

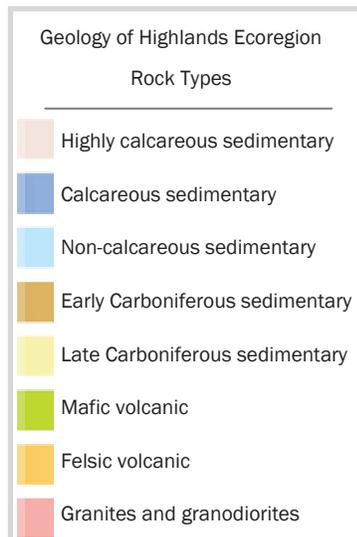
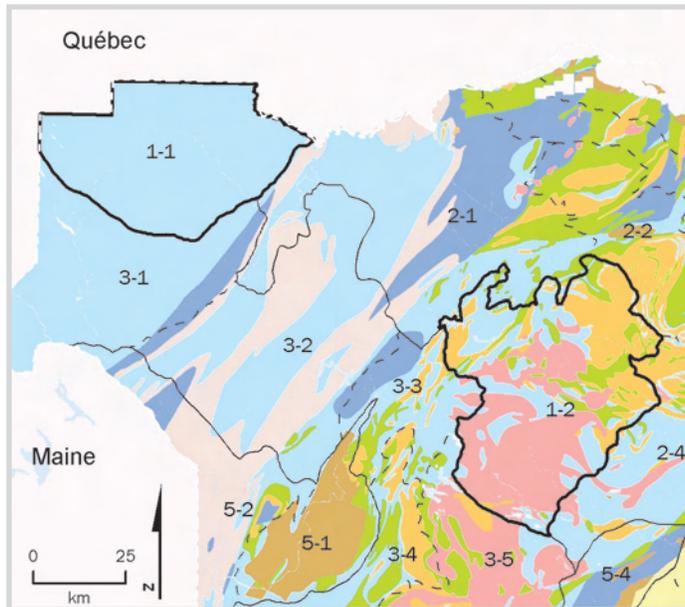
The Highlands Ecoregion is a relatively mountainous area of northern New Brunswick that contains biological elements of the boreal forest .

## Chapter 7

### 1. Highlands Ecoregion

The Highlands Ecoregion consists of two distinct areas of high elevation located in northern New Brunswick. The western portion abuts Quebec and encompasses much of the Kedgwick River watershed. The eastern portion spans the mountainous terrain of north-central New Brunswick including Mount Carleton and the Christmas Mountains.

Separating the two parts of the ecoregion is a zone of lower elevation that takes in parts of the valleys of the Restigouche, Upsalquitch, and Tobique rivers. The forest cover here has strong boreal affinities, due to a climate with shorter, cooler growing seasons, and longer, colder winters than elsewhere in the province. Arctic and subarctic plants cling to the region's windswept summits, while its deep forests resonate in spring with the calls of boreal birds typically associated with more northerly latitudes.



## Geology and Landscape

The western portion of the ecoregion is underlain solely by Devonian metasedimentary strata with tight, upright folds shattered by vertical fractures. The eastern portion contains different lithologies: Ordovician igneous and metasedimentary rocks surrounding a high plateau of Devonian granites. Dissimilar bedrock notwithstanding, both areas have undergone tectonic uplift that has raised their terrain relative to the more southerly parts of New Brunswick. The western ecodistricts have an average elevation of about 500 m. The eastern ecodistricts

undulate with mountains surpassing 700 m including Mount Carleton which, at 820 m, is the tallest peak in the Maritimes. The headwaters of several major New Brunswick rivers originate within the region. Tributaries and other feeder streams of the Kedgwick, Gouamitz, Tobique, Miramichi, and Nepisiguit rivers emerge from the higher ground, then run swiftly down through the deeply incised terrain en route to their mother rivers. Elsewhere in the province, rivers and streams tend to move briskly, flow or meander, but here they are more likely to be furious torrents, or have impressive rapids or falls. The region contains few lakes, the mountain-rimmed Nictau and Bathurst lakes in the east, and the emerald Green States Lake in the western section being perhaps the most notable. A small and shallow lake in the far northwestern corner of the province, humbly named Mud Lake, is the only lake in New Brunswick that drains into the St. Lawrence River.

## Climate

The combination of rough topography and high elevation gives the Highlands Ecoregion a cool, wet climate characterized by mist-wrapped mountains in summer and heavy snowfalls in winter. The region sits at the same latitudes as the warmer, coastal Acadian Peninsula, yet its more elevated terrain has colder temperatures than the coast, ones more typical of a higher latitude. Average annual temperatures here are the lowest in New Brunswick, and the first frost often brushes the mountainsides by early September. The region's abundant precipitation is surpassed only by that of the

Fundy Coast Ecoregion and parts of the Central Uplands Ecoregion. The generous amounts of rain and snow result from orographic lifting, the phenomenon whereby prevailing winds rise over elevated ground, cool, and then release their condensed moisture. Precipitation falls mainly in the western portions of both western and central ecodistricts of the Highlands Ecoregion, leaving a rain shadow to the east. This regional variation in summer rainfall leads to fire-prone conditions in some areas and fire suppression in others. Orographic lifting also creates an unusual pattern of convection currents that, during the summer months, can translate into formidable lightning. The storms produce grand displays that dramatize the mountain peaks and delight sheltered hikers, but they also contribute to the region's high frequency of forest fires.

## Forest Cover

The forest cover of the Highlands Ecoregion is dominated by balsam fir, white birch, black spruce, and white spruce, species with northern affinities that reflect the cool, wet climate and harsh winter conditions. Indeed, some scientists regard the area as a small boreal outlier, isolated from the extensive boreal forest that stretches from Newfoundland to the Yukon. Traversing the ecoregion from its lower elevations up to its summits is roughly equivalent to shifting several degrees northward in latitude, with the accompanying gradation in forest composition. The exposed mountaintops with shallow soils, where they show trees at all, display boreal-type forest stands of nearly pure black spruce or balsam fir. These species require fewer nutrients and morphologically are well adapted to heavy snowfalls and strong winds. White birch and white pine appear in the more protected, well drained sites farther downslope, and yellow birch becomes more frequent at lower elevations. Rocky, gravelly soils favour mixtures of black spruce, jack pine, and white pine, whereas the more fertile soils support balsam fir with some white spruce, yellow birch, and

Mount Carleton Park, Highlands Ecoregion.





Mountain ash is usually a large shrub but in the Highlands Ecoregion it often grows to occupy the forest canopy. *Photograph courtesy of the New Brunswick Museum.*

mountain ash. The last-named species achieves an unusually large size in this area of the province, perhaps in part because white tailed deer are relatively scarce here. The transition to other ecoregions occurs at lower elevations. Here, sugar maple, red spruce, and beech begin to appear alongside the yellow birch, fir and spruce. Cedar, white elm, balsam poplar, and black ash occasionally occur, but species with more southerly ranges – ironwood, hemlock and butternut, for instance – are notably absent.

Because the eastern parts of the ecoregion lie in rain shadows and undergo regular lightning strikes, fire disturbance has been a determinative factor in forest composition. Fire-adapted species such as jack pine and trembling aspen are concentrated in the Nepisiguit River valley; jack pine also occurs at other locales in scattered patches. The western section, by contrast, receives abundant precipitation that helps to reduce the frequency of fires; it therefore has few jack pine and aspen. Regional understorey species mirror the northern affinities of the canopy. The less fertile soils over granitic bedrock support such boreal indicator plants as bunchberry, Schreber's moss, plume moss, wild lily-of-the-valley, wintergreen, sheep-laurel, and blueberry. The more fertile soils associated with sedimentary terrain might support a higher diversity among the understorey dominants, including mountain wood fern, common wood-sorrel, and other sub-boreal species. Several rare subarctic plants also occur in this region (see Kejwik and Ganong ecodistricts).

## Wetlands

The ecoregion's rugged terrain leaves little room for wetland formation. Only limited areas suitable for wetlands can be found along its fast-flowing rivers and steep-sloped lakes. The most common wetland type is streamside shrub swamps that usually are dominated by alder. In addition, peatlands have developed in ancient glacial drainage channels or in scattered small depressions. Preliminary investigations of these peatlands indicate that they typically have an abundant cover of shrub and dwarf trees, with a low diversity of sphagnum moss species. Beaver activity has added to the number and diversity of wetlands in this, as well as most ecoregions in New Brunswick. Meadows have formed over some sites formerly occupied by beaver ponds. The meadows display an array of graceful sedges and grasses, plus shrubs associated with acidic conditions: leather-leaf and Labrador tea, for instance. The more calcareous sites may harbour some of the less common sedges such as lake sedge or hidden-scale sedge.

## 1.1. Kejwik Ecodistrict

The Kejwik Ecodistrict is a visually dramatic area in the northwest extremity of New Brunswick adjoining the Gaspé area of Québec. It is one of two ecodistricts within the Highlands Ecoregion.

### Geology

The bedrock is composed solely of Devonian metasedimentary strata belonging to the Temiscouata Formation. They consist mainly of siltstone and slate, with some sandstone and greywacke along the northern reaches of Green River and its tributaries.

Rocks in the area have been compressed into tight upright folds with many vertical fractures so that outcrops typically appear shattered.

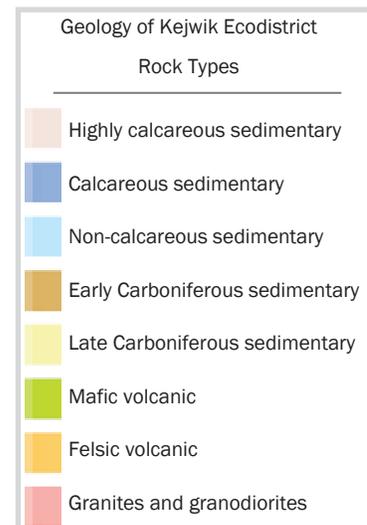
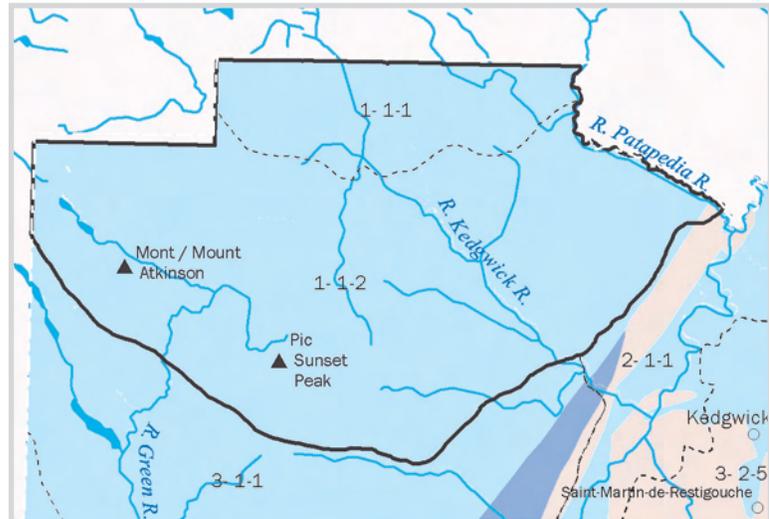
The terrain displays a regional pattern of faults and other lineaments that subsequently influenced the flow direction of waterways and glacial ice.

The most recent glacial event occurred between about 2.5 million and 11,000 years ago. It produced massive ice sheets that scoured existing river valleys such as those of the Kedgwick and Green rivers, rounding hilltops and transporting unconsolidated sediment. Soils in the ecodistrict owe much to the sand, silt, clay, and rock fragments deposited by retreating glaciers.

### Landscape and Climate

The Kejwik Ecodistrict presents a stunning landscape of tumultuous rivers and steep-sided valleys. Waterways have eroded and incised the bedrock into ridges, slopes, and canyons. Two of the three main rivers – the Kedgwick and Gounamitz – drain the east and north portions of the ecodistrict into the Restigouche River. The third river, the Green, originates near Wild Goose Lake then turns southeast to drain into the Saint John River.

Maps of this ecodistrict display colourful names such as Six Mile Gulch and Devil's Elbow Rapids. The old supply camp of Rapids Depot on Kedgwick River speaks to one of a string of rapids that interrupt the river along its noisy passage down from the Gaspé.



The many bedrock fractures and fissures provide natural pathways for streams and rivers. Conversely, the combination of porous rock structure and rugged landscape effectively has precluded the accumulation of large bodies of water. The ecodistrict as a result has very few lakes, none longer than 3 km, the most noteworthy being States Lake and Wild Goose Lake. Relief is moderate in the western portion of the district, and tends to be steeper and visually more dramatic in the eastern part, in the valley of the Kedgwick River.



The Kedgwick River Valley is flanked by forests of white pine, black spruce and balsam fir. NBDNR photo.

With elevations ranging from 200 m at Kedgwick River to 600 m on the ridges, the average elevation of this ecodistrict is a fairly high 500 m, which results in cool temperatures and abundant rainfall.

### Soils

Soils in the Kejwik Ecodistrict are moderately fertile, as the bedrock of metasedimentary slate, siltstone and metaquartzite weathers slowly to yield moderately acidic soil. Locally, rocks and transported glacial till are calcareous, and soil pH may approach neutral values. Soils are derived from a variety of glacial deposits plus pre-glacial residual material. Textures range from loamy to gravelly.

The ridgetops are covered primarily by weathered, *in situ* rock fragments and soil of the stony, loamy Glassville Unit. Non-compact, gravelly and sandy loams of the McGee Unit blanket the more protected hillsides. Compact, sandy loams and loams of the Holmesville Unit are associated with well drained areas of lower relief such as north of States Lake. The coarse-textured Grand Falls Unit was formed from glaciofluvial gravel and occurs near Mud Lake and on upper reaches of McDougall Brook. In areas of the northeast, natural processes have led to development of soils with cemented iron pans at a depth of 20 to 30 cm. These limit tree rooting and appear to negatively affect productivity for forestry.

### Biota

The Kejwik Ecodistrict displays a range of ecosites typical of a cool moist climate with high relief.

Balsam fir dominates the forest at all locales. The acidic upper slopes and ridgetops (5h and 7) tend to support a mixed forest of balsam fir with white birch, red maple and yellow birch as the

dominant hardwoods. American mountain-ash is more common here than elsewhere, and occasionally reaches tree-size proportions, surpassing its more typical bush aspect.

The lower plateaus and warmer mid-slopes (5) are covered with balsam fir accompanied by white spruce or red spruce; red spruce grows preferentially on more protected aspects such as along tributaries of the Kedgwick River. At even lower elevations (2), black spruce with some white pine is fairly common in areas of frequent fire disturbance such as north of States Lake. Black spruce and white pine also tend to occur on sites underlain by dry soils of the Grand Falls Unit.

The South Kedgwick River Black Spruce Ecological Reserve is situated just northeast of Summit Depot on an upland area of rolling hills. This site supports an outstanding example of an upland black spruce stand, and federal government scientists intensively studied it during the 1960s. Summit Depot, in the western portion of the district, was a hub of scientific activity in the 1950s and 1960s as federal scientists studied the effects of a spruce budworm outbreak on the fir-dominated forest.

Fox sparrows can be found nesting in coniferous forests of this ecodistrict. The eastern population approaches the southern limit of its breeding range here, in northern New Brunswick.

Stands with a greater proportion of yellow birch and sugar maple appear at the ecodistrict's southern fringes, but beech, like most species with southern affinities, is very uncommon throughout the area. Post-harvest stands are often dominated by balsam fir, white birch, and pin cherry, with an understorey of balsam fir.

The Kejwik Ecodistrict contains an interesting assemblage of unusual or rare flora and fauna, some with boreal associations. A bedstraw commonly known as northern wild licorice occurs at Summit Depot, as does the small round-leaved orchis and a very rare sedge, the closed-head sedge. Just north of Summit Depot is Wild Goose Lake, which has an unusually high pH of 9.5.

The rare aquatic plant awlwort grows in the shallows of States Lake. States Lake at 50 m is the deepest lake in the province and also is one of only twelve provincial lakes with a self-sustaining lake trout population. Lake trout is a species typical of cold waters.

## Settlement and Land Use

This ecodistrict lies within the traditional Mi'kmaq territory of Gespegeoag. Coastal people from the former village of Tjigog

(located outside the ecodistrict at Atholville) visited Kejwik Ecodistrict regularly for hunting and fishing, and also used it for overland travel to the Saint John River valley. The Mi'kmaq name of *madawamkejwik*, given to the 'river that likes to flow underground', has transformed over time into Kedgwick River.

Clyde Hynes, the Kedgwick Bard, ca. 1920. Photograph courtesy of the Harriet Irving Library Archives.



Europeans visited the area by at least the 1500s, but for the next few centuries concentrated more on its rich fur and fish resources than its magnificent stands of pine and spruce. When the Miramichi Fires of 1825 devastated timber throughout much of central New Brunswick, New Brunswick lumber barons cast their eyes northward.

Within four decades, timber crews had exhausted the largest stands of mast pine along the Restigouche and its tributaries and had begun to remove saw logs. The 1875 completion of the Intercolonial Railway through the ecodistrict gave further impetus to logging and other economic ventures.

Several lumber companies were active here during the 1920s. Rapids Depot on Kedgwick River served as a halfway station, storing supplies brought up from Restigouche River before they were shipped further inland. The depot's most famous caretaker was Clyde Hynes, known as the Kedgwick Bard for his poems and stories.

### 1.1. Kejwik Ecodistrict at a Glance

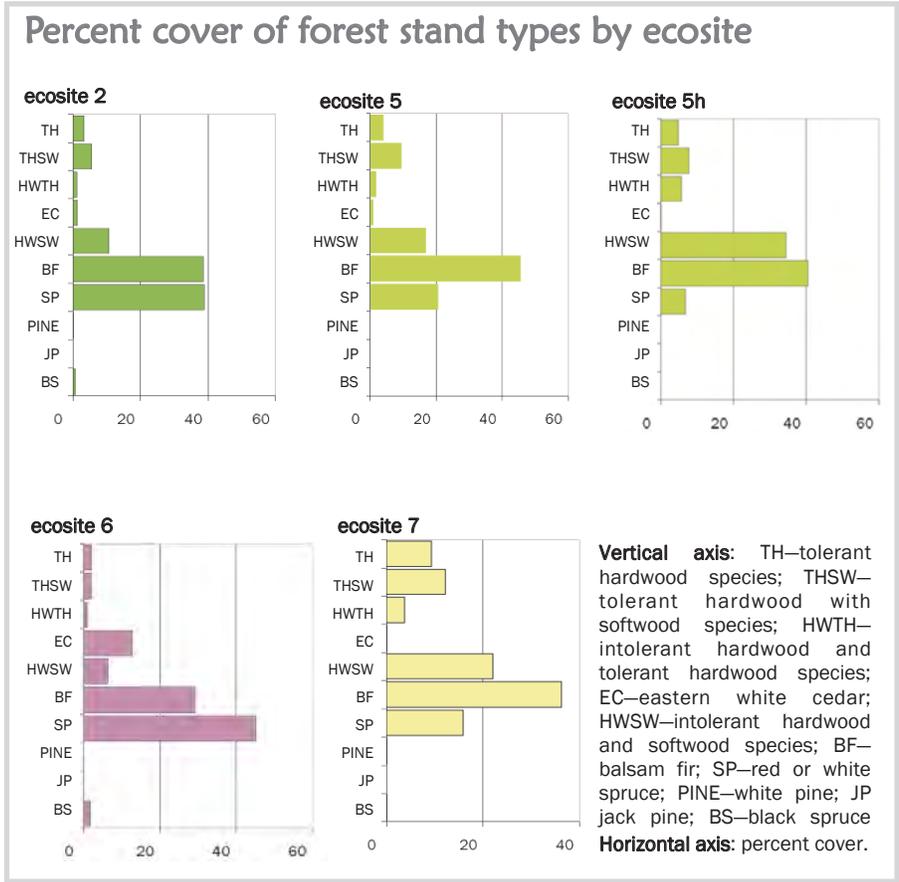
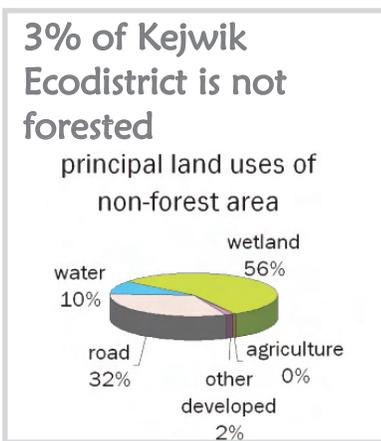
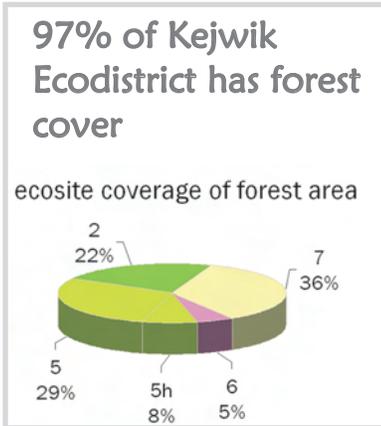
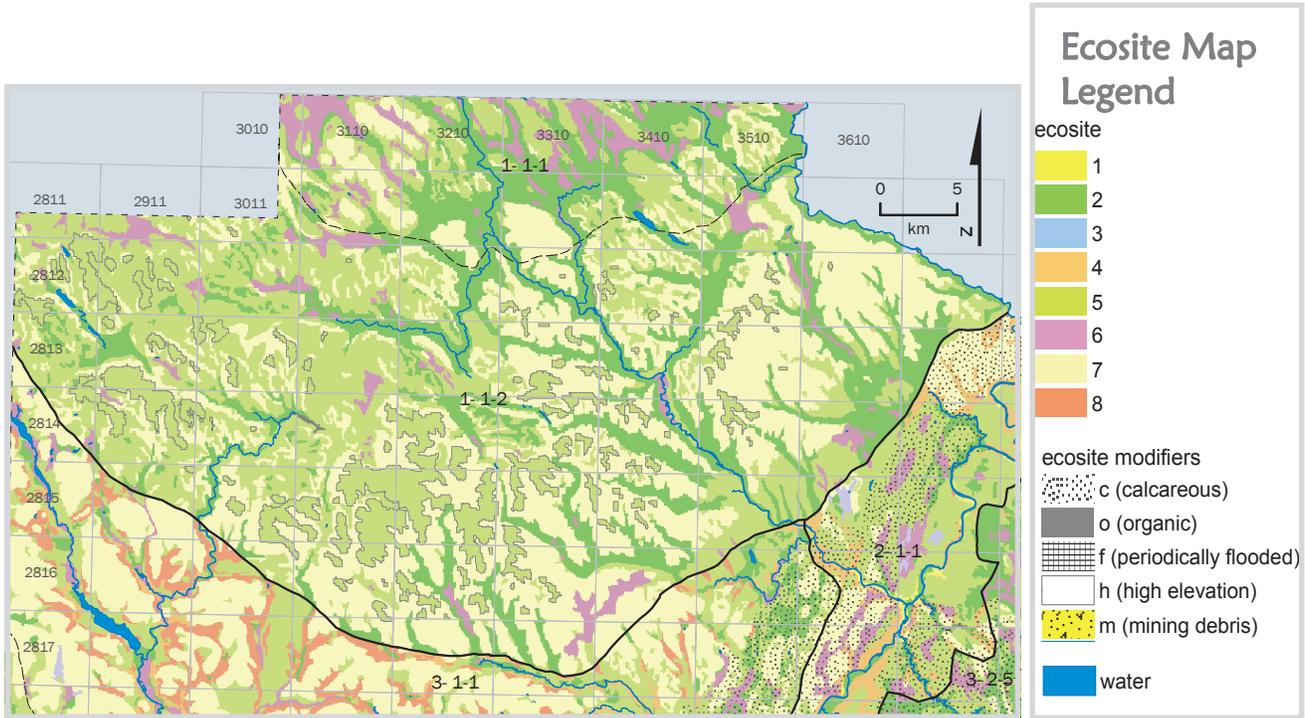
Ecoregion: Highlands

Area: 208, 689 ha

Average elevation above sea level: 416 m

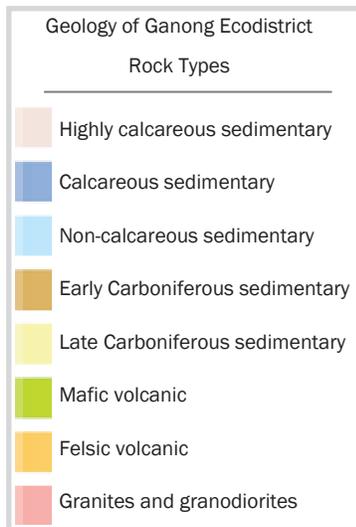
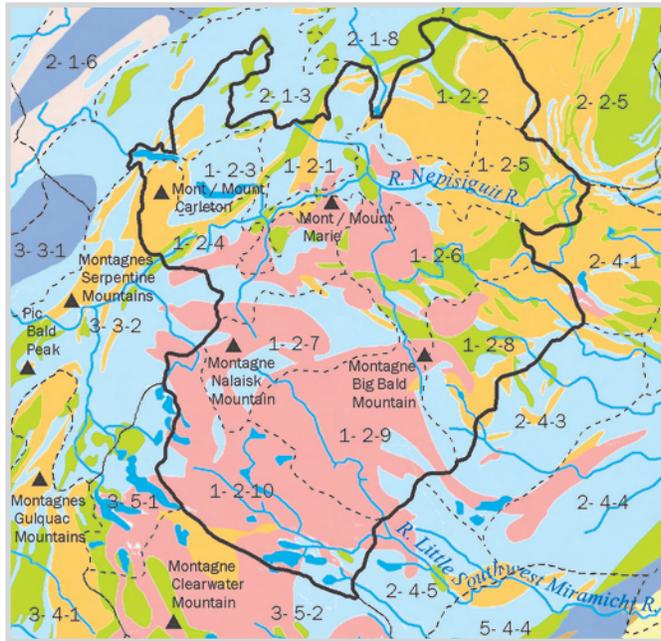
Average May-September precipitation: >500 mm

Average annual degree-days above 5°C: 1300–1400



## 1.2. Ganong Ecodistrict

The Ganong Ecodistrict lies in north-central New Brunswick encircled by the lower terrain of the Southern and Northern Uplands. It is one of two ecodistricts within the Highlands Ecoregion and has truly boreal affinities.



### Geology

The bedrock in Ganong Ecodistrict consists primarily of Ordovician volcanic, metasedimentary and granitic rock, all of which have been intruded or overlain by several types of Devonian rocks.

The Naturalists Range in the northeast corner is formed mainly of Ordovician volcanic rocks. Mount Carleton and Sagamook Mountain in the northwest are underlain by Devonian felsic volcanics and metasedimentary rocks. Mount Elizabeth, Big Bald Mountain, and Christmas Mountains lie further south and are located within plutons of Devonian granites and related rocks. The names of mountains in

the Naturalists Range acknowledge some early New Brunswickers such as William Francis Ganong, Moses Perley and Montague Chamberlain who laid the groundwork for much of our present scientific knowledge of the province.

On January 9, 1982 an earthquake measuring 5.7 on the Richter scale shook New Brunswick. Its epicentre lay within the granite pluton containing the Christmas Mountains and Big Bald Mountain.

During early stages of deglaciation, the summits in and around Mount Carleton began to protrude above the thinning ice. Exposure caused the rocks to undergo intense frost shattering, resulting in the formation of angular bedrock projections called tors. Tors remain visible on most higher peaks in the area.

### Landscape and Climate

The rocks here translate into three broad divisions within the landscape: a northern mountainous terrain of felsic volcanic and metasedimentary rocks; a high central plateau of granites and related rocks; and a southern granitic area with a more gently rolling

topography.

Mount Carleton at 820 m is the tallest peak in the Maritimes. Mount Carleton and Sagamook Mountain lie in the northern division, where elevations commonly exceed 600 meters. Together they create the divide of two river systems, as Nictau Lake drains west via the Tobique River into the Saint John River, and Nepisiguit Lake drains east via the Nepisiguit River into Chaleur Bay.

Nepisiguit River and its tributaries roughly delineate the border between the north and central divisions. The river rises in the northwest corner of the ecodistrict and drains from west to east, incising the mountainous terrain deeply into a patchwork of slopes and canyons. In some locales, such as Mount Marie near Popple Depot, the river gorge drops 400 m from peak to riverbed.

The average elevation remains around 750 m in the central granitic plateau, then gradually drops below 500 m as one moves southward into a landscape of rounded hills and broad valleys. The southern area contains noticeably more lakes, a reflection in part of its gentler terrain.

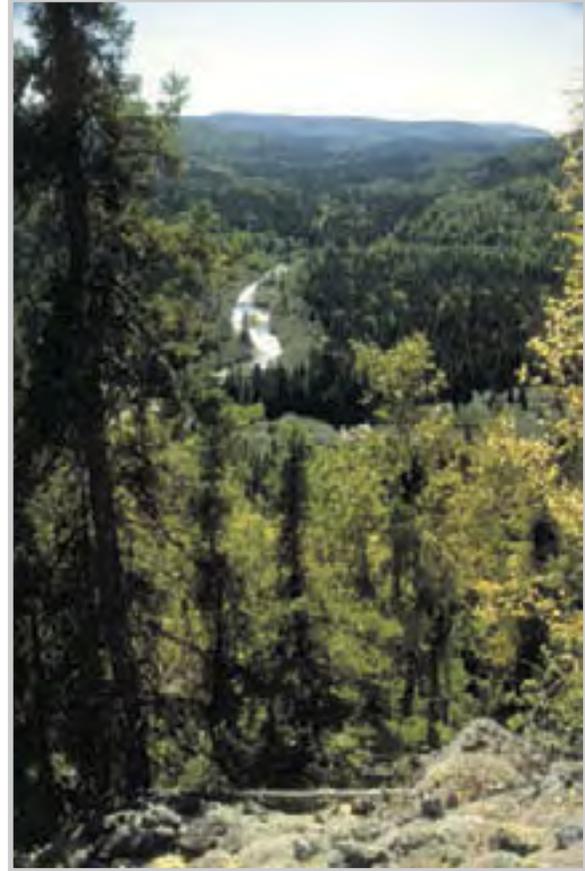
The extreme elevations and resultant cold, wet climate give this ecodistrict the lowest annual average temperatures in New Brunswick. As well, its average summer precipitation is exceeded provincially only by that in the Fundy Coast Ecoregion.

## Soils

The range of soil texture and fertility mirrors the variation in bedrock and glacial history.

The felsic volcanic rocks in the north weather very slowly and give rise to coarse-textured, poor soils, except where they are accompanied by metasedimentary rocks which contribute fine-textured particles. Least fertile are the gravelly, loamy sands of the Gagetown Unit that line the Nepisiguit River valley. Shallow, stony loams and sandy loams of the Lomond Unit blanket the felsic volcanic summits, whereas deeper, compact loams of the Popple Depot Unit are associated more with middle and lower slopes. Both Popple Depot and Lomond soils have low inherent fertility.

The central plateau contains granites, granodiorites, and



The view from Mt. Marie, looking west, shows the Nepisiguit river below and, in the distance, the igneous bedrock massif that includes Mt. Carleton, Mt. Sagamook, and other high points within Mt. Carleton Provincial Park. *DNR photo.*

related rocks. Such soils can be moderately productive sites for timber if they are medium textured, but units in this area generally are coarse textured and have low productivity. The Big Bald Mountain Unit, for instance, derives from *in situ* weathering of granitic rocks, contains a high proportion of coarse rock fragments, and is found on hill crests and upper slopes where outcrops are common.

Soils in the south can be somewhat richer. The most fertile units are loamy Britt Brook Unit soils derived from a mixture of granitic and metasedimentary rock types. The Juniper Unit also is common in the south, but its non-compact, bouldery-to-gravelly loamy sands are too coarse for high forest productivity.

## **Biota**

Balsam fir and black spruce dominate the forest here, but their relative prominence and accompanying tree species shift from north to south. Balsam fir prevails in the northern terrain. White birch appears as a post-fire, early successional species near Mount Carleton, specifically on shallow soils covering strong slopes (4). Trembling aspen is limited mainly to roadsides and to low elevations in the Nepisiguit River valley. Beech is absent here and throughout the ecodistrict. The high plateau of the central terrain is blanketed by a nearly pure cover of balsam fir (5h). In November of 1994, approximately 17,000 ha of this forest was blown down in a windstorm. The more nutrient-enriched mid-slopes (5) support balsam fir accompanied by white spruce and red spruce, white birch and yellow birch, red maple, and American mountain ash.

In the southern division, balsam fir prevails in sites with moist soil (2), but black spruce becomes more dominant on dry granitic soils (1). The granitic summit and talus slopes of Mount Elizabeth, for instance, are covered by a representative black spruce forest, which is now designated as the Mount Elizabeth Ecological Reserve. On warmer sites at lower elevations (7), mixed stands of sugar maple and yellow birch become more prominent. However, sites supporting pure sugar maple stands are rare.

Forests underlain by the Gagetown Unit along the Nepisiguit River have experienced high fire frequency, which favours the propagation of jack pine. Jack pine dominates in these areas of dry, coarse-textured soils that line steep river valleys, and in places it forms pure stands. The Nepisiguit River valley also displays patchy, scattered stands of white pine that could represent remnants of

earlier extensive tracts. Red pine is even less common overall, but is present locally on a peninsula jutting into Bathurst Lake in Mount Carleton Park.

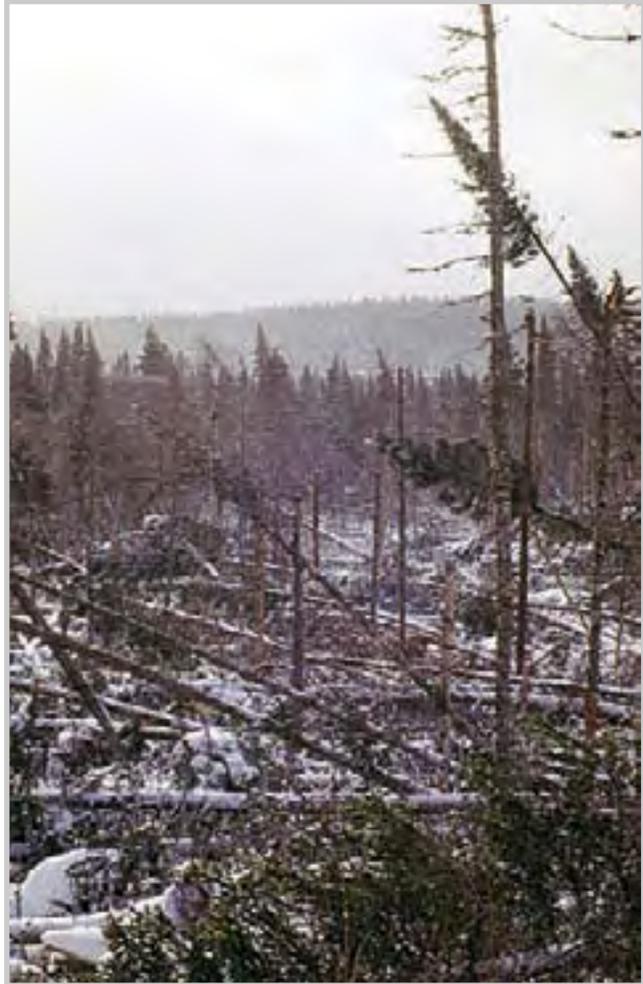
The Freeze Lakes Protected Natural Area embraces an undisturbed, densely canopied balsam fir stand with little undergrowth except for mosses.

The Ganong Ecodistrict displays boreal and subarctic elements that yield an unusual assemblage of flora and fauna. A very lucky (and careful) day's walk across Big Bald Mountain could reveal sightings of some extremely rare sub-arctic plants: the highland rush and dwarf birch. Mount Carleton Park also possesses several species that thrive on alpine slopes or shaded mossy rocks – plants such as Bigelow's sedge and the tiny mingan moonwort. Mount Denys is one of only a very small number of known sites in New Brunswick for the alpine bilberry.

Despite its rarity elsewhere in New Brunswick, the Gaspé shrew has made its home on both Mount Carleton and Sagamook Mountain. The Gaspé shrew is one of only four mammals found only in Canada and nowhere else (the other two are the Vancouver Island marmot, the Labrador collared lemming, and the Maritime shrew). Another significant species in this ecodistrict is the Bicknell's thrush, a rare bird that typically nests in dense conifer or, occasionally, mixed-wood stands at cool, high-elevation sites. Prior to 1996, the species was considered an isolated population of the more common grey-cheeked thrush. It is now considered vulnerable by the committee on the status of endangered wildlife in Canada (COSEWIC). Summer visitors also may be fortunate enough to spot the purple lesser fritillary butterfly.

## Settlement and Land Use

The Ganong Ecodistrict straddles traditional territories of the Maliseet and Mi'kmaq people, and aboriginals have frequented the area for at least 2500 years. Its rivers provided salmon, served as a route into the highland interior for hunting game, and facilitated



This patch of older Balsam fir forest was blown down in the November 1994 windstorm that levelled 17,000 hectares of similar forest, triggering a huge wood salvage effort by the New Brunswick forest industry. *DNR photo*



Serpentine Mountain, Ganong Ecodistrict.

traveling overland via portages between the Saint John and Restigouche rivers.

The Mi'kmaq name of winpegijooik was given to the '*river that dashes roughly along*' and over time has been substantially altered into Nepisiguit River.

European immigrants likely viewed the terrain of Ganong Ecodistrict with little enthusiasm as it was difficult to reach, inhospitable and effectively non-arable. The only settlements were lumbering camps erected to accommodate itinerant loggers.

Commercial lumbering began in the early 1800s along the most accessible river valleys, concentrating on the Nepisiguit and Northwest Miramichi. A number of base-metal and gold deposits have been discovered over the last century or so, some of which were developed.

The mountainous landscape with its distinctive flora and fauna has attracted naturalists from the early 19th century to the present day. The New Brunswick government created Mount Carleton Provincial Park in 1970 to recognize the ecodistrict's scientific and aesthetic significance, a commitment that has led to an increasing number of visiting hikers and naturalists.

## 1.2. Ganong Ecodistrict at a Glance

Ecoregion: Highlands

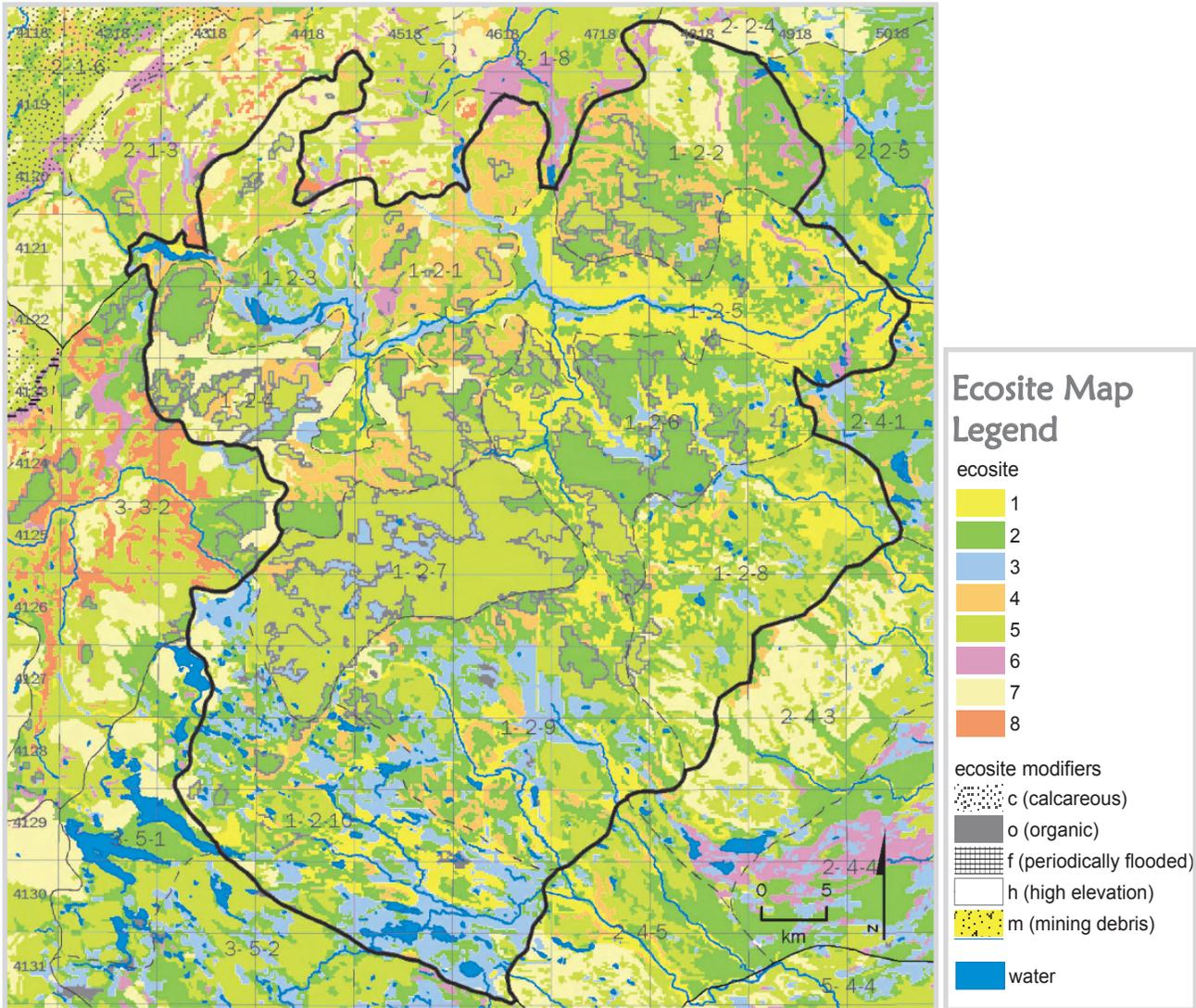
Area: 282, 178 ha

Forest area: 95% of total

Average elevation above sea level: 473 m

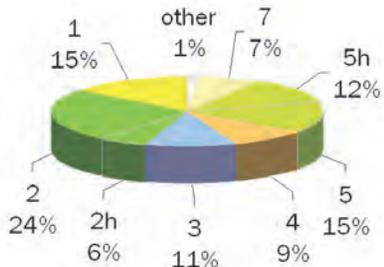
Average May–September precipitation: > 500 mm

Average annual degree-days above 5°C: < 1300



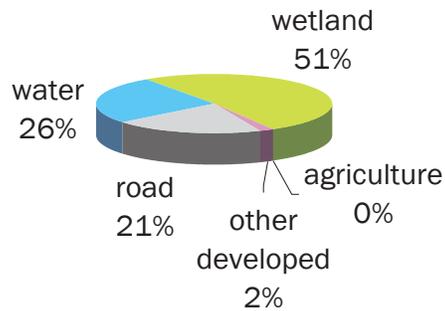
**95% of Ganong Ecodistrict has forest cover**

ecosite coverage of forest area

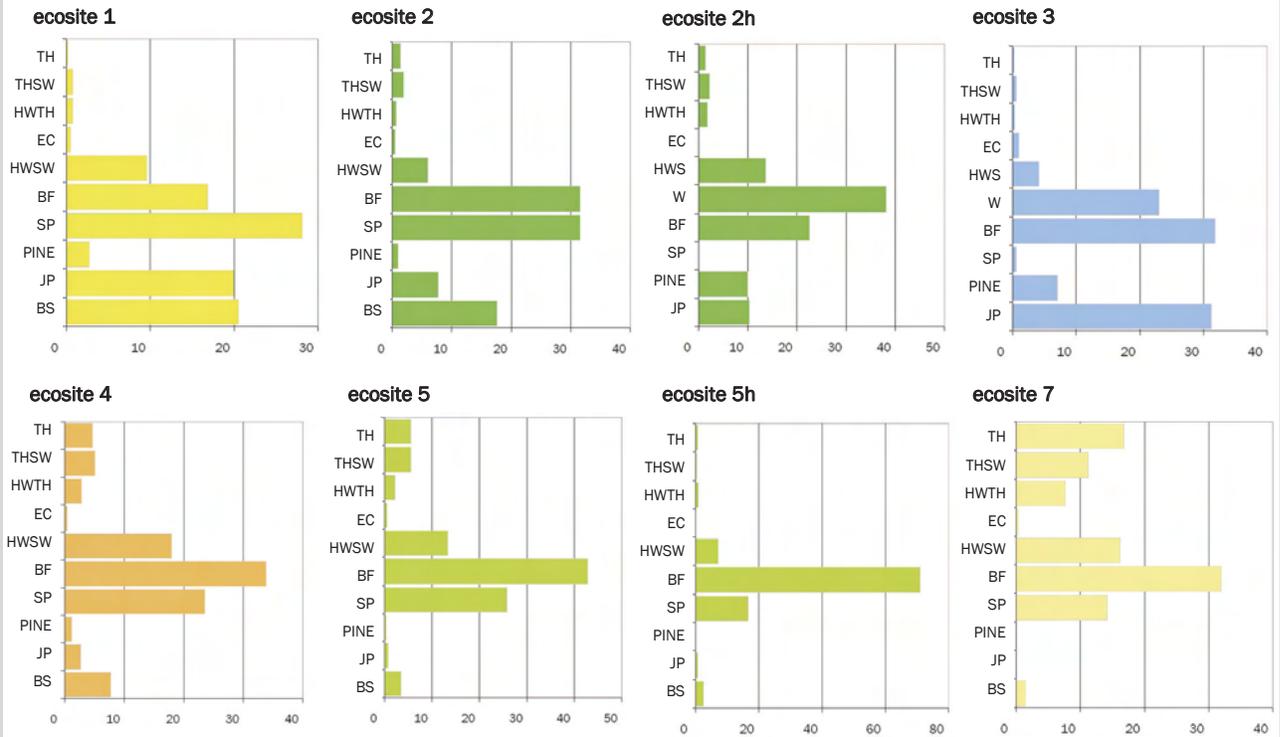


**5% of Ganong Ecodistrict is not forested**

principal land uses of non-forest area



## Percent cover of forest stand types by ecosite



**Vertical axis:** TH—tolerant hardwood species; THSW—tolerant hardwood with softwood species; HWTH—intolerant hardwood and tolerant hardwood species; EC—eastern white cedar; HWSW—intolerant hardwood and softwood species; BF—balsam fir; SP—red or white spruce; PINE—white pine; JP jack pine; BS—black spruce **Horizontal axis:** percent cover.