

Current Condition Report for Forest Biodiversity: Lakes Timber Supply Area

APPENDIX 3

Summary of Wildfire and Insect Disturbance in the Lakes Timber Supply Area (TSA)

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Forest Biodiversity Management in the Lakes TSA

Wildfire Overview

Wildfires are a natural and important part of forest ecosystems in B.C. and are critical to maintaining biodiversity in B.C.'s forests. The CEF Forest Biodiversity assessments focus on loss of mature and old forests from severe natural disturbances that can cause high levels of tree mortality and shift forest condition to an early seral state. The forest biodiversity assessments consider severe wildfires that cause mortality of more than 80% of trees as stand-initiating events that convert mature and old forest habitats to early seral forest. Depending on the ecosystem, forest regeneration following wildfire may take a few years to decades to re-establish a new forest stand and centuries to recover the habitat characteristics of mature and old growth forest stands. However, in this time, standing dead trees, open conditions, and new undergrowth generated by wildfires create habitats for a variety of early seral and generalist species.

Area Affected by Wildfire from 1999 to 2019 in the Lakes TSA

Wildfire activity in the Lakes Timber Supply Area (TSA) varies by natural disturbance type (NDT). Most of the TSA is covered by NDT3 (frequent stand-initiating events) ecosystems including the Sub-Boreal Pine-Spruce (SBPS) and Sub-Boreal Spruce (SBS) dry, SBS moist, and Engelmann Spruce-Subalpine Fir (ESSF) moist biogeoclimatic (BEC) groups. The NDT3 ecosystems experience the greatest area affected annually compared to the wetter and colder ecosystems that comprise the NDT2 (infrequent stand-initiating events) and NDT1 (rare stand-initiating events).

Figure 1 illustrates the area affected by wildfires over the past 50 years in the Lakes TSA by BEC group. Wildfire area is represented using the [BC Historic Wildfire Perimeters](#) data layer that provides the outer perimeters of wildfires that have occurred in B.C. Figure 2 illustrates the wildfires that have occurred from 2010 to 2019 in the Lakes TSA. The TSA experienced very large wildfires in 2010, 2014, and 2018, primarily in the SBPS and SBS dry, and SBS moist ecosystems (Figure 2). This includes the large 2018 wildfire season that affected over 200,000 hectares.

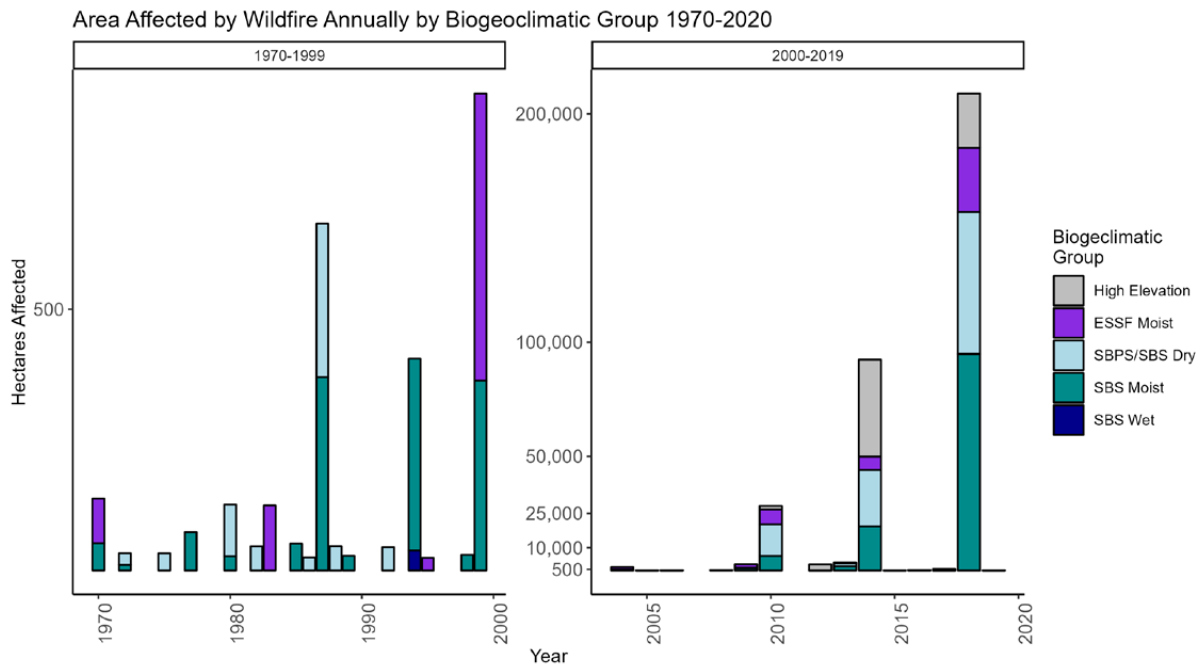


Figure 1: Total Area (Hectares) Affected Annually by Wildfire in each Biogeoclimatic (BEC) Group in the Lakes Timber Supply Area from 1970 to 1999 (left) and 2000 to 2019 (right).

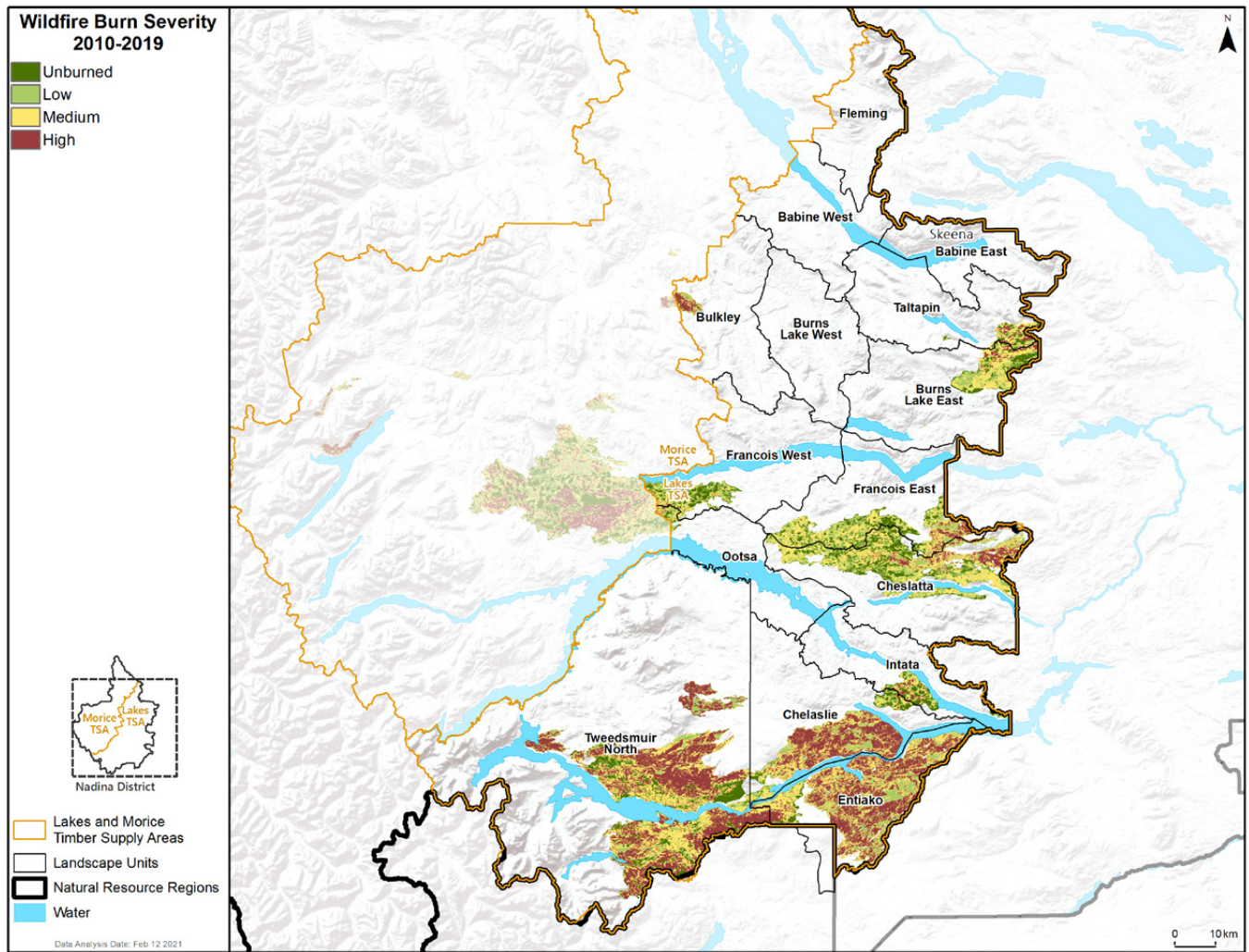


Figure 2: Wildfire Perimeters and Burn Severity Ratings for Wildfires Occurring from 2010 to 2019 in the Lakes Timber Supply Area.

Insect Overview

Forest insects such as bark beetles, weevils, and defoliators that attack trees play an important role in maintaining forest biodiversity in B.C.'s forest ecosystems. When insects kill or damage host trees it can create important habitat elements, such as large standing dead trees (snags) that also eventually result in downed wood and canopy gaps that allow light to generate new growth in the forest understory or the release of advanced tree regeneration. Forest insects affect more forest area annually, on average, than wildfires and therefore are a major influence on forest structure and composition across B.C.

The CEF Forest Biodiversity assessments focus on loss of mature and old forests and severe natural disturbances that can cause severe tree mortality and shift forest condition to an early seral state. The assessment considers four primary bark beetles that are responsible for the majority of tree mortality in B.C.'s forests including: mountain pine beetle (MPB: *Dendroctonus ponderosae*), spruce beetle (SB: *Dendroctonus ruifipennis*), western balsam bark beetle (WBB: *Dryocoetes confuses*), and Douglas-fir beetle (DFB: *Dendroctonus pseudotsugae*).

The B.C. Ministry of Forests [annual forest health overview flight survey data](#) was used to estimate the disturbance to B.C.'s forests from insects between 1999 and 2019. The survey datasets are themed by insect, year of attack, and mortality severity rating categories that represent the percentage of trees recently killed in a mapped forest area for a specific year. The severity categories are used to estimate the approximate percent of host tree mortality that is assigned to that mapped area (Table 1).

Table 1: Mortality Severity Ratings used to Characterize the Extent of Insect Attack within a Mapped Forest Polygon.

Mortality Severity Rating*	Percent of Trees in Polygon Recently Killed*	Percent Tree Mortality Assigned
Not recorded	0	0
Trace (T)	<1%	0.5%
Light (L)	1-10%	5%
Moderate (M)	11-29%	15%
Severe (S)	30-49%	30%
Very Severe (V)	>50%	75%

^a Severity categories and estimates of percent of trees in polygon recently killed are from the Damage Agent Mortality Severity Ratings here: <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/aerial-overview-surveys/methods/damage-ratings>

Area Affected by Cumulative Insect Attack from 1999 to 2019 in the Lakes TSA

The cumulative percent insect mortality from 1999 to 2019 was estimated by adding the percent tree mortality for each year from the aerial overview survey data. For example, when insect attack recorded in one area over multiple years is added together (i.e., year 1999 mortality 0.5%; year 2000 mortality 5%; year 2001 mortality 15%; year 2002 mortality 30%; year 2003 mortality 30%; year 2004 mortality 15%; year 2005 mortality 0.5%), the combined mortality creates the resulting severity of attack category over that time period (i.e., from 1999 to 2005 the combined mortality equals 96% and would be categorized as *Very Severe* (>50%) for that period). In many cases where percent mortality is *Moderate*, *Severe*, or *Very Severe* for several years, the percent mortality will exceed 100% using this calculation method. However, in reality, the percent mortality in any given year is based on the proportion of living host trees from the previous year. For example, 5% percent tree mortality in 1999 means only 95% of the stand could be affected in 2000, and so the number should never exceed 100% mortality. However, this approach represents an estimate and once percent mortality accumulates to values >50% or *Very Severe*, the outcome is the same.

Between 1999 and 2019, mountain pine beetle (MPB) was the most extensive and severe insect affecting forests in the Lakes TSA. Spruce beetle, Douglas-fir beetle, and western balsam bark beetles also affect substantial areas, but most attack is limited to moderate or lower severity levels (Table 2). The maps included in this appendix illustrate the areas affected by cumulative severity attack for each of the four bark beetles.

Table 2: Cumulative Area Affected by Bark Beetles in the Lakes Timber Supply Area from 1999 to 2019.

Bark Beetle Species	Land Base	Severity of Attack (hectares)						Total Trace-Very Severe
		Not Recorded	Trace	Light	Moderate	Severe	Very Severe	
Mountain Pine Beetle	HFLB	104,611	42,902	88,955	189,475	250,234	638,966	1,210,532
	CFLB	69,469	28,886	72,237	168,910	240,946	627,721	1,138,700
Spruce Beetle	HFLB	1,263,475	9,854	32,937	8,714	161	2	51,668
	CFLB	1,158,279	9,238	32,256	8,233	161	2	49,890
Douglas Fir Beetle	HFLB	1,313,127	626	702	331	274	83	2,016
	CFLB	1,206,174	626	687	325	274	83	1,995
Western Balsam Beetle	HFLB	951,166	140,565	191,249	27,977	3,412	774	363,977
	CFLB	864,715	133,104	180,025	26,226	3,327	771	343,454

Mountain Pine Beetle

The Nadina Natural Resource District, of which the Lakes TSA forms the eastern portion, has experienced two MPB outbreaks in the past 50 years. The first outbreak occurred in the early to mid-1980s with the forest area affected annually close to over 2,000 hectares for three consecutive years (Figure 3 left side). The second major outbreak is associated with the MPB epidemic of the late 1990s to early 2000s where the forest area affected increased rapidly and largely subsided by 2010, affecting over 1 million hectares annually over five consecutive years (Figure 3 right side). Many of the same lodgepole pine stands were affected over those consecutive years such that the cumulative area of *Severe* to *Very Severe* insect severity increased over this period.

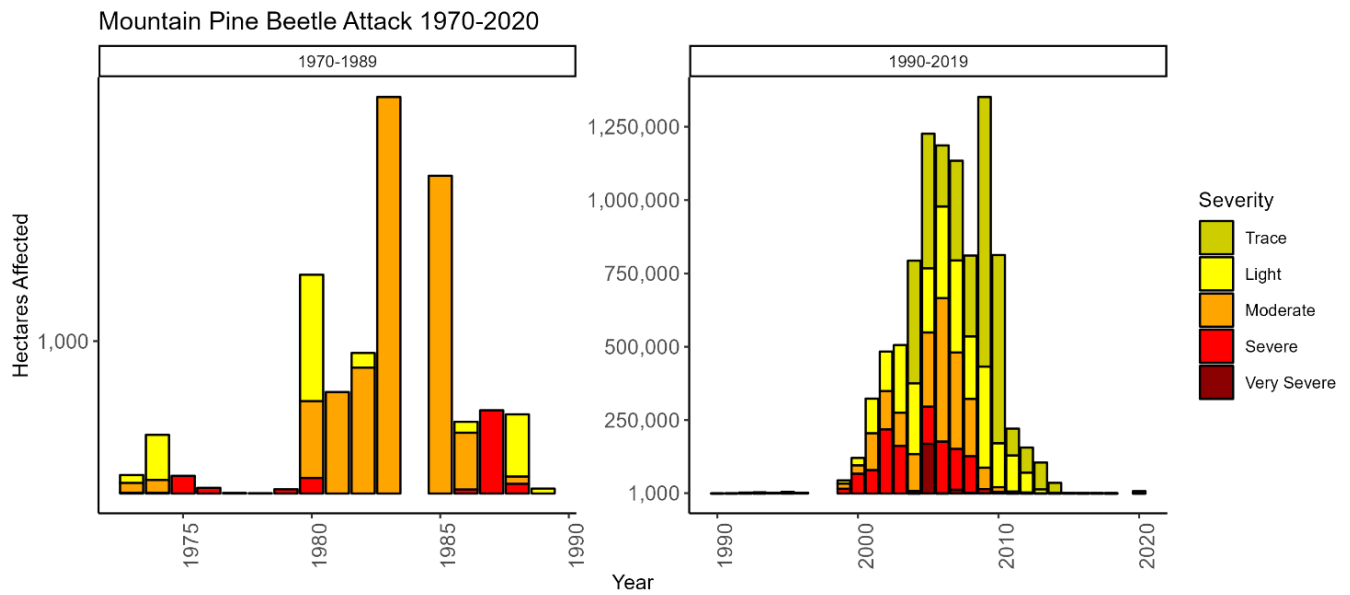


Figure 3: Total Area (Hectares) Affected Annually in the Nadina District by Mountain Pine Beetle (MPB) According to Insect Severity Classes based on Annual Aerial Overview Flight Survey Information between 1970 to 1989 (Left) and 1990 to 2019 (Right)^a.

^a The scale of the y-axis (hectares affected) differs between the 1970-1989 and 1990-2019 time periods.

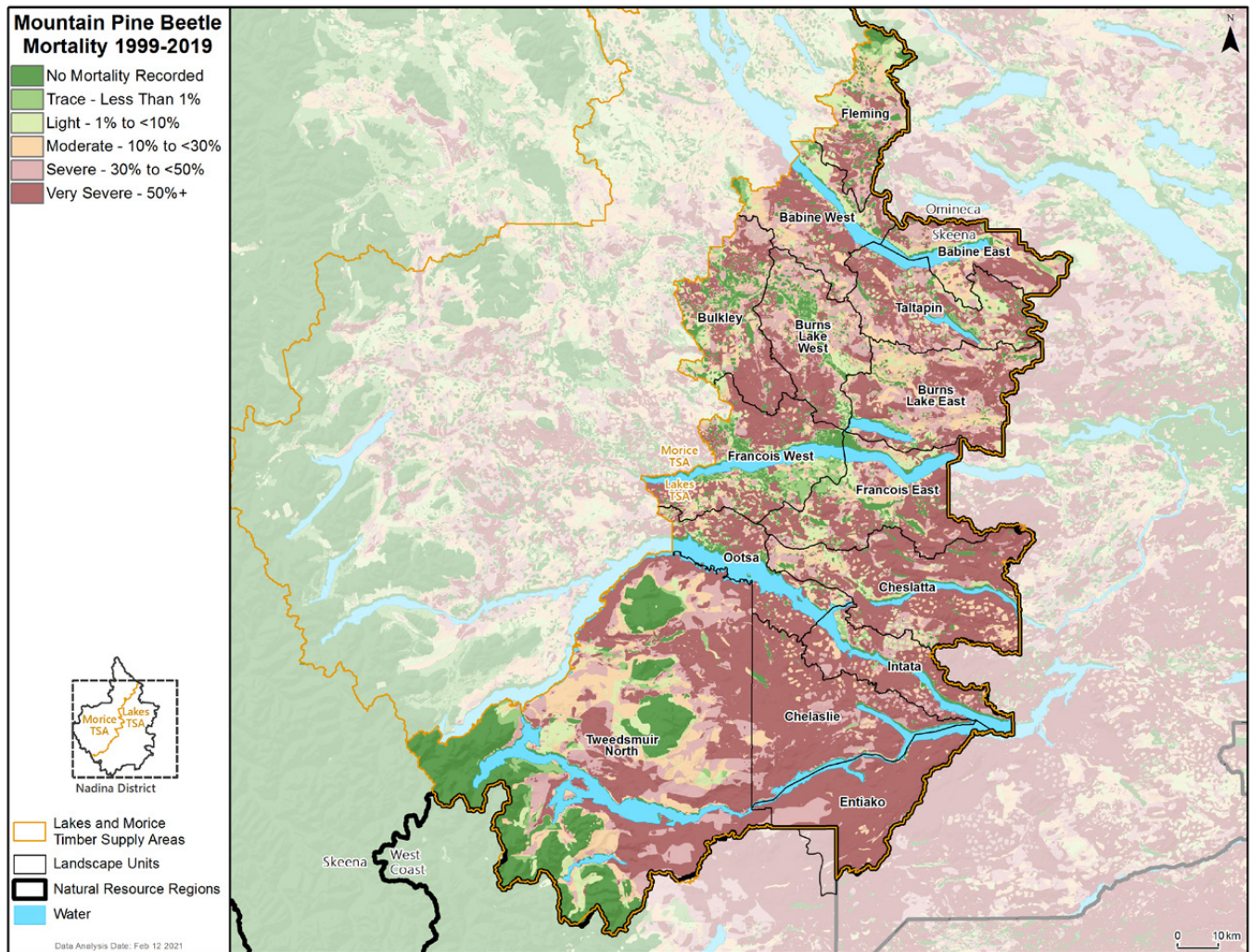


Figure 4: Mountain Pine Beetle Cumulative Attack Severity in the Lakes Timber Supply Area from 1999 to 2019.

Douglas Fir Beetle

Douglas-fir Beetle in Lakes TSA is relatively limited in extent with some patches of *Trace* to *Moderate* cumulative severity recorded in the François East LU (Figure 5).

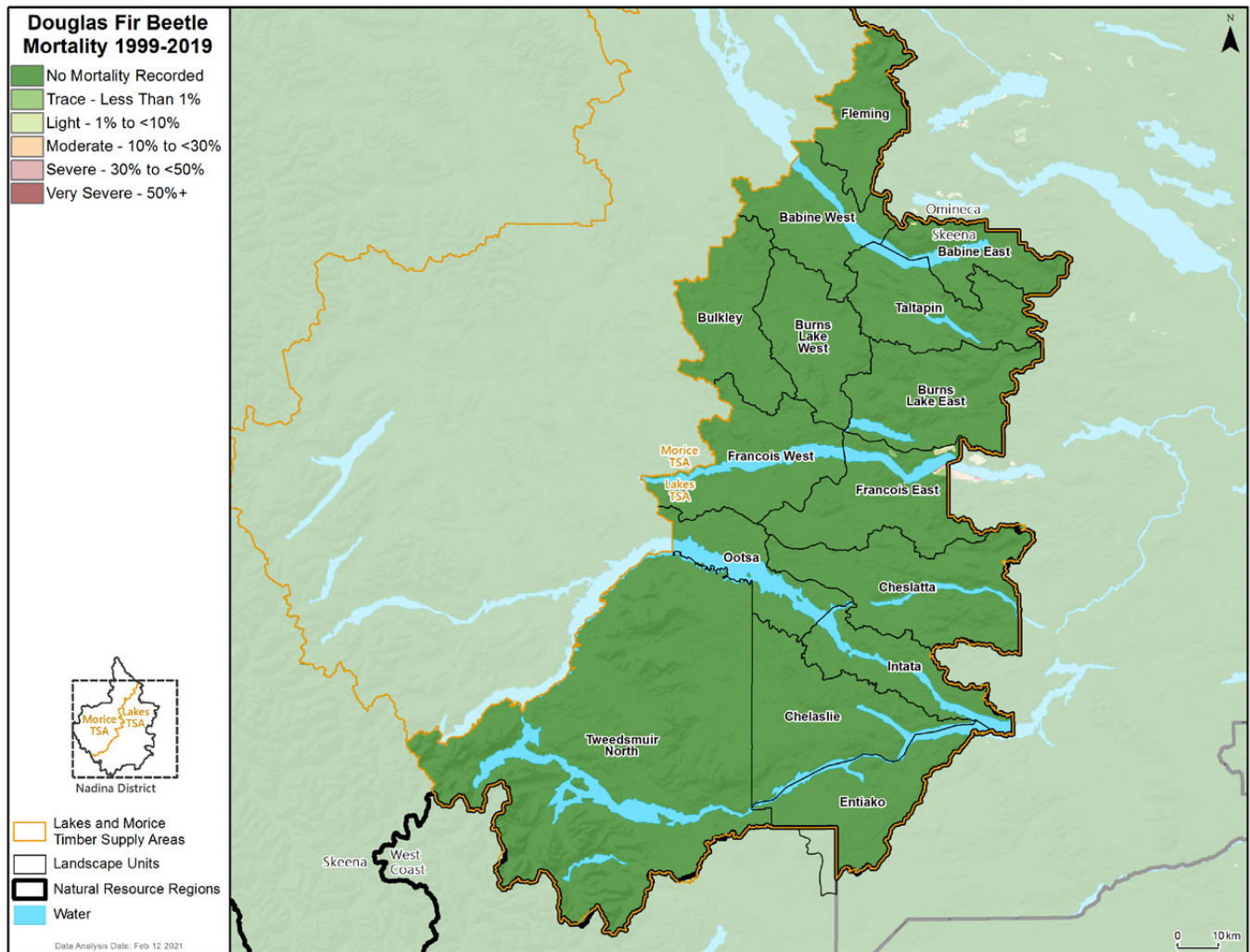


Figure 5: Douglas-fir Beetle Cumulative Attack Severity in Lakes Timber Supply Area from 1999 to 2019.

Spruce Beetle

Spruce Beetle is limited in extent and severity through the Lakes TSA with some small patches of *Trace* to *Moderate* cumulative severity occurring throughout spruce-leading forests at higher elevation (Figure 6).

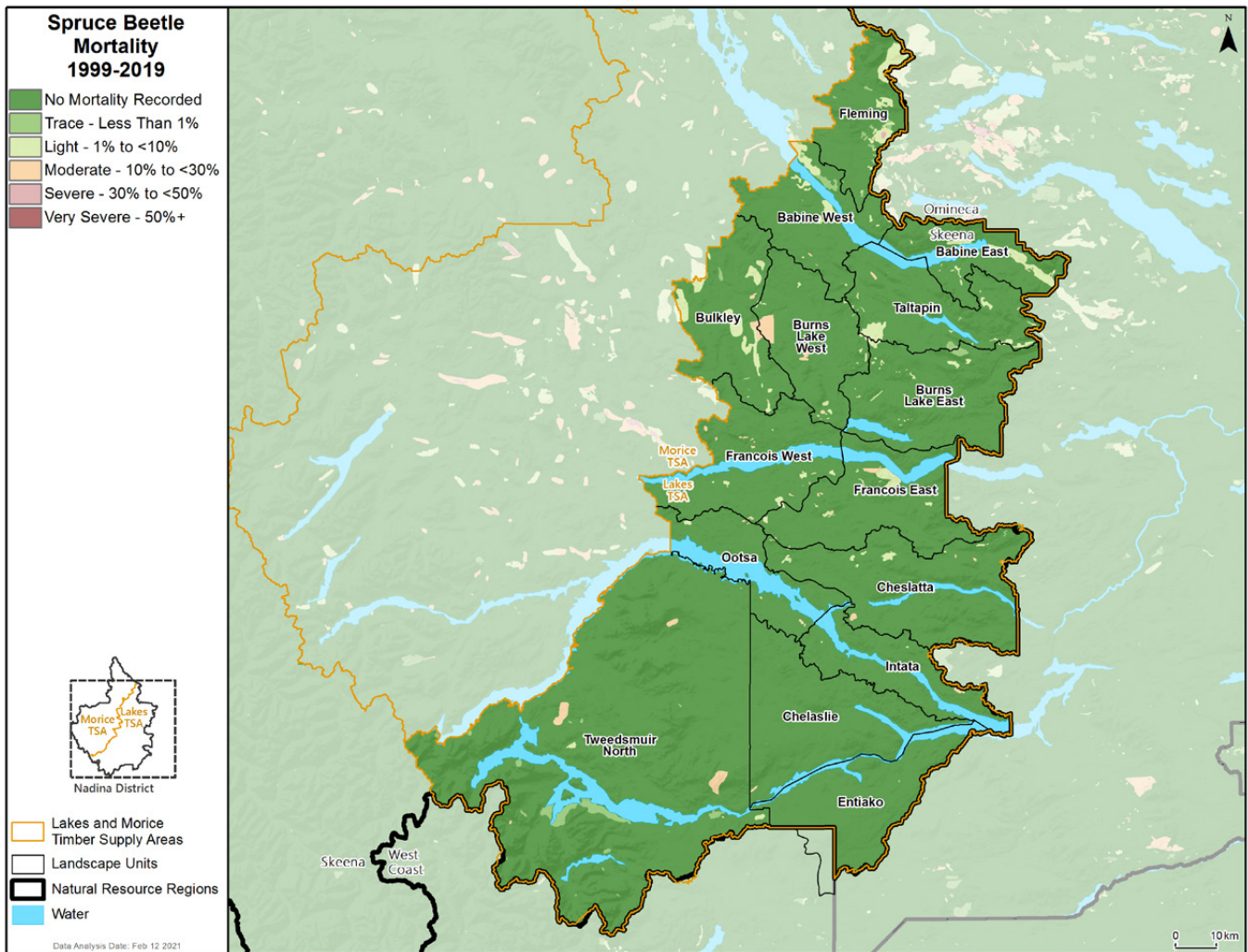


Figure 6: Spruce Beetle Cumulative Attack Severity in the Lakes Timber Supply Area from 1999 to 2019.

Western Balsam Bark Beetle

The cumulative severity of Western balsam bark beetle infestations, which mainly affects higher elevation sub-alpine fir forests, has greatly increased over the past decade with extensive *Low* to *Moderate* cumulative severity occurring primarily in the higher elevation ESSF forests in Fleming, Babine East, Taltapin, and Tweedsmuir North LUs (Figure 7).

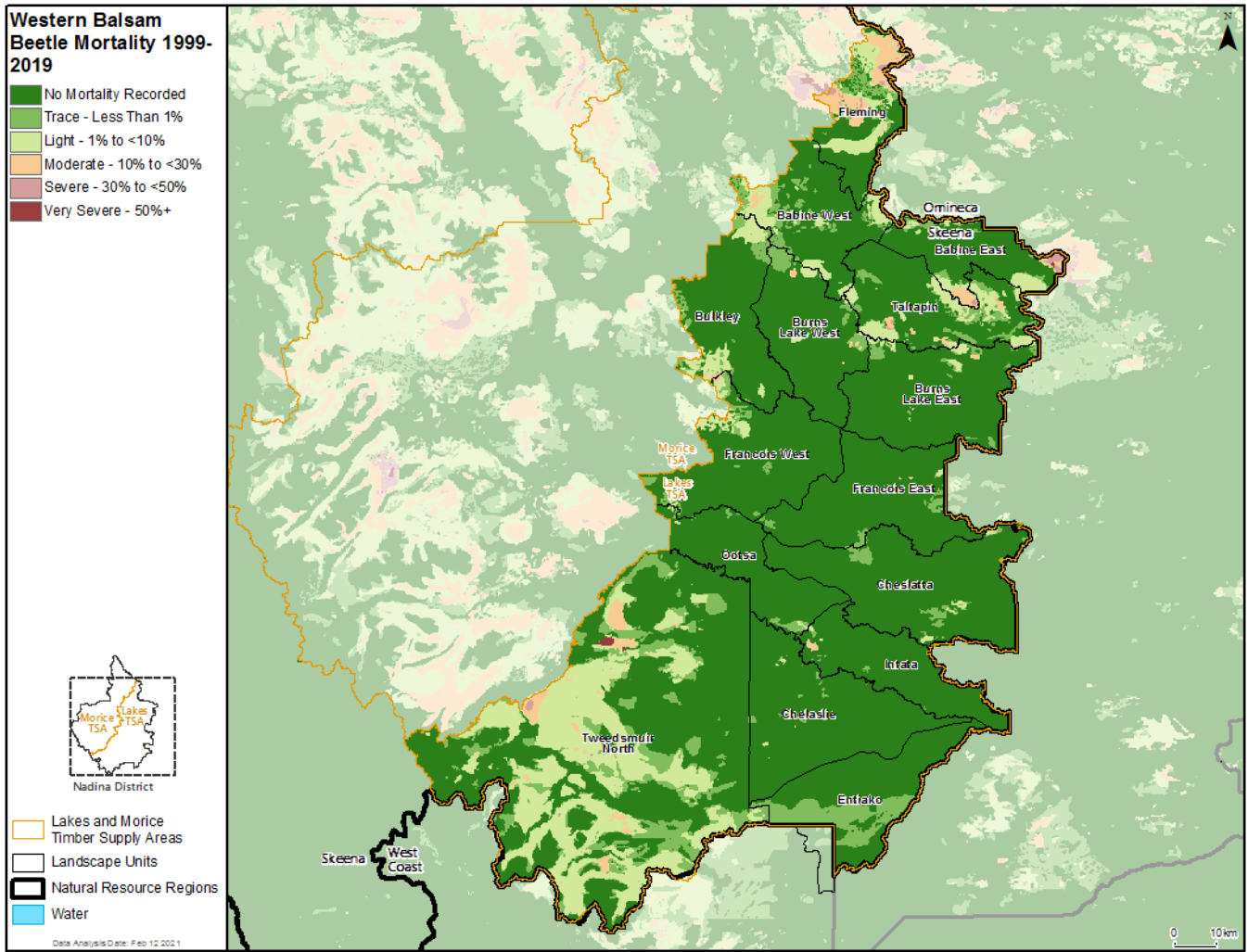


Figure 7: Western Balsam Beetle Cumulative Attack Severity in the Lakes Timber Supply Area from 1999 to 2019.