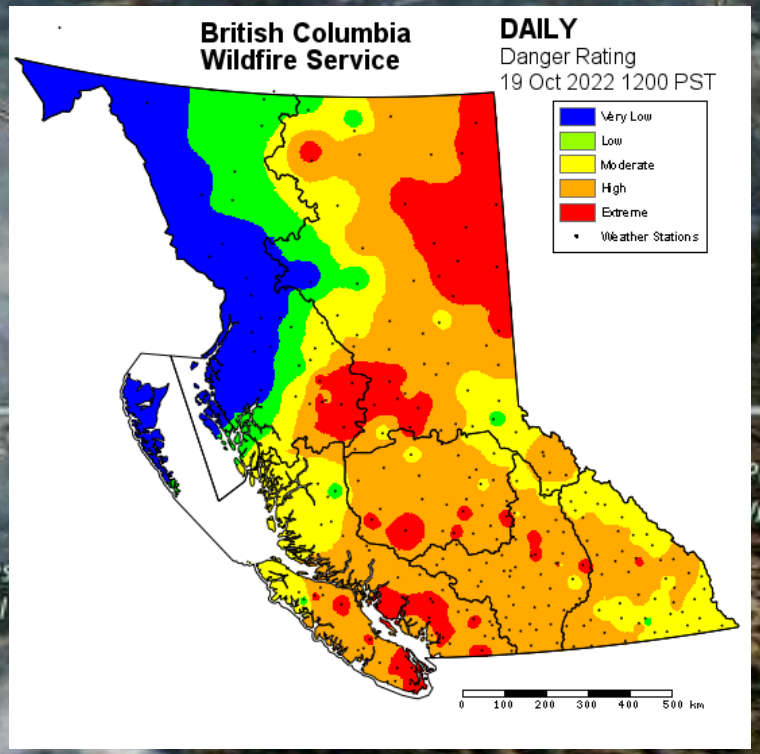
Adaptation for Wildfire Resilience

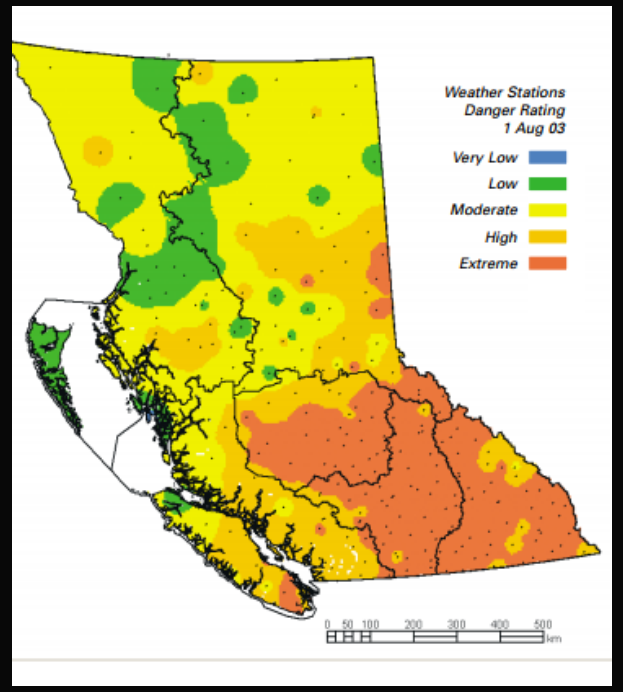


Lori Daniels, Kelsey Copes-Gerbitz & Kea Rutherford
Forest and Conservation Sciences, UBC-Vancouver

BC Community Forest Association AGM and Conference, October 2022

Firestorm 2003: A “wakeup” call for British Columbia

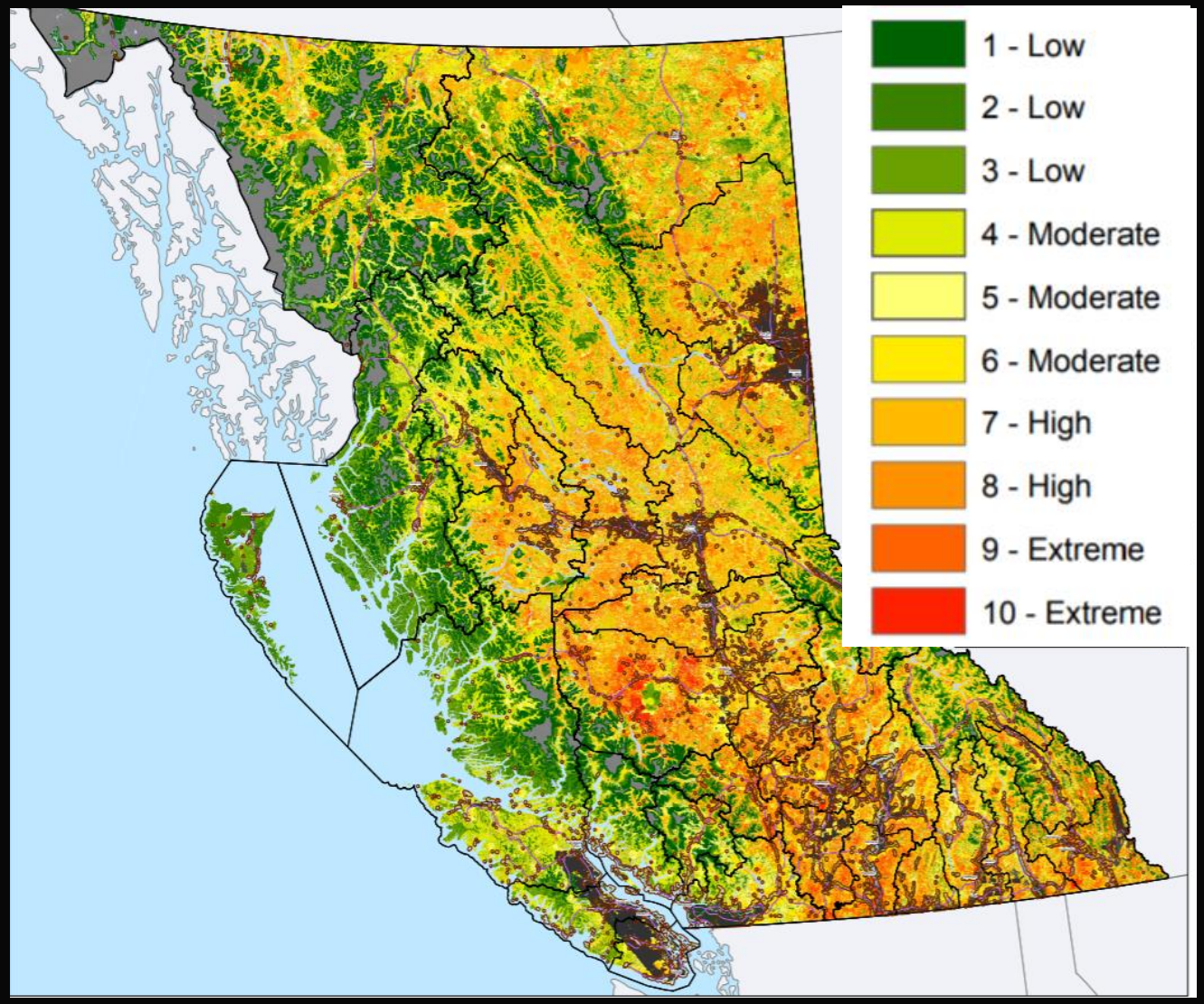
August 1, 2003



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?

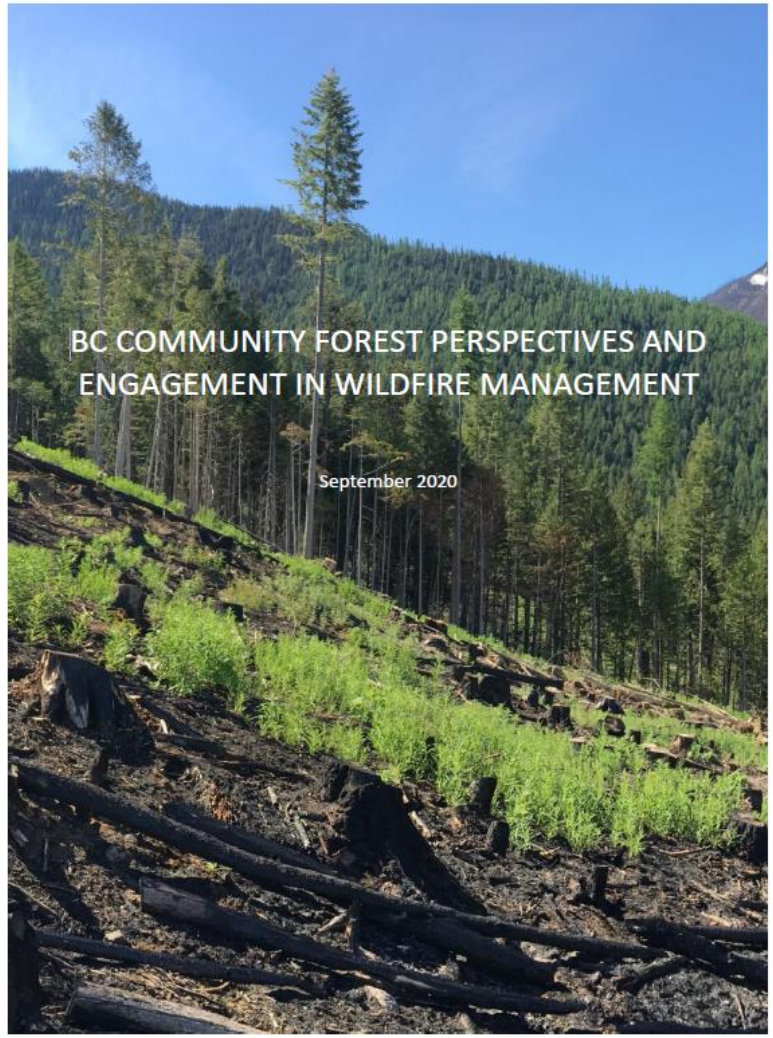
BC communities are concerned but underprepared

- 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

Copes-Gerbitz et al. 2022 *Frontiers in Forests and Global Change*

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?


SIFCo, Bone 2018

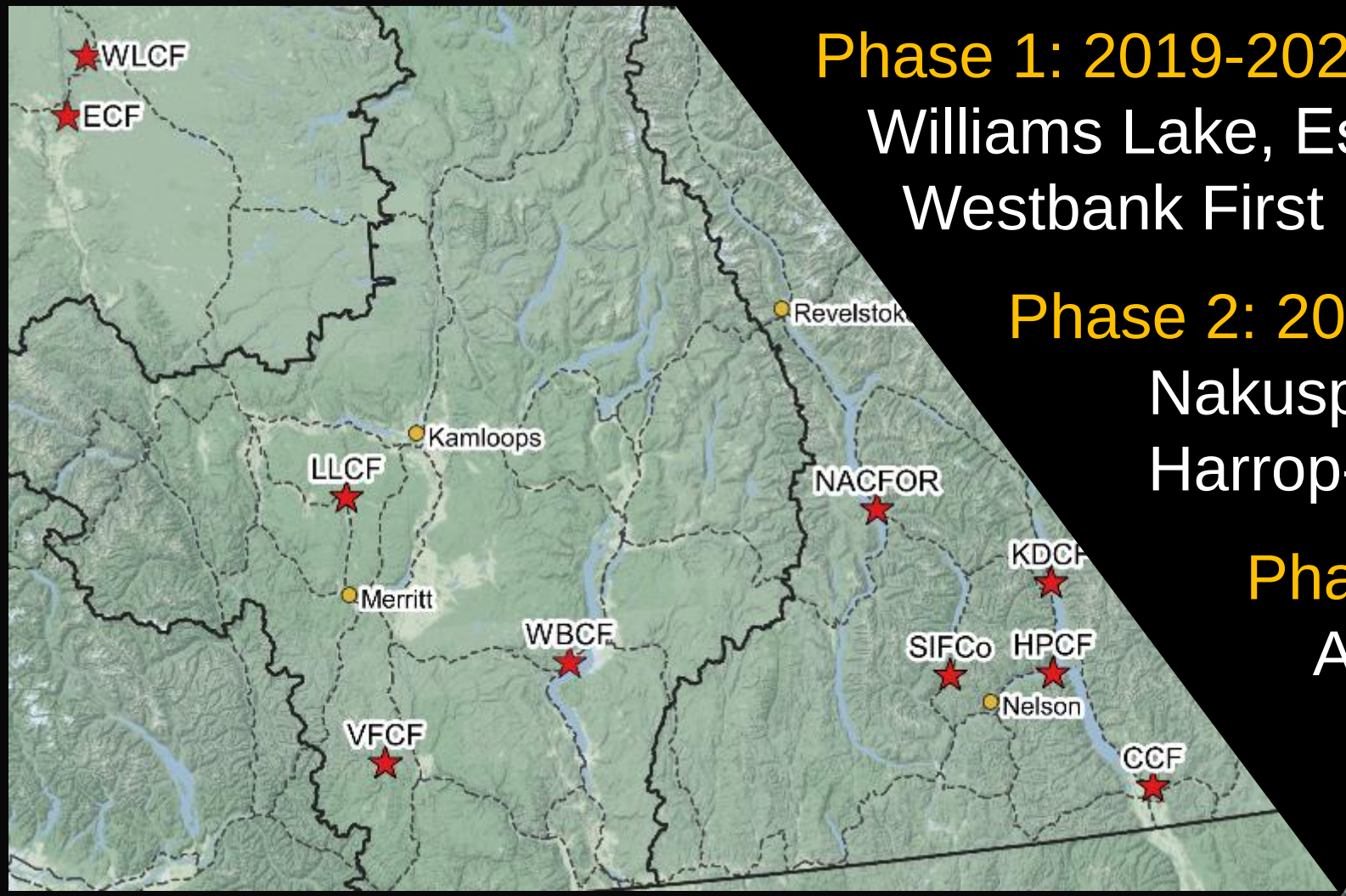
Challenges identified – still ongoing?

- ❑ 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'etemc, Logan Lake, Westbank First Nation CFs

Phase 2: 2021-2022

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

Phase 3: 2022+

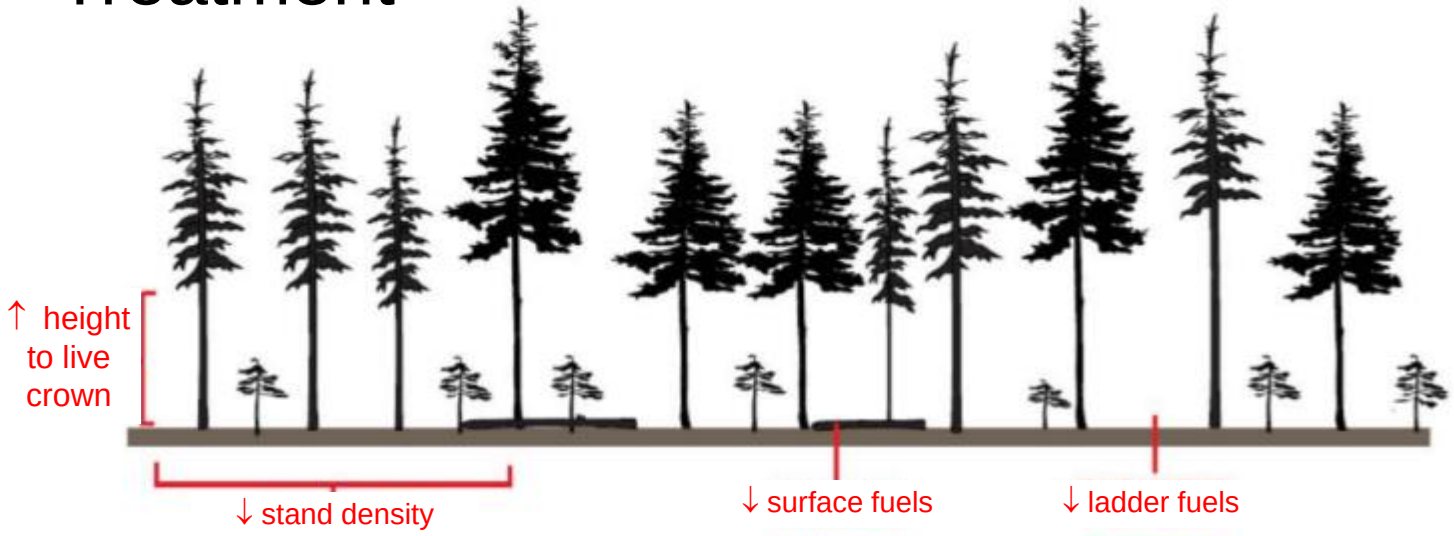
Additional Communities
+ WRR Treatments

British Columbia Community Forest Association

Treatment Goals & Assessing Efficacy

No Treatment

Treatment



Treatment goals:

↓ surface fire intensity
↓ active crown fire
↑ fire resilience

Fuels mitigation:

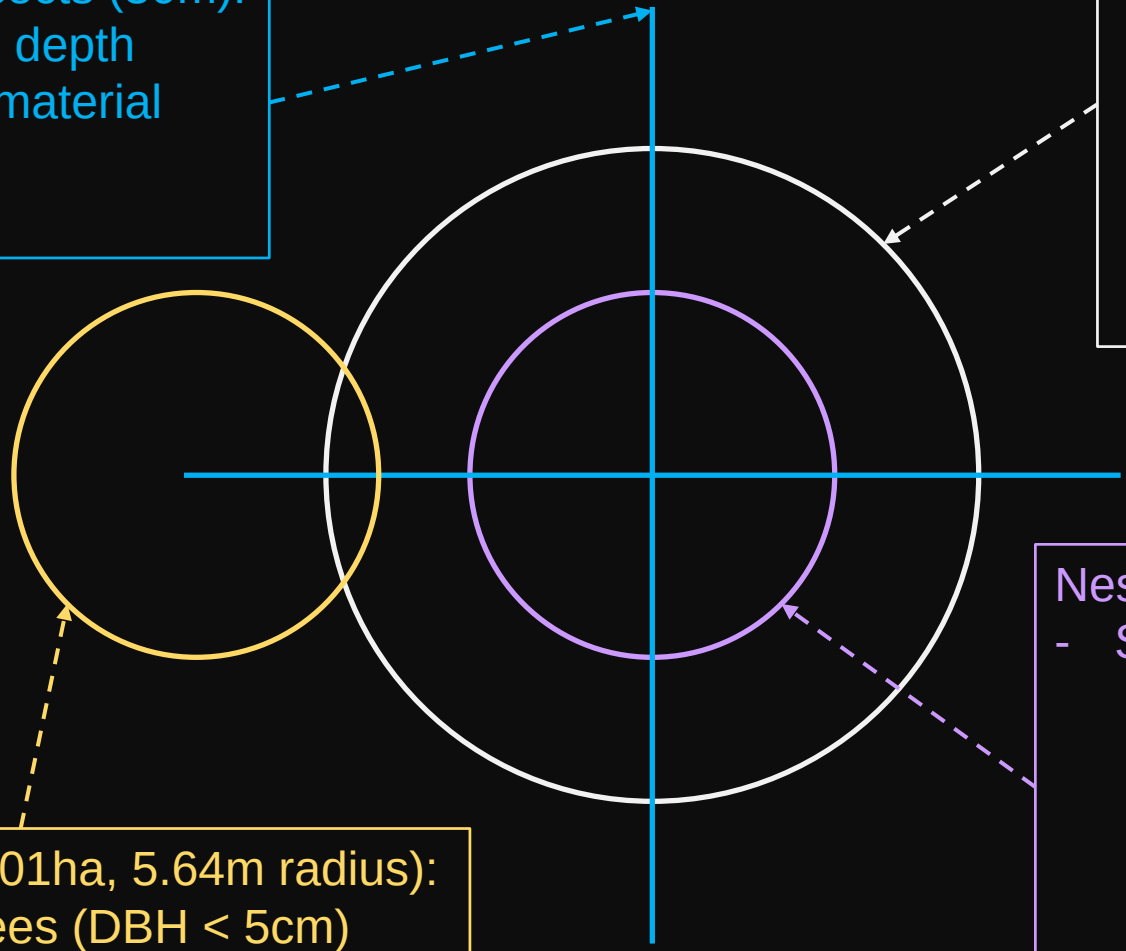
↓ tree density
↓ surface fuels
↑ height to live crown

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 ≥ 12.5 cm)
  - Species
  - DBH
  - Total height
  - Height to live crown base
  - Height to dead crown base
  - Crown position

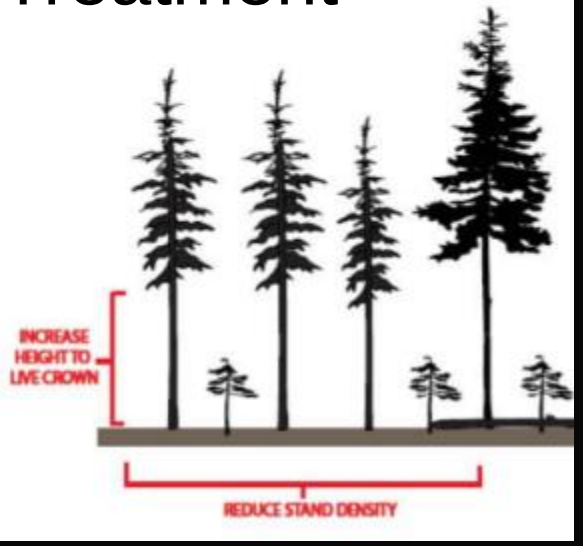
Satellite subplot (0.01ha, 5.64m radius):
- Regenerating trees (DBH < 5cm)

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

Assessing Treatment Efficacy: Paired Plots

No Treatment

Treatment



Williams Lake

Logan Lake

Westbank FN

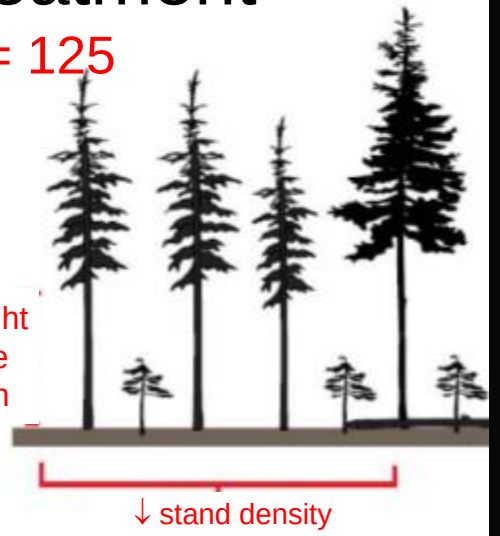
Treatment Efficacy: Fire Behaviour Modelling

No Treatment

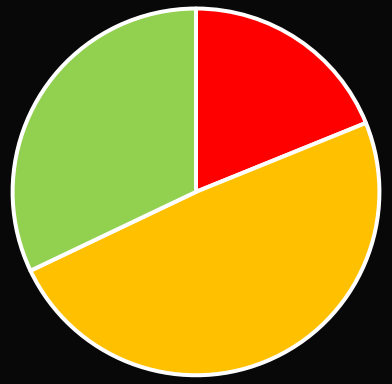
n = 53

Treatment

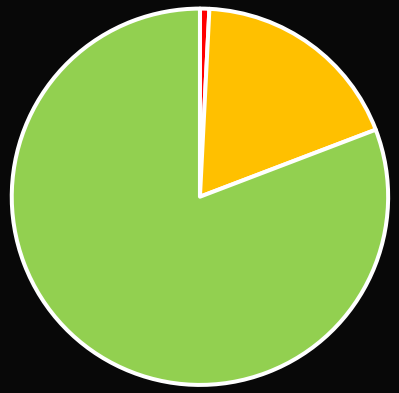
n = 125



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



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

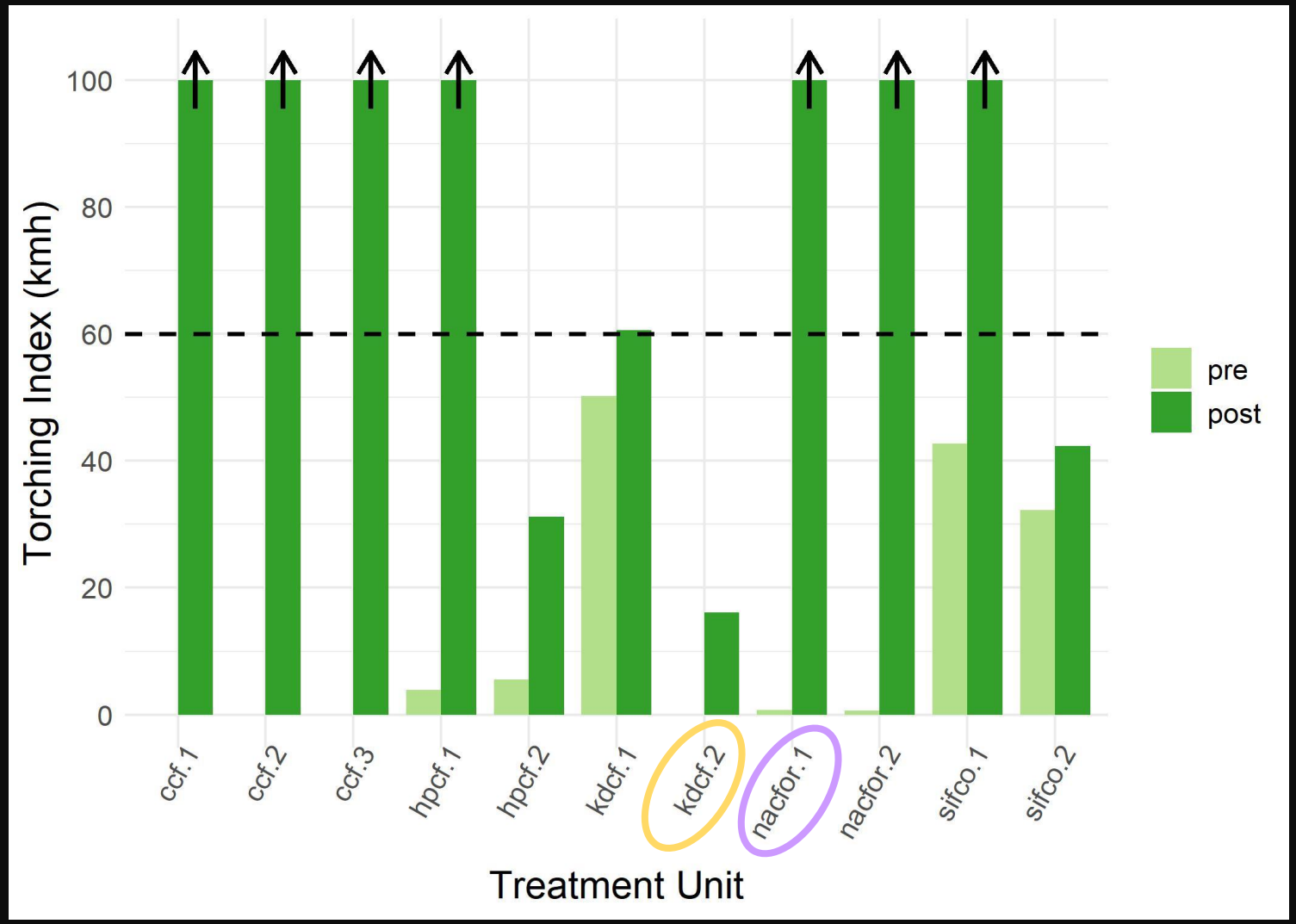
– Crowning Index (kmh): wind speed at which active crown fire is expected
  - Active crown fire: propagates through the canopy

– Higher values indicate a lower potential of passive/active crown fire

Fire severity

– Probability of mortality at an individual tree level

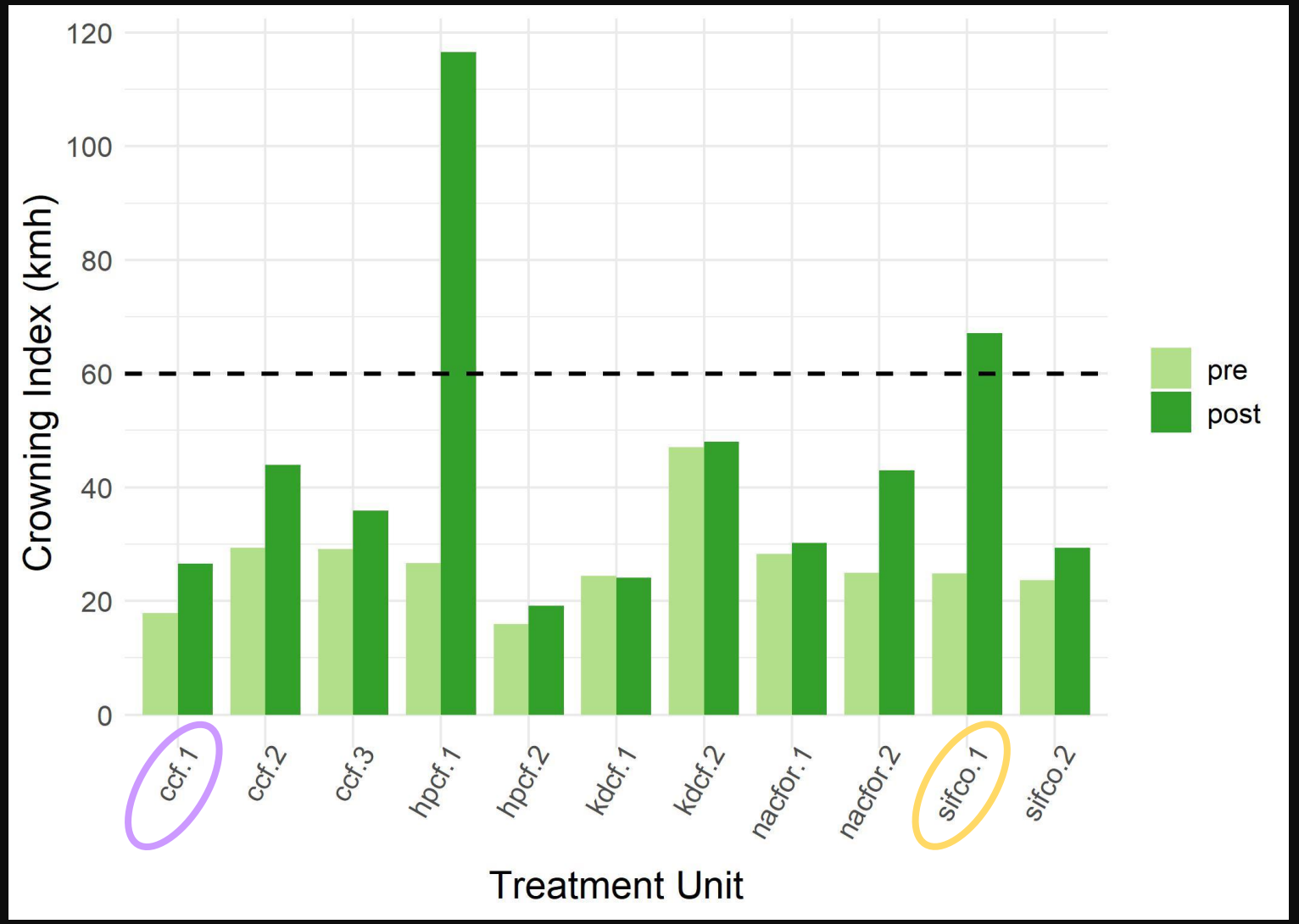
Potential for passive crown fire decreases with treatment



(nacfor.1)

(kdcf.2)

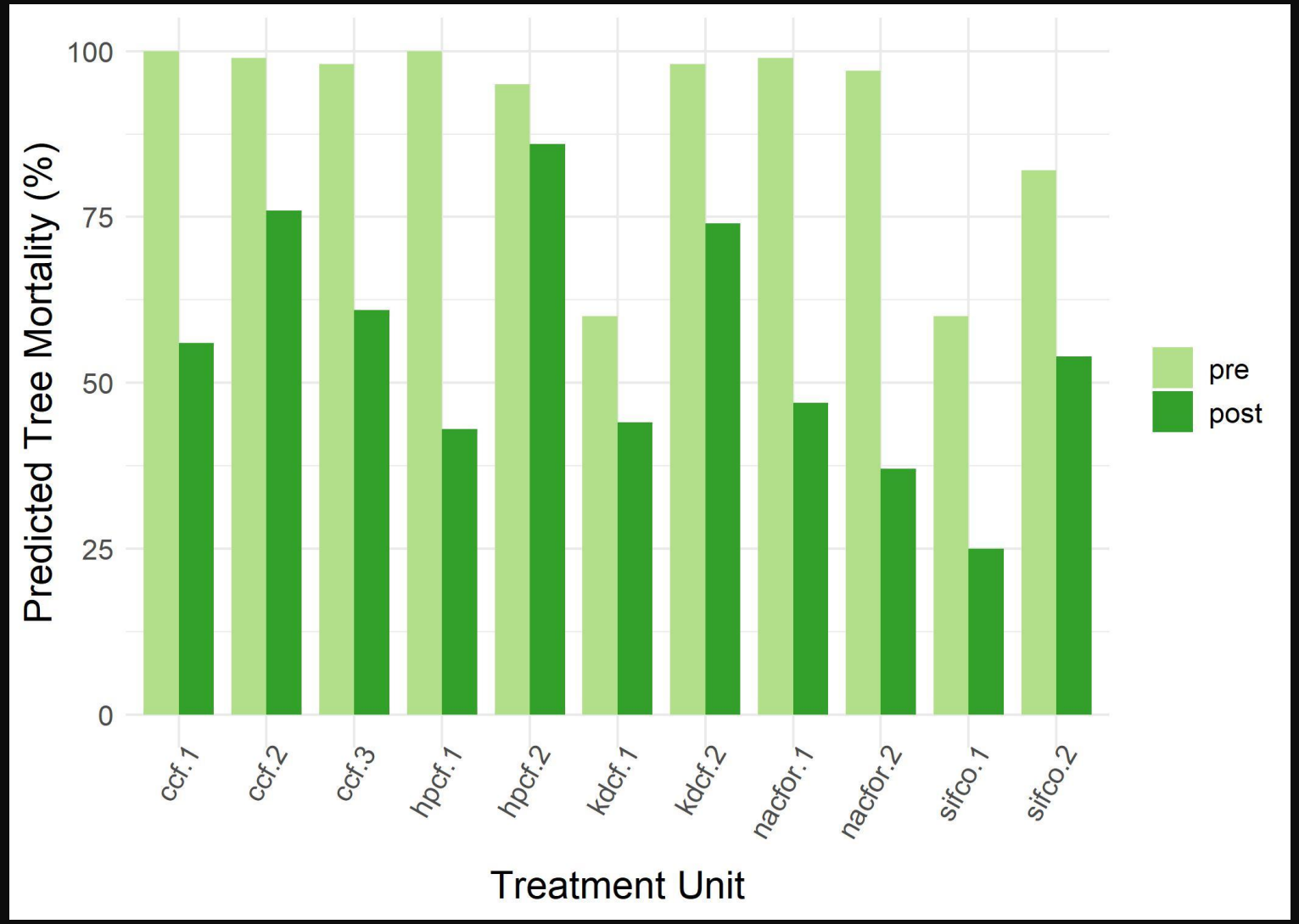
Potential for active crown fire decreases with treatment



(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)

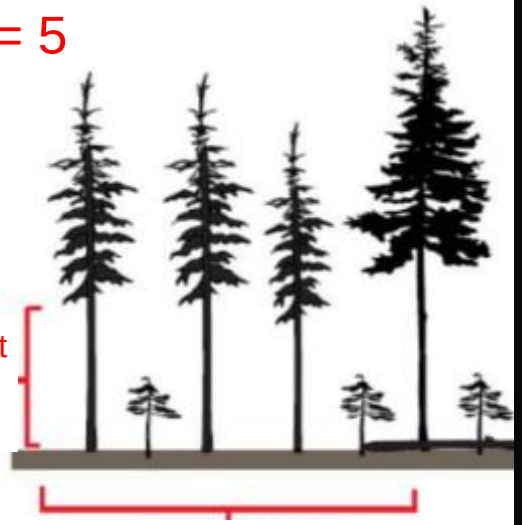
Logan Lake: Treatment Effectiveness

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

British Columbia Community Forest Association

PETER WALL INSTITUTE FOR ADVANCED STUDIES
THE UNIVERSITY OF BRITISH COLUMBIA VANCOUVER

UBCM Union of BC Municipalities

First Nations' Emergency Services Forest Fuel Management

BRITISH COLUMBIA
BC Wildfire Service

Canada Wildfire

Thank you

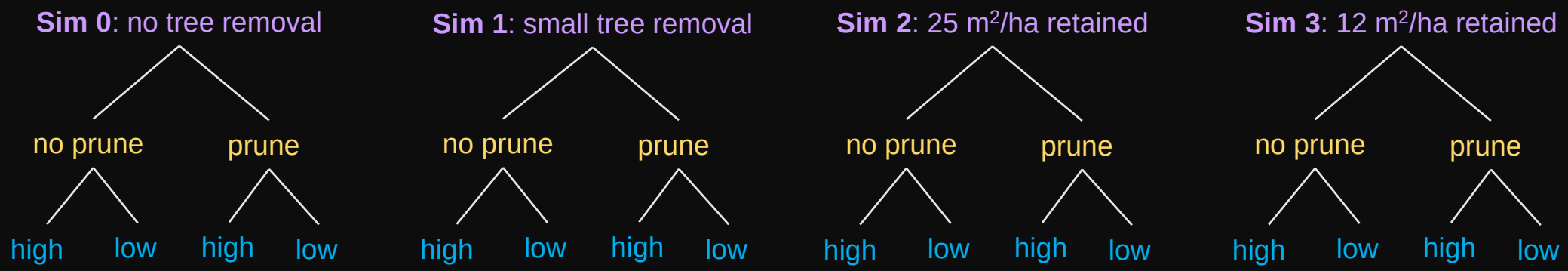
Questions?

https://treering.forestry.ubc.ca/wildfires-in-bc/

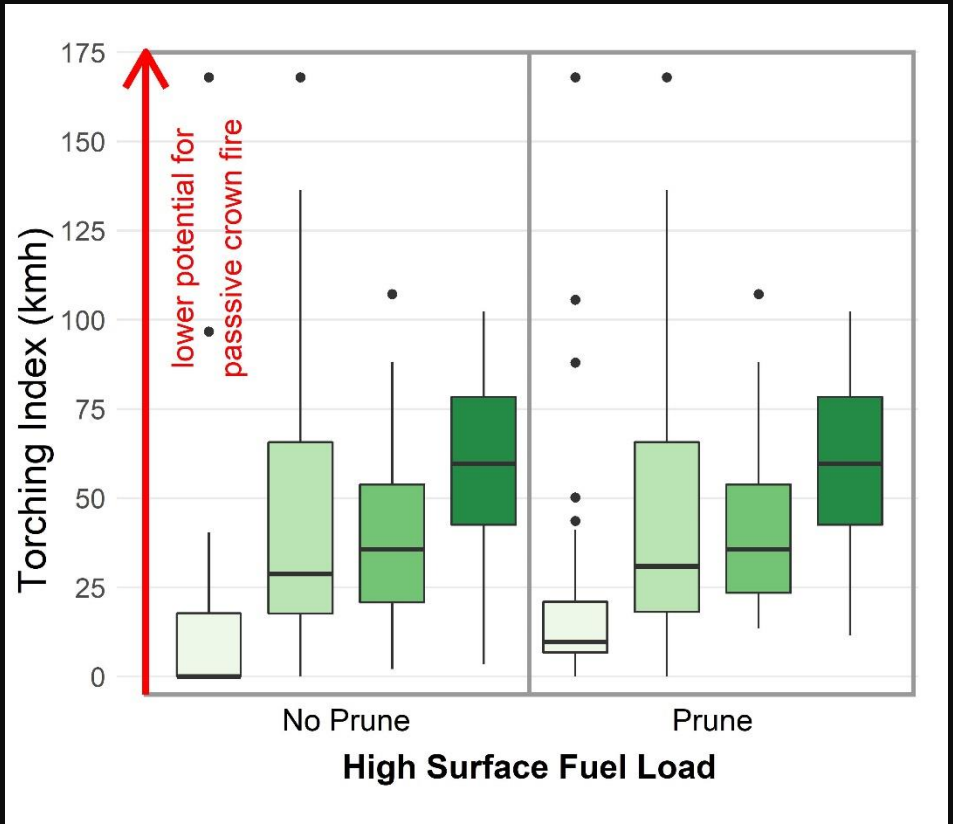
Simulation scenarios

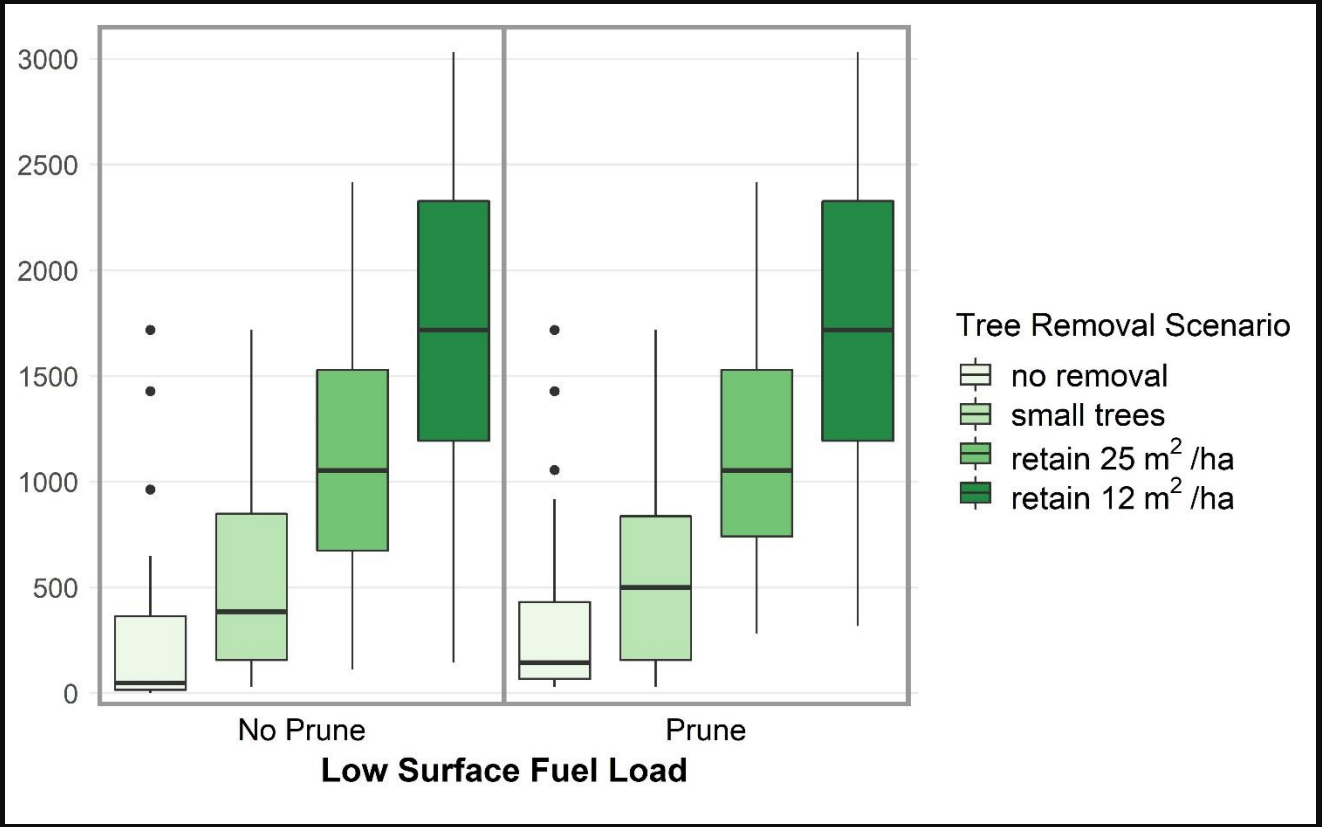
How does crown fire potential and fire severity differ between alternative:

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

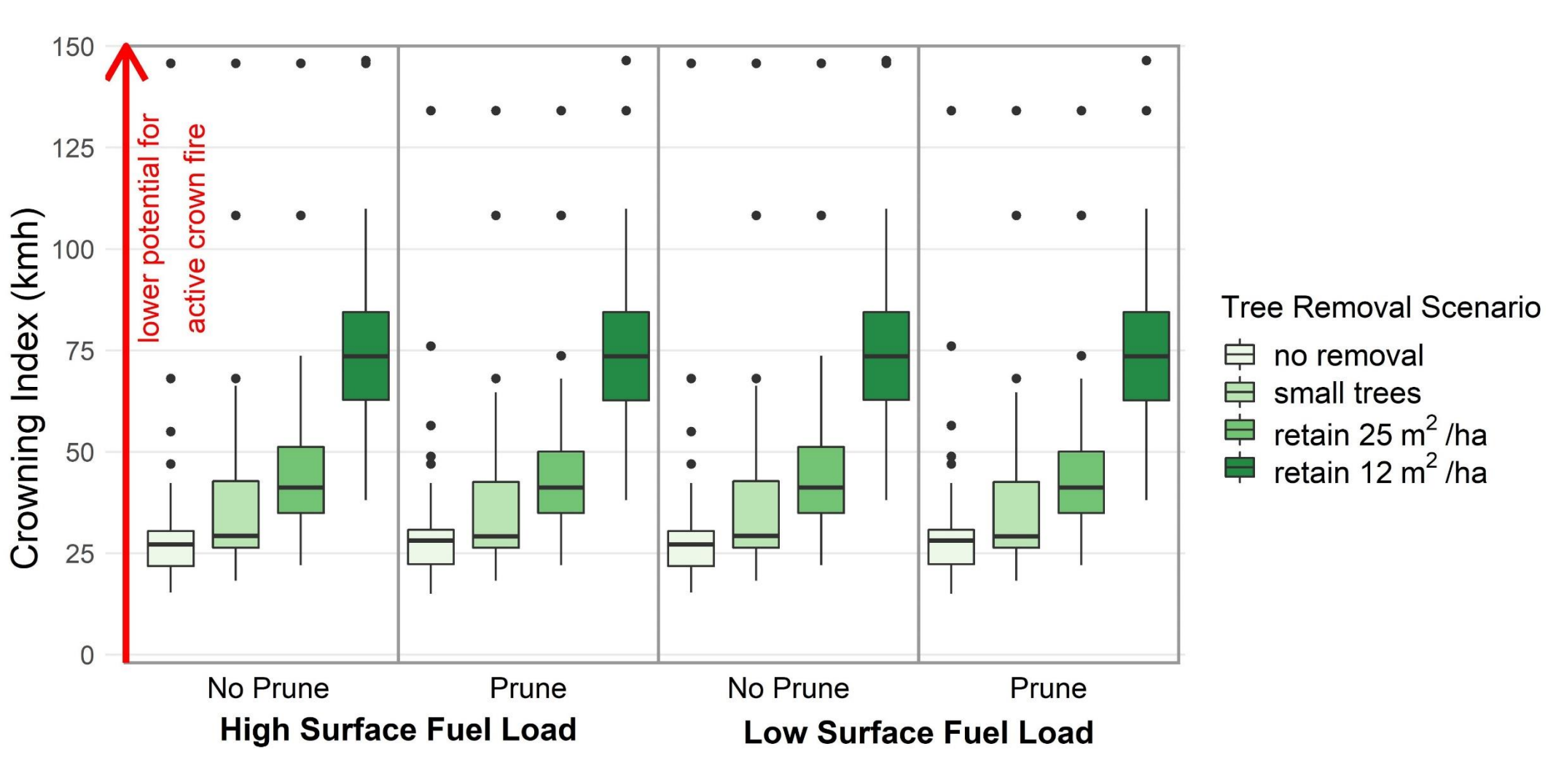


Torching Index: tree removal and surface fuel load but not pruning

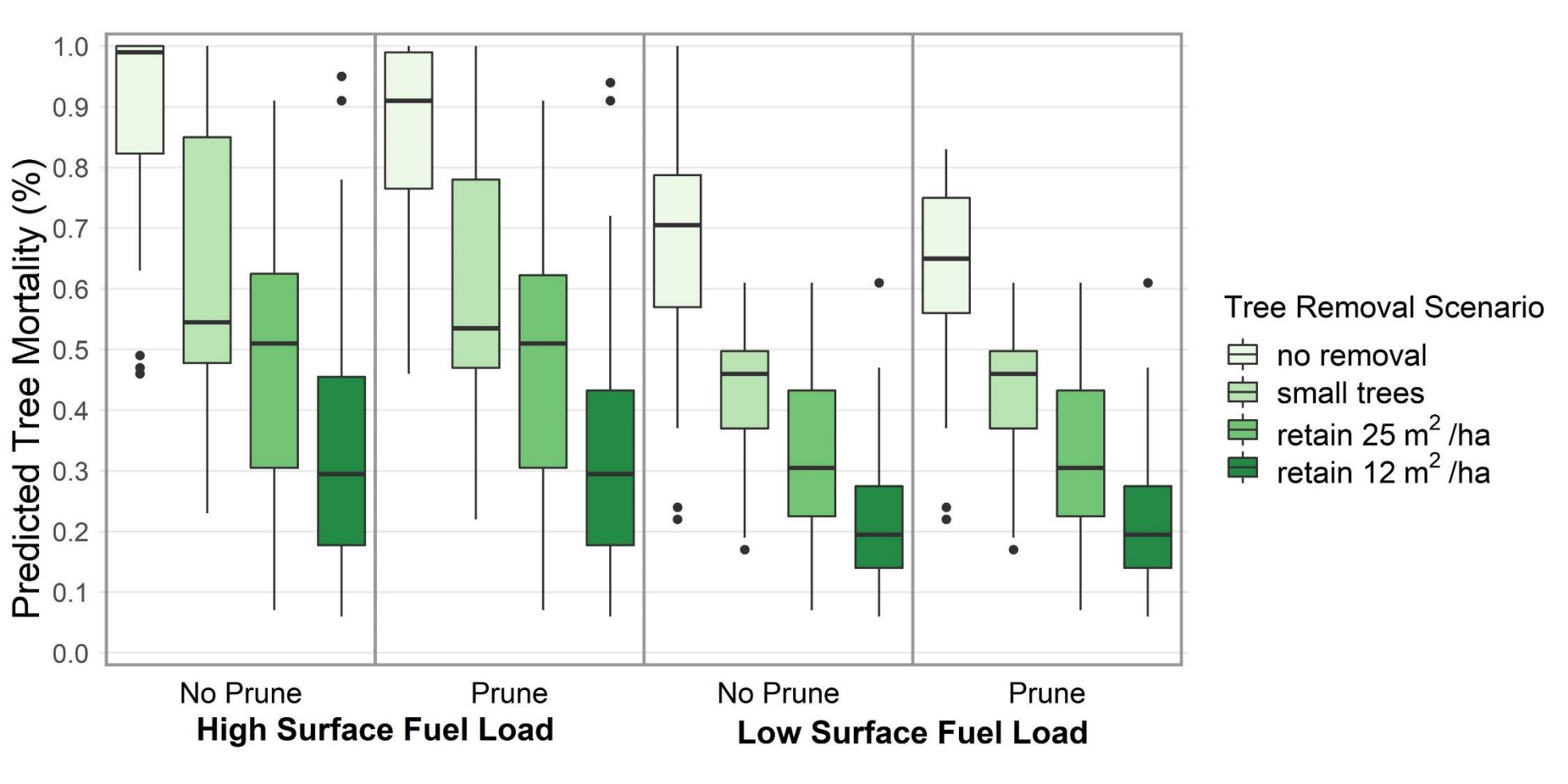




Crowning Index: tree removal only



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

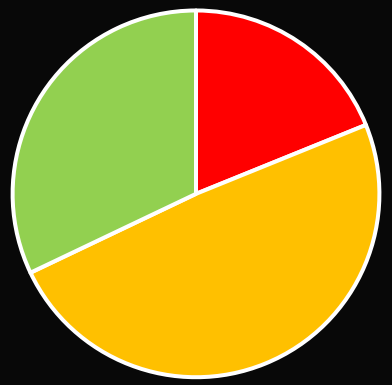


Treatment Efficacy: Fire Behaviour Modelling

CFIS + FBP @ 90th percentile fire weather:

No Treatment

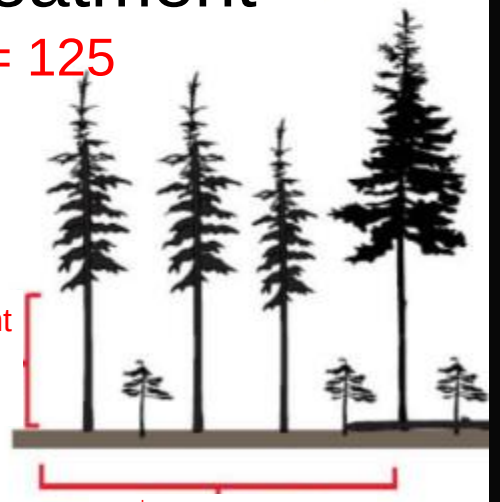
n = 53

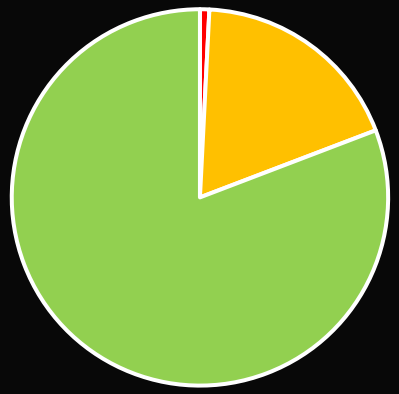


Active Crown	Passive Crown	Surface Fire	
240	130	200	Canopy (ha^{-1})
1170	410	770	Subcanopy (ha^{-1})
0.17	0.16	0.14	CBD (kg/m^3)
6.4	5.0	9.0	CBH (m)

Treatment

n = 125





700	100	170	Canopy (ha^{-1})
300	240	270	Subcanopy (ha^{-1})
0.10	0.06	0.09	CBD (kg/m^3)
7.3	5.6	10.0	CBH (m)

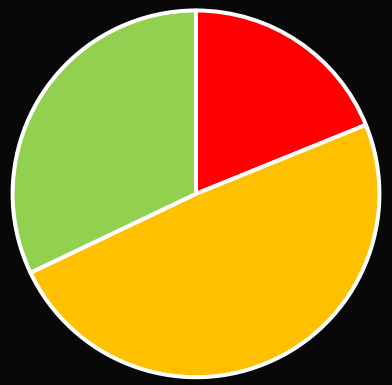
As subcanopy tree density decreases, shift toward surface fire.

Treatment Efficacy: Fire Behaviour Modelling

CFIS @ 90th percentile fire weather:

No Treatment

n = 53



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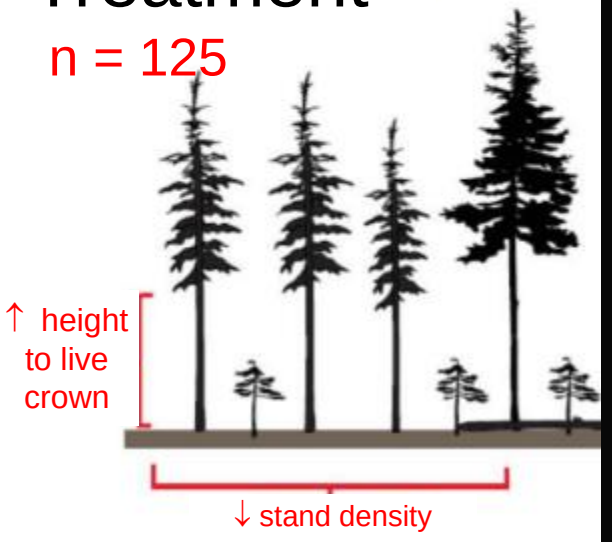

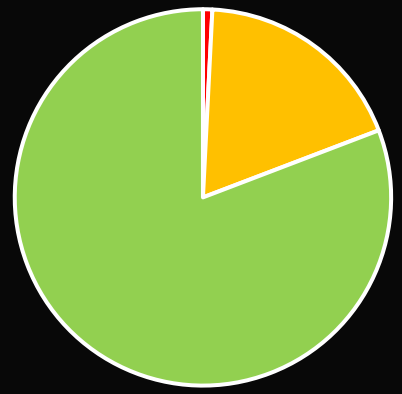

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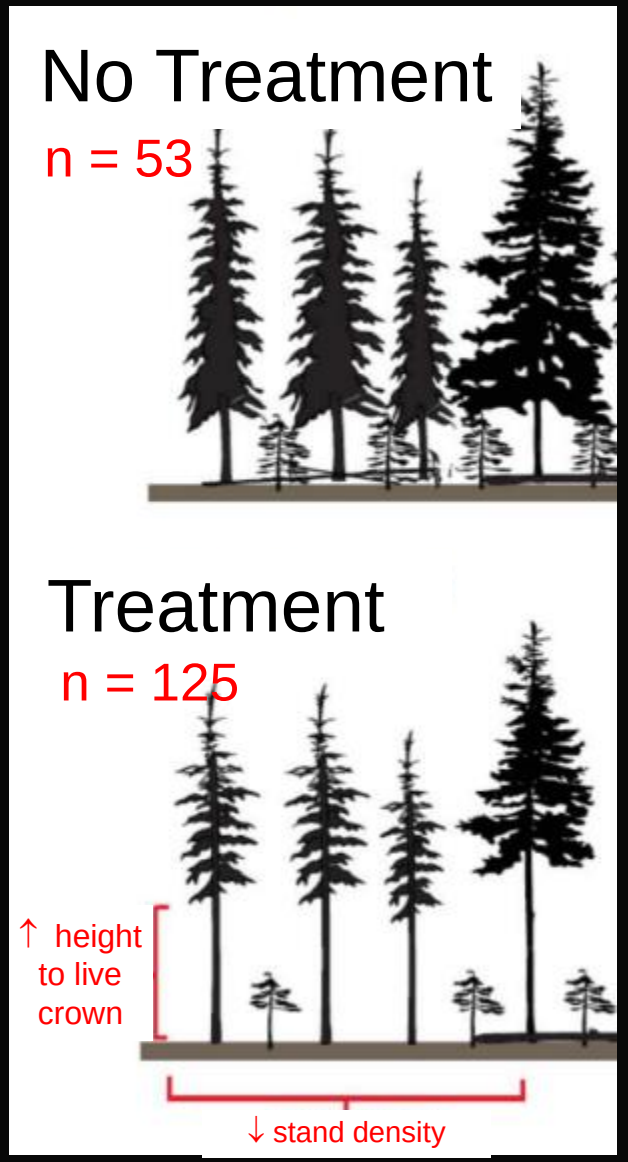
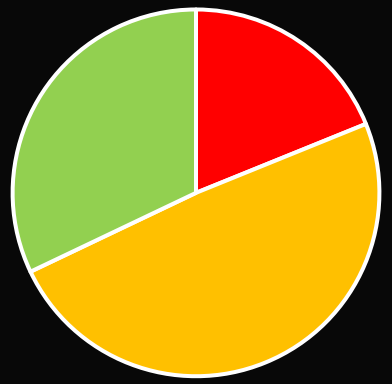
300	240	270	Subcanopy (ha^{-1})
0.10	0.06	0.09	CBD (kg/m^3)
7.3	5.6	10.0	CBH (m)

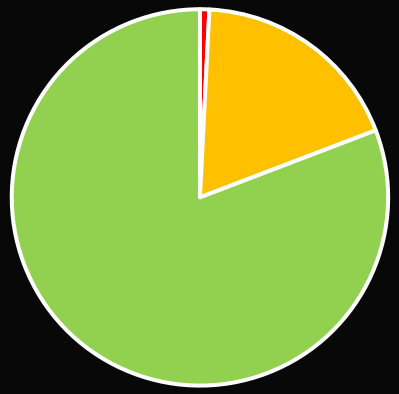
As subcanopy tree density decreases, and CBH increases, shift toward surface fire.

Treatment Efficacy: Fire Behaviour Modelling



CFIS @ 90th percentile fire weather:





Active Crown	Passive Crown	Surface Fire	
1.5	1.4	1.5	Wood (kg/m²)
3.5	2.7	4.2	FF+Duff (kg/m²)
0.10	0.06	0.09	CBD (kg/m³)
0.6	1.7	1.2	Wood (kg/m²)
2.3	3.4	1.6	FF+Duff (kg/m²)

Surface woody fuels comparable, but >1kg m^{-2}
Forest floor + duff exceed small woody fuels