

E.1 MOUNTAIN ECOLOGY

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Forest habitat

This region lies within generally the most rainy biogeoclimatic zone in BC, the Coastal Western Hemlock biogeoclimatic zone. In this climatically mild zone common canopy trees found here are western hemlock, western red cedar and douglas fir. Amabilis fir and yellow cedar are common in wetter parts of this zone. Shore pine (lodgepole pine) is found in very dry or very wet spots in this zone. Grand fir, western white pine, and bigleaf maple occur in drier areas with red alder, willow species and other shrubs present in logged areas or other disturbed sites.

The shrub layer is generally well developed with salal, various ericaceous species (blueberries, huckleberries), and azalea present. The herb layer is generally sparse with several moss species (step moss and lanky moss) and often mushrooms.

The complexity of the landscape dictates much of the vegetation occurrence thus the habitats present. Two major landscape features are the distinct valley bottoms that are developed but have extremely high habitat value. The topography and aspect is well portrayed by the top left map. In our highly temperate climate the difference between aspect is marginal. However, slope would be much more significant as they can dictate landscape use. The bottom left map is an age-classed map of forest cover in the region.



These are areas of mature forests greater than 250 years old. These are the trees that are found in the steeper, inaccessible areas. This is ideal habitat for bears, cougars, deer, avians etc.

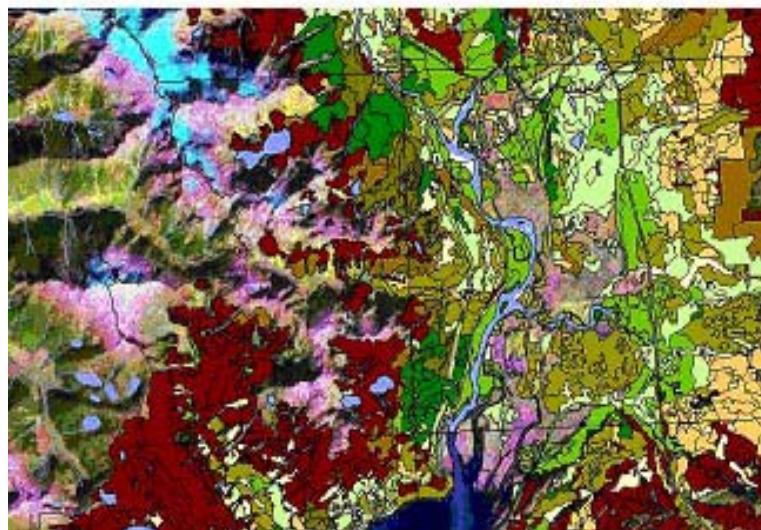
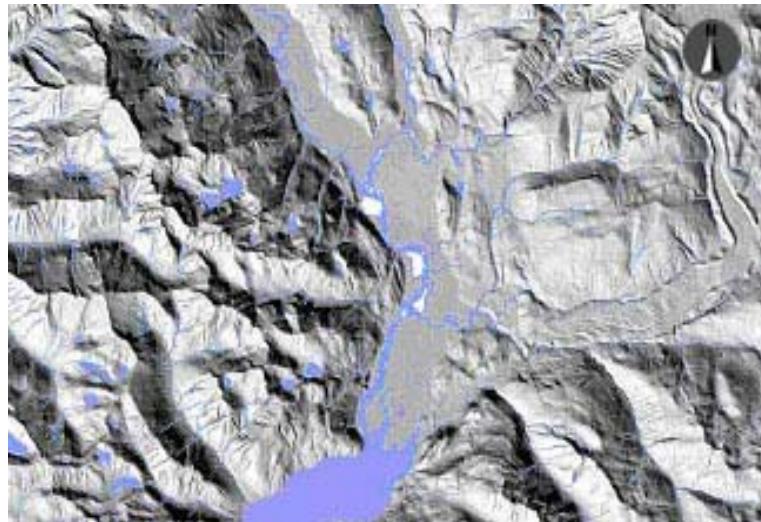


These are the early to mid seral stages of shrubs and seedlings. These would be areas of hunting, not necessarily for refuge though.



These areas are the range of the forests through different stages of maturity from 100 years to 250 years old.

It is interesting to note that only a few kilometres out of the main townsites the hills have been logged. Fragmentation of important habitat to large mammals, as well as avians, is a problem.



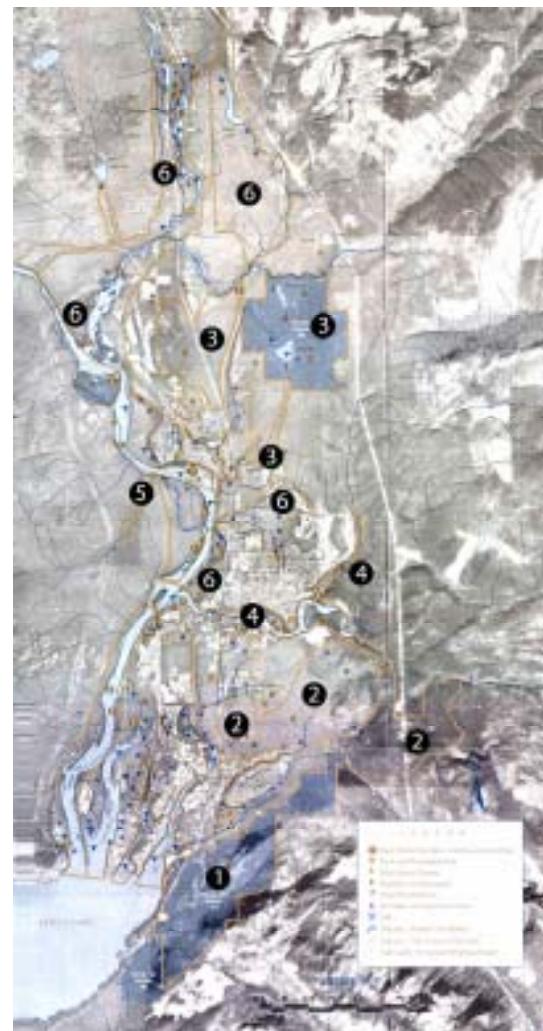
Important forest stands in the Squamish region

- 1** Stawamus Chief Provincial Park: In addition to being the dominant feature of the region it is important wildlife habitat providing everything from upland coniferous forests to timber filled granite gullies that are important for certain avian species.
 - 2** Little Stawamus Watershed, Smoke Bluffs, Wood's Woodlot: Presence of upland mixed deciduous/coniferous forest, upland deciduous forest, upland scrub-rock and upland coniferous forest creates a myriad of habitat types from mammals to salmonids. The continuousness of this land provides refuge, a movement corridor for wildlife as well as fish habitat
 - 3** Dryden Creek and Tributaries, Brackendale Woods and Alice Lake Provincial Park: Another contiguous plot of upland deciduous forests and upland coniferous forests linking Alice Lake with Judd Slough, and Cheakamus River. This is again important for refuge, habitat, movement corridors and fish habitat.

Important upland stream habitat in the Squamish region

- 4** Mashiter Creek, Mamquam River spawning channels: This is proven fish habitat for spawning as well as rearing. Chinook, chum, coho, and pink salmon are only a few of the fish that are found in this creek. The riparian zone is also home to many mammals and waterfowl.
 - 5** Fries Creek mouth: This is excellent riparian habitat for wildlife however, the stream, though fish presence has been recorded, it is more suited for rearing habitat versus spawning due to high water velocity.
 - 6** Squamish River – Meighan Creek and Tributaries, Lower Cheekeye, Cheakamus River and Brohm Creek Watershed: These creeks provide habitat for a variety of fish such as spawning and rearing areas due to the complexity of the landscape that the streams travel through.

Stream Habitat



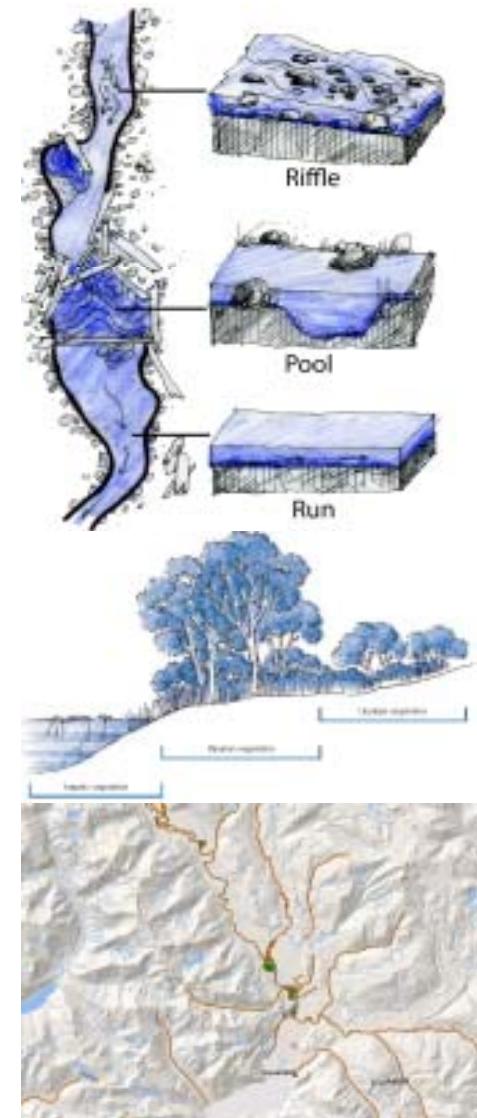
For salmonids, the stream habitat is extremely important for spawning but also for rearing. Some fish reside permanently in these habitats where others eventually migrate to the ocean. The riparian zone, the strip of forest that borders a stream channel, is also an important component of the stream habitat. In addition to providing shade and coarse woody debris to the stream, this area is often higher in both floral and faunal biodiversity.

Stream channel habitat can be divided up into 3 morphological categories:

1. Riffles: These are basically areas of fast, shallow moving water over a bed of coarse material. This is often spawning habitat.
2. Pools: Pools are slow moving water that may become refuge to fish.
3. Runs/glides are intermediate in many characteristics between riffles and pools.

In this region there are 2 types of streams: the natural channel and the enhanced streams. Some examples of the natural stream would be Brohm Creek and Loggers Lane Creek. These are small and of low-gradient therefore excellent habitat for fish such as coho which generally spend most of their lives in these streams.

Enhanced streams are the natural groundwater streams that were constructed by the Department of Fisheries in the past. These are often a natural extension of the larger river. Some examples of enhancement would be the placement of coarse woody debris (large logs etc.) into the stream channel to enhance stream morphology, or to excavate to the water table level so that the up welling of the water keeps the channel silt free.



E.2 FORESHORE AND ESTUARY ECOLOGY

Heather Olsen, Alison Chisholm

E.2.1 Context & Biophysical Effects

The Squamish estuary is where the fresh water of the Squamish River meets the salt water of the sea, mixing together. The estuary is influenced by the sea's tides and the salt content of the water. But because Squamish estuary is located far inland, then it is protected from the worst of the sea storms, high tides and winds. The sheltered waters and land surrounding the estuary provide food and shelter for animals and plants.

Important types of habitats found in the Squamish estuary are extensive salt marshes, mud and sandflats, grasses, rushes, shrub and woods. The variation of different habitats over a relatively small area creates ideal places for over 200 species of birds, millions of ocean bound salmon and trout which have hatched from in the rivers upstream and make their way out to sea, a wintering population of bald headed eagles.

Salmon use this area extensively the brackish water helps as a transition zone for salmon for the transition between salt water and fresh water. Juvenile salmonids use the estuary as nurseries and rearing grounds because of the abundance of food & protection & it allows them to acclimatize to the salt water.

Adult salmon also move through the estuary to their spawning grounds further upstream. The adult salmon contribute to the nutrient content of the rivers, which attracts to the lower Squamish watershed an internationally important wintering population of bald eagles which feed on the salmon. From early November through to March, thousands of bald eagles gather along the gravel shores of the Squamish, Cheakamus and Mamquam rivers to feast on the eggs and carcasses salmon which have spawned.

Several walking trails are accessible from downtown Squamish and lead out into the habitats along the estuary, such as the meadow walk which is an open trail with extensive views or the forest walk with forest and meadow habitat, passing a 300 year old Spruce.



- Meadow Walk
- Forest Walk
- Swan Walk
- Other trails and access

E.2.2 Estuary Flood Control, Mitigation, and Advancement

The estuary is an important feature for flood-control. Four main mountain streams flow into the estuary—thus illuminating flooding as an important future consideration for estuarine-area development. Given the right combination of high tides, strong wind, heavy rainfall and snowmelt the result will be a large amount of water inundating the estuary.

The mudflats and marshes help to mitigate the flooding as they are intersected by channels, smaller flood channels and have inter-tidal drainage channels crossing them. These act as a natural buffer between the land and ocean, absorbing flood waters and dissipating storm surges. This is not complete protection in all cases. The diagram left shows the lower estuary with Squamish and the flood plain areas. In this diagram all land below 3m is on the floodplain, many of the built areas are already on the floodplain.

Man's influence on the estuary has reduced its ability to absorb flood waters, today over half of the Squamish estuary has been altered. For example in 1972 a river dyke was built from the Mamquam river mouth to the Howe sound to divert the Squamish River to the western half of the river delta. At the time, this had a dramatic effect on salmon stocks as freshwater flow was cut off to the central channel formally had been the main channel which sent young salmon directly out into Howe Sound which was followed by a dramatic decline in salmon stocks.

The estuary is advancing out into Howe sound at a rate of about 4 metres a year. This is because of all the rocks and sediment that are brought down from the mountains by the rivers. The river speed slows down as it enters the sound and as the rivers meet the incoming tides, particles are dropped forming the alluvial delta areas.



E.2.3 Estuary/Foreshore Planning, “Ownership”, and Character

1. **Community residential development should uphold the estuarine environment** and realize that the opportunities tied to the estuarine foreshore lands remain the integral character in Squamish **“as a community landscape”**
2. **Future development provides an opportunity** for developing trails, improving access points to existing Squamish estuary trails, and support for further facilities within the general estuarine environment. [One key example of facility improvement: the bald-eagle viewing huts situated at the north-end of the estuary (see photo at top right).]
3. **Interacting with the current state of estuary health** is the introduction of both windsurf and powerboat use. The implication of this type of use both harms and hinders the needs of organisms inherently existing within the foreshore area. Thus, **finding alternative “zones” for these introduced sports would be invaluable** for an uncompromised habitat.
4. **Perceived ownership** of adjacent industrial and residential properties is both a liability and strength. Important to many life-long residents **the estuary is inseparable from the neighbourhood or niche perception**. Invading this privilege, however, is the over use of the foreshore lands for active or semi-active use which in turn partially deconstructs what nature has established.
5. **Foreshore planning** must address central channel drainage patterns. Further alteration of this channel (development alterations for example) would disturb the natural pattern inherent to the estuarine and benthic organisms present.
6. **Outdoor recreation** in the Squamish area often brings new real-estate and tourism options to the forefront. Economically recreation is an undeniable interest within this captivating valley. Whether summer or winter, water or mountain-**sports and recreation define Squamish appeal**. As critical components to trail systems diversity of use, value of experience and surrounding destinations factor the human experience within this valley region.



site photos



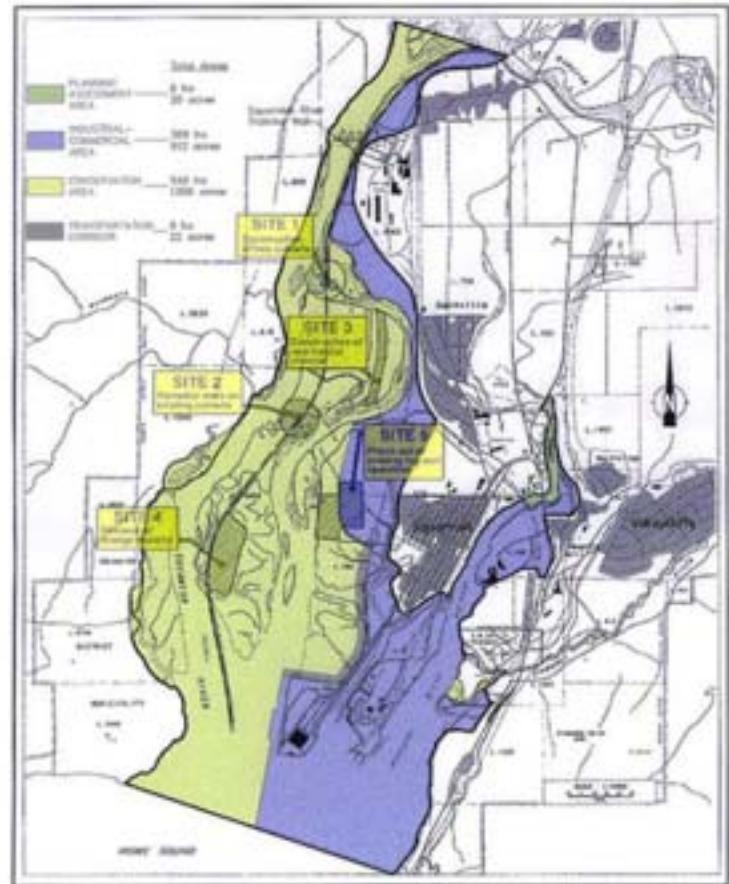
E.2.4. Estuary/Foreshore Promotion, Collaborative Effort and Public Support

The illustration, at right, shows the two distinctive areas of designated conservation and commercial zones.

As we know, existing expansion factors which sacrifice crucial foreshore land are:

1. Industry,
2. Marine Traffic
3. Commercial & Residential development

- Past foreshore habitat initiatives &/or objectives are further detailed in Section F.2.
- Estuarine trail and access improvement initiatives need to be highly publicized practices—conjuring both economic and stylistic response for future development.
- Promotion of the estuary should be carefully scrutinized for future collaboration efforts involving school, provincial and national-level support groups. One example of habitat improvement support is the Ducks Unlimited group based out of the U.S.
- Establishing a group of diverse, sincerely-interested community individuals can often further support for future remediation or amenity improvement



Squamish Area Habitat/Land Use Diagram