Sunshine Coast Community Forest: Wildfire Tactical Planning Report

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Submitted by:
Nicholas O. Soverel; MSc RPF
Mac Montgomery; MGEM, FIT
Frontera Forest Solutions
www.fronterasolutions.ca

Delivered to:
Sara Zieleman
Executive Director, SCCF
Phone: (604) 885-7809
Cell: (604) 399-9849

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BACKGROUND

The Sunshine Coast Community Forest (hereinafter 'SCCF') contracted Frontera Forest Solutions, Inc (hereinafter 'Frontera') in mid 2023 to complete a multiphase wildfire tactical planning project focusing on three main deliverables:

- SCCF Wildfire Assessment and Tactical Plan,
- Identification and Prioritization of Treatments, and
- Public Engagement.

This project had two main objectives. The primary objective was to characterize and identify wildfire threat and risk within the SCCF tenure areas and determine feasible and professional forestry-focused approaches to reducing these risks. The secondary objective was to seek ways in which the SCCF can support local wildfire planning and wildfire resiliency efforts on the Sunshine Coast, in particular the findings and work outlined in the 'Sunshine Coast Regional District Community Wildfire Protection Plan' (2021).

This report outlines Frontera's main findings and recommendations from this project.

APPROACH

The principles of the approach and methodology we used follows similar recommendations and guidance found in:

- Wildland Urban Interface Wildfire Risk Reduction Plan: 2023 Development Standard Guidance Document[1], and
- Practicing Landscape Fire Management (Forest Practices Board Technical Bulletin)[2].

A schematic of the overall approach we used is provided in Figure 1. Figure 2 outlines a bit more detail into the approach and workflow taken for determining wildfire threat, risk, and management recommendations.

[1] https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/fire-fuel-management/fuels-management/wui_wrr_plan_development_standard_and_guidance_document.pdf
[2] https://www.bcfpb.ca/release-publications/releases/practicing-landscape-fire-management-technical-bulletin/

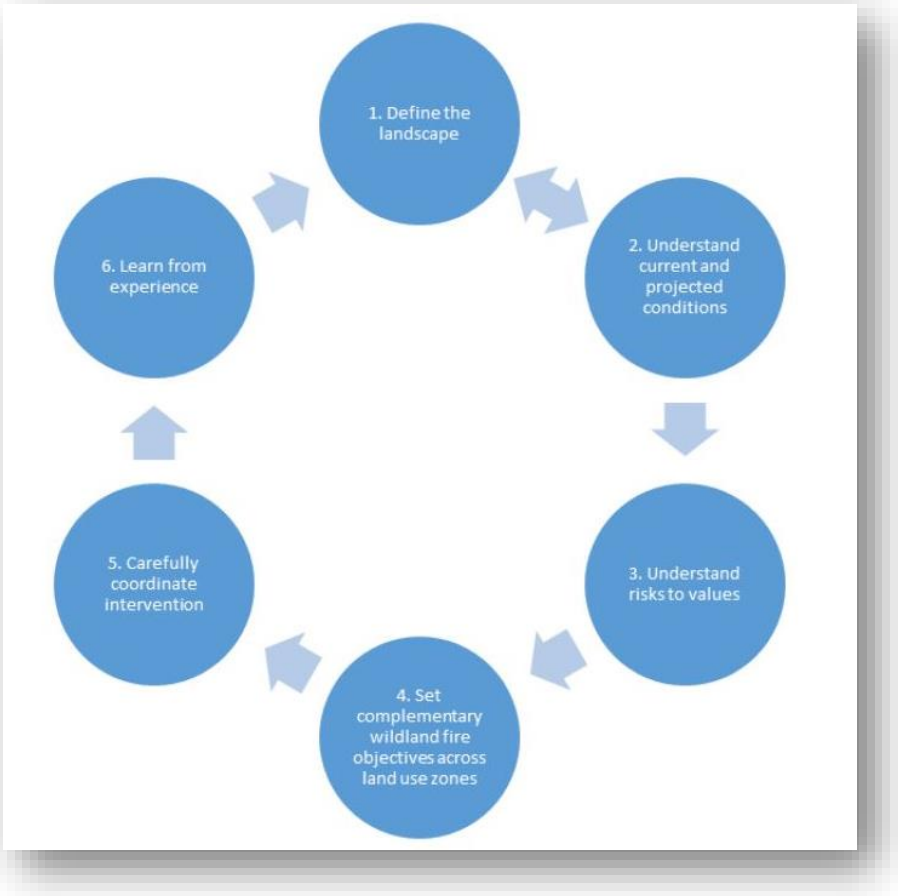


Figure 1. Schematic taken from *'Practicing Landscape Fire Management – Technical Bulletin'*.

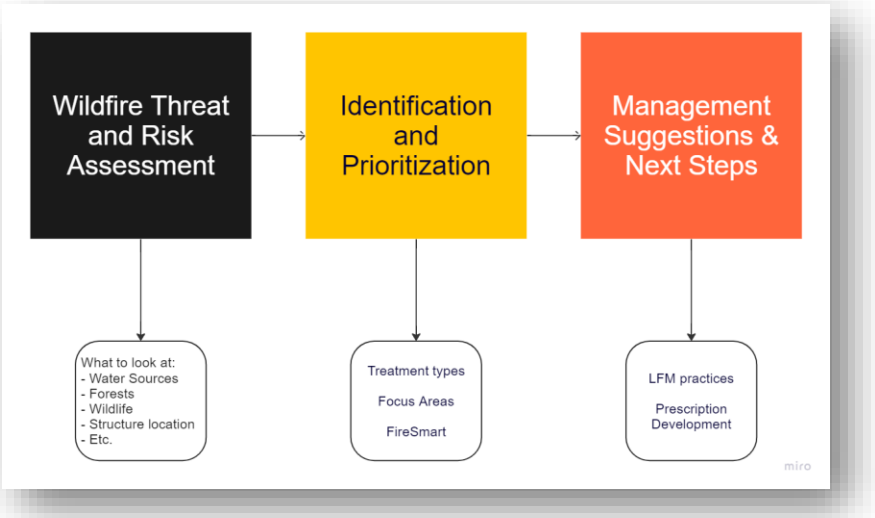


Figure 2: The Tactical Planning Process.

SCCF STUDY AREA

The study area for this work was focused on the SCCF tenure, particularly where it overlaps with the wildland urban interface (WUI) (Figure 3).

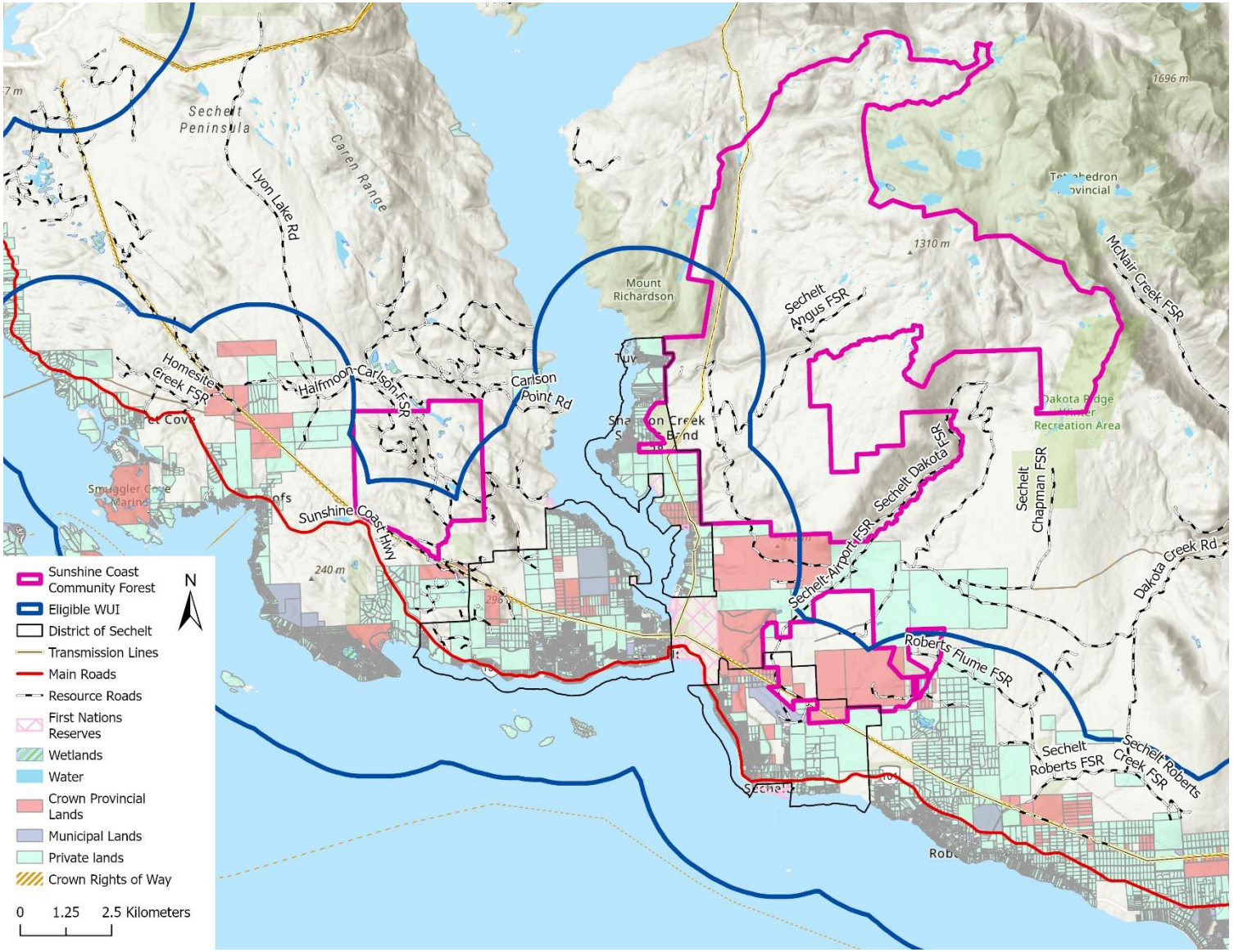


Figure 3. Area of Interest - SCCF Tenure and WUI

WUI AND WUI+1 AREAS

Wildfire Risk Reduction Zones can be defined in order to prioritize different activities based on distance from homes: firstly, the “WUI Zone” which was based on the WUI developed in the Sunshine Coast Regional District CWPP from 2021 and is approximately 2 km from a structure density class of 6, and the “WUI + 1km Zone” which is an additional kilometre buffer added on to the WUI Zone (see Figure 4).

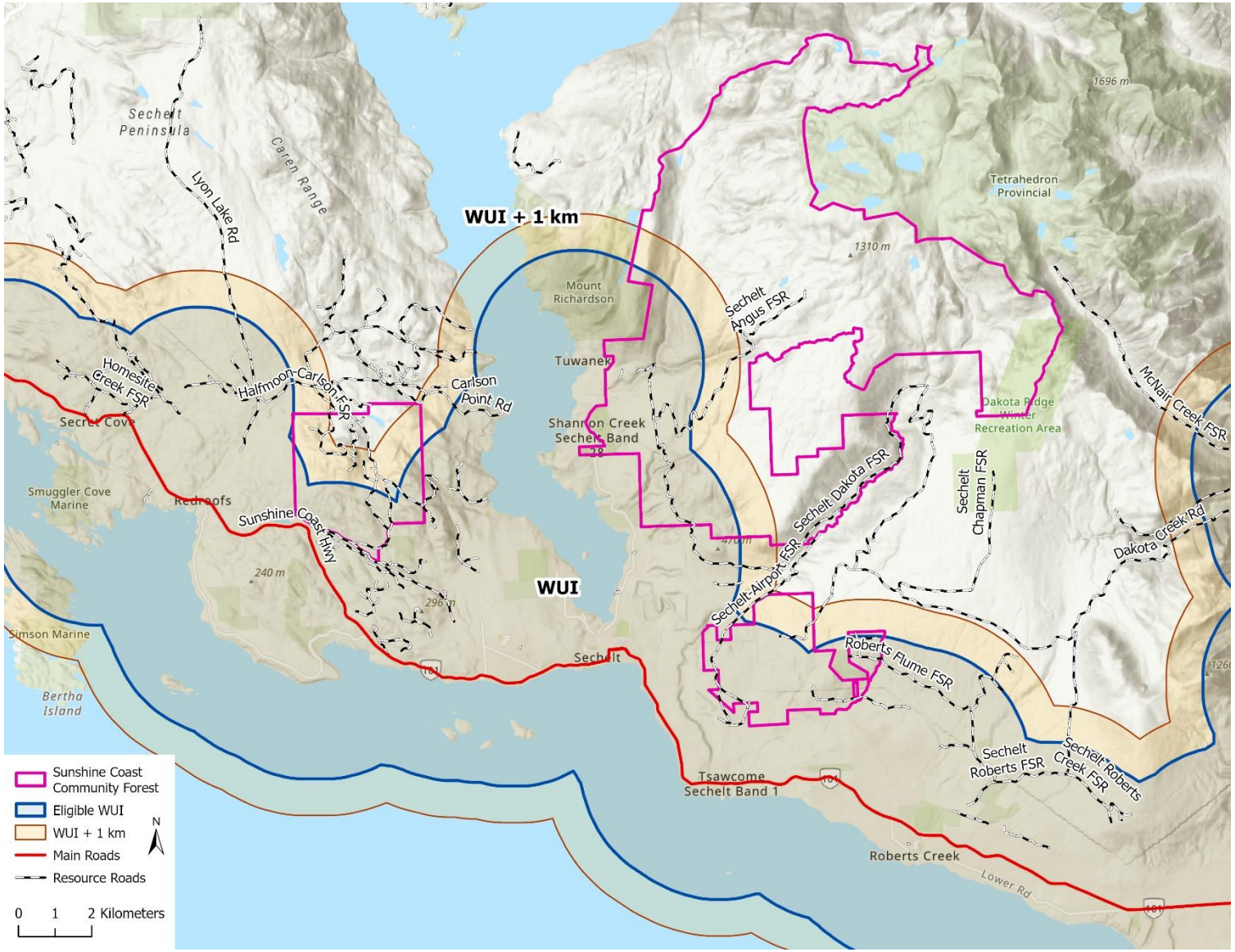


Figure 4. Sunshine Coast Community Forest WUI and WUI + 1 km map.

FIRE ECOLOGY & HISTORY IN THE SCCF

The Biogeoclimatic Ecosystem Classification (BEC) zone in the study area is predominantly Coastal Western Hemlock (CWH), with most of the study area in the subzones CWHxm (very dry maritime) and CWHdm (dry maritime). The CWH zone is generally wet, with hot and dry summer seasons. The subzones closer to sea level are warmer and drier, with increased moisture and cooler temperatures moving away from the coast and upslope.

Natural disturbances in the study area include windthrow, insect and disease outbreaks, and wildfire, among others. The predominant natural disturbance type (NDT) in the study area is NDT-2 "Ecosystems with infrequent stand-initiating events", indicating that these forests generally experienced infrequent wildfires (every 200 years or so) and wildfires were usually of moderate size (20-1000 ha).

HISTORICAL WILDFIRE NATURAL HISTORY PACIFIC NORTHWEST RESEARCH FINDINGS

In order to determine the threat and risk of wildfire for SCCF, it is important to determine the historical wildfire regime – what type of fires are likely to occur, and where? There are generally two types of wildfires throughout the Pacific Northwest (PNW) region:

1. Small to moderate events (0-10,000 ha fires),
2. Extreme events (10,000 ha+; sometimes but very rarely as large as 100,000 ha+)

Small/Moderate Type Wildfire Events

A local example of the small/moderate wildfire event is the 2015 Old Sechelt Mine Wildfire, which was 423.3 ha in size (288 within SCCF tenure), human-caused and wind-driven, and resulted in no property damage but one fatality, a tree faller. This was the first major fire on the Sunshine Coast since the 30s-40s, driven by dry fuels in a severe drought year.

Large/Extreme Type Wildfire Events

A coastal example of the large/extreme type of wildfire is the 2015 Elaho Fire, which was 12,495.2 ha in size. This fire occurred about 100km from SCCF, was lighting-caused and wind-driven.

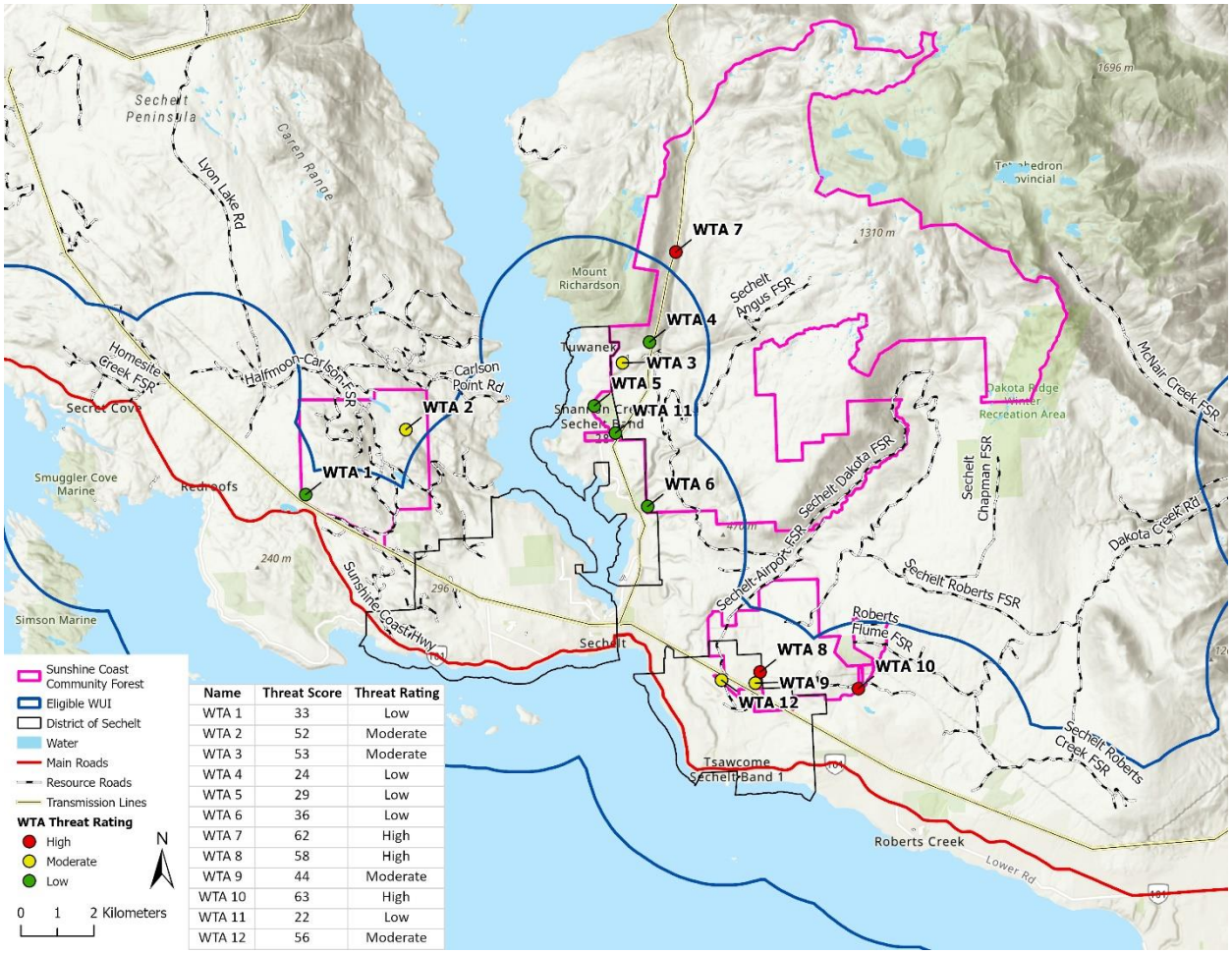
Additional information on this topic can be found in Appendix A.

WILDFIRE THREAT & RISK ASSESSMENT

FIELD DATA COLLECTION: WILDFIRE THREAT ASSESSMENT & RECONNAISANCE

Frontera visited the SCCF for field data collection and reconnaissance on August 23-24, 2023. Two field crew (Mackenna Montgomery, FIT and Meagan Warkentin, FIT) completed a total of 12 Wildfire Threat Assessments (WTAs), particularly focusing on areas identified by the SCCF as of concern, areas within the WUI near infrastructure or homes, and areas near Critical Infrastructure. Drone flights were also conducted to take aerial photos of the forest and view areas that were difficult to access.

Of the WTAs completed, three out of twelve received a “High” rating, while the remaining 9 plots were rated as “Moderate” or “Low” (Figure 5).



Name	Threat Score	Threat Rating
WTA 1	33	Low
WTA 2	52	Moderate
WTA 3	53	Moderate
WTA 4	24	Low
WTA 5	29	Low
WTA 6	36	Low
WTA 7	62	High
WTA 8	58	High
WTA 9	44	Moderate
WTA 10	63	High
WTA 11	22	Low
WTA 12	56	Moderate

Figure 5. SCCF WTA Map.

During reconnaissance and plot data collection, it was noted that the terrain was variable, with some stands having negligible slopes of 0-5% and other stands relatively steep at 30-35% slope. Many stands had high levels of ladder fuels and CWD. WTA plots that received a Low or Moderate threat assessment score were generally lower-density in both the overstory and understory and had lower ground fuel loading and higher canopy-base heights (CBH). WTA plots that received a High rating were generally higher-density, particularly in the understory, had more ladder fuels, and higher ground fuel loading.

WILDFIRE MODELLING RESULTS

The wildfire modeling process uses the Fire growth modeling software to simulate wildfires over broad areas, particularly focusing on the WUI and WUI +1km areas. This part of the method is crucial for identifying high-risk areas, which are often characterized by dense conifer forests and uninterrupted vegetation, making them more prone to fire spread.

Through modeling, we generate detailed simulations that consider the landscape's layout, potential ignition points, and the influence of wind. The outcome is a series of maps showing potential fire intensity, how quickly fires might spread, and their likelihood. A significant finding from these simulations is the presence of numerous high-risk zones, especially around residential areas and subdivisions, as well as near important structures and facilities within the community forest.

Following the simulation, an in-depth analysis of each map section is carried out. Here, each area is assigned a threat score based on the projected fire behavior, which includes the intensity and speed of potential fires, and the probability of their occurrence (see Figure 6). This step is particularly vital given the close proximity of the community forest to populated and infrastructural areas, highlighting several zones with elevated risk.

After mapping out critical and valuable locations within SCCF, such as critical infrastructure, each area's risk score is then determined based on how close these important sites are to the potential fire zones. This aspect is of high importance due to the tenure's inclusion and nearness to areas of private land and critical infrastructure.

Finally, we merge the fire threat scores with the proximity scores to establish an overall risk level for the area of interest (see Figure 7). This comprehensive risk assessment classifies each area on a scale from minimal to extreme threat, taking into account both the nature of the potential fires and their proximity to key human locations. This method not only evaluates the potential behavior of wildfires but also emphasizes their closeness to inhabited and critical areas, particularly within and around the community forest. Such an approach is essential for effective planning and response in wildfire management.

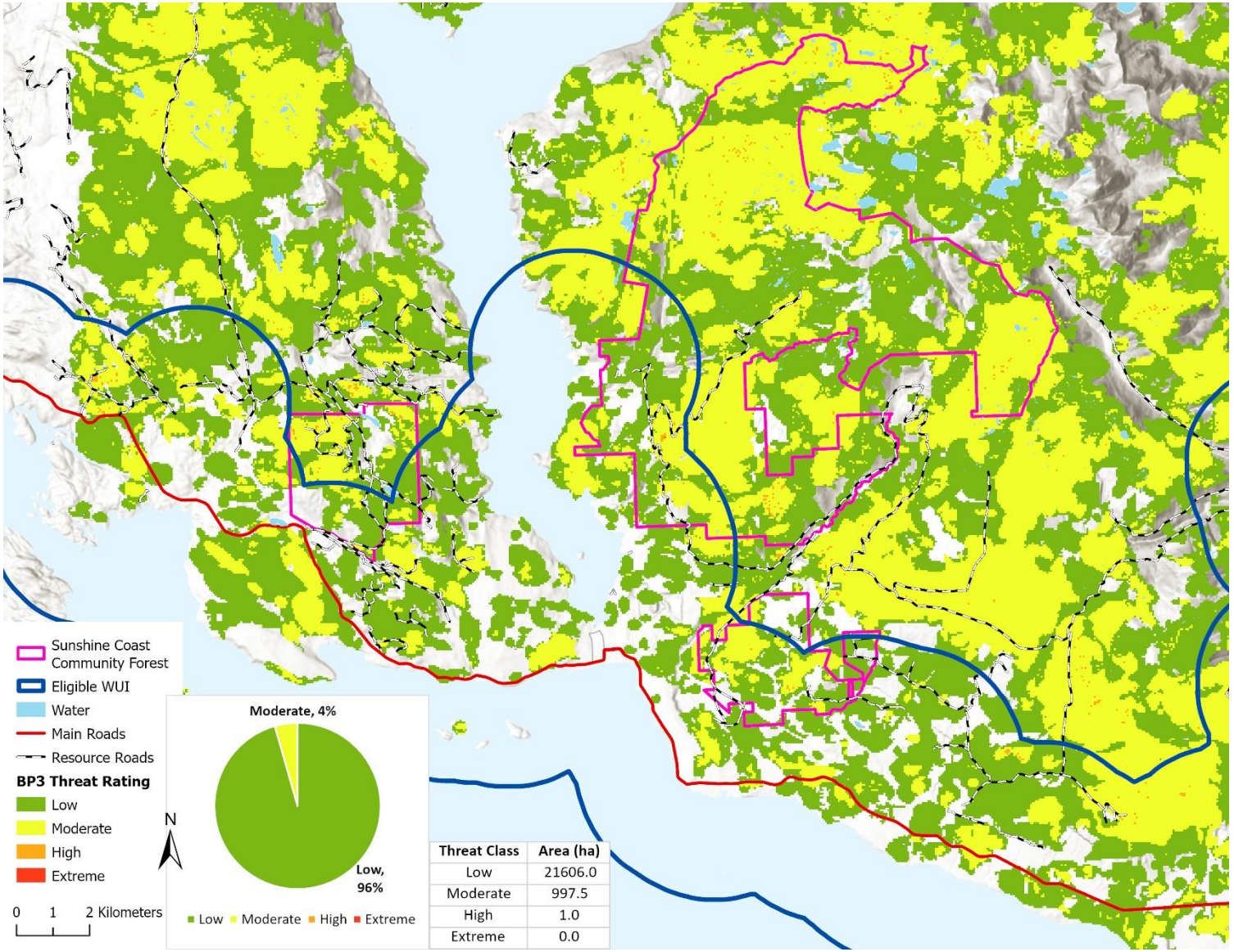


Figure 6. Burn P-3 Modelling Outputs – Threat Rating.

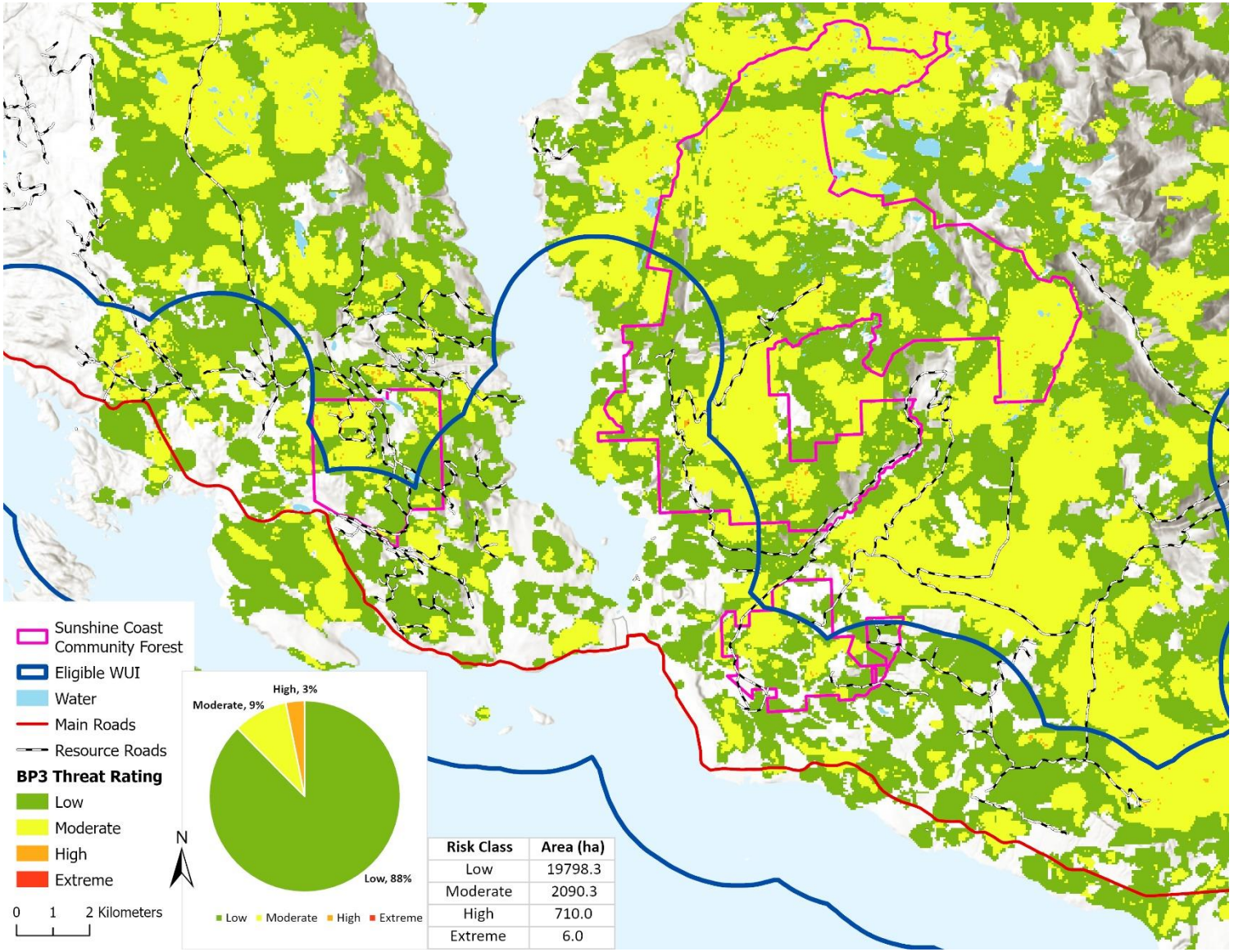


Figure 7. Burn P-3 Modelling outputs – Risk Rating.

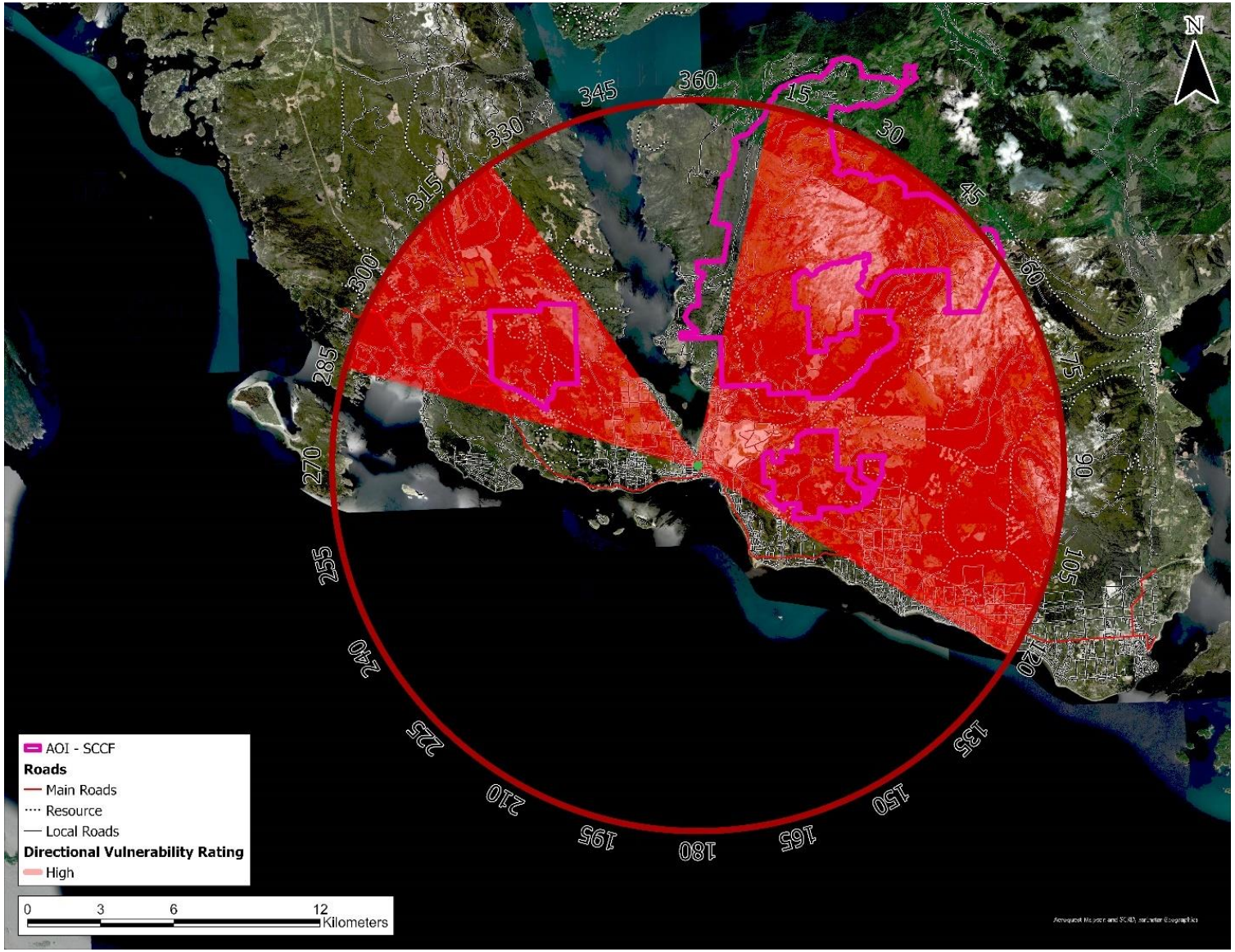


Figure 8. Sunshine Coast Community Forest Directional Vulnerability Map.

MANAGEMENT RECOMMENDATIONS & NEXT STEPS

WUI AREA MANAGEMENT RECOMMENDATIONS

- Prescribe and operationally treat proposed treatment polygons within the WUI, listed in this Tactical Plan (See WUI map),
- Complete vegetation management activities using FireSmart principles around critical infrastructure, and wherever feasible in the WUI
- Employ forestry practices that increase overall diversification across a landscape (see WUI+1 km map).

Within the WUI Zone, fuel management treatments can be prescribed and implemented to protect homes and critical infrastructure. These treatments should be done, where possible, simultaneously with the SCRD and home FireSmart treatment activities. These fuel management areas should be located within 1,000 m of homes and can be considered long-term or perpetual treatments – as such they require monitoring and maintenance treatments to maintain reduced fuel levels. Treatment activities can include prescribing: tree thinning, pruning, surface fuel removal, pile burning, prescribed fire, vegetation, or species conversion. FireSmart principles and actions should also be employed, particularly within the FireSmart Ignition Zones (HIZ) up to 30 m from critical infrastructure (see Figure 9).

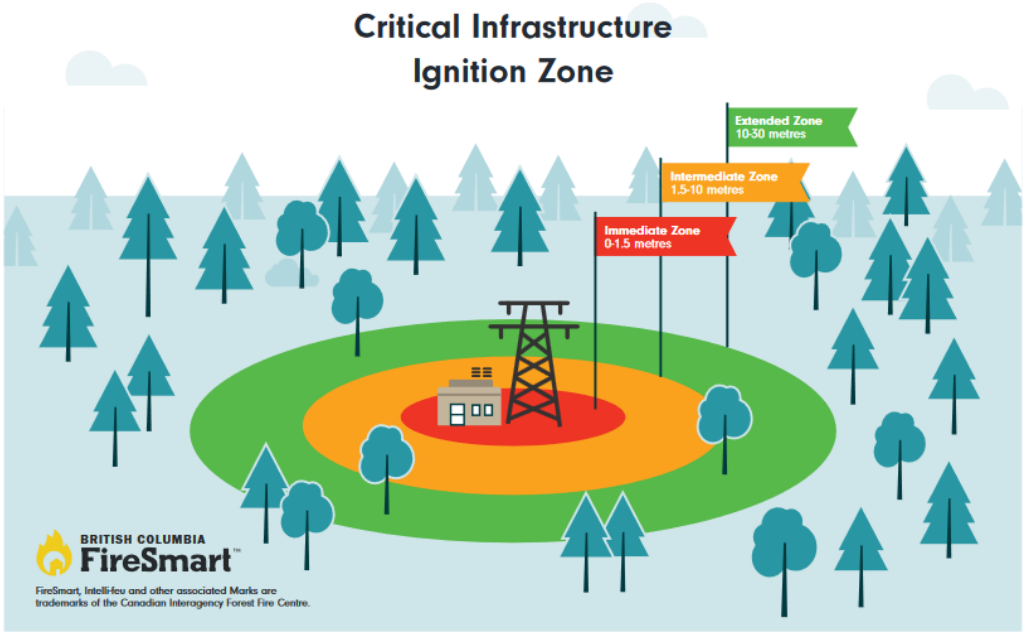


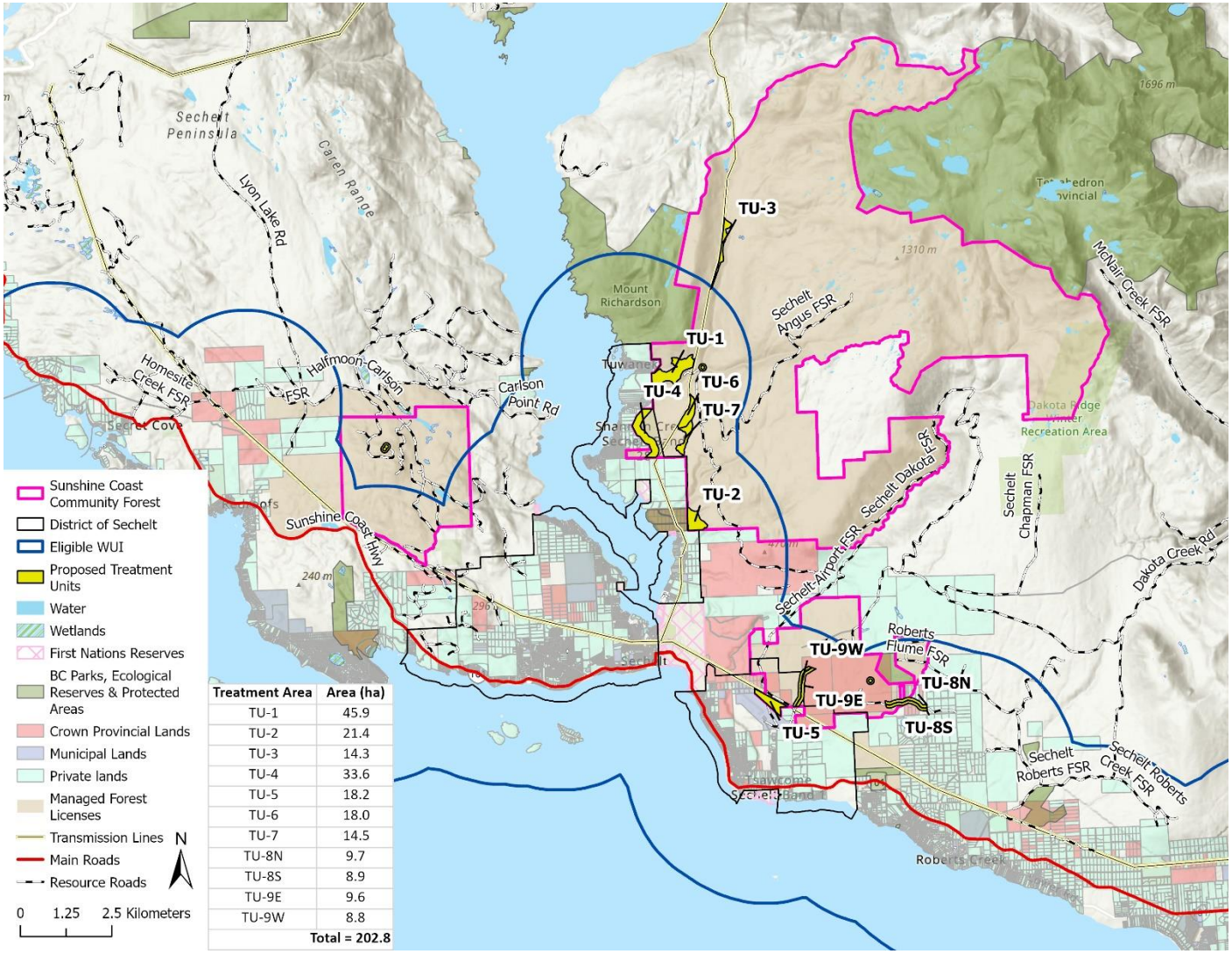
Figure 9. The FireSmart Critical Infrastructure Ignition Zones.

PROPOSED FUEL MANAGEMENT TREATMENTS

Table 1 lists all SCCF proposed fuel management treatments, ordered by priority for treatment.

Table 1. Prioritization table for SCCF Fuel Management Treatments

AreaID	TU Unit ID	Fire Threat Class	Feasibility Class	TU Area_ha
TA-3	TU-3	Extreme	High	14
TA-8	TU-8S	Extreme	High	9
TA-8	TU-8N	Extreme	High	10
TA-9	TU-9E	Extreme	High	10
TA-9	TU-9W	High	High	9
TA-5	TU-5	High	High	18
TA-1	TU-1	High	Moderate	46
TA-4	TU-4	Moderate	Moderate	34
TA-2	TU-2	Moderate	Low	21
TA-6	TU-6	Low	High	18
TA-7	TU-7	Low	High	14
FireSmart Units				
TA_FS100	TU_FS100_HP	High	Moderate	5
TA_FS50	TU_FS50_HP	High	Moderate	2
TA_FS100	TU_FS100_EW	Moderate	High	3
TA_FS100	TU_FS100_CCW_B	Moderate	Moderate	3
TA_FS50	TU_FS50_CCW_B	Moderate	Moderate	1
TA_FS50	TU_FS50m_GW	Moderate	Moderate	1
TA_FS50	TU_FS50_EW	Low	High	1
TA_FS100	TU_FS100_GW	Low	Moderate	3



Treatment Area	Area (ha)
TU-1	45.9
TU-2	21.4
TU-3	14.3
TU-4	33.6
TU-5	18.2
TU-6	18.0
TU-7	14.5
TU-8N	9.7
TU-8S	8.9
TU-9E	9.6
TU-9W	8.8
	Total = 202.8

Figure 10. Sunshine Coast Community Forest Proposed Treatment Area Map.

WUI + 1KM ZONE WILDFIRE MANAGEMENT RECOMMENDATIONS

Within the extended distance of the WUI + 1km zone, it is recommended that the SCCF employ forest activities that seek to:

- Reduce the flammability of the forest overall,
- Reduce the probability of ignition, particularly along high human traffic areas like roads,
- Create discontinuity so that wildfires do not spread as readily, and
- Promote access into the forest for firefighting crews and increase firefighter safety.

Based on the above, the recommended forest practices that can be implemented by the SCCF include:

- Modifications to reforestation practices, including reduction of coniferous density planting as well as increasing proportion and mix of deciduous trees and shrubs diversity and composition,
- Changes in harvest shape, location and size to create discontinuity,
- Additional tree removal along or near forestry roads to improve firefighter access,
- Innovative and additional slash or fuel abatement in these areas,
- Increased use of prescribed or cultural burning where appropriate and safe to do so.

More specifically, forest practice recommendations from *'Practicing Landscape Fire Management'*[3] are provided for general context in Table 2.

Table 2: Examples of integrating landscape fire management strategies into forest planning and practices.

STRATEGY	INTEGRATION INTO PLANNING AND PRACTICES
Create primary / secondary / shaded fuel breaks	• Road planning, building, and maintenance
Manage surface fuel loading	• Prescribed or cultural burn • Post-harvest pile • Post-harvest mastication / chipping • Post-harvest pile and burn • Stand treatment hand cleaning
Reduce crown fuel load	• Target harvesting • Modified stocking • Spacing / thinning (commercial or pre-commercial)
Increase crown base height	• Targeted harvesting • Pruning

[3] https://www.bcfpb.ca/release-publications/releases/practicing-landscape-fire-management-technical-bulletin/

APPENDIX A: WILDFIRE CONTEXT IN COASTAL BC

WET PACIFIC NORTHWEST FIRE ECOLOGY

Along the Coast of BC, the settler fire history record (< 100 years old) is likely insufficient to fully predict the size range, intensity, or severity of fires. Furthermore, fire suppression began in earnest after the second world war which is very likely to have reduced the size and number of Pacific Northwest fires. Furthermore, there has been a limited amount of academic or research of fire history within the Sunshine Coast area. This may be in part because it is difficult to study fire regimes and ecology in a natural system that burn irregularly.

Therefore, in this section, we broaden the geographic scope to studies and research within the Pacific Northwest Region which generally encompasses the US states of Oregon, Washington and the entire Province of BC.

CHARACTERISTICS OF WET PACIFIC NORTHWEST FIRES

There are generally two types of wildfires throughout the area: 1) small to moderate events (0- 1,000 ha fires), 2) Large or extreme events (10,000+; rare events 100,000 ha+). The more frequent small to moderate events occur during fire season typically on drier Douglas-fir dominated south/east facing slopes throughout the Pacific Northwest. However, the rare large/extreme events indicate that the largest wildfire events (or episodes) burned up to 100,000–1,000,000 ha. 1967; Henderson et al. 1989, Spies et al. 2018). Some local wildfires that occurred in the region and within settler history included the 1902 Yacolt Burn in the southwest Washington Cascades (~400,000 ha) and the 1933 Tillamook Burn in the Oregon Coast Range (>100,000 ha; Holbrook 1960, Kemp 1967).

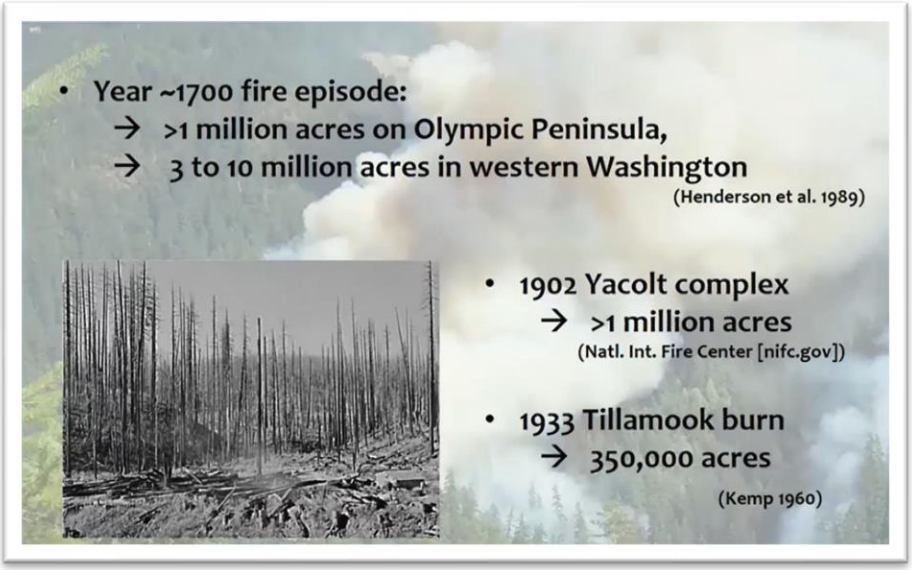


Figure 11. Screen capture taken from https://www.youtube.com/watch?v=6EDFmK2_7l8 (webinar).

These large/extreme wildfire events typically have three coinciding factors (Figure 12):

- Exceptional summer drought,
- Ignition source,
- Synoptic wind event.

Schroeder (1964) states the following broad description of synoptic winds for the Pacific Northwest Region:

> *The critical season is June through September, with occasional critical periods as early as April and as late as November. Fire danger is produced by surface air flow with an offshore component. There are two types: Pacific High with Post-frontal or East Winds and Northwest Canadian High with Post-frontal or East Wind. High fire danger occurs in the postfrontal areas of a cold front if the isobars are oriented so that the flow is from the northeast quadrant. Flow from this direction not only keeps the marine air offshore but also results in adiabatic warming. If a portion of a Pacific or Northwest Canadian High moves into the area east of the Cascades, easterly winds are found in the region between this area and a trough along the Pacific Northwest coast, and high fire danger occurs west of the Cascades.*

Furthermore, Evers et al. (2022) describes additional important characteristics of these winds:

> *Historical reports of megafires in temperate rainforests of Oregon and Washington describe rapid fire growth occurring during periods of low fuel moisture and strong, sustained, downslope mountain, east winds, suggesting that synoptic-scale weather patterns drive fire disturbance in the region.*

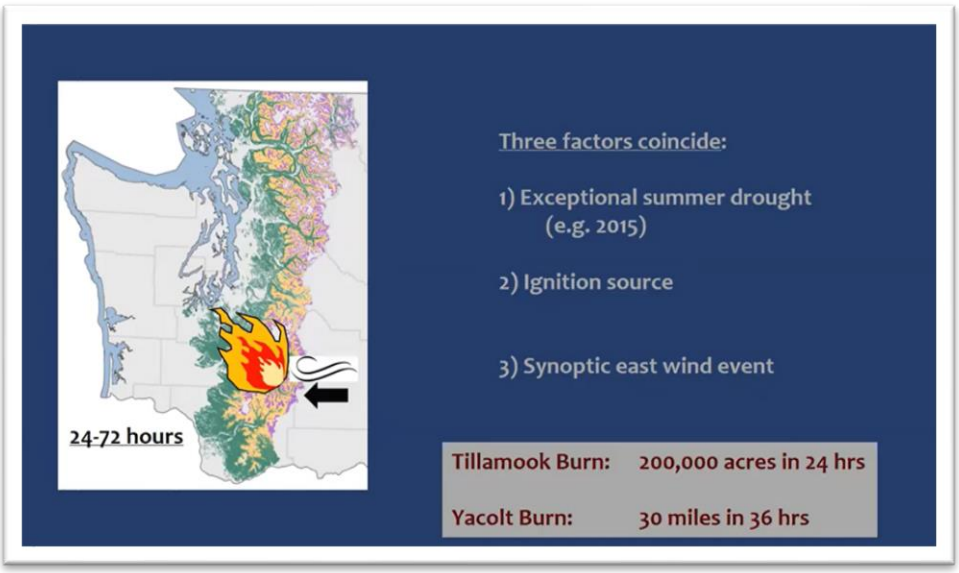


Figure 12. Screen capture taken from https://www.youtube.com/watch?v=6EDFmK2_7l8 (webinar).

Both through historical wildfire documentation and wildfire simulation modelling, the largest wildfires in the west Pacific Northwest could more appropriately be characterized as wind-driven fire events rather than purely fire events. The recent Elaho fire of 2015 burned 12,500 ha with much of this growth exploding only after the start of Northern outflow winds (Simpson, 2016). From this report, Simpson writes:

'The July 4/5 event was different. It resulted in fire growth not witnessed in at least a generation on the South Coast. The run started as an escape from a quiet part of the perimeter on the south flank of the fire. On July 4th at 1800 northerly winds reached surface and crews working the south flank of the fire reported an escape with trees candling, and fire spread described as "slow". By 2000, when the last resources were leaving the fire, suppression personal described the entire south flank of the fire moving south being pushed by "strong" northerly winds. Estimated spotting distances of 500m were estimated with continuous crown fire filling in from behind. Unfortunately, most of this run occurred at night and was not observed. The security guard standing by the fuel bowser (13km from the escape) said "a wall of fire" could be seen from his position at 24:00 – he left shortly after. A crew sent to check the fire and evacuate campsites along the river bottom reported "the whole valley was on fire" and that convection winds drawing into the fire damaged a truck door by ripping it backwards.'

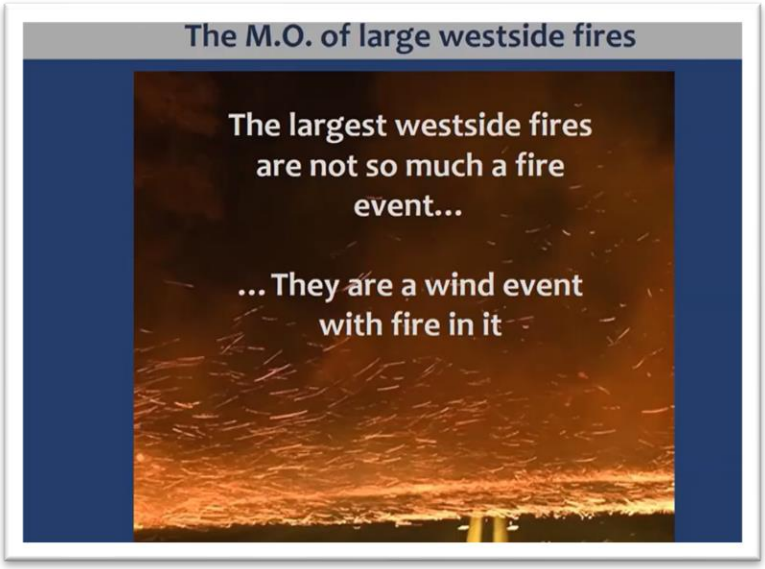


Figure 13. Screen capture taken from https://www.youtube.com/watch?v=6EDFmK2_7I8 (webinar).

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Figure 14. Screen capture taken from https://www.youtube.com/watch?v=6EDFmK2_7l8 (webinar).

Typically, ignitions in the Pacific Northwest are human caused and under the above coinciding conditions, multiple fires can coalesce into even larger wildfires. Similar research also found that smaller fires (<1,000 ha) can also have very high disproportionate negative effects to communities and human values.

PLANNING AND MANAGEMENT TAKEAWAYS

Wet Pacific Northwest communities including those in BC are rarely represented, named, or ranked in community wildfire risk and exposure reports and papers drawing on mean-based metrics, giving the impression that these interface communities are either not at risk at all, or that the risk is miniscule, and resources should be allocated elsewhere[4].

While wildfire may be an unlikely annual occurrence, the potential consequences and concerns around wildfire in these areas demands a more nuanced approach to understanding and communicating risk. Part of this nuance is understanding the two dominant types of west side fires:

- **Moderate-condition events (Figure 15),**
- **Extreme-condition events (Figure 15).**

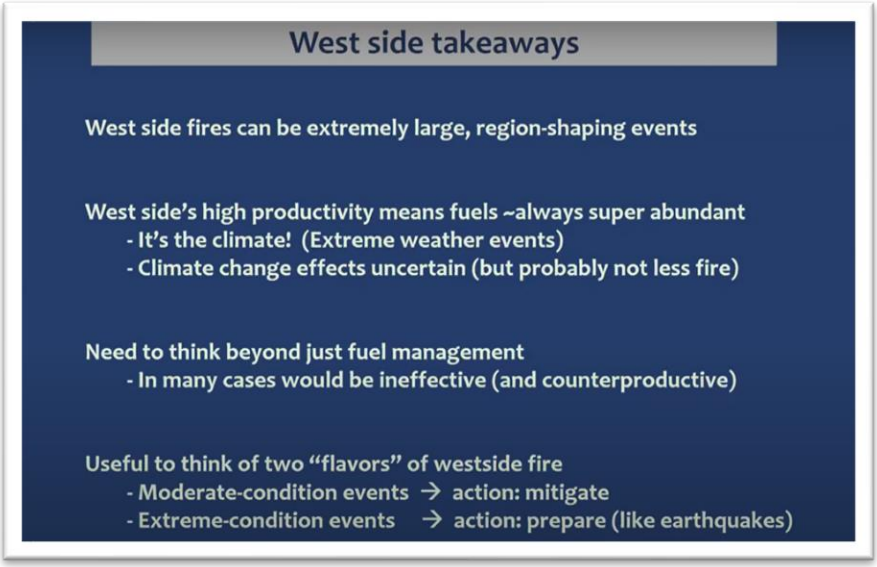

Figure 15. Screen capture taken from https://www.youtube.com/watch?v=6EDFmK2_7l8 (webinar).

[4] *https://www.fs.fed.us/pnw/pubs/journals/pnw_2021_mcevoy001.pdf*

IMPLICATIONS OF CLIMATE CHANGE AND WILDFIRE

BC Coastal summer temperatures are expected to increase with a corresponding decrease in water availability, increasing the probability of extreme heatwaves, drought, and wildfires. In addition to high heat quickly drying 1-hr wildfire fuels (e.g., grasses and shrubs), heatwaves in the region pose a health danger to the community due to the normally high marine-layer humidity that inhibits overnight cooling coupled with a presumed low proportion of air-conditioned households (BGC Engineering Inc, 2022). An increase in wildfires will have a negative effect on regional air quality, including elevated quantities of particulate matter (e.g., PM2.5, PM10), volatile organic compounds (VOC), and Nitrous Oxides (Urbanski et al., 2009).

Across the Pacific Northwest, climate projections suggest an intensification of the overall region's summer drought pattern (Mauger et al. 2015) and, with it, increases in wildfire activity (Littell et al. 2010) and potential changes in landscape structure (Halofsky et al. 2018a). Increases in climate variation also increase the chances for decreased forest health and overall ecosystem resiliency. These type of unhealthy or stressed forests are generally more likely to have higher fuel loads and have therefore an increased chance of wildfire risk. Furthermore, the general unpredictability of climate change and its impacts makes managing for it difficult.