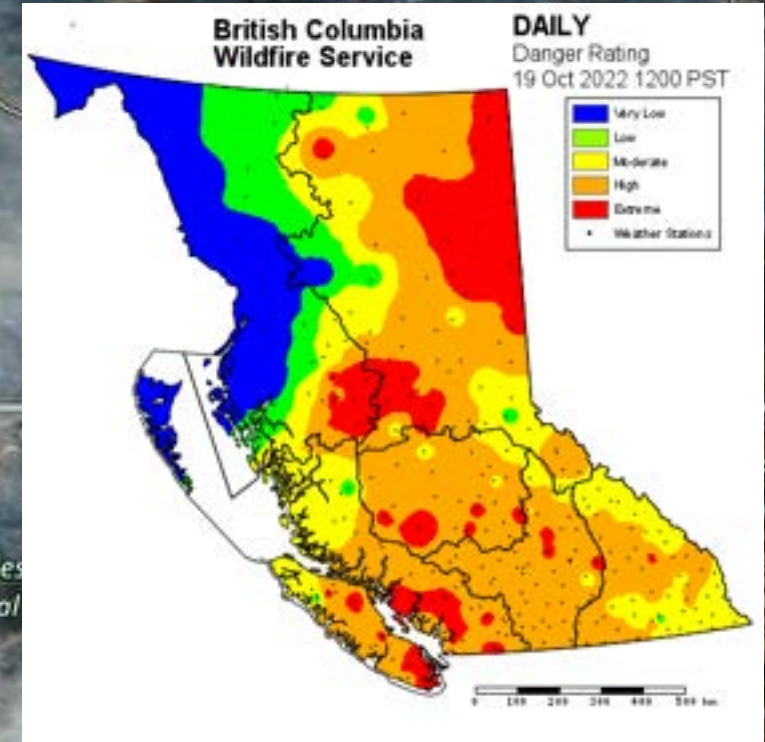


Adaptation for Wildfire Resilience

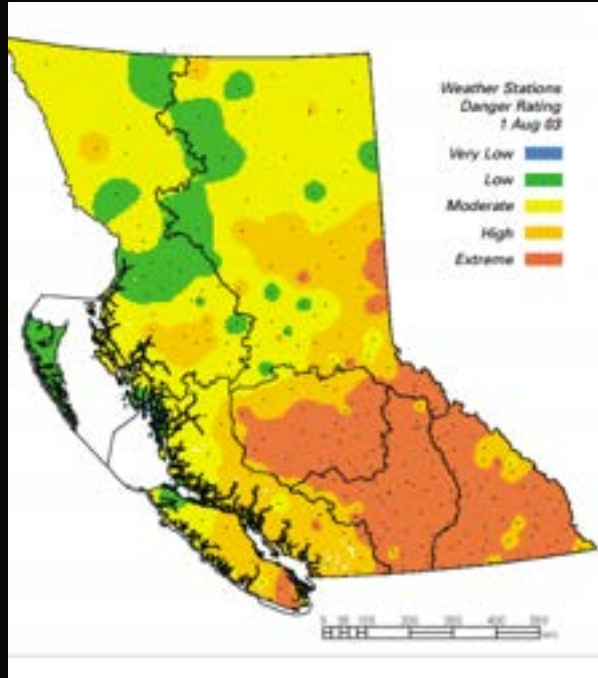


Lori Daniels, Kelsey Copes-Gerbitz & Kea Rutherford
Forest and Conservation Sciences, UBC-Vancouver

BC Community Forest Association AGM and Conference, October 2022

Firestorm 2003: A “wakeup” call for British Columbia

August 1, 2003

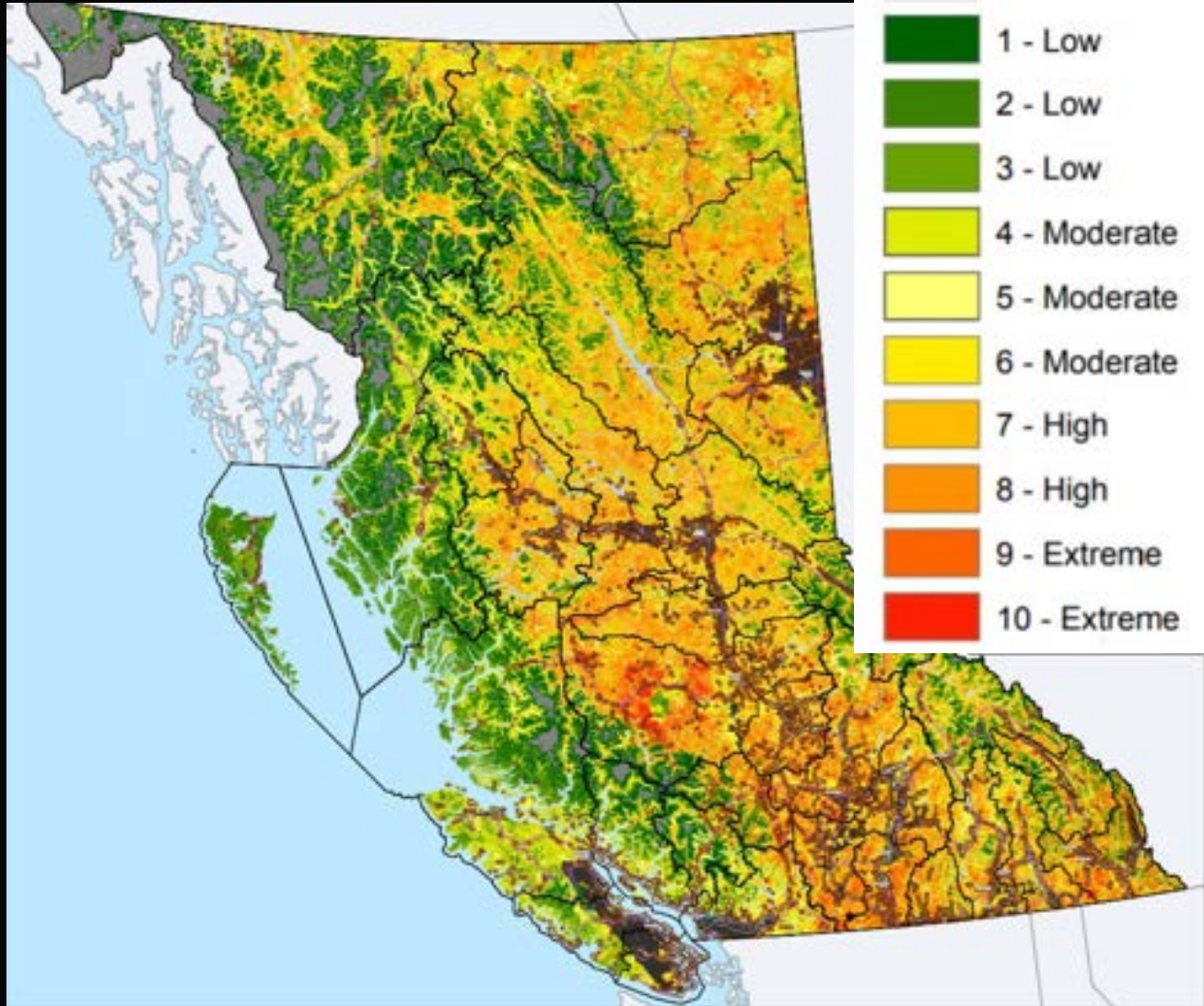


2500 fires
265,000 ha burned
\$371M to suppress
30,000 evacuees



Okanagan Mountain Park, August 2003

“Firestorm 2003”: Filmon Report & Recommendations



Wildland-Urban Interface

1.6M ha hazardous fuels

685,000 ha **high to extreme**

950,000 ha **moderate to high**

Wildfire Risk Reduction

>150 municipalities

>200 Indigenous communities

~\$500M fuels mitigation

(@\$5000 per ha <10%)

~\$7B on suppression



How are communities proactively managing wildfire risk within and beyond the WUI?

What are key challenges and priorities for proactive wildfire management?

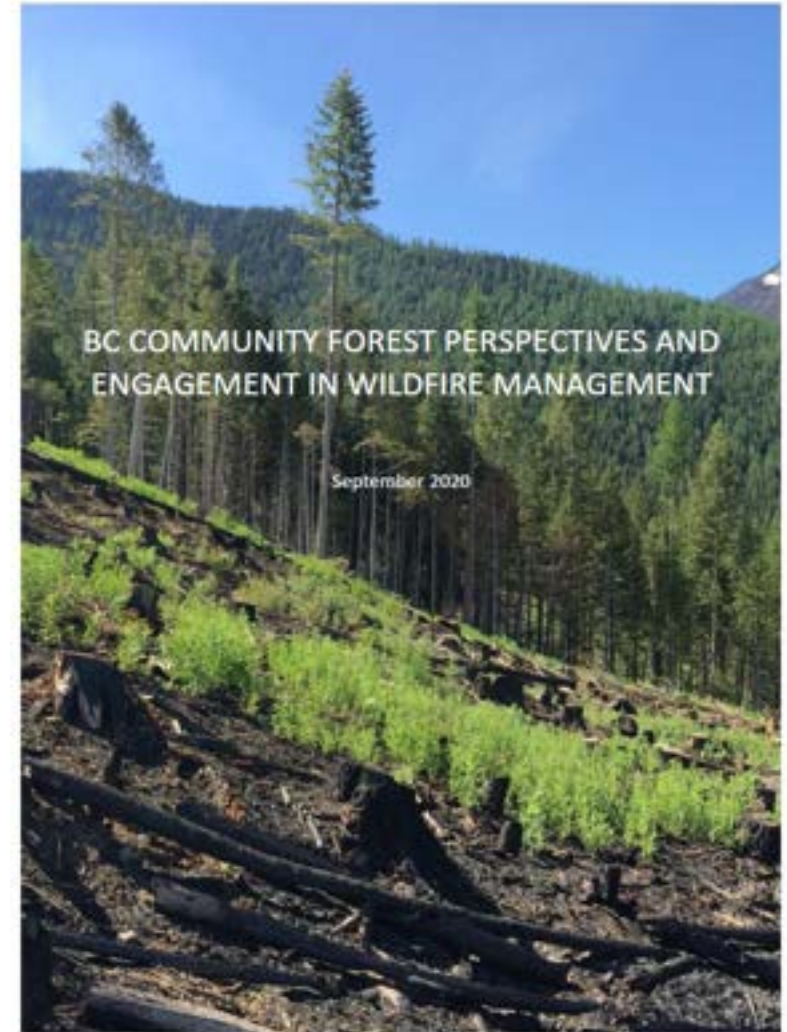
BC communities are concerned but underprepared

- 2017 survey (pre-wildfire season)
- 77 communities
- 99% think addressing wildfire risk is urgent priority
- 89% communities participating in proactive management
 - First Nations and smaller communities (<5000 residents) less likely to have community wildfire plans → why?
- Funding and staff time limit engagement with proactive management
 - Similarly limiting for applying for funding programs



Community Forests leading proactive management

- 24 Community Forest interviews in 2019
- Wide diversity of approaches across scales
 - Homeowner preparedness and community outreach
 - Building capacity for wildfire response
 - Fuels treatments – most common
 - Planning – WUI and landscape level
- Success facilitated by key relationships
- Priorities: scaling up by integrating wildfire management with forest management



Challenges identified

- Capacity: funding and resources
 - Time/expertise to apply for funding
 - Time/expertise to develop prescriptions and plans
 - Expertise on effectiveness/efficiency of fuels treatments
 - Admin burden of funding
 - Mismatches in funding scope to priorities
 - Cost of fuels treatments
- Existing planning and legislative frameworks
 - Statutory obligations
 - FRPA
 - Other land use restrictions (e.g., OGMA)
- Negotiating trade-offs in multi-value landscapes
 - Community pushback
 - Other priorities above wildfire
- Others?



Challenges identified – still ongoing?

☐ Capacity: funding and resources

- ☐ Time/expertise to apply for funding
- ☐ Time/expertise to develop prescriptions and plans
- ☐ Expertise on effectiveness/efficiency of fuels treatments
- ☐ Admin burden of funding
- ☐ Mismatches in funding scope to priorities
- ☐ Cost of fuels treatments

☐ Existing planning and legislative frameworks

- ☐ Statutory obligations
- ☐ FRPA
- ☐ Other land use restrictions (e.g., OGMA)

☐ Negotiating trade-offs in multi-value landscapes

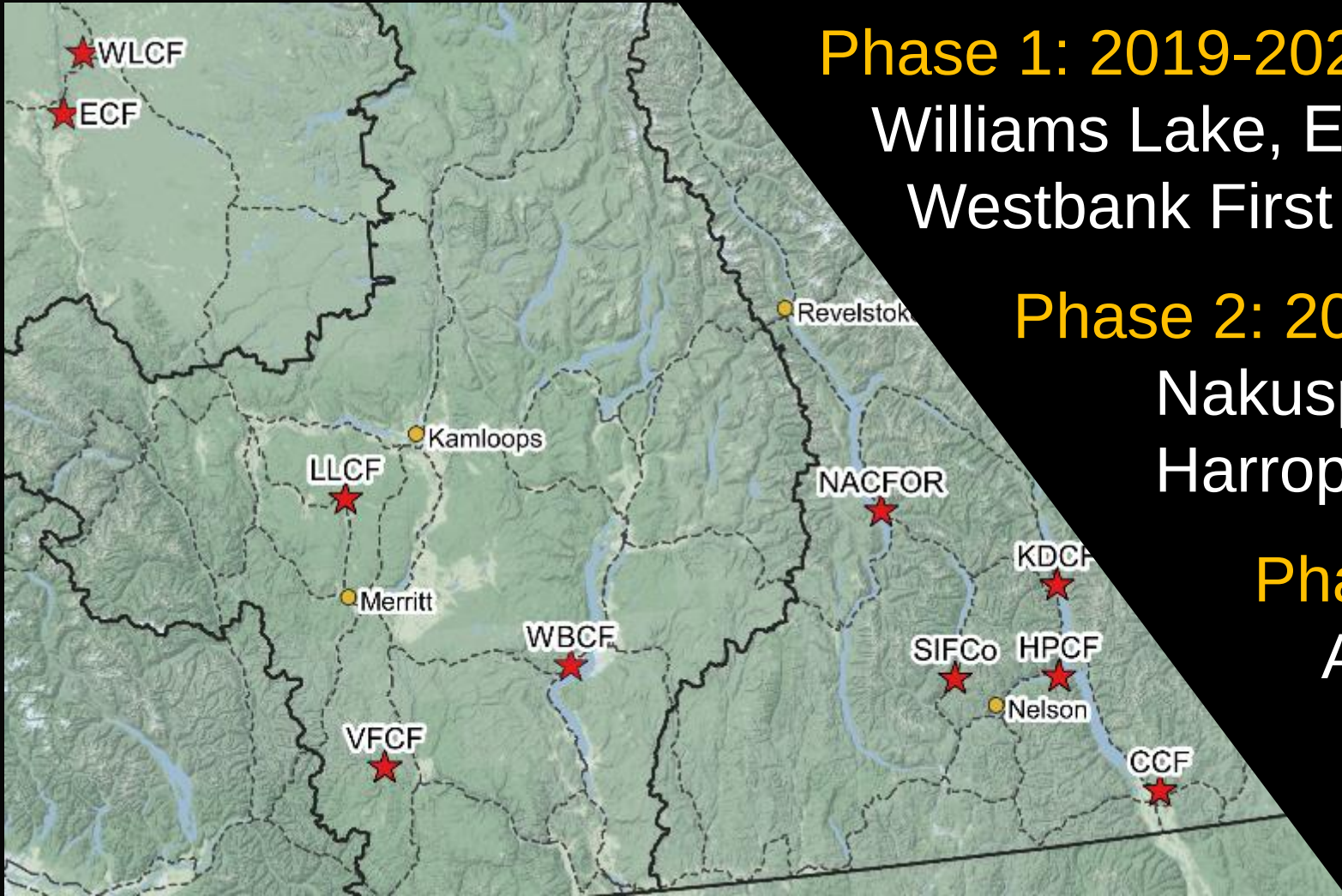
- ☐ Community pushback
- ☐ Other priorities above wildfire

☐ Others?

5-minute survey – on your table!

- This will help inform next phases of research
- **Optional:** include name, CF, and contact info if you are interested in being involved in research
- Return to Kelsey, Kea or Lori at any point

Fuels Mitigation: Are treatments working?



Phase 1: 2019-2021

Williams Lake, Esk'etenc, Logan Lake,
Westbank First Nation CFs

Phase 2: 2021-2022

Nakusp, Kaslo, SIFCo,
Harrop-Procter, Creston CFs

Phase 3: 2022+

Additional Communities
+ WRR Treatments

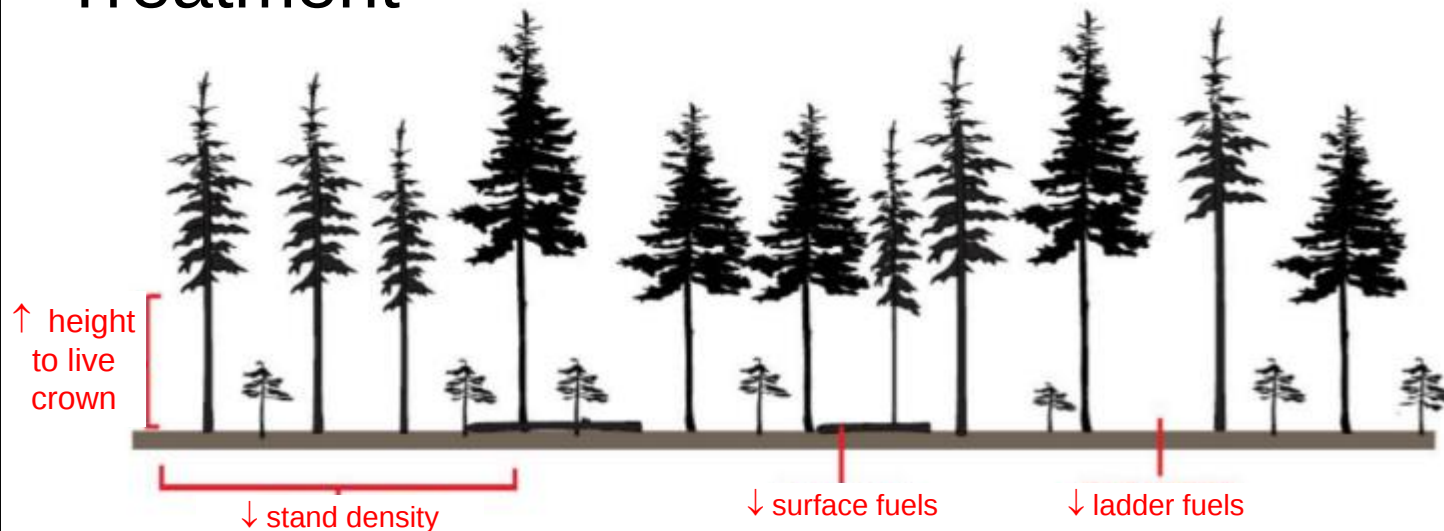


Treatment Goals & Assessing Efficacy

No Treatment



Treatment



Treatment goals:

- ↓ surface fire intensity
- ↓ active crown fire
- ↑ fire resilience

Fuels mitigation:

- ↓ tree density
- ↓ surface fuels
- ↑ height to live crown

Assessing efficacy:

Field measures +
Fire behaviour models

Field measurements

Perpendicular transects (30m):

- Duff, litter, & fuel depth
- Downed woody material
- Shrubs
- Canopy cover

Large plot (0.04ha, 11.28m radius):

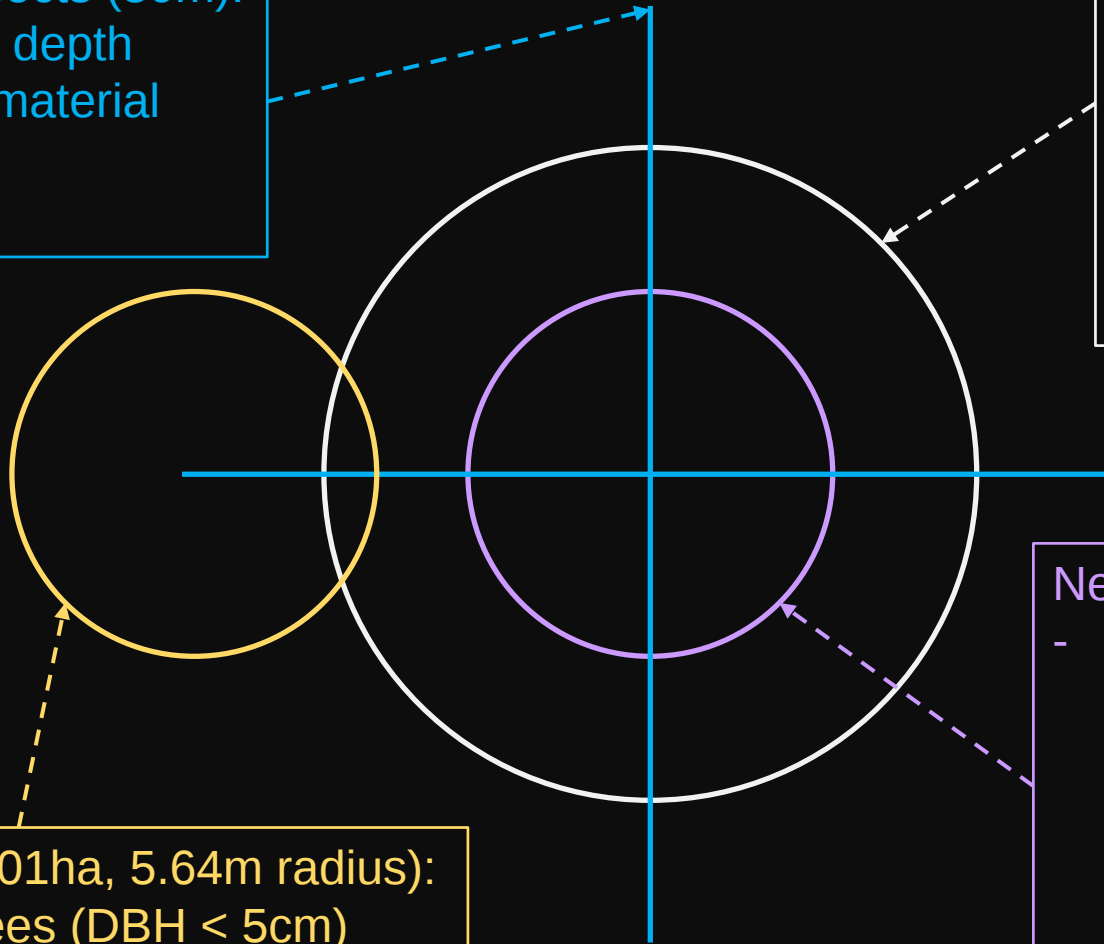
- Large trees (DBH $\geq$ 12.5 cm)
 - Species
 - DBH
 - Total height
 - Height to live crown base
 - Height to dead crown base
 - Crown position

Nested subplot (0.01ha, 5.64m radius):

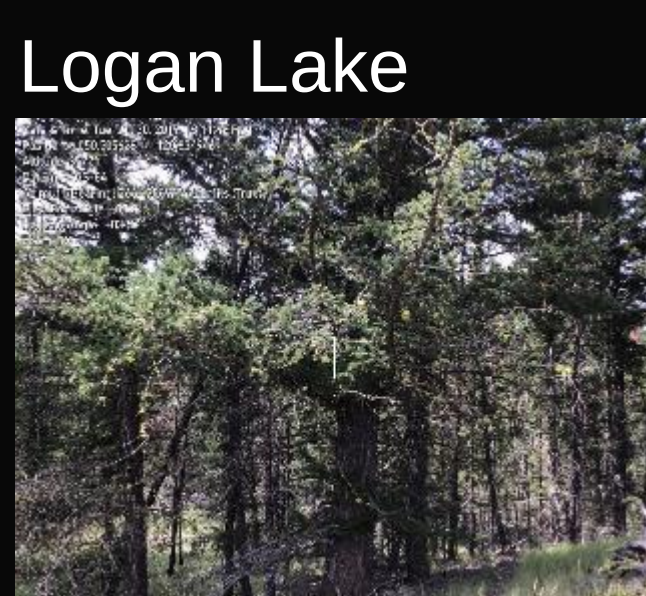
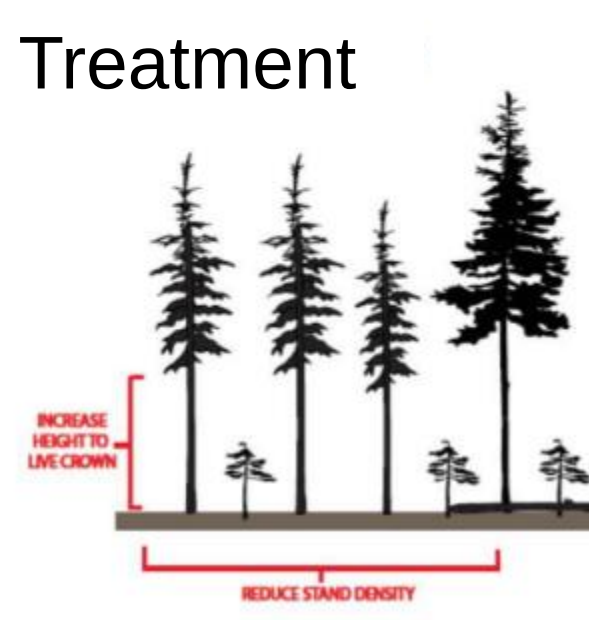
- Small trees (DBH $<$ 12.5 cm)
 - Species
 - DBH
 - Total height
 - Height to live crown base
 - Height to dead crown base
 - Crown position

Satellite subplot (0.01ha, 5.64m radius):

- Regenerating trees (DBH $<$ 5cm)



Assessing Treatment Efficacy: Paired Plots



Treatment Efficacy: Fire Behaviour Modelling

Crown Fire Initiation Spread + Canadian FBP @ 90th percentile fire weather

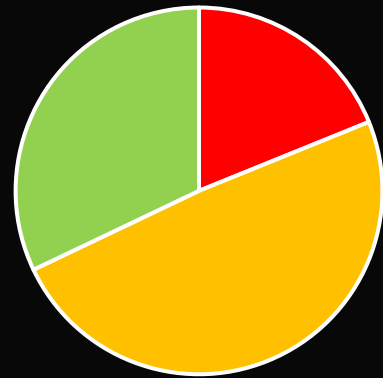
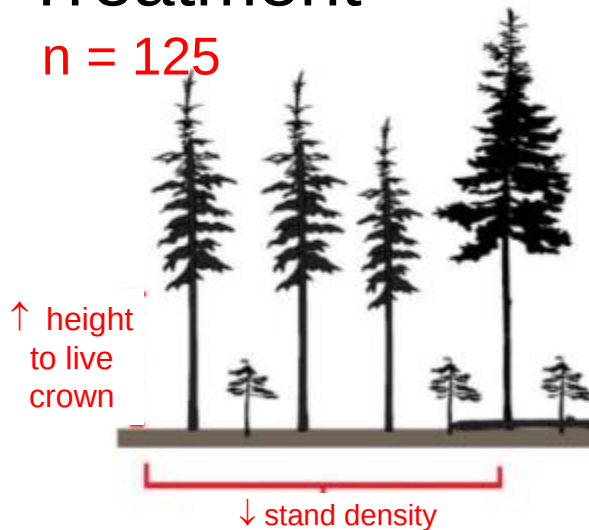
No Treatment

n = 53

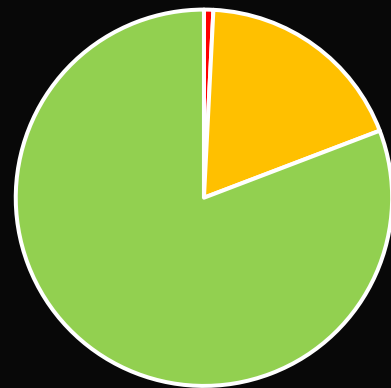


Treatment

n = 125



19%	Active crown	29.9 m min ⁻¹
49%	Passive crown	13.8 m min ⁻¹
32%	Surface fire	3.4 m min ⁻¹



1%	Active crown	32.0 m min ⁻¹
18%	Passive crown	13.4 m min ⁻¹
81%	Surface fire	8.1 m min ⁻¹

Are current fuel treatments successfully mitigating crown fire potential and fire severity?

Pre-treatment (2021)



Post-treatment (2022)



(Harrop Procter, BC)

Are current fuel treatments successfully mitigating crown fire potential and fire severity?

Pre-treatment (2021)



Post-treatment (2022)



(Slocan, BC)

Fire behaviour modelling

90th percentile weather conditions

Fuels Management Analyst Plus (FMA, Carlton 2004)

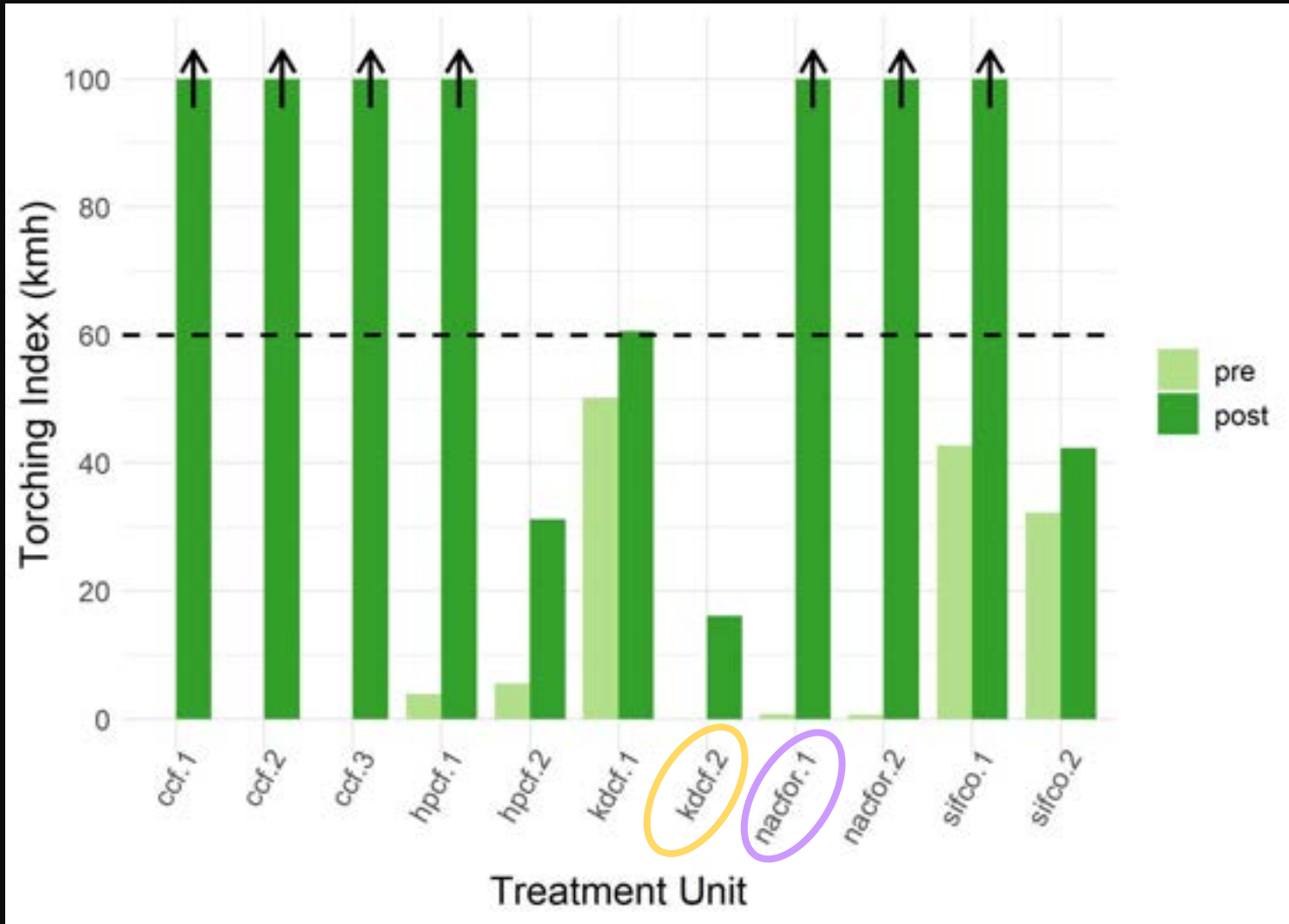
Crown fire potential

- Torching Index (kmh): wind speed necessary to initiate passive crown fire
 - Passive crown fire: torching, individual or small groups of trees are ignited
- Crowning Index (kmh): wind speed at which active crown fire is expected
 - Active crown fire: propagates through the canopy
- Higher values indicate a lower potential of passive/active crown fire

Fire severity

- Probability of mortality at an individual tree level

Potential for passive crown fire decreases with treatment

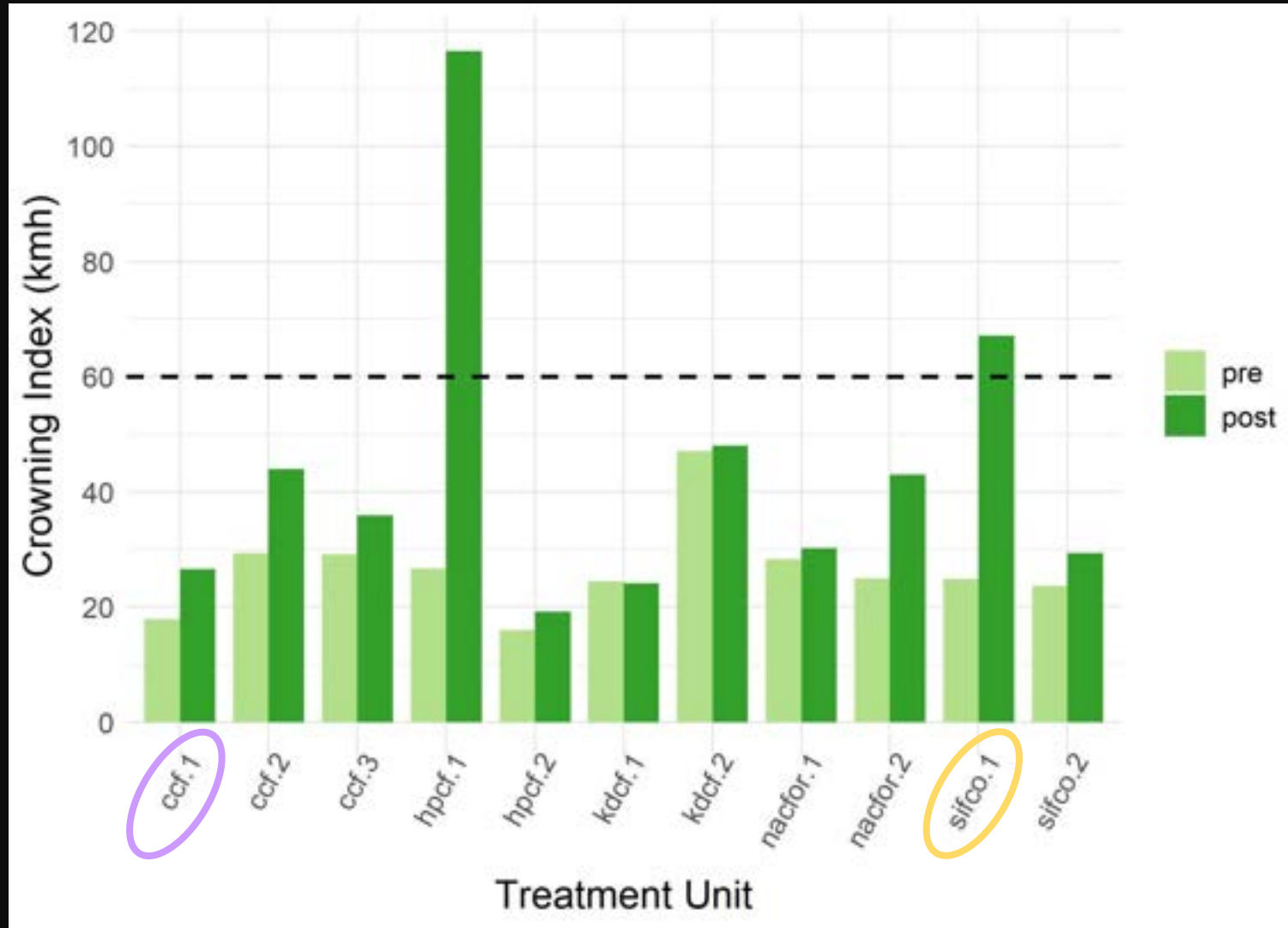


(nacfor.1)



(kdcf.2)

Potential for active crown fire decreases with treatment

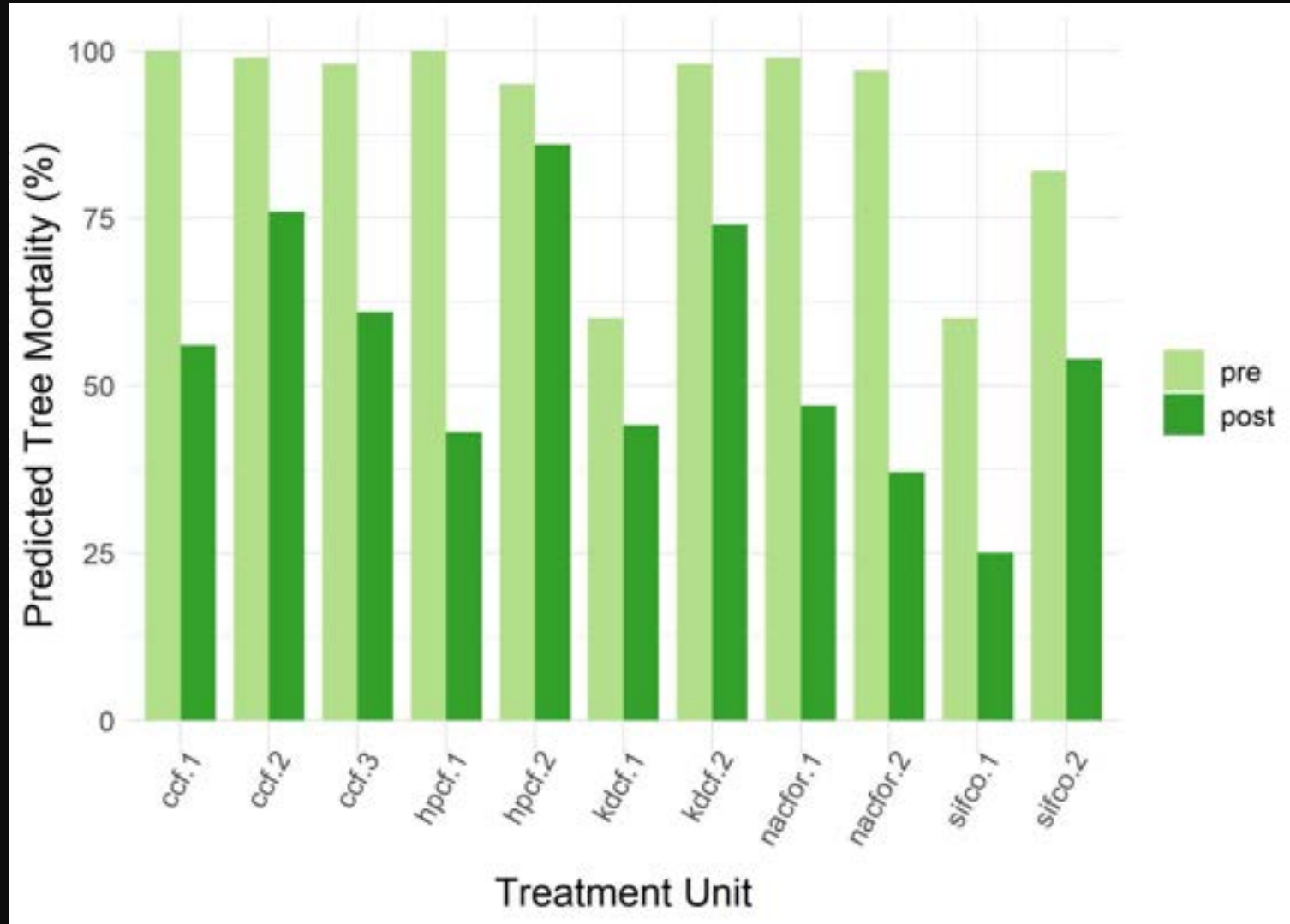


(ccf.1)



(sifco.1)

Predicted tree mortality decreases with treatments



Fuels Mitigation: Are treatments working?

Efficacy: Will a treatment work?

Effectiveness: *Did treatments work when challenged by wildfire?*



(Tremont Creek Fire in Logan Lake, BC, 2021 Source: Garnett Mierau)

Logan Lake: Treatment Effectiveness

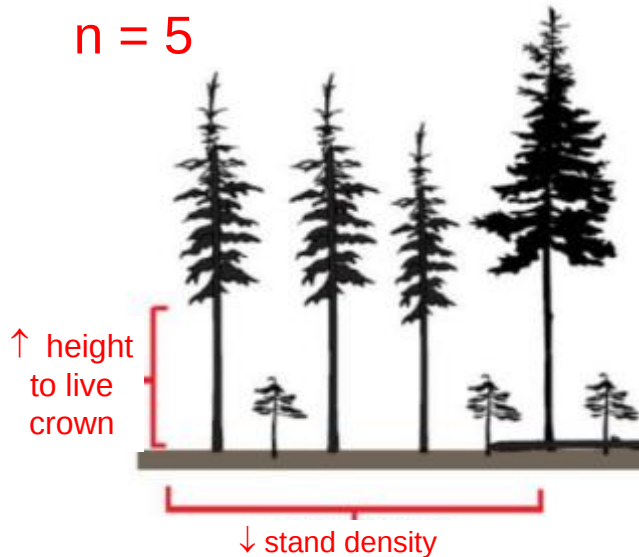
No Treatment

n = 11



Treatment

n = 5



Actual > predicted (planned ignition)

76% mortality of 286 trees

94% crown scorch

90% ground scorch to
mineral soil (n = 9)
= 212 surface impact



Actual < predicted (suppression)

18% mortality of 95 trees

13% crown scorch

73% ground scorch with
FF+duff intact (n = 4)
= 93 surface impact



Next Steps...

- streamline + standardize field protocols for operational use
- expand to include new treatments + communities
- think creatively about future collaborations
- advocate for policy change and increased funding



Is 2022 a(nother) wake-up call?

We are awake and have been for 20 years.
We know what to do, how to do it, and that it works.
Now is the time to invest in community resilience.



**Thanks to our collaborators and
the agencies that fund our research**



Thank you

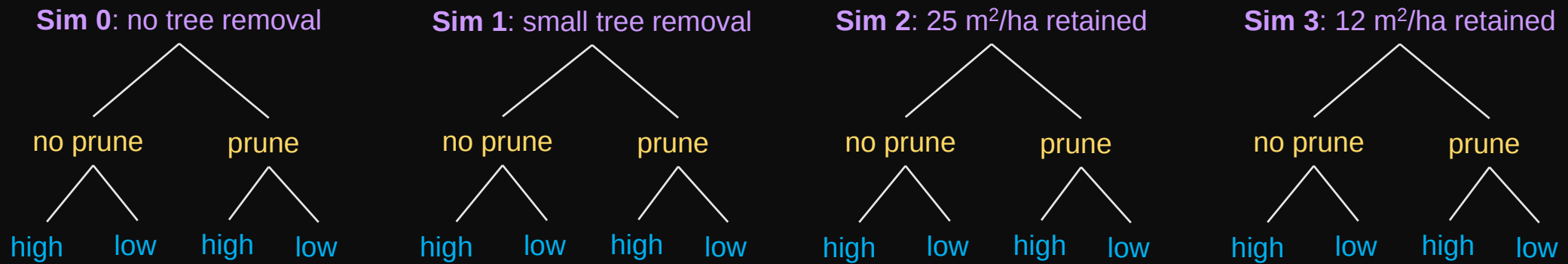
Questions?



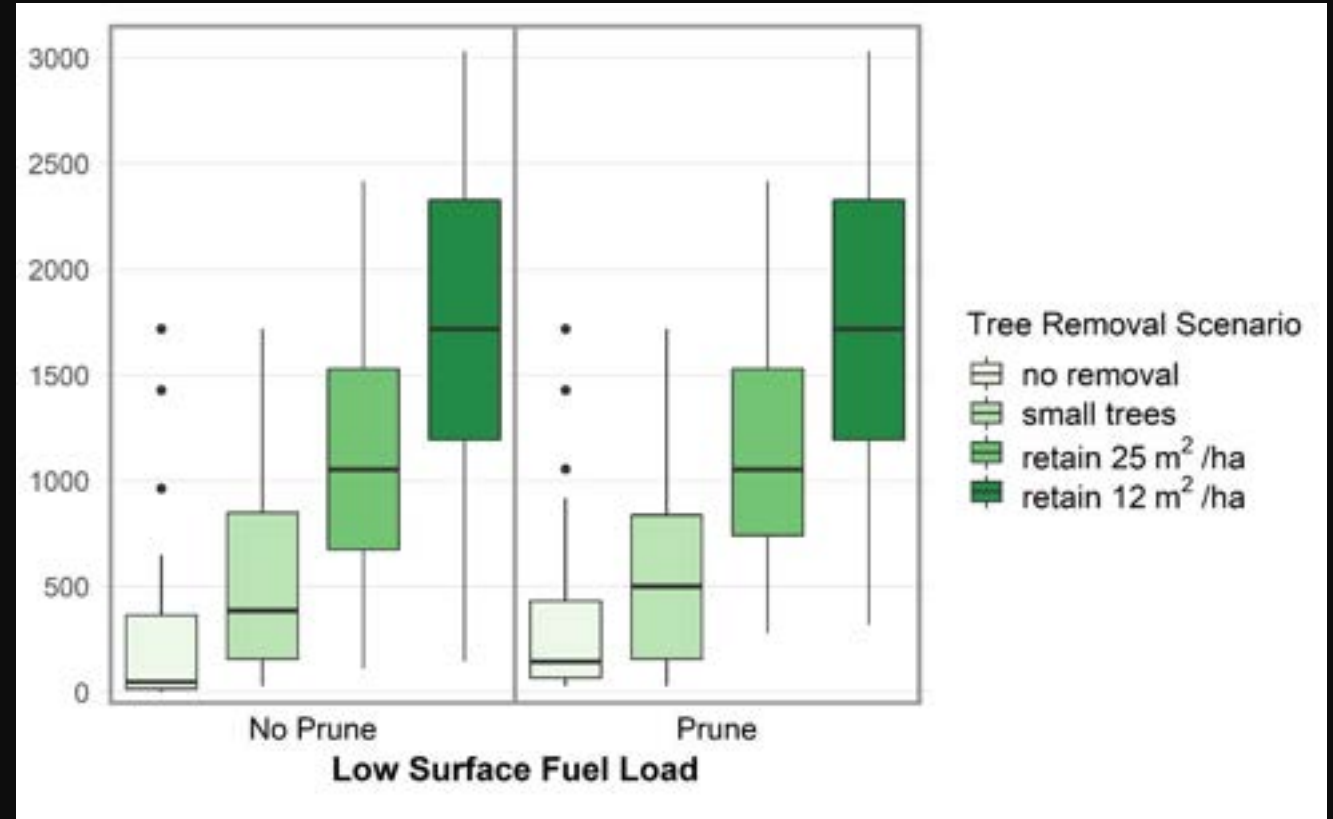
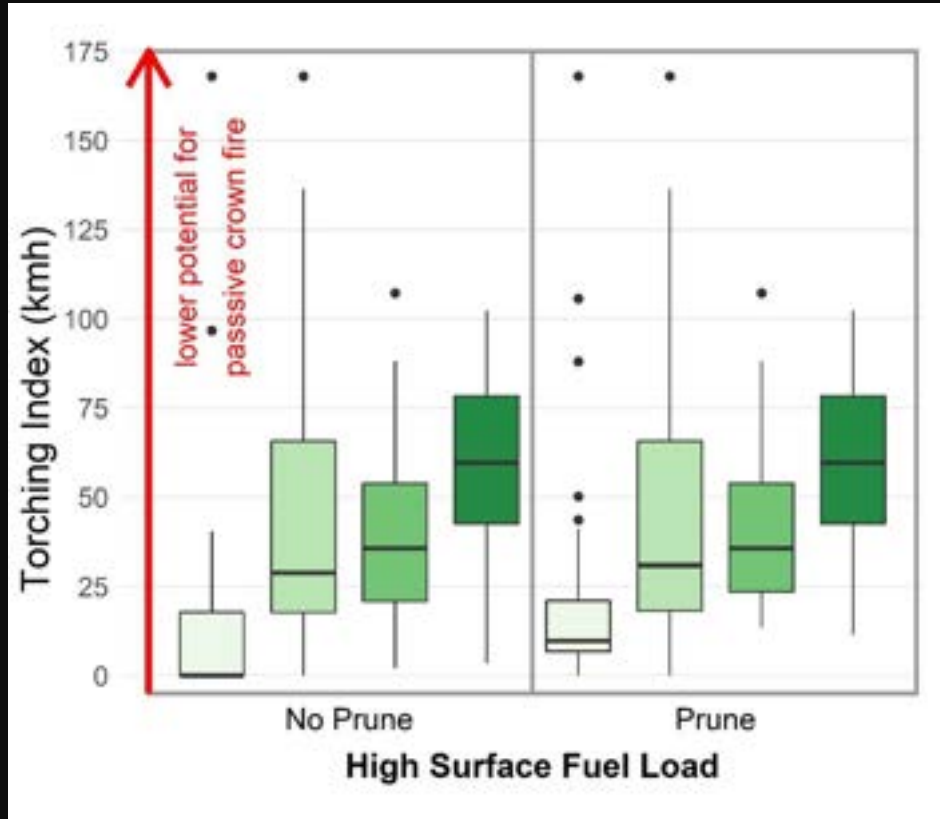
Simulation scenarios

How does crown fire potential and fire severity differ between alternative:

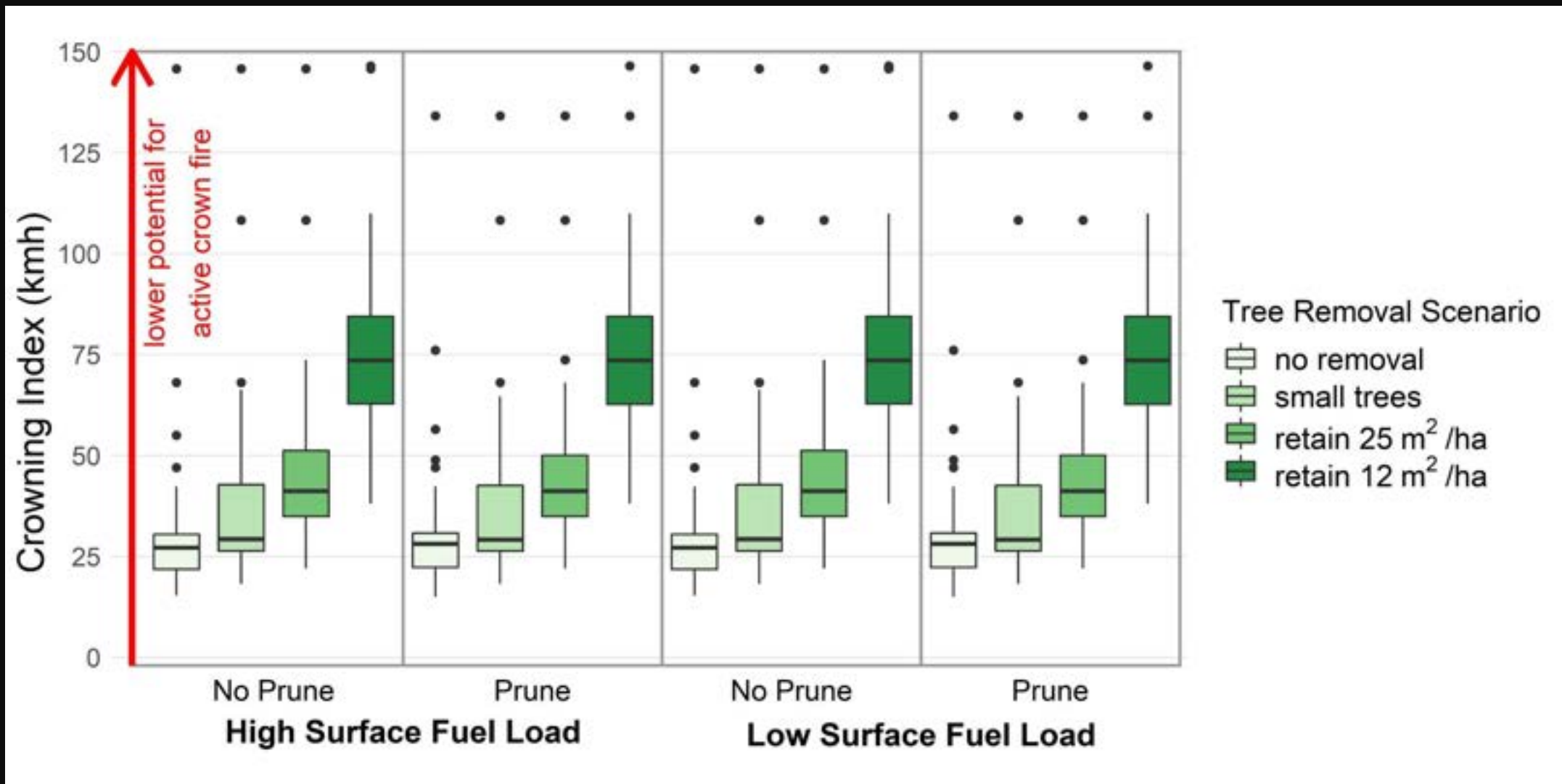
- tree removal scenarios
- pruning scenarios
- surface fuel load scenarios



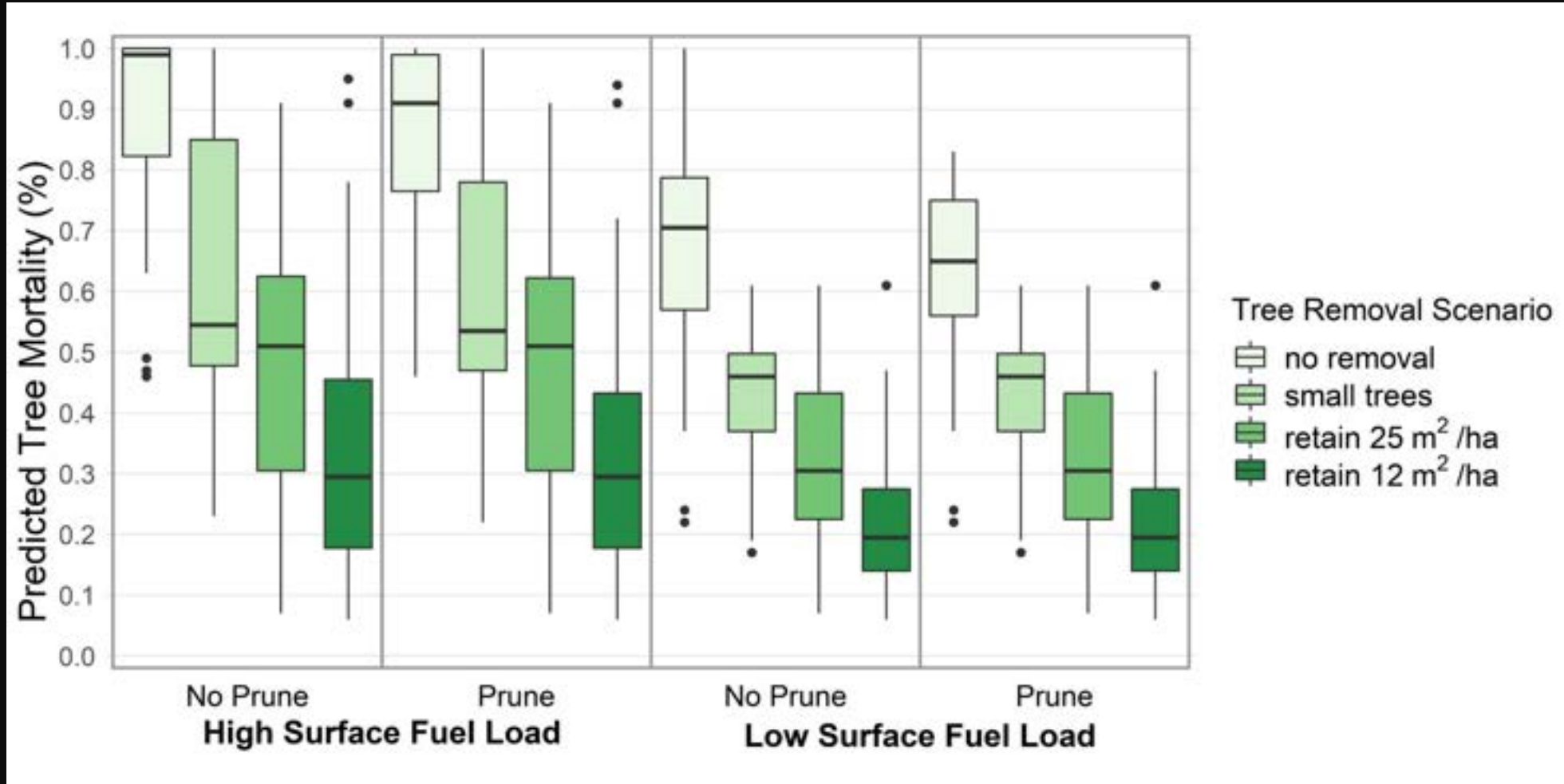
Torching Index: tree removal and surface fuel load but not pruning



Crowning Index: tree removal only



Predicted tree mortality: tree removal and surface fuel load but not pruning



Treatment Efficacy: Fire Behaviour Modelling

CFIS + FBP @ 90th percentile fire weather:

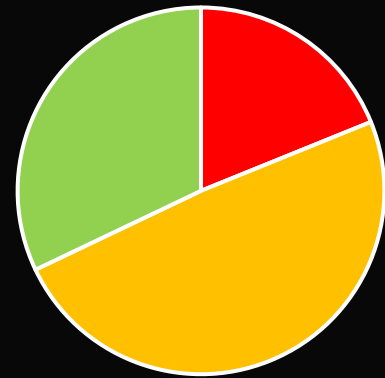
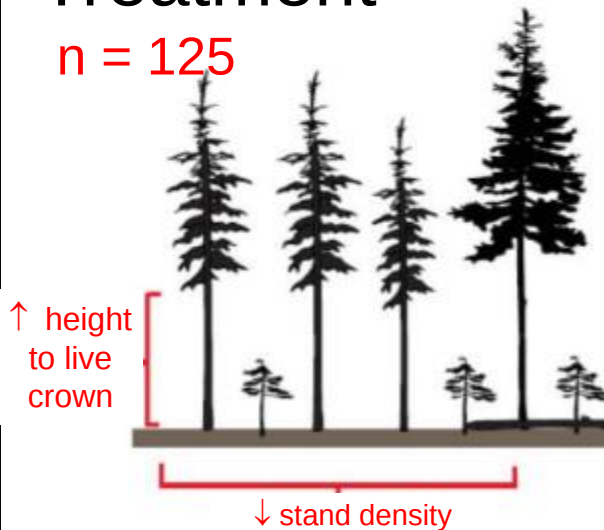
No Treatment

n = 53



Treatment

n = 125



Active
Crown

Passive
Crown

Surface
Fire

240
1170

130
410

200
770

Canopy (ha⁻¹)

Subcanopy (ha⁻¹)

0.17

0.16

0.14

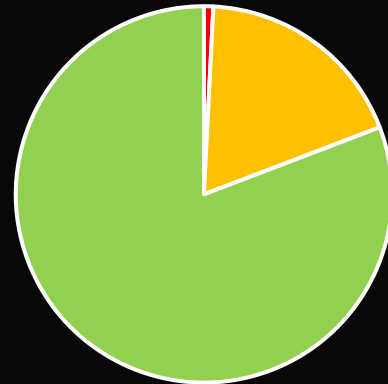
CBD (kg/m³)

6.4

5.0

9.0

CBH (m)



700
300

100
240

170
270

Canopy (ha⁻¹)

Subcanopy (ha⁻¹)

0.10

0.06

0.09

CBD (kg/m³)

7.3

5.6

10.0

CBH (m)

*As subcanopy tree density decreases,
shift toward surface fire.*

Treatment Efficacy: Fire Behaviour Modelling

CFIS @ 90th percentile fire weather:

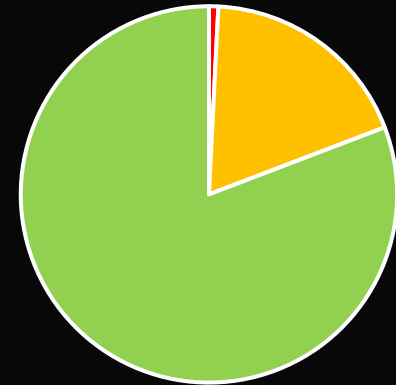
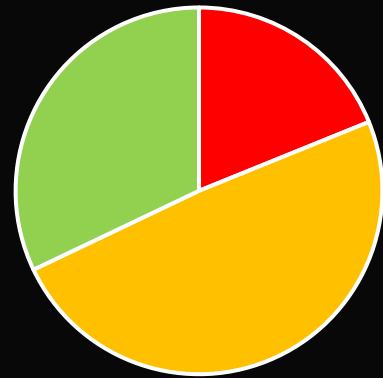
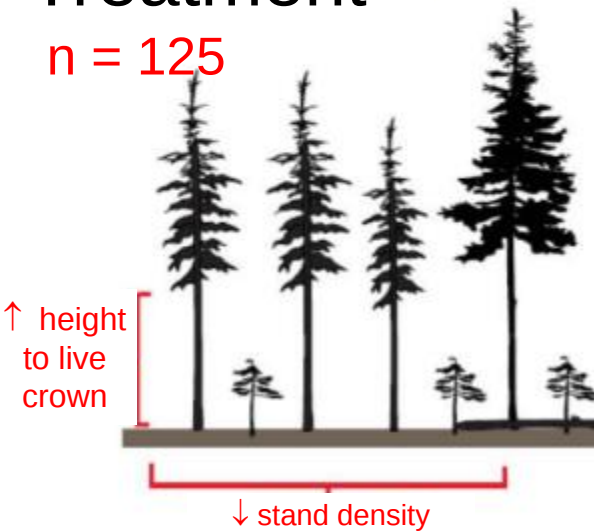
No Treatment

n = 53



Treatment

n = 125



**Active
Crown**

**Passive
Crown**

**Surface
Fire**

240
1170
0.17
6.4

130
410
0.16
5.0

200
770
0.14
9.0

Canopy (ha⁻¹)

Subcanopy (ha⁻¹)

CBD (kg/m³)

CBH (m)

700
300
0.10
7.3

100
240
0.06
5.6

170
270
0.09
10.0

Canopy (ha⁻¹)

Subcanopy (ha⁻¹)

CBD (kg/m³)

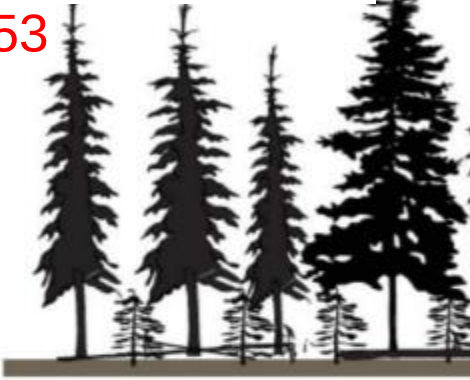
CBH (m)

*As subcanopy tree density decreases,
and CBH increases, shift toward surface fire.*

Treatment Efficacy: Fire Behaviour Modelling

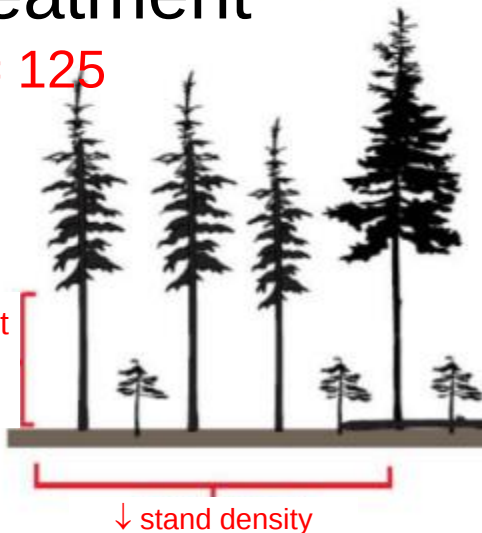
No Treatment

n = 53

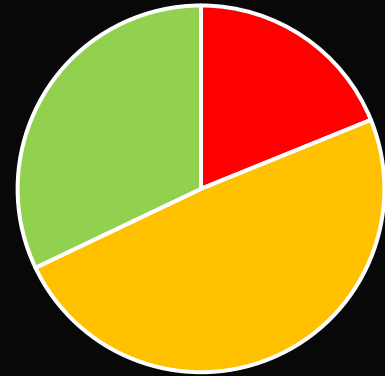


Treatment

n = 125



CFIS @ 90th percentile fire weather:



Active
Crown

Passive
Crown

Surface
Fire

1.5
3.5

1.4
2.7

1.5
4.2

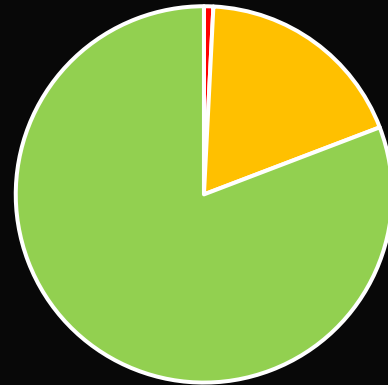
Wood (kg/m²)
FF+Duff (kg/m²)

0.10
0.6
2.3

0.06
1.7
3.4

0.09
1.2
1.6

CBD (kg/m³)
Wood (kg/m²)
FF+Duff (kg/m²)



*Surface woody fuels comparable, but >1kg m⁻²
Forest floor + duff exceed small woody fuels*