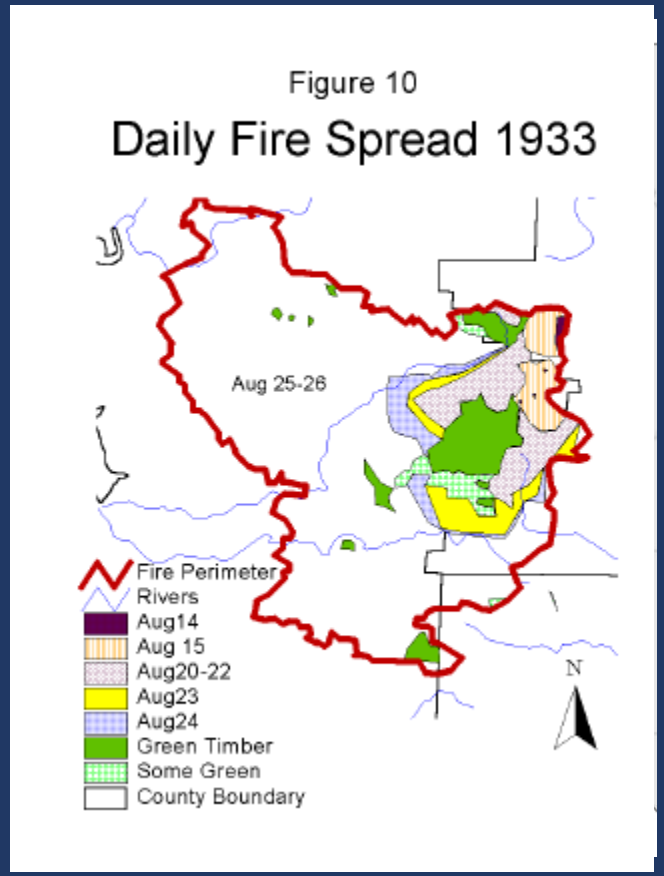

Three factors coincide:

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Tillamook Burn:	**200,000 acres in 24 hrs**
Yacolt Complex:	**30 miles in 36 hrs**


Camp Fire
Paradise
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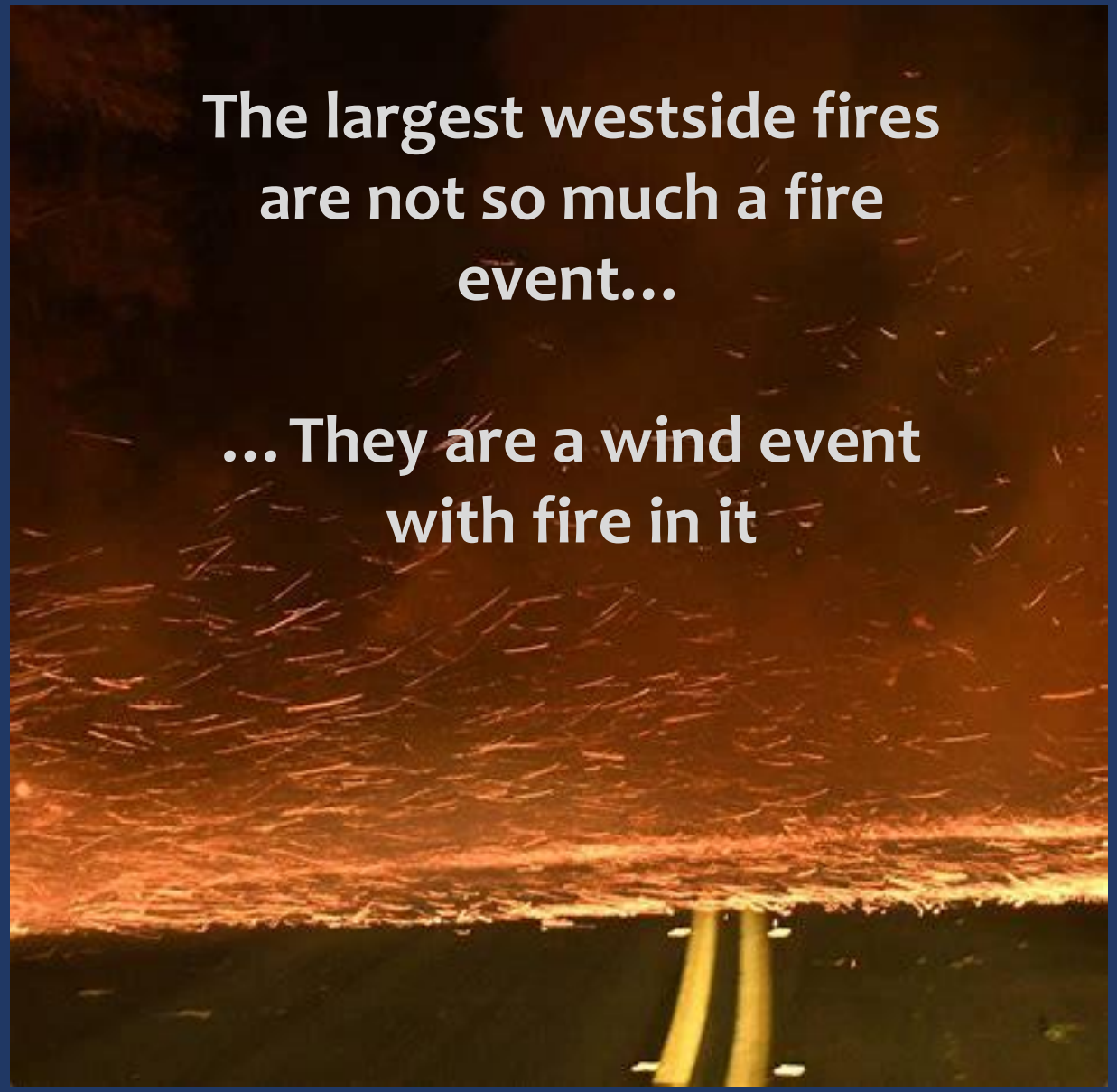
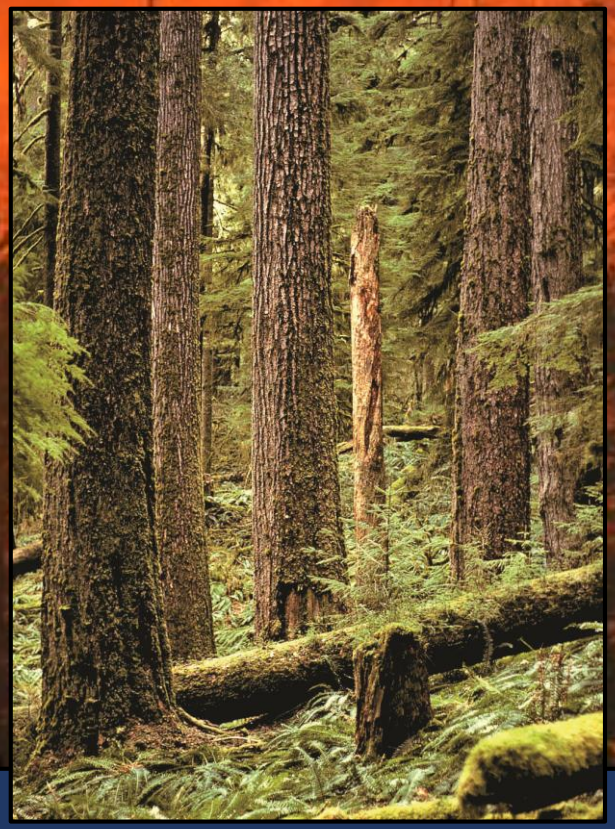
100 km

The M.O. of large westside fires

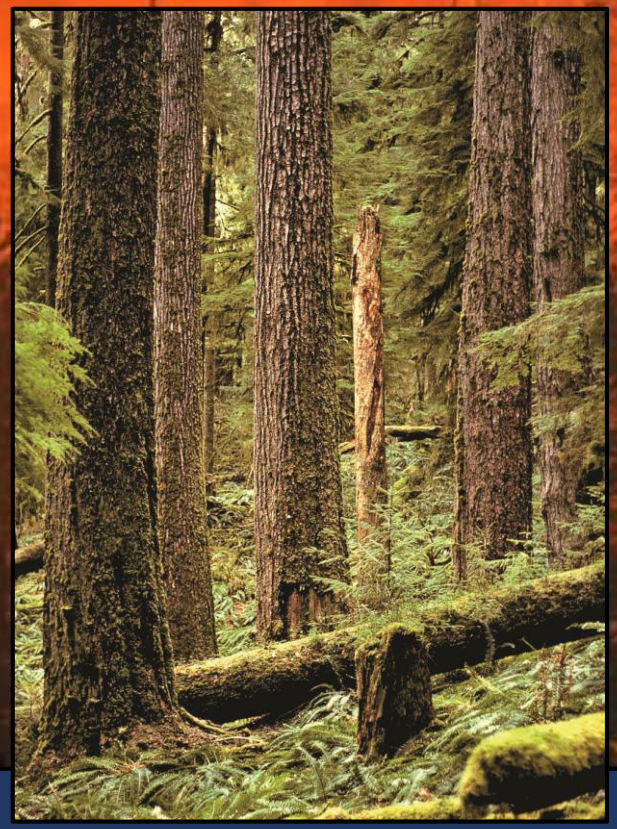


- Not just a historic thing
- Not just climate change
- Not forest mis-management



- Not just a historic thing
- Not just climate change
- Not forest mis-management

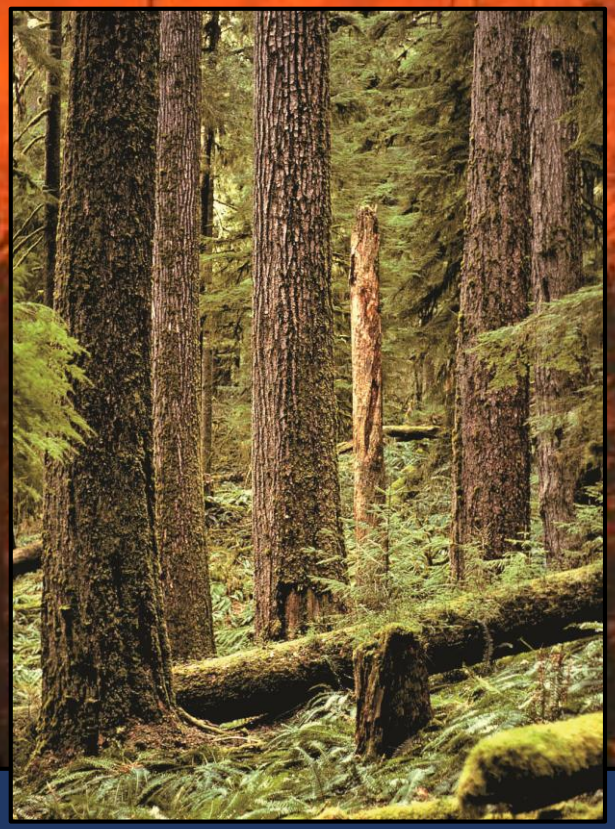
- Big events are part of the system
- Built-in resilience



Some parallels: Cascadia Subduction Earthquakes

Last event: 1700

“Cascadia Subduction Fires”



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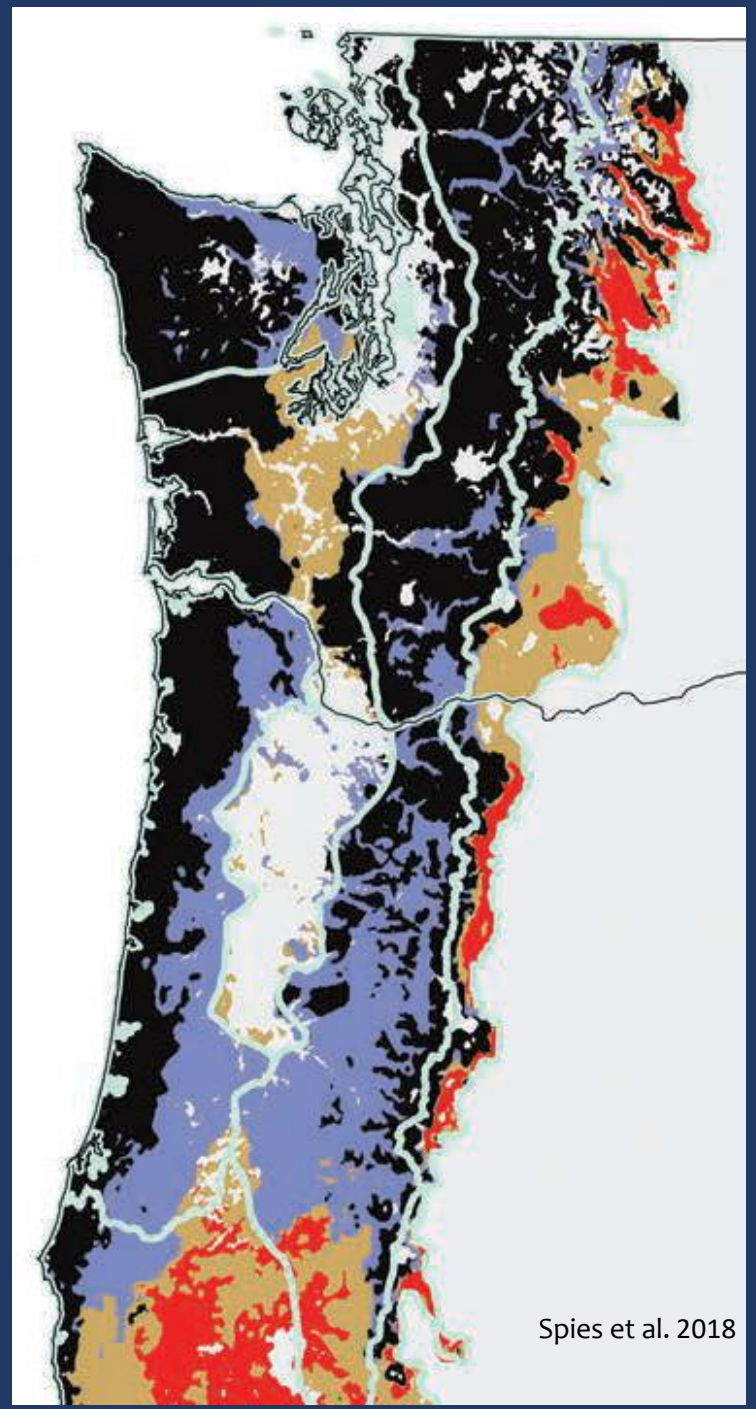

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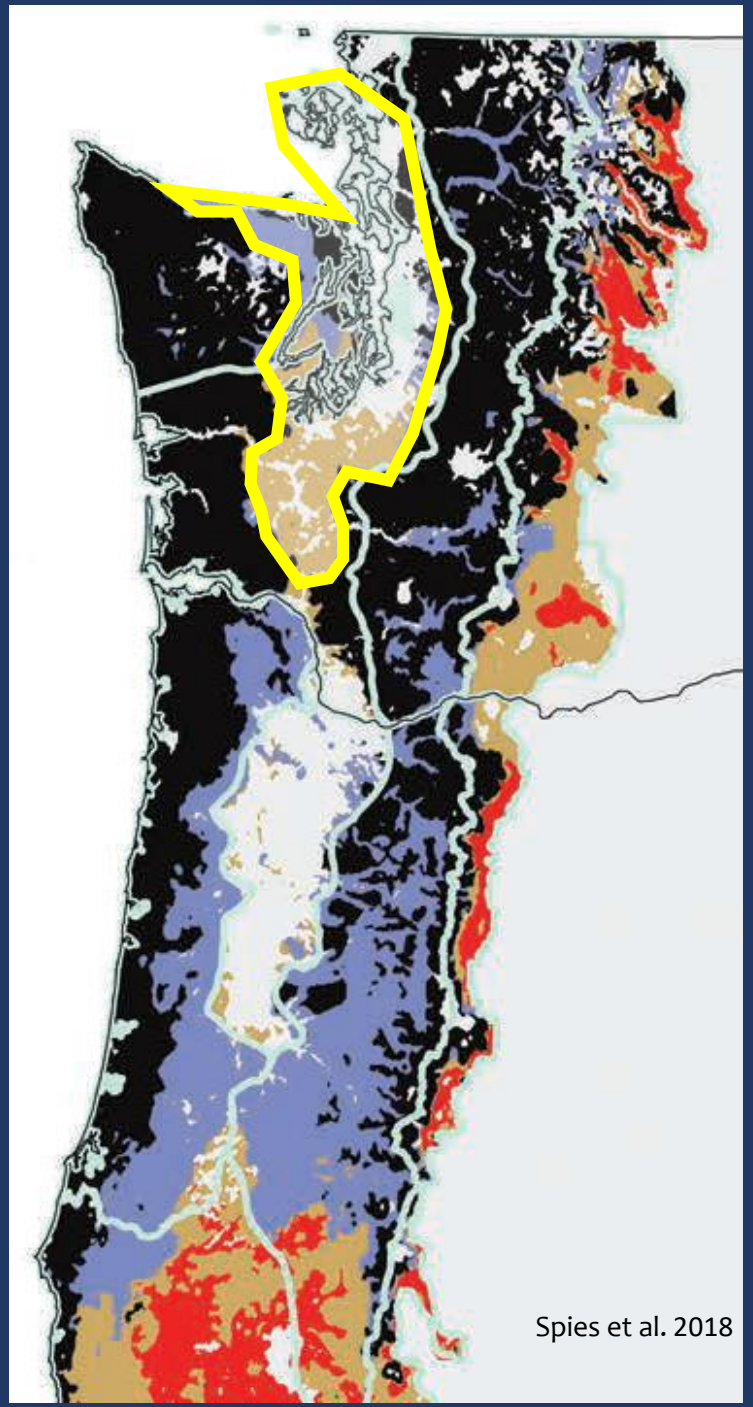

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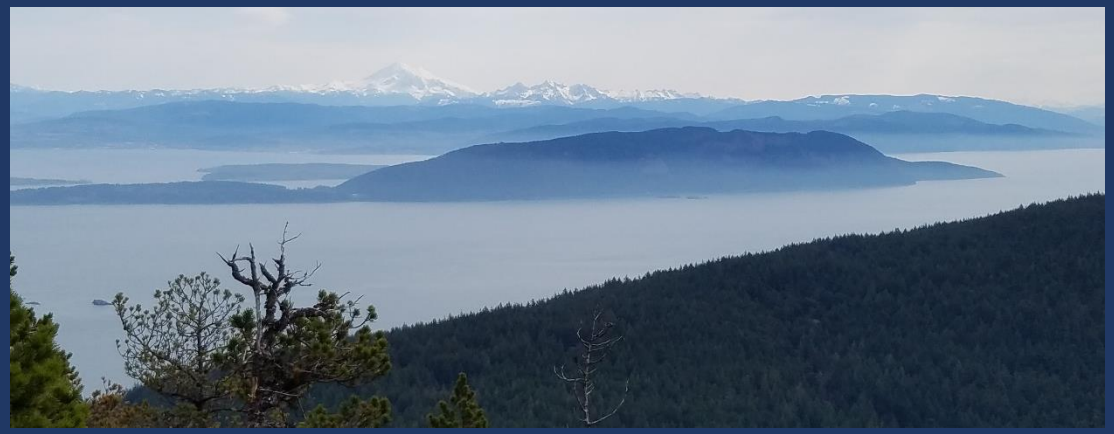
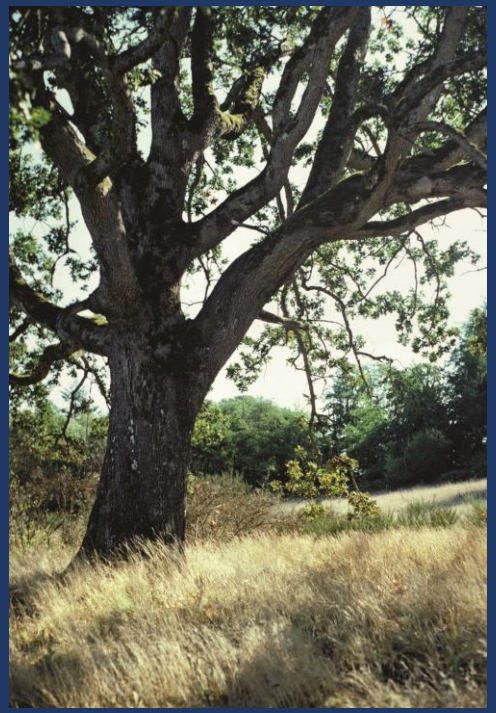
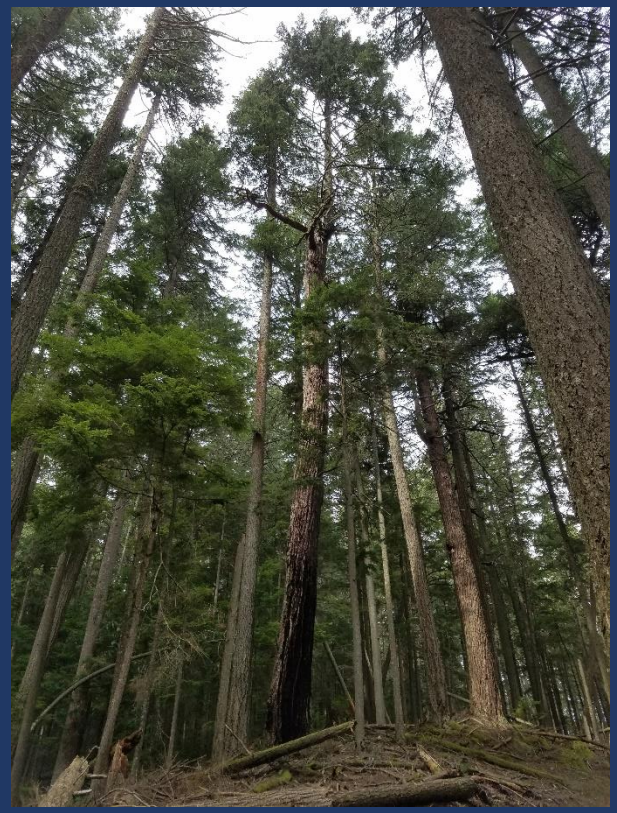
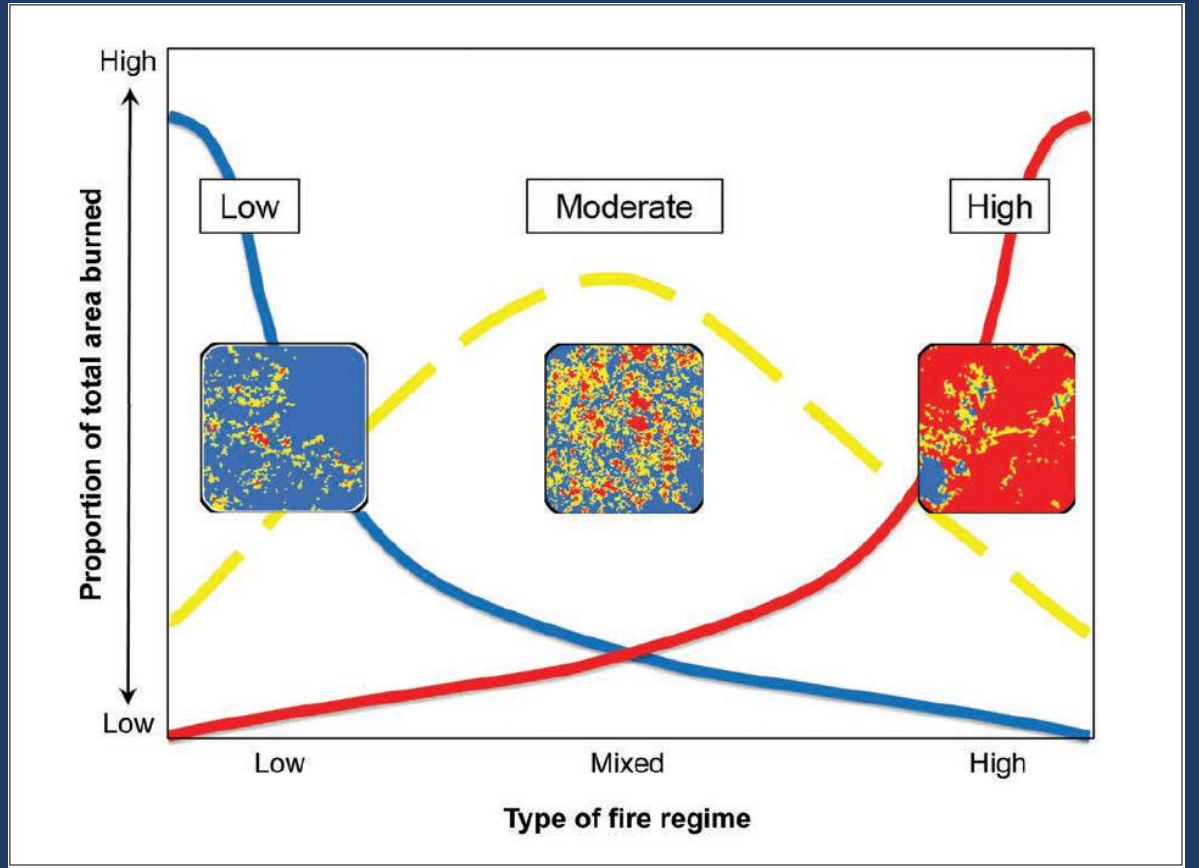
Mixed severity regimes (e.g. Puget Lowlands)







Fire Regimes



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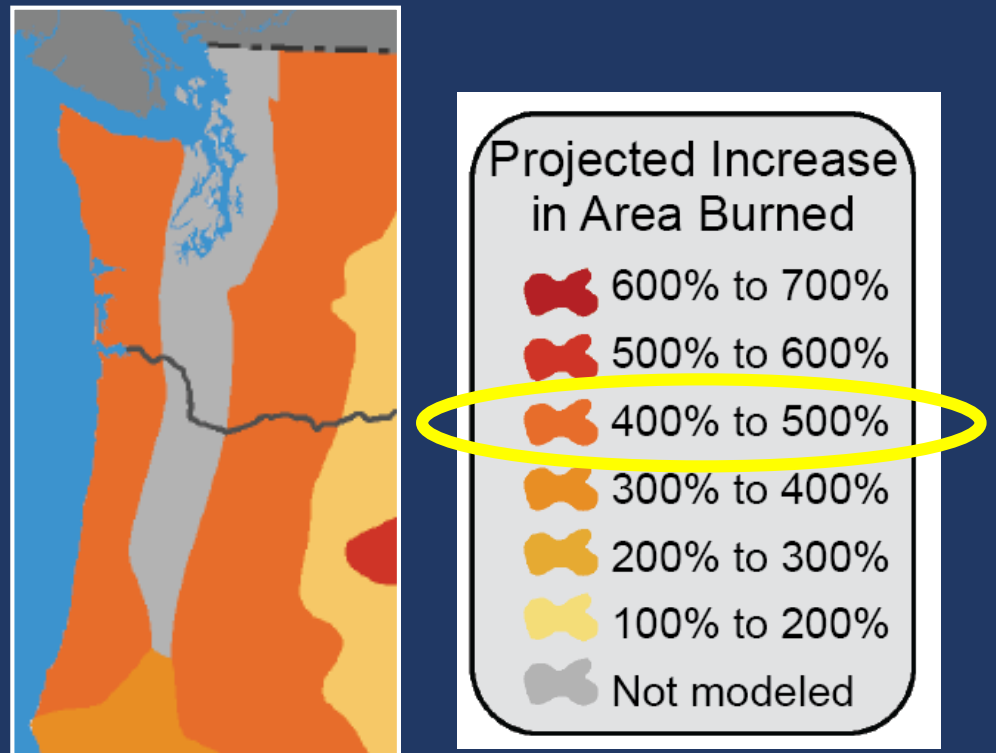
Mixed severity regimes:
Fine and Coarse Scale Mosaic

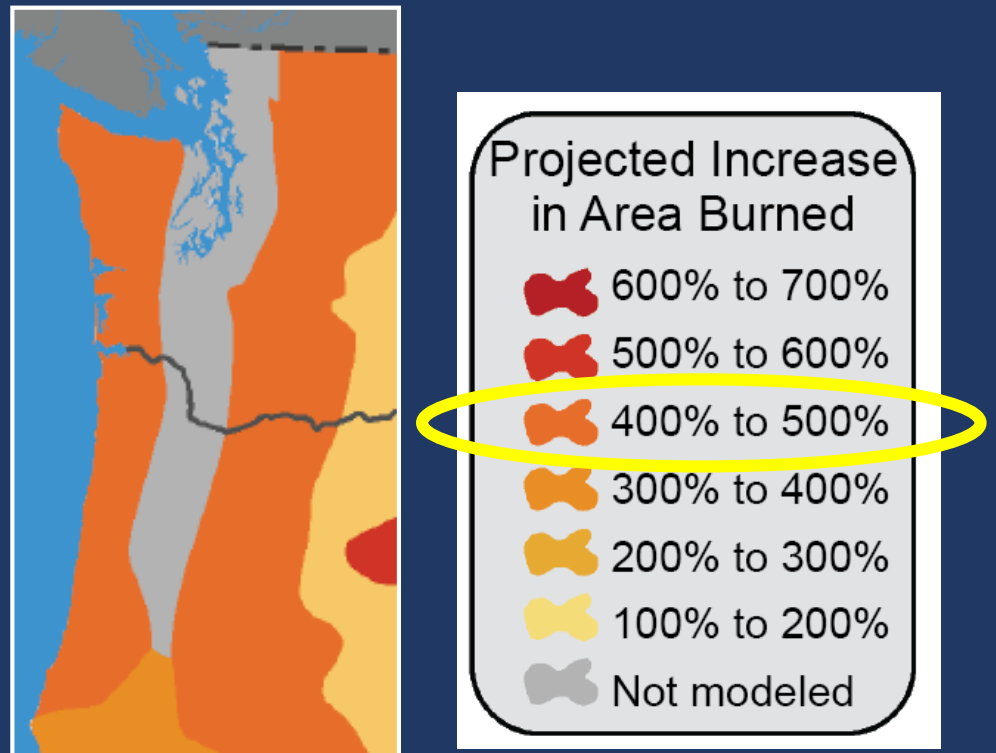
- Fuels and topography become more important
- Occasional large patches of high severity in weather-driven fires
- Small to moderate events more common
  (i.e. more manageable)
- East side principles more applicable

Climate change and westside fire



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

Climate change and westside fire



Mote et al.
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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)
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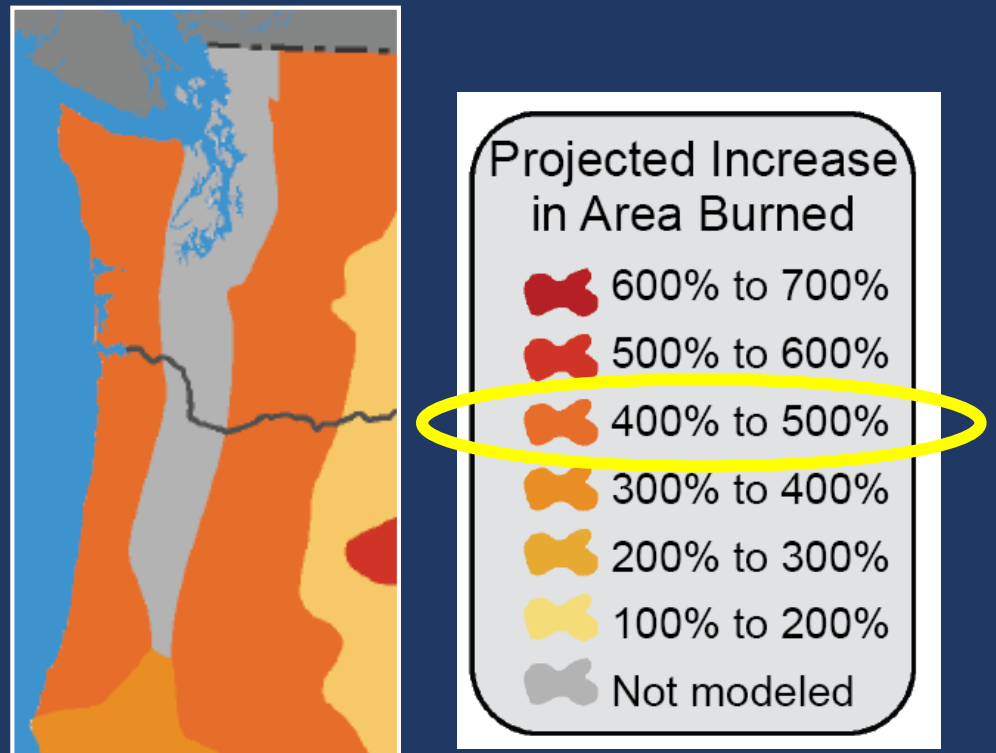
Climate change and westside fire



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Summer droughts will ↗

Ignitions will likely ↗

Major wind events will ?

So, what do we do *before* a fire?

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Pre-fire management options	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*
	✓	✘	✘
	✓	✓	?
	✓	✓	?
	✓	✓	?

So, what do we do *before* a fire?

Pre-fire management options	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*
Basic stand-level fuel reduction (thinning, surface fuels, ladder fuels)	✓	✗	✗
Promote species diversity within and across stands, include hardwoods	✓	✓	?
Promote structural diversity within and across stands when feasible	✓	✓	?
Fire-wise principles around high value resources (thinning, fuel breaks)	✓	✓	?

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	✓	✓	✓
	✓	✓	✓
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Promote structural diversity within and across stands when feasible	✓	✓	?
Fire-wise principles around high value resources (thinning, fuel breaks)	✓	✓	?
Reduce other ecosystem stressors (invasives, fragmentation)	✓	✓	✓
Coordinate with adjacent landowners on fire management plans	✓	✓	✓
Limit human ignitions	✓	✓	✓
Aggressive wildfire detection	✓	✓	✓
Develop post-fire response strategies	✓	✓	✓

So, what do we do *during* a fire?

During a fire	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*

So, what do we do *during* a fire?

During a fire	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*
Aggressive suppression of wildfires while event is still small	?	✓	✓
Permit wildfire when risk to other values is low	✓	?	✗

So, what do we do *after* a fire?

Post-fire management options	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*

So, what do we do *after* a fire?

Post-fire management options	Puget Lowlands (mixed severity)	West Cascades (high severity)	
		Small fire events	*Large fire events*
Assess fire impacts relative to management objectives (can be + or -)	✓	✓	✓
Leverage natural regeneration - inexpensive, diverse, can't replant everywhere	✓	✓	✓
Planting: promote species diversity within and across stands, consider hardwoods	✓	✓	✓
Promote structural diversity within and across stands when feasible	✓	✓	✓
Coordinate post-fire activities with adjacent landowners	✓	✓	✓
Use events as learning opportunities (research, monitoring, trials, adaptive mgt.)	✓	✓	✓


Thanks!
D&M; oregonhikers.org

Large fires couldn’t happen today, right?

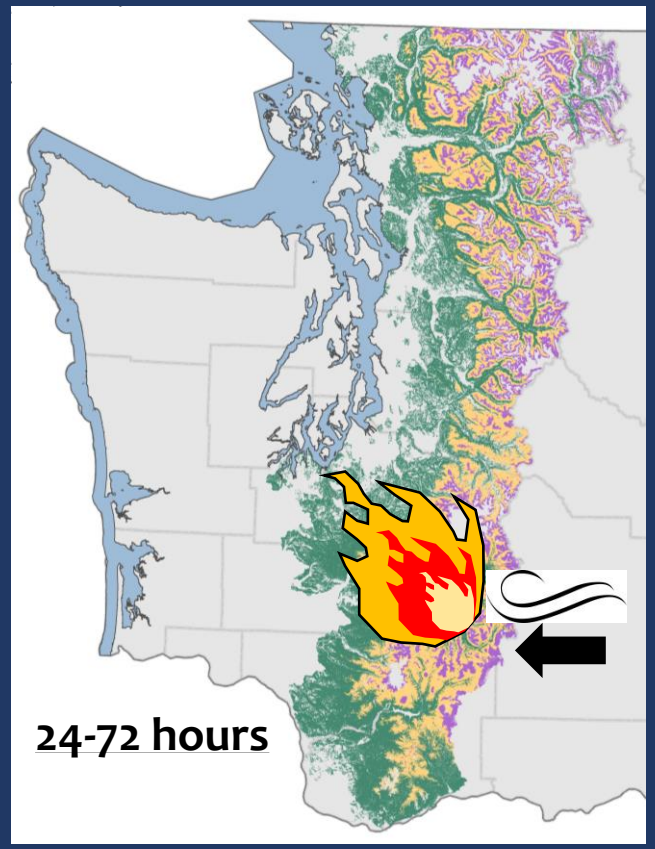
Fire suppression?

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?

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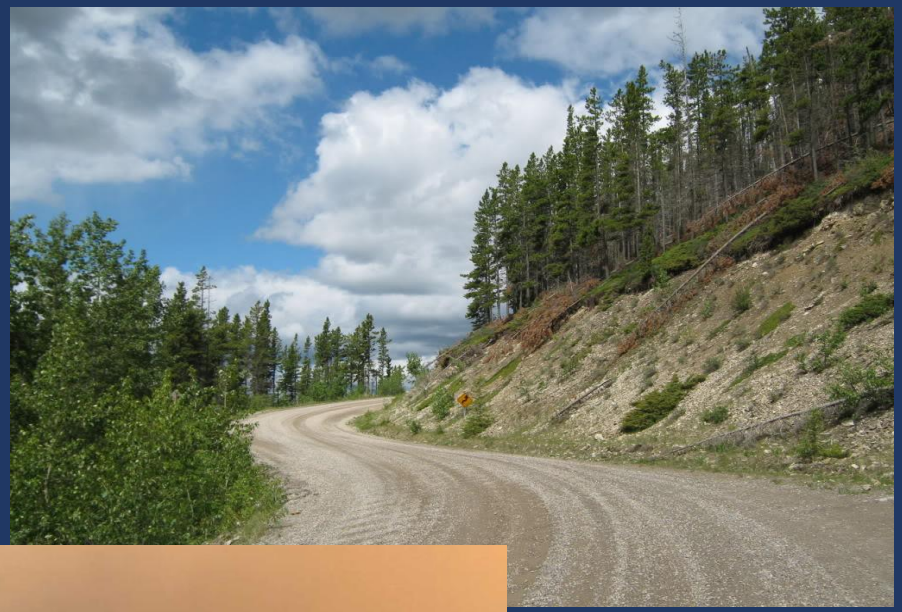


Large fires couldn't happen today, right?

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

Modern infrastructure? → Largest events burn through

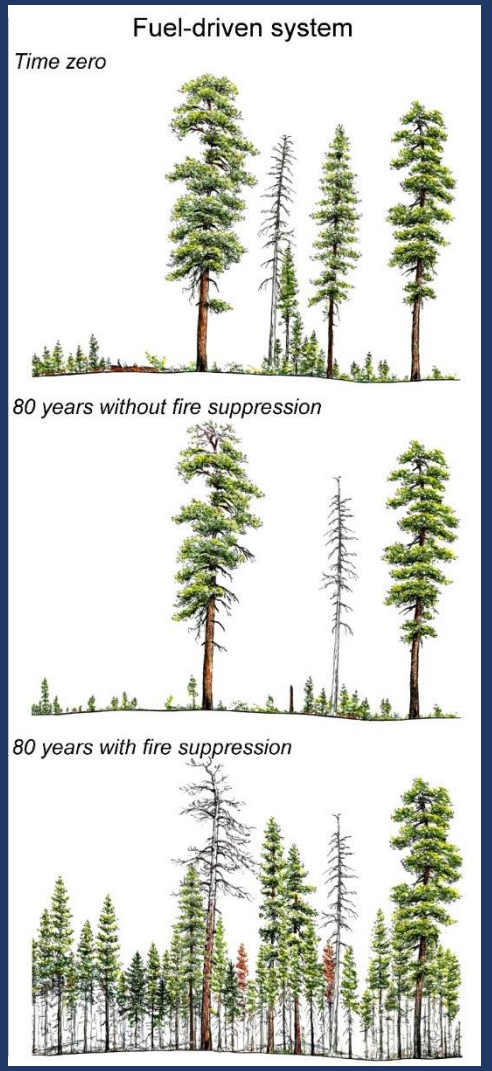
Fuels management?

Large fires couldn't happen today, right?

Fire suppression?

Modern infrastructure?

Fuels management?

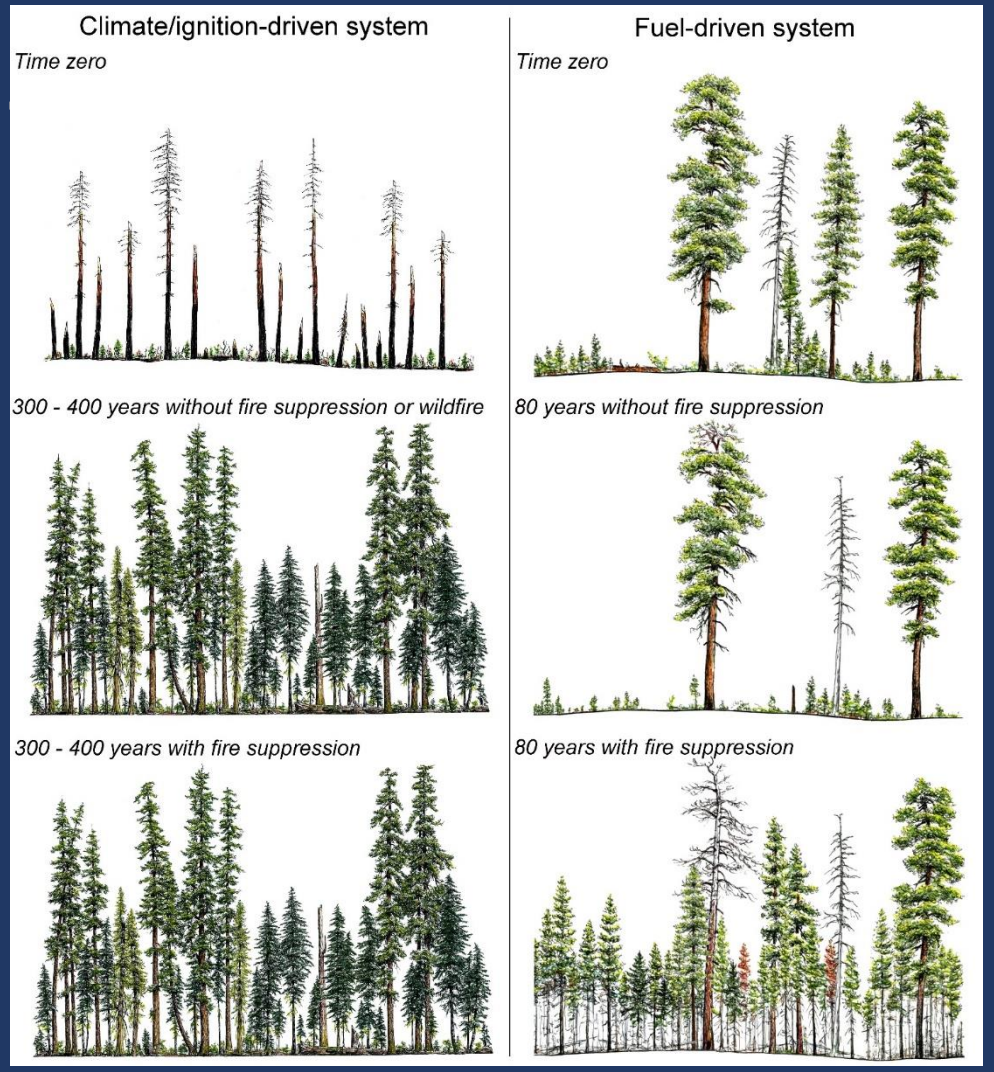


Large fires couldn't happen today, right?

Fire suppression?

Modern infrastructure?

Fuels management?



Not a fuel-limited system

Large fires couldn't happen today, right?

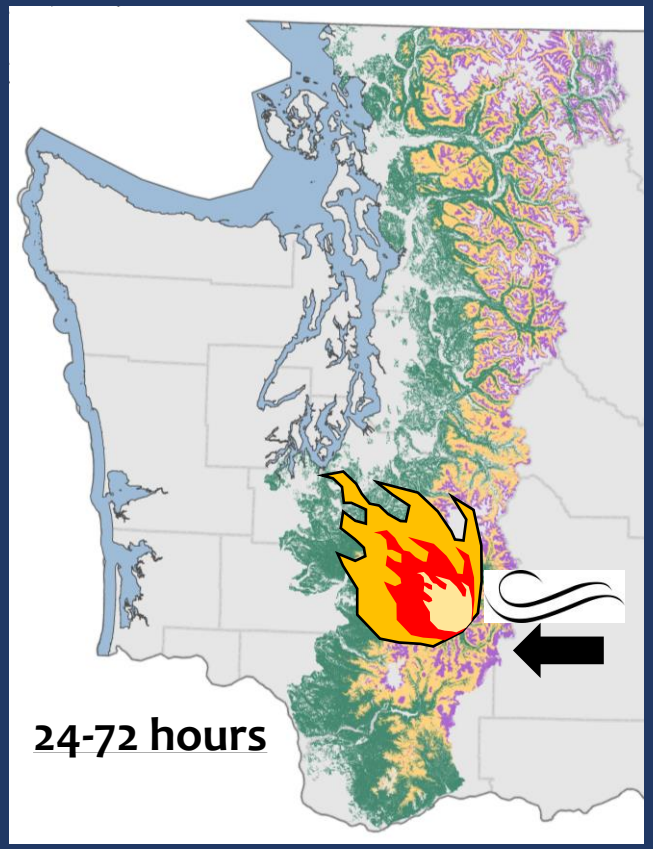
Fire suppression? → During wind event, a non-factor

Modern infrastructure? → Largest events burn through

Fuels management? → Less relevant on west side

The future: Climate change

The future: Climate change



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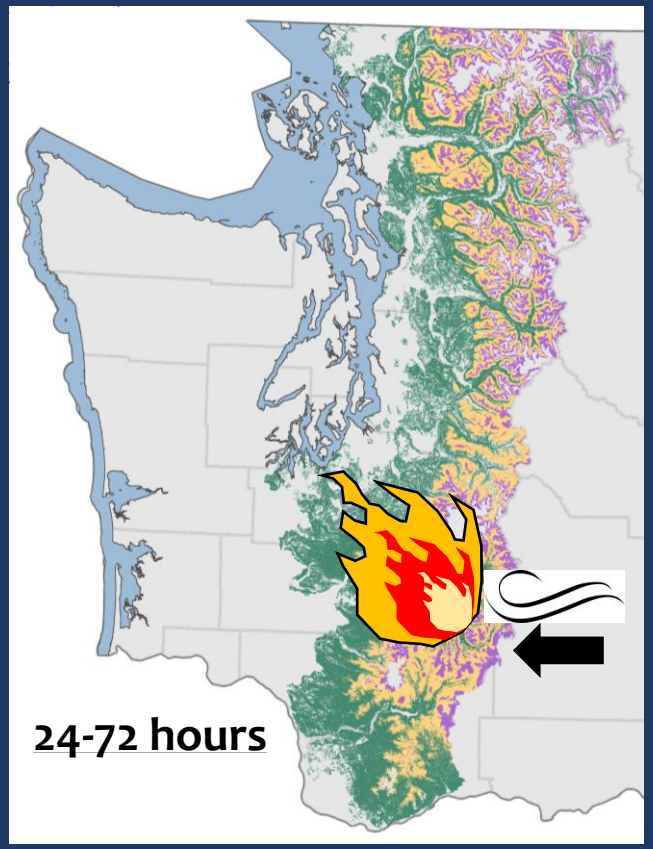
The future: Climate change



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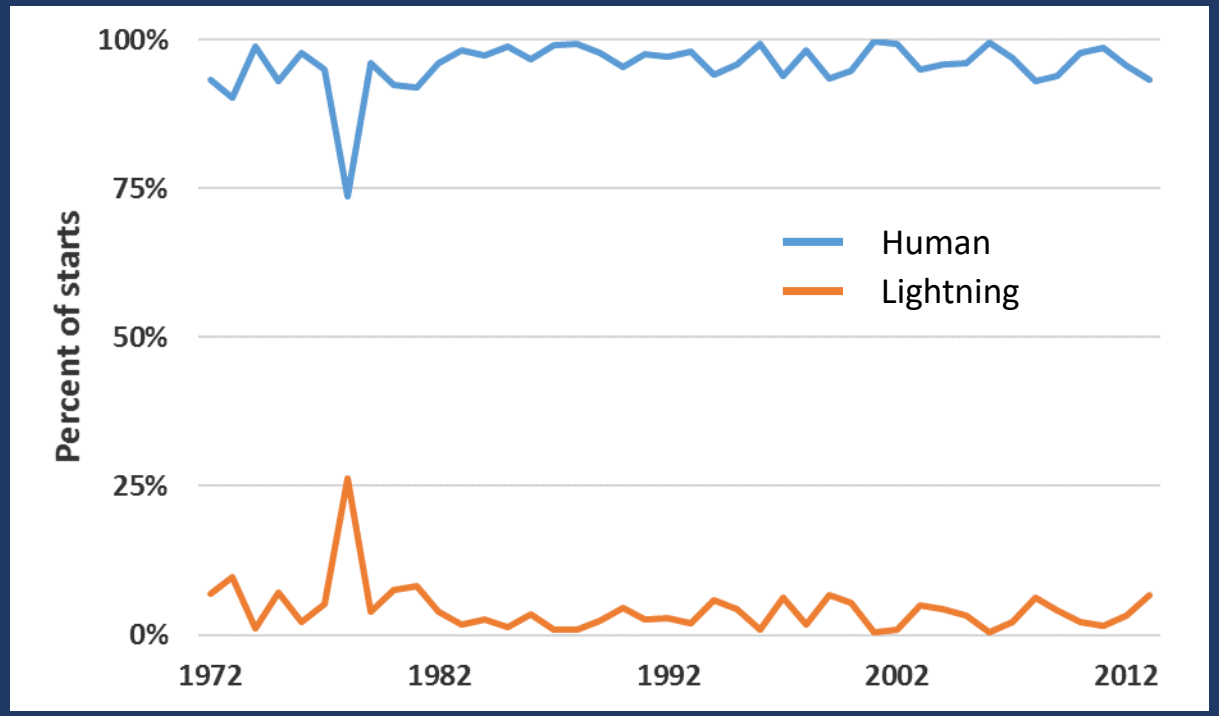
Causes of western Washington fires

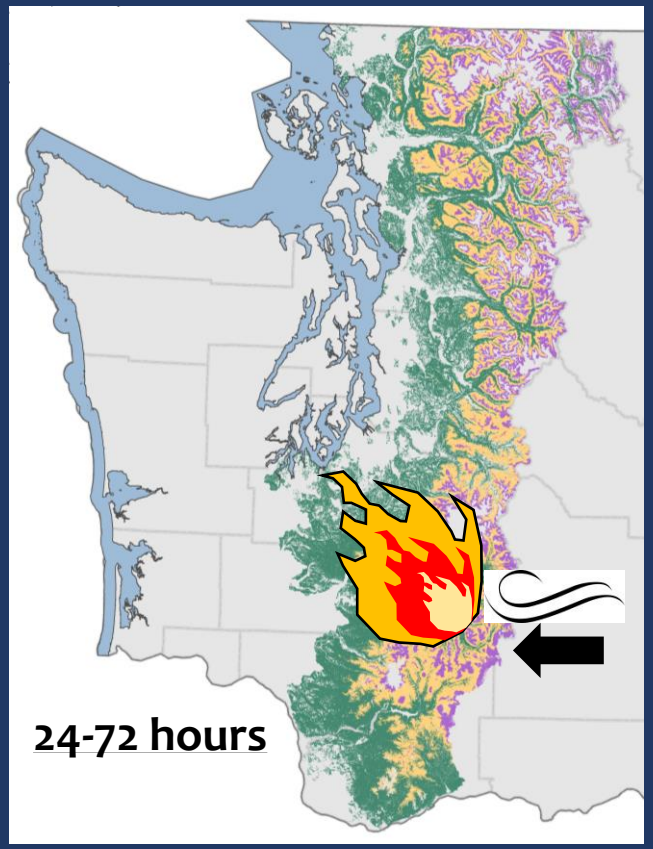


Population increase of ~2.5 million between 2010-2040 across Washington

-WA State Office of Financial Management, 2017

-DNR Wildfire Division

The future: Climate change



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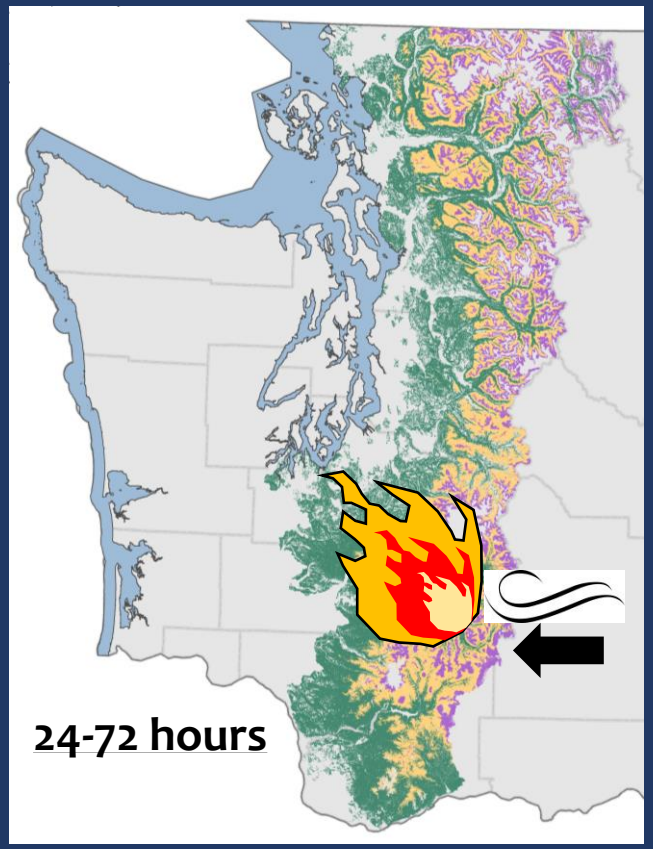

Three factors coincide:

1) Dry, late summer conditions ↑

2) Ignition source ↑

3) Synoptic east wind event ?