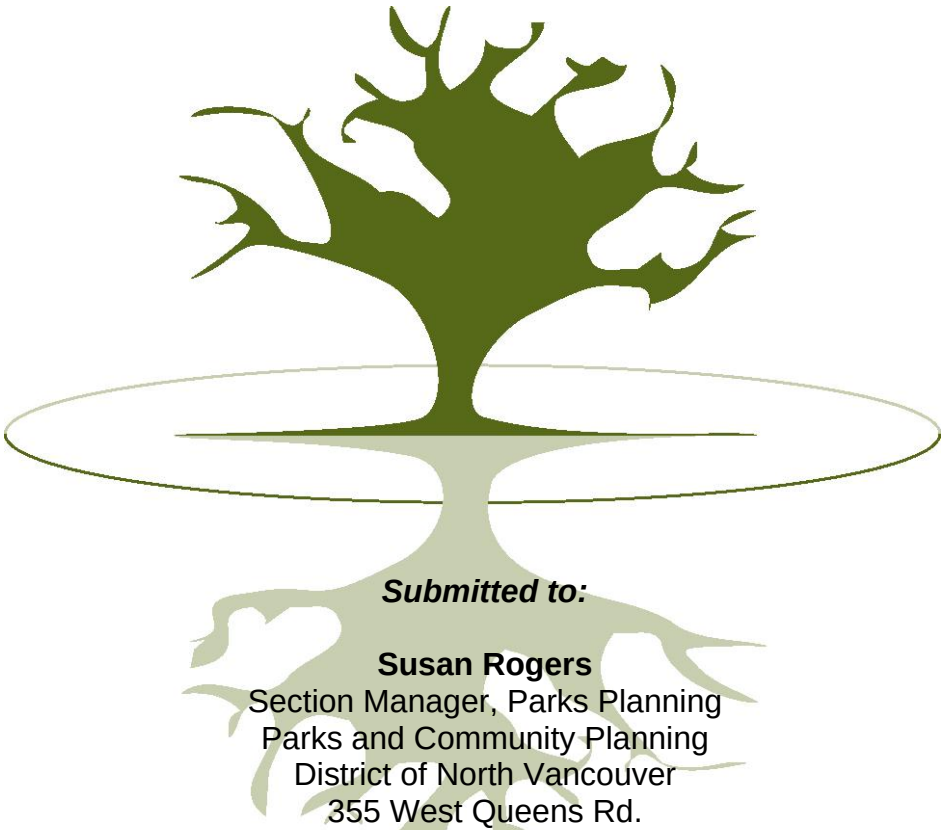
District of North Vancouver
Fromme Mountain Area
Ecosystem Analysis



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Introduction

The North Shore has become recognized as one of the best locations for mountain biking in the world. As such, there has been a dramatic increase in the demand for, and subsequent building of, mountain bike trails and structures. This has presented a serious challenge to land owners in terms of managing the associated liability and impacts to the surrounding environment. To date, the majority of trail building activities on the North Shore have been largely unsanctioned and unregulated by any governing body. The concern is that by not considering the ecological and social impacts of these trails there is little direction on whether new trails should be built, old trails should be decommissioned and what trail building techniques constitute best management practices.

On the North Shore, an extensive trail network continues to be expanded without any regulation or the knowledge of the landowner. In order to properly manage these trails, the District of North Vancouver (DNV) requires some level of knowledge of the biophysical attributes that exist in these areas. The objective of this analysis is to use existing GIS databases, orthophoto analysis and representative ground plots to compile and analyze some baseline ecological information that can be used to start this planning process.

Ecological Inventory Methodology

The ecological inventory presented in this analysis was developed using existing GIS databases as well as representative ground plots. The GIS databases include:

- Vegetation Resource Inventory (Forest Cover) databases purchased from the Ministry of Sustainable Resource Management
- Biogeoclimatic Subzones provided by the Ministry of Sustainable Resource Management
- Creek locations provided by DNV
- Topographic contours provided by DNV
- Legal property boundaries provided by DNV
- Street locations provided by DNV
- Trail locations provided by DNV
- Orthophotos provided by DNV

These databases were compiled using *ArcView 3.1* to produce a number of theme maps including Biogeoclimatic subzones and site series, potential habitat for red and blue listed plant communities, forest attributes, water features and slope gradients. These themes provided some baseline ecological knowledge, however the accuracy of the databases were unknown and required some level of ground truthing.

In June and July of 2004, each polygon located within the Fromme mountain study area was visited to verify the existing databases and collect additional ecological information. A representative 20m by 20m plot was established and a detailed inventory was collected including the following fields:

- Terrain
  - Slope (%)
  - Aspect (Degrees)
  - Slope position

- Ecology
  - BGC zone and subzone
  - Soil moisture regime
  - Soil nutrient regime
  - BGC site series by percentage
  - Soil texture
  - Soil coarse fragment content (%)
  - Humus types
  - Humus depth

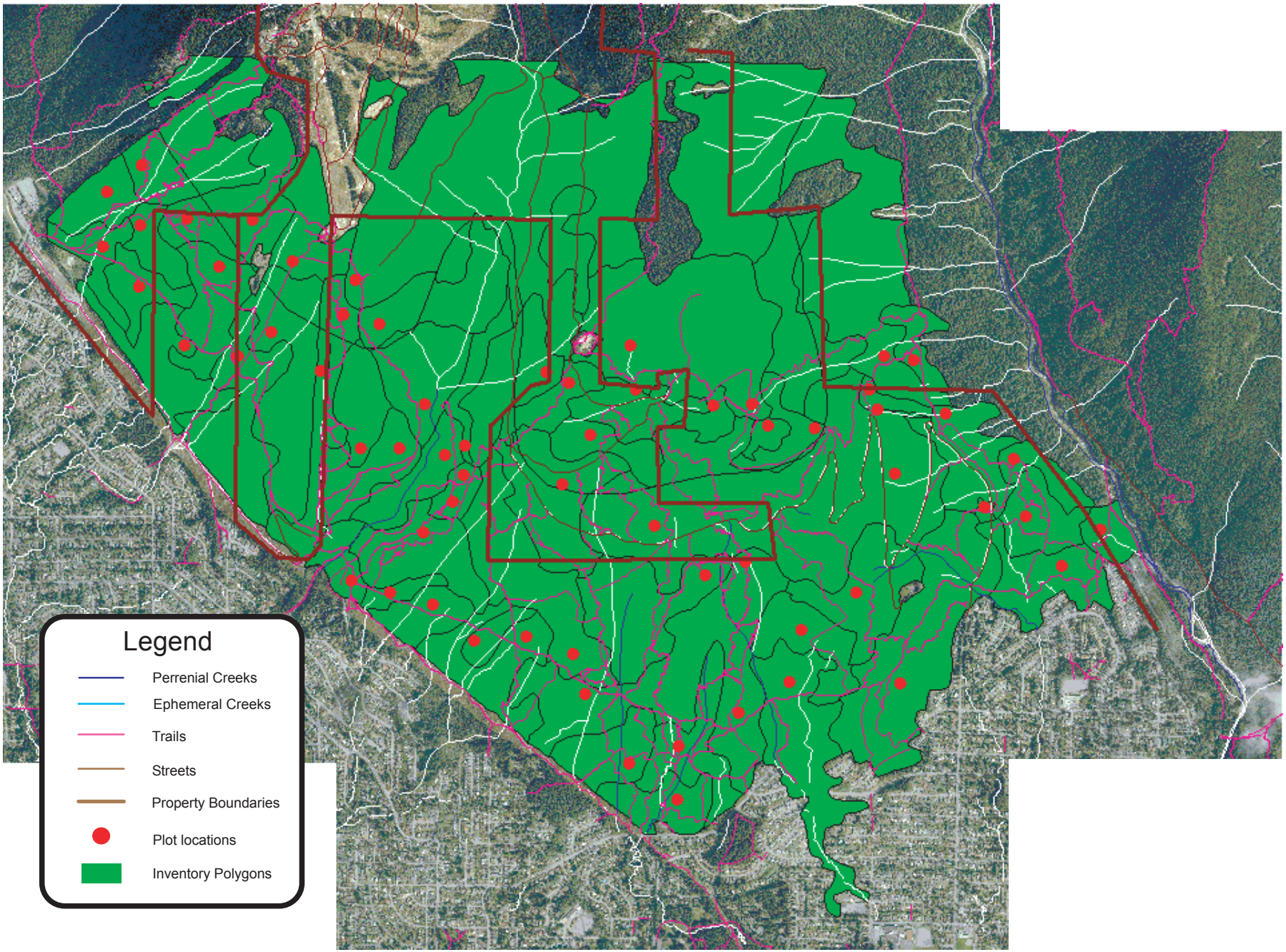
- Understory Vegetation Inventory
  - Each species within the plot was recorded along with its total ground cover

- Stand characteristics
  - Tree species composition by layer
  - Tree stems/ha by layers:
  - Tree age (dom and co-dom trees)
  - Average height (dom and co-dom trees)
  - Average diameter (dom and co-dom trees)
  - % live crown of dom trees
  - Crown closure
  - Stand structural stage
  - Stems/ha of Wildlife trees decay class 1-5
  - Stems/ha of Wildlife trees decay class 1-5

- Wildfire Hazard (these themes are presented in a separate report)
  - Ground Fuels
  - Ladder Fuels
  - Wildfire Hazard

In total, 63 plots were established between the Grouse Mountain Tram and Lynn Creek. The locations of the ground plots and polygons that have been updated are illustrated in Figure 1.

District of North Vancouver Fromme Mountain Area Inventory Analysis
Plot Locations



Fromme Mountain Ecosystem Ranking System

In order to help planners develop management zones and best management practices, an ecosystem ranking system was developed to help identify the key issues of concern. The attributes included in this ranking system were limited to the information available in the GIS biophysical databases. They generally follow recognized attributes that contribute to stand and landscape level biodiversity and include:

1) Stand structure and tree species diversity
2) The presence of water bodies or wetlands and associated riparian areas
3) The presence of red and blue listed plant communities
4) Wildlife habitat isolation

These critical factors were given a numeric ranking that increased relative to their ecological value or sensitivity. All of the individual maps were then overlaid and their ranking added together to produce a final map with a ranking out of fifty. The following is a description of the basic ecological characteristics including their ranking criteria.

Biogeoclimatic Subzone Classification of the Fromme Mountain Area

The Biogeoclimatic Classification System of BC (BEC) (Green and Klinka, 1994) is a hierarchical arrangement that stratifies B.C.'s landscape into similar ecosystem types based on a combination of climate, physiography, surficial material, bedrock geology, soils and vegetation. This system consists of a broad regional classification as well as a more specific site classification. The regional classification stratifies the landscape into the basic units of this system called subzones. Within each subzone, specific sites are further classified based on the levels of available moisture and nutrients. An extensive description of this system can be found in the publication *Ecosystems of British Columbia* (Meidinger and Pojar, 1991).The study area contains two Subzones within the Coastal Western Hemlock Zone. The Dry Maritime (CWHdm) and the Montane Very Wet Maritime (CWHvm2). The location of these subzones is illustrated in Figure 2.

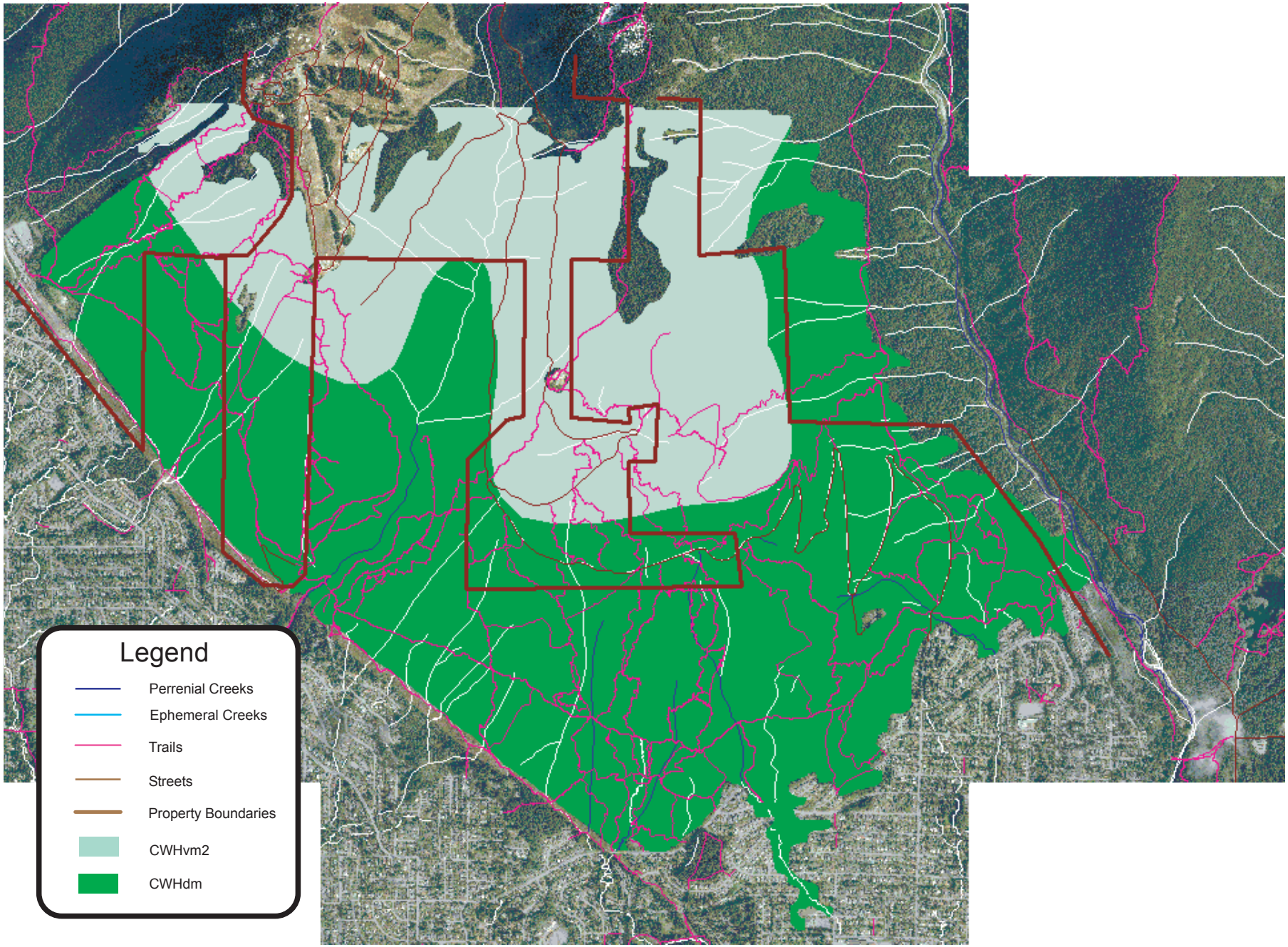
Coastal Western Hemlock Dry Maritime Subzone (CWHdm).

Occurs from 0-650 meters. This subzone experiences warm, relatively dry summers and moist, mild winters with little snowfall. This subzone occurs below the CWHvm1. The dominant trees are western hemlock (*Tsuga heterophylla)* and western red cedar *(Thuja plicata)* with lesser amounts of Douglas-fir *(Pseudotsuga menziesii)*. The shrub layer is dominated by common red huckleberry (*Vaccinium parvifolium*) and salal (*Gaultheria Shallon*) with the moss layer dominated by step moss (*Hylocomium splendens*) and flat moss (*Plagiothecium undulatum)*.

Coastal Western Hemlock Very Wet Maritime subzone (CWHvm2).

Occurs from 650-1000 meters. The CWHvm2 subzone occurs above the CWHvm1 between the elevations of 650m and 1200m. In comparison to the CWHvm1 it receives much more snowfall, experiences cooler temperatures and a shorter growing season. The dominant trees are western hemlock (*Tsuga heterophylla)* and amabilis fir (*Abies amabilis)* with lesser amounts of western red cedar *(Thuja plicata)*, yellow cedar (*Chamaecyparis nootkatensis*) and mountain hemlock (*Tsuga mertensiana*). The understory layer consists of common Alaskan blueberry (*Vaccinium alaskaense)*, five leaved bramble (*Rubus pedatus)* and a moss layer of step moss (*Hylocomium splendens)*, pipe cleaner moss (*Rhytidiopsis robusta*) and lanky moss (*Rhytidiadelphus loreus)*.

District of North Vancouver Fromme Mountain Area Inventory Analysis
Biogeoclimatic Subzones



Red and Blue Listed Plant Communities

Within the BEC system, subzones are further categorized into units called site series according to the level of available moisture and nutrients in the soils. Plant and tree species have certain moisture and nutrient thresholds and ranges in which they will survive and compete. For this reason, distinct plants communities with a relatively uniform plant species composition and physical structure are characteristic of each site series.

The British Columbia Conservation Data Centre (CDC) is a part of the Wildlife Inventory Section of the Resources Inventory Branch of B.C. This organization is responsible for collecting and storing information on rare and endangered plants, animals and plant communities in B.C. All of these entities have been ranked by the CDC as red, blue or yellow-listed. Red-listed entities are considered extirpated, endangered, or threatened in British Columbia. Blue-listed entities are considered vulnerable and are sensitive to human activity or natural events. Yellow-listed plant communities are not at risk in British Columbia. The red and blue listed plant communities described in Table 1 were identified in the study area. The location of these plant communities is illustrated in Figure 3.

Table 1 - Red and blue listed plant communities found within the study area

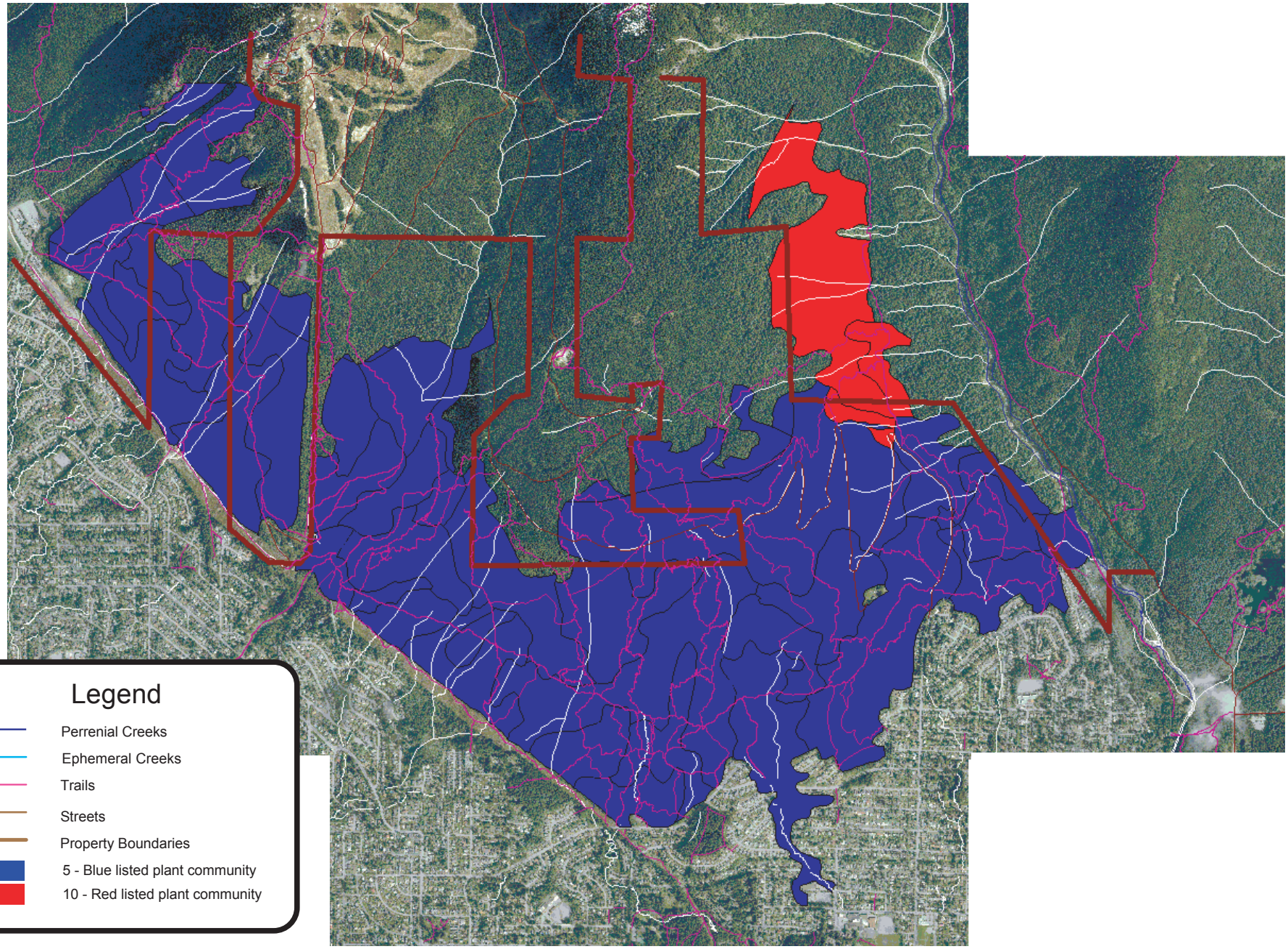
Scientific name	English name	BGC Site Unit	Prov. Rank	Prov. List
Pseudotsuga menziesii - Tsuga heterophylla / Gaultheria shallon Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	CWHdm/03	S2S3	Blue
Thuja plicata / Polystichum munitum Dry Maritime	Western redcedar / swordfern Dry Maritime	CWHdm/05	S2S3	Blue
Thuja plicata / Tiarella trifoliata Dry Maritime	Western redcedar / three-leaved foamflower Dry Maritime	CWHdm/07	S2S3	Blue
Thuja plicata/Picea sitchensis - Lysichitum americanum	Western redcedar/Sitka spruce - skunk cabbage	CWHdm/12	S3	Blue
Tsuga heterophylla / Plagiothecium undulatum	Western hemlock / flat moss	CWHdm/01	S2S3	Blue
Tsuga heterophylla - Thuja plicata / Blechnum spicant	Western hemlock - western redcedar / deer fern	CWHdm/06	S2	Red

All forest cover polygons that contained greater than 20% of a red or blue listed plant community were identified and ranked accordingly to Table 2 and as illustrated in Figure 3.

Table 2 – Ecological ranking for red and blue listed plant communities found within the study area

Presence of red and blue listed species and plant communities	Value
Contains red listed plant communities	10
Contains blue listed plant communities	5
Contains no or less than 20% confirmed red or blue listed species/plant communities	0

District of North Vancouver Fromme Mountain Area Inventory Analysis
Red and Blue Listed Plant Communities



Forest Structural Stage

Forest structural stages are defined by stand age and structural features. The greatest degree of biological diversity is usually found in the earliest and latest stages of stand development. Young shrub communities contain a diverse composition of herbs and shrubs that form a complex structural habitat and abundant food sources for many species. As the forest ages into a young stand, the tree canopy closes and the understory is shaded out, causing the structural and species diversity to decline. After about 80 years (in ecosystems found in the Fromme Mountain Area) the biodiversity level increases again as the trees reach a larger size, scattered wildlife trees are created, coarse woody debris increases and gaps form in the canopy admitting light to the forest floor. The stand structure has been measured by classifying the successional stage of the forest.

Tree ages were determined in the field using increment core samples. These ages along with structural characteristics of the stands were used to separate the forest polygons into distinct structural stages. Four structural stages were identified within the study area.

1. Pole/Sapling

Pole/Sapling forests are typically dense with little vertical structure. On the coast, this structural stage is typically found in forests of 20-40 years old.

2. Young Forest

In a Young Forest, the forest canopy has begun to differentiate into distinct layers with the density of the trees opening up much more than what is found in a pole sapling stage. Consequently, there is much more understory vegetation as well. Young Forests generally are found in stands with ages from 40-80 years.

3. Mature Forest

In a Mature Forest, a secondary layer of shade-tolerant trees may have developed and a vigorous understory of shrubs and herbs establishes. On the coast, this structural stage is typically found in forests of 80-250 years. This category was divided into two classes in the ranking system as the forests start to show some old growth characteristics and support a greater diversity of species after about 140 years.

4. Old Forest.

Old Forests are uneven aged, structurally complex stands comprised of shade tolerant tree species, abundant snags and coarse woody debris of all stages of decomposition. Old Forests on the coast, are typically found in forests >250 years old.

The forest cover polygons were divided into the following classes and ranked according to Table 3 and as illustrated in Figure 4.

Table 3. Ecological rankings for the forest structural stage classes.

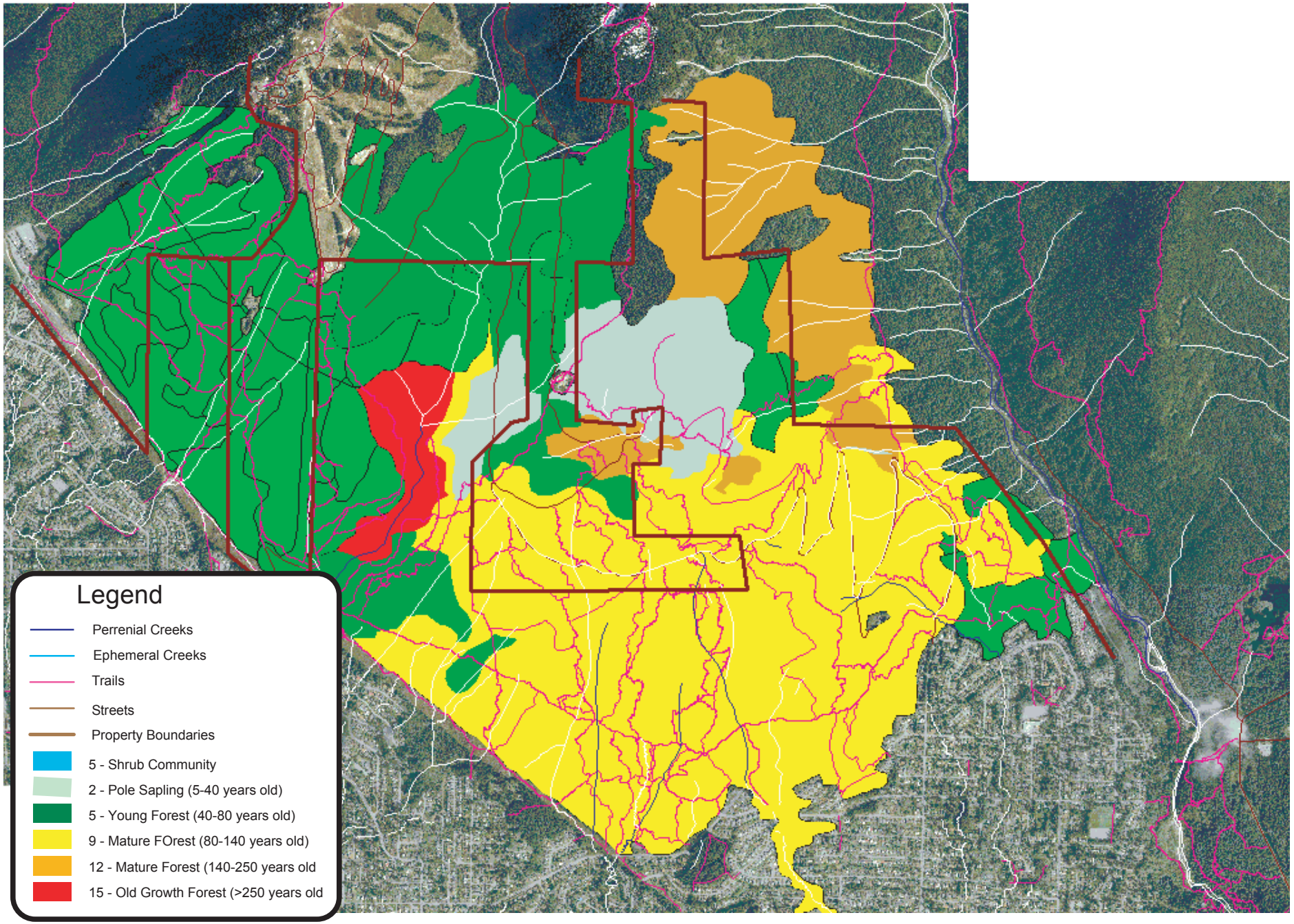
Structural Stage	Value
Old Growth Forest (>250 years old)	15
Mature Forest (140-250 years old)	12
Mature Forest (80-140 years old)	9
Young Forest (40-80 years old)	5
Pole Sapling (5-40 years old)	2
Shrub Herb Community (0-5 years old)	5

In additional to the forest structural stage, the diversity of habitat types provided by a forest increases with the number of tree species present. This was measured by determining the number of species in the main canopy layer. Polygons were assigned rankings according to Table 4 and as illustrated in Figure 5.

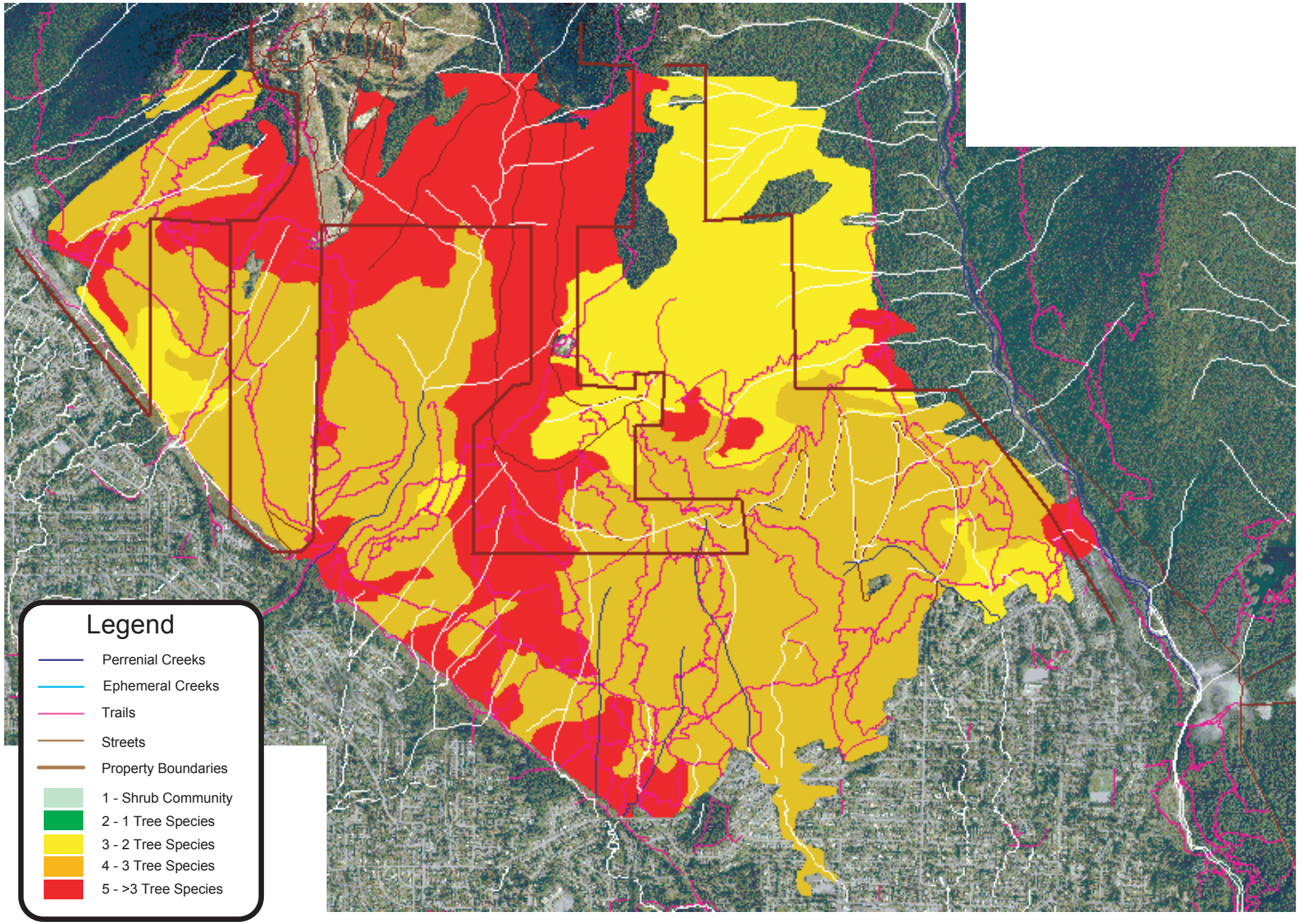
Table 4. Ecological rankings for the forest species diversity

Tree Species Diversity	Value
Stand with greater than 3 tree species present	5
Stand with 3 tree species present	4
Stand with 2 tree species present	3
Stand 1 tree species present	2
Shrub community	1

District of North Vancouver Fromme Mountain Area Inventory Analysis
Structural Stage



District of North Vancouver Fromme Mountain Area Inventory Analysis
Tree Species Diversity



Creeks and Riparian Zones

Water sources and their associated riparian areas support a diversity of wildlife and plant species. The abundance of water and high nutrient input in these areas make them highly productive, which in turn provides food sources and cover for wildlife as well as critical access to water sources. Adjacent vegetation provides important woody debris input, stabilizes creek banks, maintains microclimate conditions and contributes food and nutrients to aquatic species in the form of insects and litter fall.

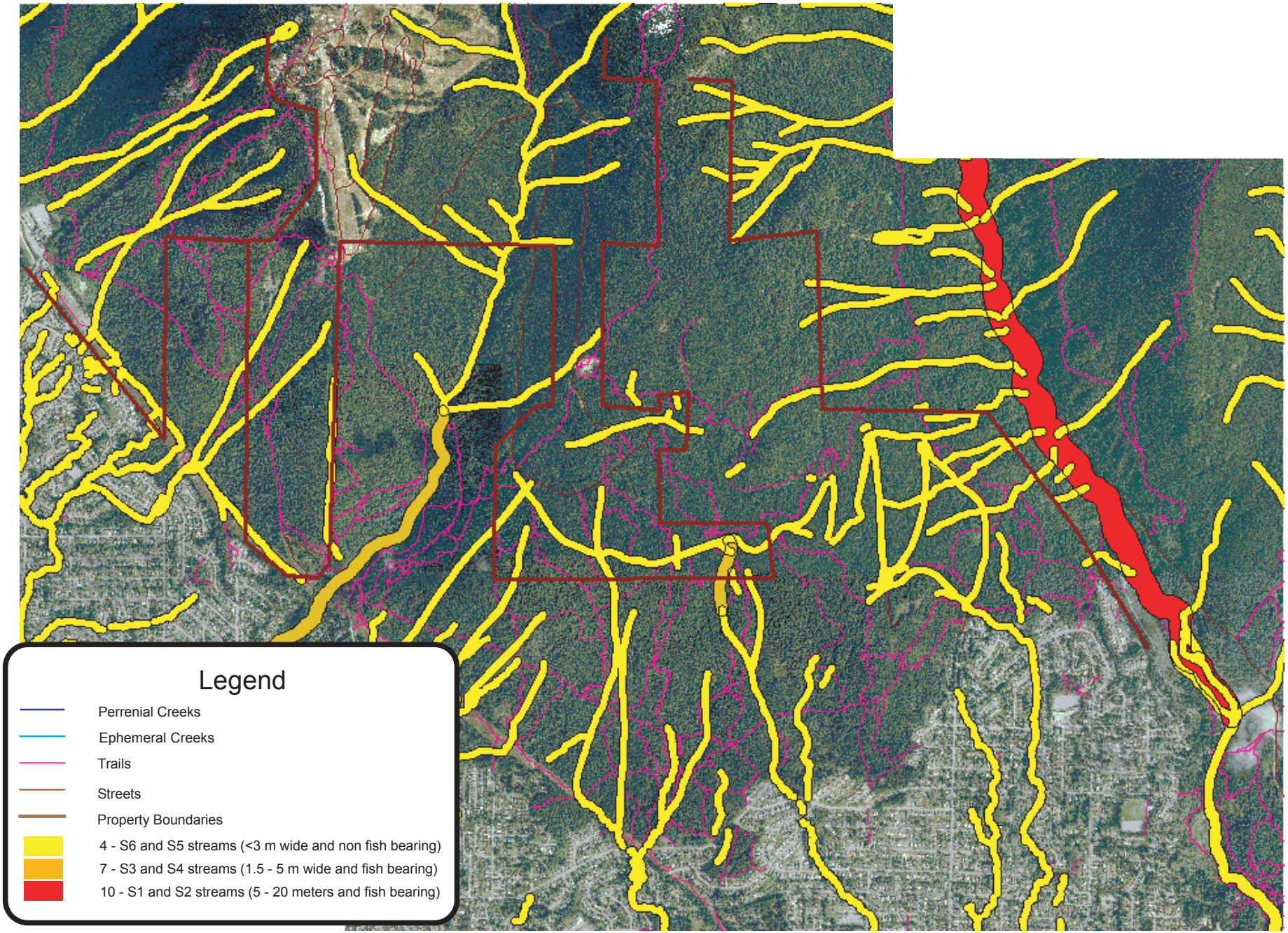
The creeks in the GIS database were updated using orthophoto analysis as well as visual observations during the field work. Missing creeks were added and others were relocated. These creeks were classified according to Forest Practices Code standards. Due to the steep terrain of the study area, the majorities of these streams are narrow ephemeral creeks with a gradient of greater than 20%. Consequently, it is unlikely that any of these streams support fish and therefore they are predominantly classified as S6. These creeks require a 20 meter wide riparian management zone (RMZ) according to the Forest Practices Code Riparian Area Management Guidebook (RAMG). The two significant creeks that support fish are Lynn Creek and lower Mosquito Creek and their immediate tributaries. Lynn Creek is classified as an S2 and requires an RMZ of 50 meters. Mosquito Creek is classified as an S3 creek and requires an RMZ of 40 meters. There is also a short perennial creek running just south of the 6th switchback that has a gradient of less than 20% and has the potential to support fish. This creek is classified as an S4 creek and requires an RMZ of 30 meters.

All creeks were classified and designated the required RMZ and a ranking according to Table 5. The creek locations are illustrated in Figure 6.

Table 5. Ecological rankings for the creek riparian areas

Creeks and Riparian Zones	Value
Stream Class S1 (Fish stream with channel width >20 m. Riparian area of 70 meters)	10
Stream Class S2 (Fish stream with channel width 5-20 m. Riparian area of 50 meters)	10
Stream Class S3 (Fish stream with channel width 1.5-5 m. Riparian area of 40 meters)	7
Stream Class S4 (Fish stream with channel width <1.5 m. Riparian area of 30 meters)	7
Stream Class S5 (Not fish stream with channel width >3 m. Riparian area of 30 meters)	4
Stream Class S6 (Not fish stream with channel width <3 m. Riparian area of 20 meters)	4
Contains no streams or wetlands	0

District of North Vancouver Fromme Mountain Area Inventory Analysis
Streams



Habitat Isolation

The presence of humans and our developments have a detrimental impact on the diversity of wildlife species that will inhabit an area. This is due to a number factors including:

- The loss of natural habitat. Development removes plant communities replacing them with a surfaces that affects the transport of water, nutrients and sediment
- Human developments can present hazards to animal movement and alters behavior patterns.
- The fragmentation of landscapes causing smaller habitat areas. This can divide populations into smaller groups and creates habitat pockets with a greater edge ratio
- The presence human activity and their pets can create persistent annoyance that can lead to habitat avoidance or permanent abandonment
- Noise pollution from human activity can have detrimental impacts on nesting, feeding and sheltering

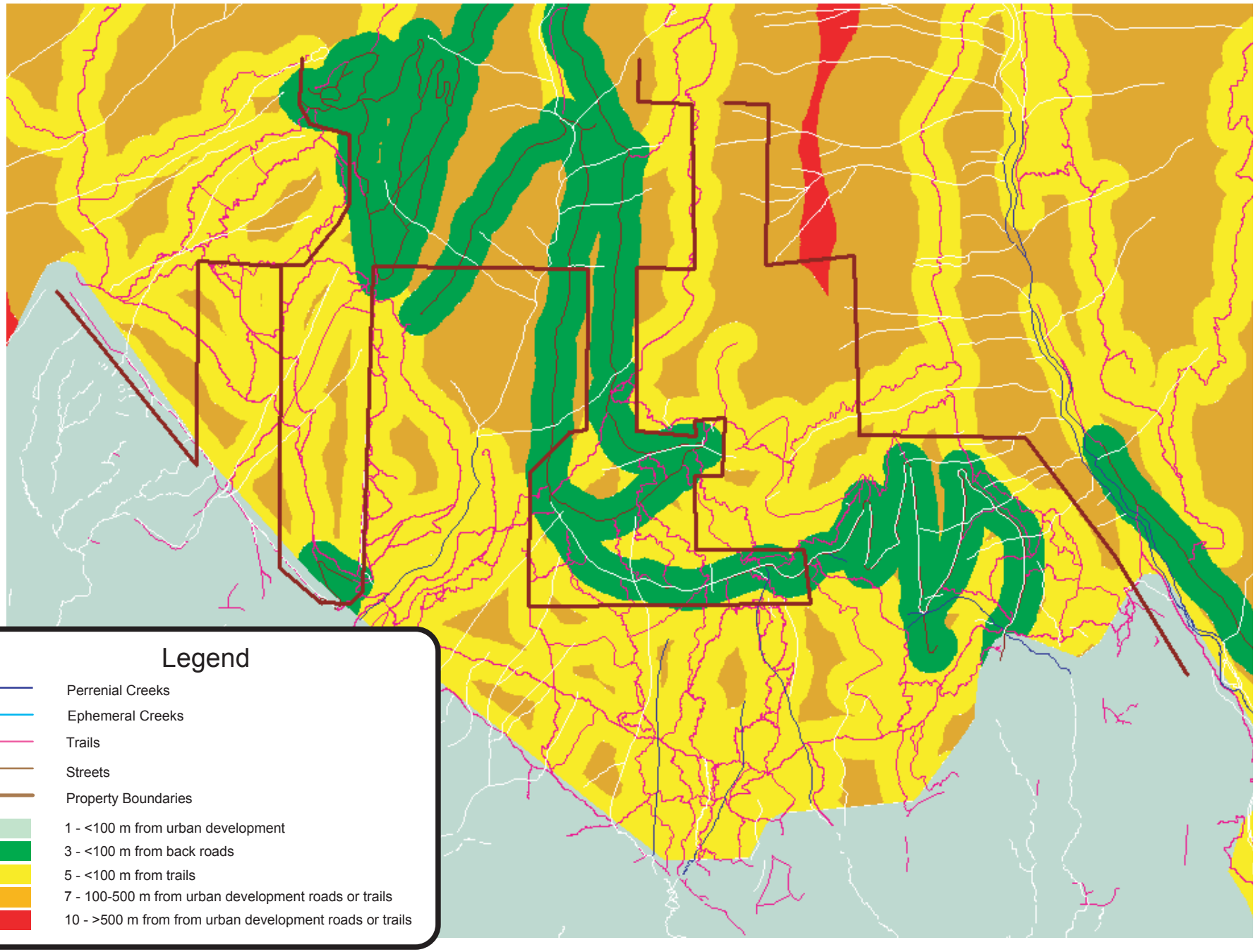
The impacts of our presence on individual wildlife species is dependent on whether the remaining natural area contains habitat with a carrying capacity that can support a particular wildlife species. If not, the result is a net loss of ecological diversity and potentially the local extirpation of the species.

The value given to isolation depends on the distance from as well as the type of facilities or activities nearby. All facilities, trails and roads were buffered to 100 and 500 meters. The ranking assigned to these areas increased with the distance from human activity and relative to the level of human disturbance or activity. The habitat isolation polygons were ranking according to Table 6 and as illustrated in Figure 7.

Table 6. Ecological rankings for habitat isolation

Isolation	Value
> 500 meters from major urban development/trails or roads	10
100-500 meters from major urban development/trails or roads	7
<100 meters from trails	5
<100 meters from back roads	3
<100 meters from major urban development	1

District of North Vancouver Fromme Mountain Area Inventory Analysis
Habitat Isolation



Final Ranking

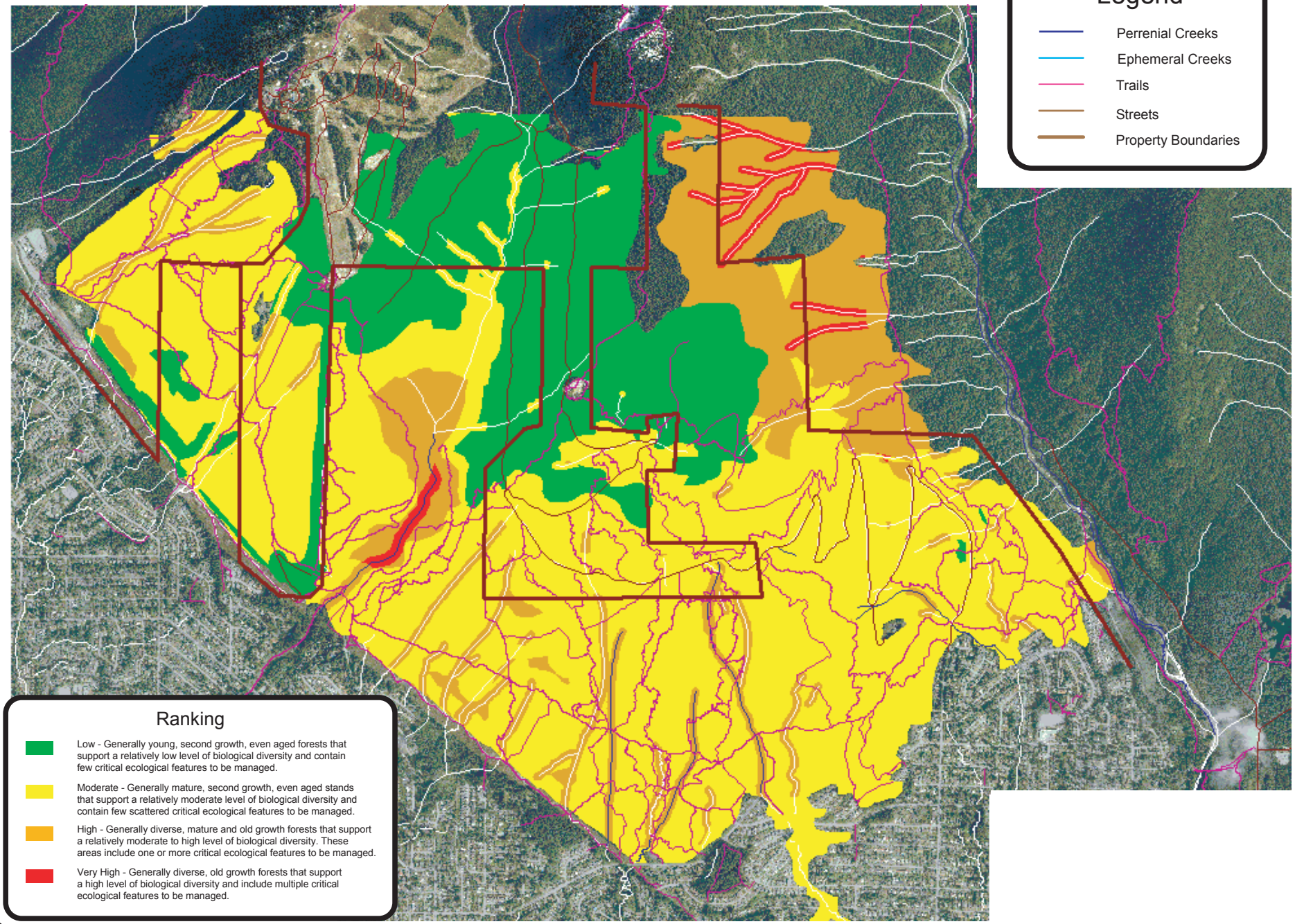
The final ecological ranking was calculated by adding together the values of the four critical attributes to produce a final weighting with a maximum value of 50. The purpose of this final ranking is to provide a visual representation of the four critical attributes together. It is meant to be used as a planning tool although management strategies should be developed taking into consideration each of the four critical attributes independently. The general ranking categories have been presented as follows. In general terms, a polygon ranked as “high” or ‘’very high’’ would contain important features for at least three of the four critical attributes. A polygon ranked as “moderate” would contain important features for two to three critical attributes.

The final ecological ranking was classified according to Table 7 and as illustrated in Figure 8.

Table 8 – Final ecosystem rankings

Ranking	Value
Very High	41-50
High	31-40
Moderate	21-30
Low	0-20

District of North Vancouver Fromme Mountain Area Ecological Analysis



Final Remarks

This analysis provides a precursory foundation from which specific management policy can be developed. The next phase of the planning process should be to establish draft management zones with associated best management practices for recreation. For each management zone, key issues of concern should be identified. These key issues should then be used to guide the development of best management practices. The management zones and best management practices can be undated in the future as more accurate and detailed ecological data becomes available.

Appendix A -Rare and Endangered Wildlife Species that may be Present in the Study Area

It is widely agreed that the protection of rare and endangered species is critical for conserving both genetic and species diversity in B.C. The British Columbia Conservation Data Center (CDC) is a part of the Wildlife Inventory Section of the Resources Inventory Branch of B.C. This organization is responsible for collecting and storing information on rare and endangered plants, animals and plant communities in B.C. All of these entities have been ranked by the CDC as red, blue or yellow-listed. Red-listed entities are considered extirpated, endangered, or threatened in British Columbia. Blue-listed entities are considered vulnerable and are sensitive to human activity or natural events. Yellow-listed plant communities are not at risk in British Columbia.

The following is a list of red and blue listed wildlife species that may inhibit the Fromme Mountain area. The range of most of the rare and endangered wildlife species in the lower mainland has been substantially impacted by urbanization, agriculture and forest harvesting. The habitat characteristics required by most of these species includes those associated with old growth forest, streams, lakes and wetlands including their riparian zones.

Red Listed Species

According to the MWLAP lower mainland Region and the CDC, the following taxa are considered red-listed (either extirpated, endangered or threatened) and have to potential to inhabit the Fromme Mountain area.

Common Name	Latin Name	Key Habitat Requirements
Keen's Long-Eared Myotis	*Myotis keenii*	Important natural roost sites include tree cavities, loose bark, rock crevasses and small caves. It is suspected that it may be dependent on tree cavities associated with old growth and mature forests.
Pacific Water Shrew	*Sorex bendirii*	This shrew is found in low elevation riparian habitat. They prefer forests with an extensive canopy and an abundant shrubs and downed woody debris that border streams, swamps, or marshes.
Marbled murrelet	*Brachyramphus marmoratus*	Critical habitat for nesting includes large branches on old growth trees. They nest on large limbs higher than 15m above ground with platforms greater than 18cm across. Suitable habitat for the marbled murrelet is old growth forests located within 85 km of salt water in the CWH, CDF or MH zones. Critical habitat is defined as old growth forests located within 30km of salt water in these zones.
Mountain Beaver	*Aplodontia rufa rufa*	Preferred habitat includes riparian areas of moist forests in the lower Fraser Valley.
Spotted Owl	*Strix occidentalis caurina*	This owl is dependant on the features characteristic of growth stands which include: numerous large trees and snags, a multistoried open canopy with perches at a range of heights and abundant coarse woody debris providing habitat for small mammal prey. Superior spotted owl habitat in maritime climates includes forests with stands greater than 140 years in age.
Long-tailed Weasel	*Mustela frenata altifrontalis*	Preferred habitat includes grasslands and riparian habitat with an abundance of coarse woody debris. They feed primarily on small mammals, occasionally birds, other small vertebrates, and insects.

Common Name	Latin Name	Key Habitat Requirements
Pacific Giant Salamander	*Dicamptodon tenebrosus*	The adults generally live in moss covered soils of moist coastal forests and lay their eggs in the gravel of cold mountain streams.
Snowshoe Hare	*Lepus americanus*	Preferred habitat includes the dense cover of coniferous and mixed forests, with abundant understory vegetation.
Wolverine	*Gulo gulo luscus*	The wolverine needs large territories with a variety of habitat types in order to meet their nutritional, cover and reproductive requirements. They are opportunistic and their habitat is dependent on the availability of food and denning sites which ranges from the alpine to valley bottoms and coastal estuaries. From January to August they prefer to use south facing snow banks for denning.

Blue Listed Species

According to the MWLAP lower mainland Region and the CDC, the following taxa are considered blue-listed and have to potential to inhabit the PPMP now or in the future. The taxa that are blue-listed are species that are considered to be vulnerable. Vulnerable species are considered to possess characteristics that cause them to be particularly sensitive to human activities or natural events.

Common Name	Latin Name	Key Habitat Requirements
Tailed frog	*Ascaphus truei*	This frogs habitat includes clean streams in mature and old growth forests ranging in elevation from sea level to the sub-alpine
Rd-legged frog	*Rana aurora*	This frog inhabits moist cool forests and treed wetlands. Usually found in or near quiet bodies of water including slow moving streams, marshes and ponds.
Fisher	*Martes pennanti*	The fisher inhabits forested ecosystems that contain a variety of forest types. Critical habitat features include riparian areas with large cottonwood or spruce with cavities for nesting. They prefer a variety of vegetation communities including a dense understory and the presence of downed woody debris as this supports a wide variety of small mammals and rodents for prey.
Hutton's Vireo	*Vireo huttoni*	Prefers western hemlock/western red cedar forests in south western B.C.
Trowbridges Shrew	*Sorex trowbridgii*	Lives in a variety of low-elevation coastal forest stands, preferring habitats with dry, loose soil and deep litter.
Great Blue Heron	*Ardea herodius*	Great Blue Herons nest singly or in colonies usually in the upper part of the main tree canopy in undisturbed, mature deciduous, coniferous, and mixed woodlands near foraging habitats. Large red alder, cottonwood and Douglas-fir are preferred tree species for nesting.

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