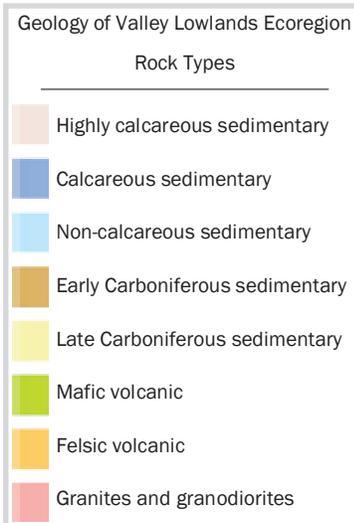
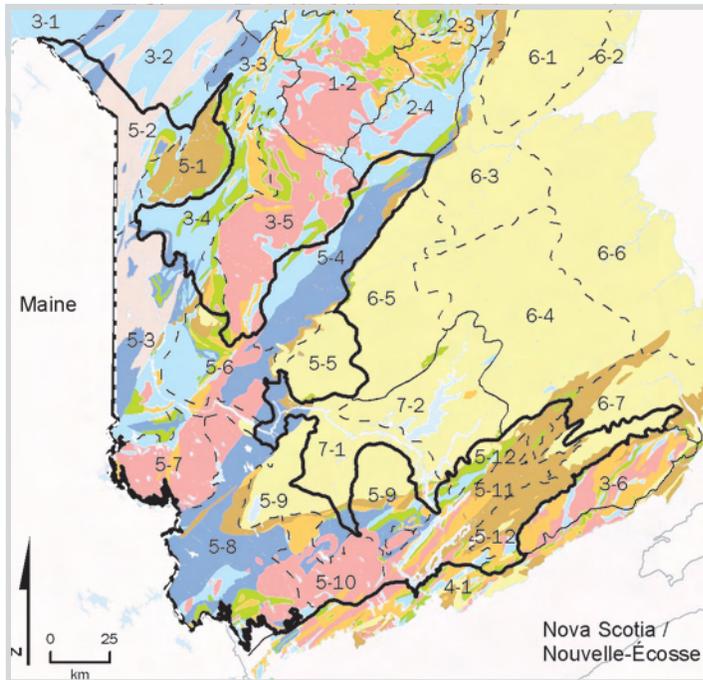


Chapter 11

5. Valley Lowlands Ecoregion

The largest of New Brunswick's ecoregions stretches from Edmundston down to Passamaquoddy Bay, and from the Maine border across almost to the Petitcodiac River. The region generally flanks the upper and middle Saint John River valley, but also includes three sinuous 'arms' that stretch northeasterly away from the valley. The defining characteristic of this region is diversity. Its geographic breadth has led to a corresponding variety of plants and animals, many with southern affinities.

The Valley Lowlands Ecoregion includes the lower reaches of the Saint John River watershed, as well as the headwaters of several Bay of Fundy rivers. This geologically diverse area is home for many southern floral elements.



Geology and Landscape

The geology of the Valley Lowlands Ecoregion is highly varied. The dominant lithology comprises sedimentary and metasedimentary rocks of Ordovician, Silurian and Carboniferous age. These are intruded by large granitic plutons that occur around Pokiok and farther south between Welsford and St. Stephen. Small, isolated patches of volcanic rocks are scattered northeast of Woodstock, southwest of Fredericton, and elsewhere.

The landscape's broad ridges and valleys have a strong northeast alignment that parallels the underlying trend of faults and bedrock lineaments.

Highest elevations occur in the northern section, where the volcanic Cameron Mountain peaks at 572 m near New Denmark. Approaching the ecoregion's border with the basin-like Grand Lake Lowlands Ecoregion, elevation drops to about 100 m.

The Saint John River dominates the northern part of the Valley Lowlands Ecoregion, being the watershed for all lesser rivers and streams in the area. Lakes are uncommon here. By contrast, the more southerly ecoregion, especially those underlain by granite, are dotted by many large and small lakes. Most watercourses in this section also drain towards the Saint John River, although a few watercourses in the extreme southwest or southeast corners flow towards the Petitcodiac River or head directly into the Bay of Fundy.

Climate

This ecoregion has a continental climate that is sheltered from the maritime influences of the Northumberland and Fundy coasts. Summers are warmer and winters are colder than in areas closer to the coast.

The Highlands and Northern Uplands ecoregions also have continental climates, but the Valley Lowlands Ecoregion receives less precipitation than either of these, because of its lower elevation. It also receives somewhat less summer precipitation than either the Fundy Coast or Central Uplands ecoregions, especially in a small rain shadow area around Woodstock. The relatively warm and

dry summers have contributed to a fairly high incidence of wildfires across the region. Granitic terrain appears particularly susceptible.

The undulating landscape causes cold air to drain nightly into the valleys to form frost pockets.

Forest Cover

The forest cover here is composed mainly of southern species such as tolerant hardwoods and red spruce rather than the more northerly species of balsam fir and white spruce. About thirty provincial tree species are represented here, including those with a strong southern affinity such as basswood, butternut, ironwood, silver maple, green ash, and white ash. These heat-loving species, are even more common in the Grand Lake Ecoregion, which has the warmest climate in New Brunswick.

The vegetation pattern generally reveals valleys and lower slopes covered with red spruce and other coniferous species that can withstand the cool night conditions caused by frost pockets. Cedar may occur in low-lying areas of water seepage, especially on calcareous soils. Silver maple is restricted to moist bottomlands or floodplains.

The lower midslopes are covered with mixed forests of red spruce, sugar maple, yellow birch, and white ash, which are joined farther upslope by beech and ironwood. Midslopes on coarse acidic soils may support various mixedwood communities of red pine, white pine, red oak, aspen, yellow birch, red spruce, balsam fir, and hemlock. Typically, the medium to higher elevation hilltops feature tolerant hardwoods: sugar maple, yellow birch, beech, and white ash. The rockier ridges, however, may support red oak and ironwood: on very rocky sites white pine, red spruce or white spruce predominate.

Tree harvesting and agriculture have significantly altered the original forests of this ecoregion since the 1700s. Mixed stands of white pine, tolerant hardwoods, spruce, and hemlock likely were more abundant in the distant past and to some degree, have been replaced by forest communities of aspen, red maple, white spruce, and balsam fir. White spruce and tamarack tend to occupy abandoned farmlands, whereas trembling aspen, balsam fir, red maple, and white birch occur in areas that have been clear cut or burned repeatedly.

The prominence of tolerant hardwoods through much of the region suggests that, in most places, fire has been relatively

infrequent in the last several hundred years. The Anagance and Mount Pleasant ecodistricts, however, are dotted with stands of red and white pine, and of spruce. This which suggests a possibility of greater fire frequency in the past, although on some of the acidic, rocky, or coarse-textured soils, it is likely that these species are able to sustain their populations in the absence of fire. Over most of the ecoregion, understory species are characteristic of the predominant mixed-wood environments. They include the dogtooth violet, hay-scented fern, sensitive fern, and Christmas fern. Alternate-leaved dogwood and riverbank grape are often found at the lowest elevations.

Wetlands

The Valley Lowlands Ecoregion harbours a diversity of wetland types, in keeping with the presence of its major river valleys, abundant lakes, varied bedrock lithology, and climatic variation from north to south.

Lakes are prevalent in the southerly ecodistricts, especially on the granitic terrain between Pokiok and Spednic Lake, and farther south around Mount Pleasant. Many of the lakes are flanked by marshlands, or by narrow zones of shallow open water wetlands that contain a varied collection of water-loving plants with a southern affinity such as fragrant water lily, sweet flag, and water plantain.

Of particular note is the extensive wetland complex called the Hampton-Kennebecasis Marsh that occurs between Hampton and Bloomfield along the Kennebecasis River. It is characterized by an extensive emergent marsh, but has elements of shallow open water and aquatic vegetation with some deciduous treed swamp and shrub swamp. The ecoregion's abundant peatlands are situated mainly in the southwest, where they have often formed large complexes that grade into marshes, shrub swamp, or wet forests. The wide range of peatland types occurs, not just because the substrates (and hence ground acidity levels) vary from one lithology to another, but also because the peatlands themselves have disparate origins. Some consist of raised bogs with well defined borders that formed in depressions and display many large pools. Others occur where moraine deposits (that is, extensive ridges of sand and gravel left behind by melting glaciers) have severely restricted the drainage of surface waters.

5.1. Wapske Ecodistrict

The Wapske Ecodistrict lies in northwestern New Brunswick along the lower Tobique River, and forms a low-lying basin surrounded by a series of more rugged terrains.

Geology

The bedrock consists almost solely of Devonian to Carboniferous (Mississippian to Pennsylvanian) sedimentary rocks, with a small zone of Devonian mafic volcanic rocks in the extreme northeast corner. The various formations are arranged in concentric zones that parallel the ecodistrict boundaries, with the youngest rocks at the centre.

Highway 109 between Perth-Andover and Arthurette begins in a rolling terrain of grey, folded Devonian sandstone, and slate. Approaching Arthurette, the undulating hills give way to a level plateau underlain by Carboniferous red sandstone.

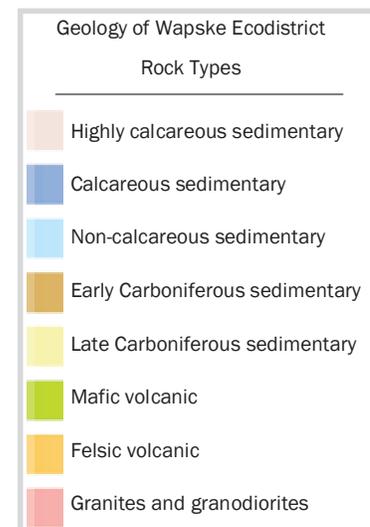
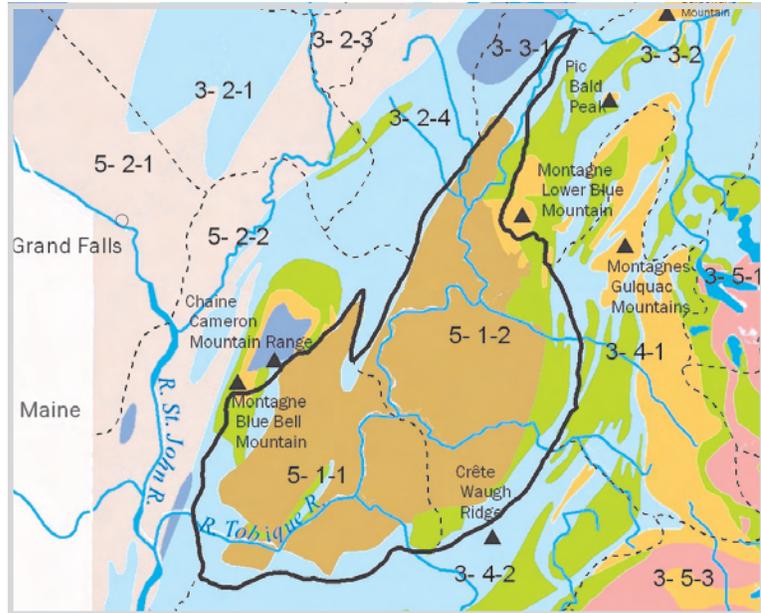
The immediate vicinity of Plaster Rock contains the Carboniferous limestone and gypsum deposits. They are exposed in cliffs along Highway 109 east of the Tobique River and in places are responsible for caves and karst topography.

Elsewhere, the formations comprise assorted calcareous and non-calcareous sediments: Devonian grey sandstone, siltstone and slate, plus Carboniferous red and green sandstone, conglomerate, siltstone, and shale.

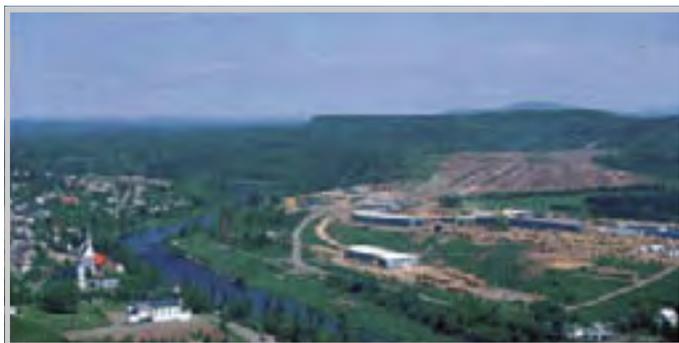
Landscape and Climate

The flat, gently sloping basin of the Wapske Ecodistrict contrasts strongly with the adjacent, more rugged igneous terrains. Its average elevation increases from 150 m in the centre to 250 m on peripheral ridges, which gives the land a saucer-like configuration.

The village of Red Rapids along Tobique River derives its name from the colour of bedrock along the river.



The landscape is primarily one of low-lying red or grey Carboniferous sandstones, which are visible along much of Highway 23 heading north from Plaster Rock. Just before Riley Brook, a person on the highway can look northeast at the distant Devonian volcanic summit of Bald Peak in neighbouring Serpentine Ecodistrict. Immediately beside the highway is Blue Mountain, which lies on the Wapske-Serpentine ecodistrict border. The Blue Mountain range also is formed of mafic volcanics, and at 450 m is the highest peak in the ecodistrict.



The Tobique River winds through the village of Plaster Rock.

One of the more aesthetic riverine sites in the ecodistrict is Maggie's Falls on the Odellach River east of Birch Ridge, where the river cascades over small ledges into a deep narrow gorge.

The Tobique River flows southeastward through the ecodistrict and in places has eroded the terrain into fairly steep river banks. The saucer shape of the ecodistrict causes most other streams and rivers to drain inwards towards the Tobique, including the substantial Wapske and Gulguac rivers. They have incised the bedrock moderately, although the area's low relief prevents them from attaining any real speed and erosional force.

The ecodistrict possesses a drier and warmer climate than occurs in adjacent uplands to the east. Its climate shows greater similarities with the more southerly Buttermilk and Meductic ecodistricts, hence its inclusion in the Valley Lowlands Ecoregion.

Soils

Soils here are derived almost solely from slightly to moderately calcareous bedrock, with Parleeville-Tobique and Salisbury units being the most prevalent. Interspersed among the areas of highly productive soil are extensive wet areas.

A large deposit of Parleeville-Tobique soil occurs at Anfield and is composed of coarse-textured ablation till. Other areas of this unit tend to have more finely textured sandy loams to loams that occur throughout the Tobique River valley.

Deep basal tills of the Salisbury Unit are widely present, especially east of the Tobique. They are fine-textured and generally are poorly drained. Where they are moderately to well drained, however, they are the most productive in the ecodistrict and rank

highly on a provincial basis.

Patchy zones of soil derived from volcanic rock occur along the ecodistrict's perimeter and belong to the Kingston, Tetagouche or Mafic Volcanic units. As well, narrow bands of Interval a soil line the Tobique River in the vicinities of Odell, Sisson Brook, and Everett.

Biota

Much of the Tobique River valley is flat or poorly drained. Poorly drained flatlands (3) consist mainly of black spruce, white spruce, red pine, and white pine, whereas the bottomland forests along the river (7b) support balsam poplar, black ash, white elm, and white spruce. Where these are very poorly drained they are dominated by black spruce and tamarack with cedar (6b). Cedar becomes more prevalent on wet sites overlying calcareous bedrock (6).

The very rare rock or yellow-nosed vole has been recorded from this ecodistrict in isolated colonies. It prefers mossy talus slopes or rocky outcrops, as found in the Tobique River valley.

The low-elevation ridgetops (8) support some areas of tolerant hardwood stands of sugar maple, yellow birch, and beech with scattered red spruce and hemlock. White ash, ironwood, and red oak are occasional components. These forests coincide with uplands rimming the ecodistrict, especially along the southeast margin, to the west of Plaster Rock and in the extreme northeast near Blue Mountain.

The Blue Mountain Ecological Reserve protects a remarkable, even-aged stand of red pine that appears to have originated after the 1825 Miramichi Fires.

Human settlement and other activities along the lower reaches of Tobique River have resulted in extensive swaths of disturbed landscape. These typically are covered with an intolerant forest community of trembling aspen, red maple, and white birch with an understorey of fir and spruce.

In places, the reddish soils of this ecodistrict are enriched with a natural source of lime, where calcareous-loving plant species may be found. The calcareous cliffs between Plaster Rock and Wapske host other rare species.

One of the most interesting wetlands in the area is protected by the Shea Lake Nature Preserve south of Plaster Rock. The site consists of an alkaline fen

The Shea Lake Nature Preserve is the home of many rare species.



with extensive stands of old growth hemlock, balsam fir and cedar. Shea Lake's plant offerings include the small round-leaved orchis, the rare Lapland buttercup, and swamp fly honeysuckle.

Settlement and Land Use

Wapske Ecodistrict lies within traditional Maliseet territory. It was used for aboriginal hunting, fishing, and overland travel, and many archaeological sites occur along the Tobique's lower reaches below Gulguac River. The Tobique River represented the initial leg in a series of aboriginal portage routes that branched from the Saint John to the Restigouche, Miramichi or Nepisiguit river systems. The name *Wapske* derived from the Maliseet *wabskihigun*, meaning *stone implements*, most likely in reference to the outcrops of felsic volcanic rock or flint that line the upper reaches of Wapske River.

Except for a few Acadian families that settled temporarily in the late 1600s, early European presence in the ecodistrict focused more on logging than on establishing permanent settlements.

Timber crews began to work the Tobique River and its tributaries in earnest in the early 1800s, attracted by red and white pine covering the riverbanks and lower valley slopes. Between 1818 and 1824, timber yields from this area jumped from 7,850 to 43,460 tons, and the Wapskehegan Valley became one of most heavily felled sites in the province.

Not until 1830 did families begin to arrive from more southerly villages down the Saint John River valley, lured by rumours of plaster (gypsum) deposits and arable soil. Settlements grew slowly at first: an 1850 map of the area shows practically no habitations, and visitors reported few farms beyond sight of the Saint John River.

In time, villages slowly emerged up the Tobique, first at Red Rapids and Arthurette, the later at the more upriver communities of Mapleview and Plaster Rock. Most early residents engaged in lumbering, sawmilling and farming, or worked at the gypsum quarries in Plaster Rock.

Today, forest lands are divided between industrial freehold land, private woodlots and Crown land.

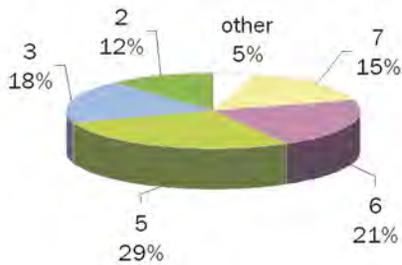
Agriculture takes place over much of the arable landscape and is primarily mixed farming dominated by the production of potatoes and beef cattle. Outfitting is another significant local livelihood, as hundreds of tourists, hikers, hunters, and fishermen visit the area each year to enjoy its diverse natural and recreational offerings.

5.1. Wapske Ecodistrict at a Glance

Ecoregion: Valley Lowlands
 Area: 99, 539 ha
 Average elevation above sea level: 196 m
 Average May–September precipitation: 475 mm
 Average annual degree-days above 5 °C: 1500

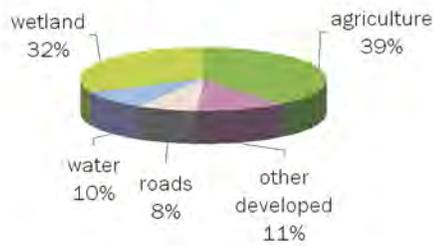
86% of Wapske Ecodistrict has forest cover

ecosite coverage of forest area



14% of Wapske Ecodistrict is not forested

uses of non-forest area



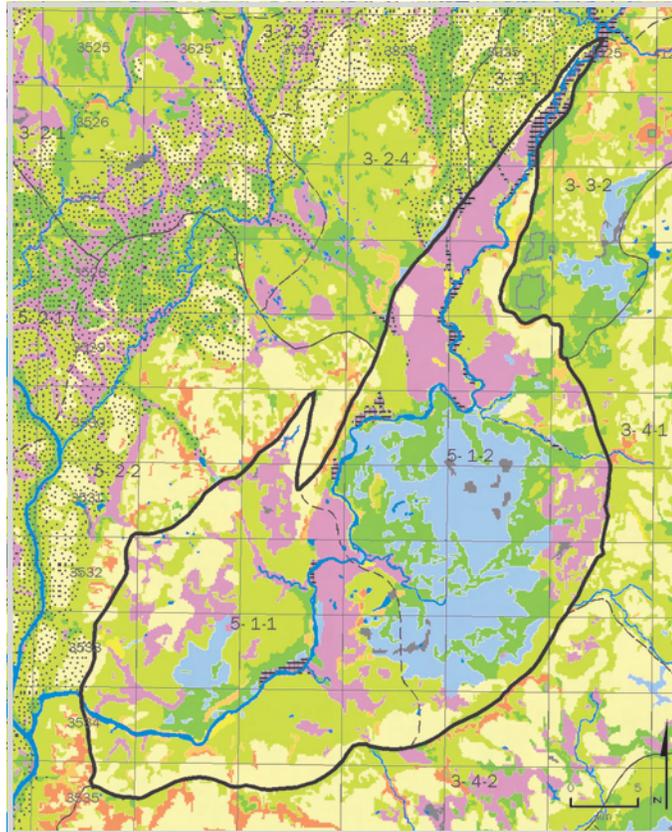
Ecosite map legend

ecosite

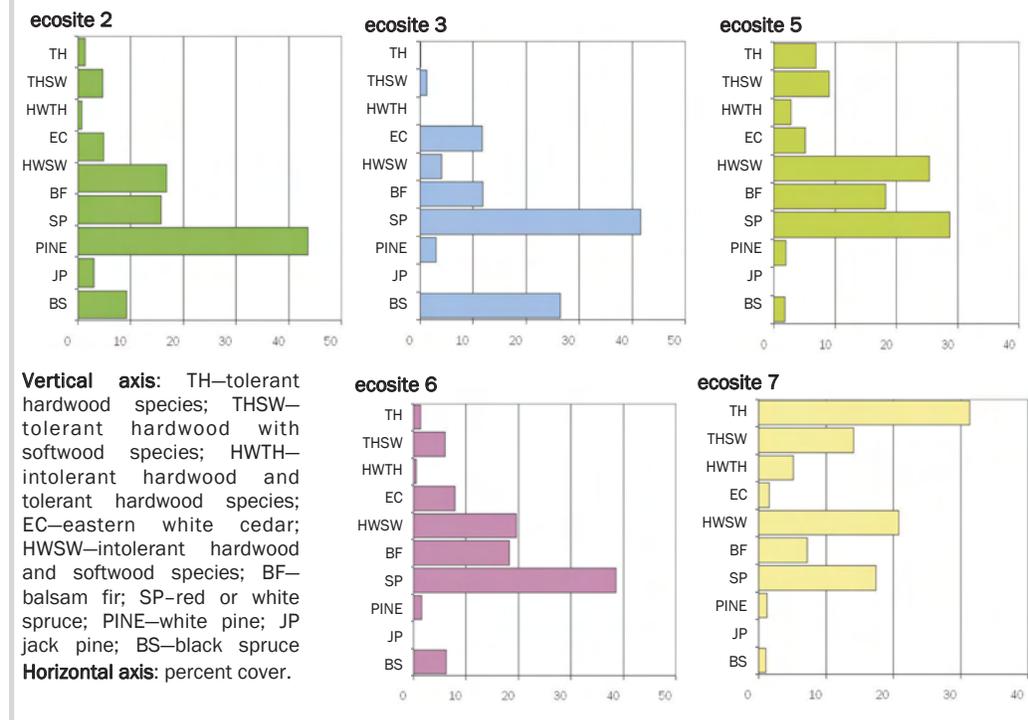
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ecosite modifiers

- c (calcareous)
- o (organic)
- f (periodically flooded)
- h (high elevation)
- m (mining debris)
- water



Percent cover of forest stand types by ecosite



5.2. Blue Bell Ecodistrict

The Blue Bell Ecodistrict is an elongated area located on the western boundary of New Brunswick just below the panhandle, and encompasses much of the upper Saint John River Valley.

Geology

Most of the bedrock is composed of Ordovician to Silurian limestone and calcareous slate of the Matapedia Group. They are joined along the southeastern margin by narrow bands of three additional formations: Devonian grey sandstone, siltstone, and slate, steeply dipping Silurian slate and siltstone, plus Cambro-Ordovician quartzose sandstone and slate.

The only igneous rocks in the area comprise a plug of resistant Silurian mafic and felsic volcanic rocks that emerges through the Devonian sedimentary strata in the vicinities of Hazeldean and Bell Grove. Two major northeasterly-trending lineaments also intersect the geological terrain, those being the McKenzie Gulch Fault and Rocky Brook-Millstream Fault. The two geological faults have a pronounced effect upon the landscape and waterways. The Rocky Brook-Millstream Fault cuts through New Denmark, then is

paralleled by Outlet Brook and Little River, before tracing part of the Saint John River below Tobique Narrows. North of Little River, the McKenzie Gulch Fault has created a strong bedrock depression that guides Salmon River.

Landscape and Climate

The western boundary is formed by the international border, which coincides with the Saint John River north of Grand Falls. Below Grand Falls, the Saint John River edges into the middle of the ecodistrict, bisecting the glacially influenced terrain into a broad, low-lying river valley.

In areas associated with the Matapedia Group, relief generally is less than 100 m except where rivers have cut deeply into the soft calcareous bedrock such as along the Aroostook and Salmon rivers. The resistant Cambro-Ordovician quartzose rocks have produced some fairly rugged terrain near Beaconsfield, where elevations can exceed 300 m.

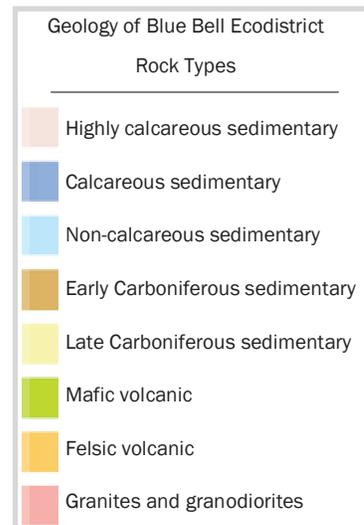
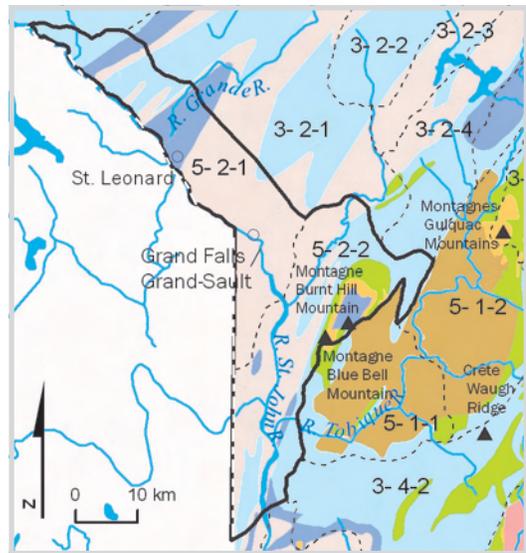
The most dramatic landscape occurs in the areas of mafic and felsic volcanic lithologies. These very resistant rocks underlie the southern hills around Blue Bell Mountain, Hazeldean, and the Cameron Mountain Range. The view from their ridgetops provides a splendid vista of the upper Saint John River valley, and in September their prominent slopes glow with fall colours. Cameron Mountain at 572 m is the highest point in the ecodistrict.

An immense railway viaduct straddles the McKenzie Gulch Fault at Salmon River. It is 68 m high and 1.2 km long, and is one of the longest railway viaducts in eastern Canada. A tunnel excavated through Blue Bell Mountain is the only bedrock railway tunnel in New Brunswick.

The ecodistrict's most famous landscape feature is Grand Falls. The falls were formed during and after the last glaciation through a combination of accumulated glacial sediments, gradual bedrock erosion, and gorge formation. The resulting waterfall continues to erode the bedrock surface of the upper gorge, while whirlpools below the falls create potholes on the lower gorge floor.

Soils

The most extensive soils are derived from argillaceous limestone. They consist mainly of fine-textured, non-compact tills of the Caribou Unit, with lesser amounts of compact till of the Siegas



Unit. Where the land is well drained, these soils are favourable for agriculture and forestry.

Coarse-textured glaciofluvial deposits line parts of the Saint John, Salmon, and Grande rivers, and are represented by the Muniac or Grand Falls units. Soils derived from metasedimentary rocks cover the ridges and hills around Beaconsfield. These materials appear either as shallow, residual soils of the Glassville Unit, or as medium-textured, compact soils of the Holmesville Unit.

Biota

Mixed forest communities cover much of the lower slopes (5), whereas coniferous communities composed mainly of cedar with some spruce are restricted to poorly drained soil derived from limestone, calcareous, and non-calcareous sedimentary rocks (6l, 6c, 6). The area of Burnt Hill Mountain contains a cedar swamp and rich calcareous woods with a delicate understorey that includes the rare pale touch-me-not. For the most part, tolerant hardwood communities cap the hilltops except at Cameron Mountain southeast of New Denmark, where a hardwood forest grows at the base, grading upslope into a stunted coniferous forest at the summit.

Tree species with a southern affinity such as white ash, ironwood, butternut, and basswood occur in the Meductic Ecodistrict immediately to the south, but are less common in this slightly cooler region. The Salmon River mouth, however, is somewhat anomalous in that it hosts butternut and silver maple, a plant assemblage that more typically appears farther south. The rivermouth also hosts elements of the herbaceous layer more common in the southern part of the province: species such as calico aster, white snakeroot, and climbing false buckwheat. The forest cover and understorey thus reflect the position of this ecodistrict as the most northern extension of the Valley Lowlands Ecoregion.

Mature pine stands are scarce. Intolerant hardwood species consisting mainly of trembling aspen and large-toothed aspen with white birch are common on former farming sites along the Saint John and Salmon rivers. White spruce, cedar, and tamarack also have regenerated on old-field sites.

As with the adjacent Wapske Ecodistrict, the extensive calcareous soils here have encouraged the growth of several rare or uncommon plants. The dynamics of the Saint John River, with its large spring freshet and ice scour, also contribute to the

creation of unique habitats for rare species. The most famous of these is Furbish's lousewort. This plant is a member of the snapdragon family and occurs at only a few sites, including the George Stirrett Nature Preserve, which is maintained by the Nature Trust of New Brunswick. The populations from the upper Saint John River valley in New Brunswick and Maine are the world's only known populations of Furbish's lousewort. It is recognized as nationally endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the species and its habitat are protected under the provincial Endangered Species Act.

The wide, northerly reaches of the Saint John River are characterized by floodplains, alluvial islands, and oxbows that support an assemblage of plants and also provide habitat for migratory and nesting birds. Bluestem and Richardson's muhlenbergia grow on Quisibis Island above the Quisibis River mouth. The site receives migrating waterfowl in the spring and autumn, as does the mouth of the Green River a few km north. Colourful swaths of tiger lily, an introduced asiatic lily, also grow on the floodplain at the mouth of the Green River, which joins the Saint John River at the village of Rivière Verte

The most frequented migratory bird locations here are at Iroquois (which lies adjacent to the nutrient-rich wastewater treatment plant for Edmundston) and Platin de St-Basile. The southern tip of the St-Basile platin is one of the larger undisturbed floodplains in the upper Saint John River valley.

Settlement and Land Use

This ecodistrict lies in traditional Maliseet territory. An important Maliseet community named *Negookgoot* occurred at the confluence of the Tobique and Saint John rivers near the present-day Maliseet village. The Saint John River valley above and below the Tobique River also supported numerous early aboriginal encampments.

The original non-aboriginal inhabitants were Acadians who



The village of Rivière Verte lies just downriver from Edmundston. The river here separates Maine, USA, from New Brunswick. The hills in the distance are in the Central Uplands Ecoregion. Photograph © Ron Garnett-AirScapes.ca.

began to arrive in the late 1600s. Timber crews frequented the area in the early 1800s, followed by Acadian and second-generation Loyalist families from southern New Brunswick who established villages such as St-Léonard, Perth, and Andover. An 1850 visitor reported that the river valley area between Andover and Grand Falls was virtually uninhabited except at the Aroostook confluence, but that French and Irish settlements were plentiful above the Quisibus River.

Subsequent immigrants arrived from Britain and Denmark (hence the villages of Hazeldean and New Denmark), and the province of Québec. The main sources of prosperity in the region were agriculture, sawmills, logging, and woodworking, all of which received an economic boost with the arrival of the New Brunswick Railway in 1877. By the turn of the century, the annual log drive over Grand Falls was a popular event initiated by Main John Glasier, the first man to run a load of timber over the falls. Grand Falls originally fell in a spectacular plunge of nearly 40 m, but was much tamed by the construction of a hydroelectric dam in the late 1920s.

Forest lands in the area belong almost solely to non-industrial woodlot owners. The forest industry remains a mainstay of the local economy, along with other forest-based activities.

Agricultural activities revolve around the production of potatoes and other crops, and a large processing plant in Grand Falls.

5.2 Blue Bell Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 125, 028 ha

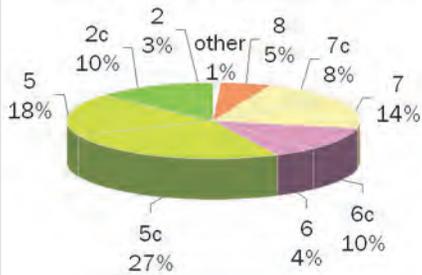
Average elevation above sea level: 219 m

Average May–September precipitation: 450–475 mm

Average annual degree-days above 5 °C: 1550–1650

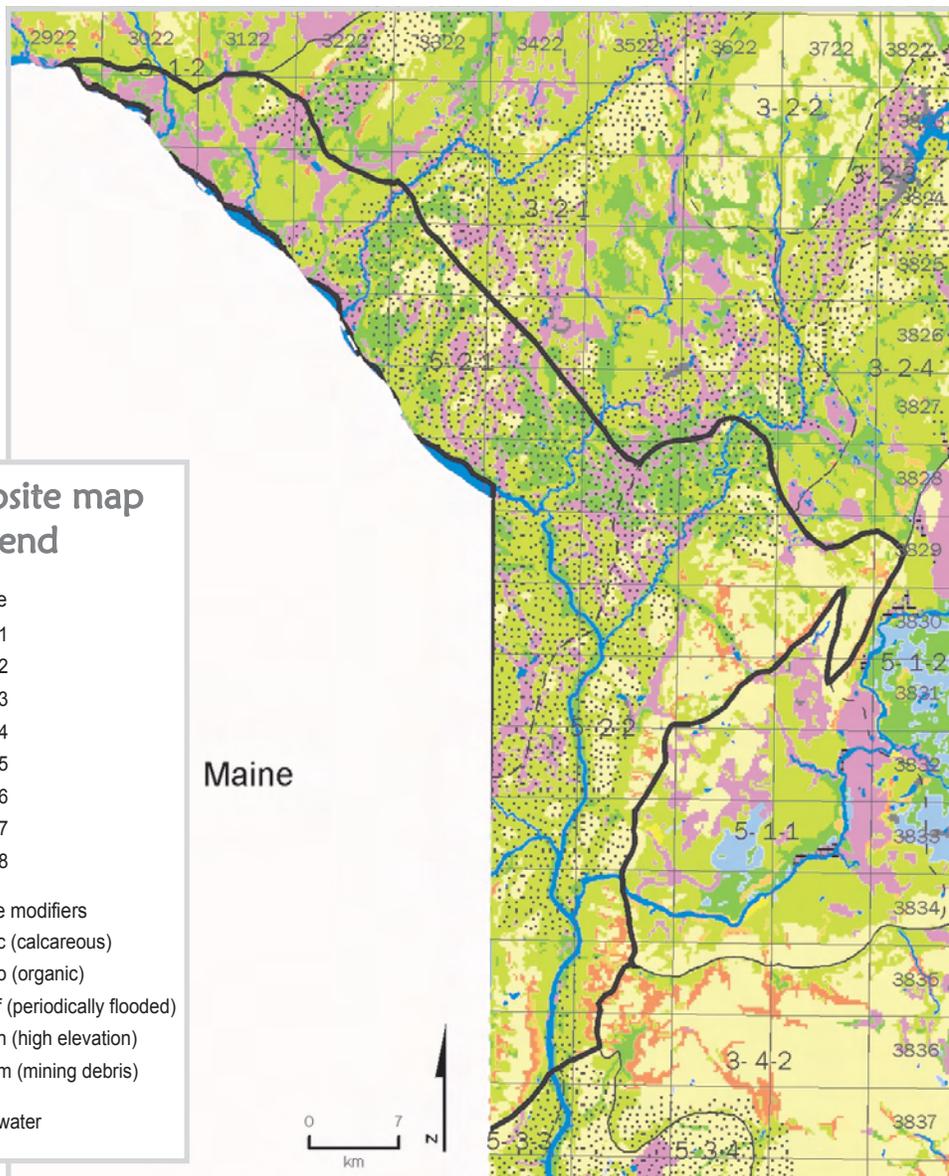
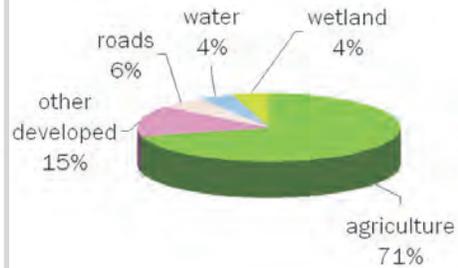
64% of Bluebell Ecodistrict has forest cover

ecosite coverage of forest area



36% of Bluebell Ecodistrict is not forested

uses of non-forest area



Ecosite map legend

ecosite

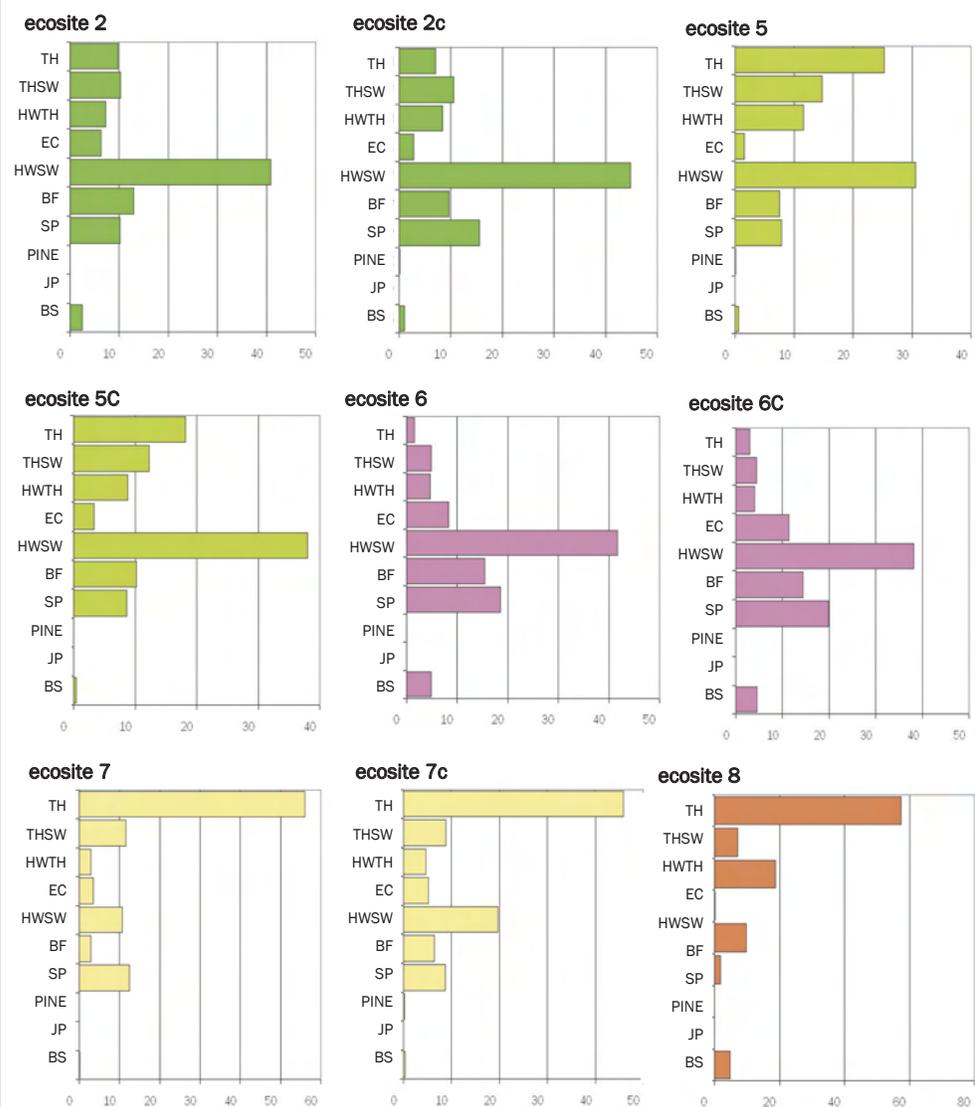
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ecosite modifiers

- c (calcareous)
- o (organic)
- f (periodically flooded)
- h (high elevation)
- m (mining debris)

water

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.

5.3. Meductic Ecodistrict

The Meductic Ecodistrict is a gently rolling lowland area that encompasses the middle Saint John River valley between Kilburn and Prince William.

Geology

Bedrock here is divided into three sections that straddle the Saint John River. The northern section lies upriver from Hartland, the second section stretches from Hartland to Middle Southampton, and the third runs downriver from Middle Southampton to Prince William.

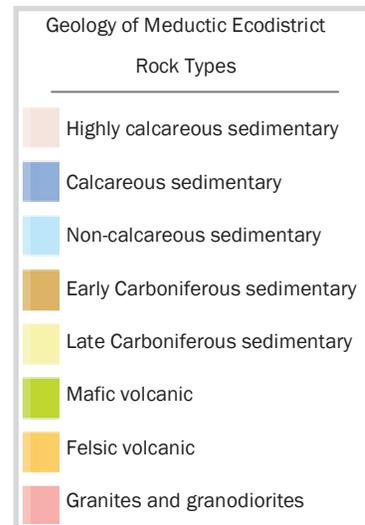
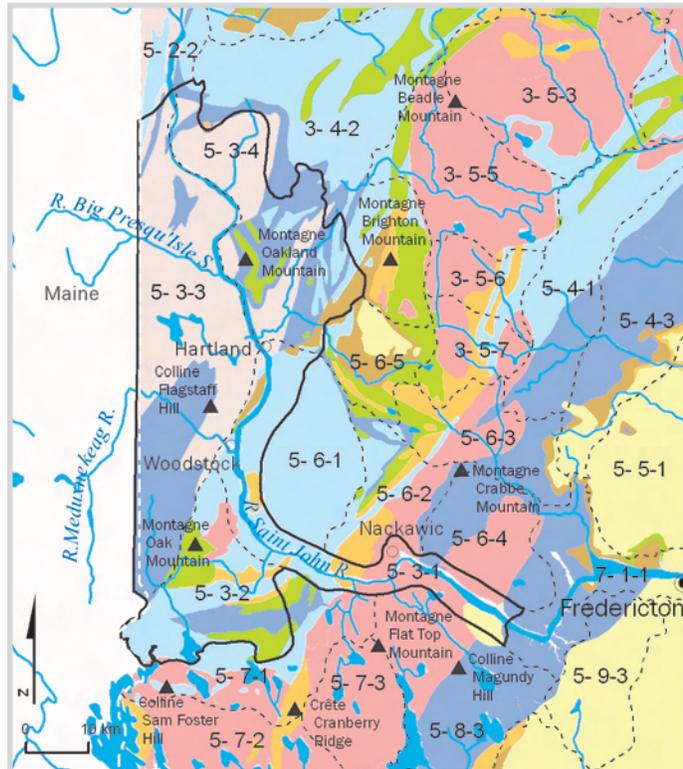
Bedrock in the northern section consists primarily of Ordovician calcareous sedimentary rocks that include slate and limestone of the Matapedia Group. The middle section is manifested as a fault-bound wedge of Ordovician sedimentary strata, which narrows as it approaches the Maine border. Rocks within the wedge are dominated by greywacke, slate, and siltstone of the Tetagouche Group, and are slightly calcareous.

The southernmost section is underlain by Devonian granitic rocks that can be seen in numerous highway roadcuts between Nackawic and Pokiok. Small intrusions and plugs of Ordovician to Devonian mafic and felsic igneous rocks also appear throughout the ecodistrict, and tend to be more resistant to erosion than the surrounding sedimentary strata.

Landscape and Climate

The dominant geographic feature is the expansive Saint John River. Its broad river valley has a pastoral appearance, reflecting the underlying calcareous bedrock and associated arable soils. The ecodistrict's western border coincides with the international boundary, and the northeastern edge is buttressed by more rugged terrain of the adjoining Serpentine Ecodistrict.

Relief of the gently rolling landscape rarely exceeds 100 m, and is punctuated by small intrusions of resistant bedrock, which underlie several local hills and mountains. An isolated plug of



Ordovician mafic volcanic rocks just west of Benton, is expressed locally as Oak Mountain and Sugarloaf Mountain. Oakland Mountain southeast of Florenceville is underlain by Silurian mafic volcanic rocks.



Hartland, New Brunswick boasts the world's longest covered bridge. Here the Becaguimec Stream meets the Saint John River. Photograph © Ron Garnett–AirScapes.ca.

Numerous rivers drain into the Saint John River from the surrounding uplands beyond the ecodistrict. The Eel River wends its way from First Eel Lake over nearly half a dozen different rock types, then forms a sequence of rapids before entering the Saint John River at Meductic. Some rivers flow easily towards their watershed destination, but others arrive from higher ground in a flurry of turbulent

water. The early Maliseet marked this aspect of Meduxnekeag River by naming it *medukseneekik* meaning 'rough at its mouth'.

First Eel Lake is one of the largest in the ecodistrict, and is first in a string of lakes that stretch southward beyond the ecodistrict through to Spednic Lake and the St. Croix river system. Williamstown Lake west of Hartland is bigger than First Eel, but is so shallow that it is more like a wetland than a lake. Moose Lake lies in the northern part of the ecodistrict and, like White Mud Lake, is covered on its bottom with lime-rich marl deposits. White Mud Lake east of Maplehurst currently produces marl on a seasonal basis. The lake is the only active marl producer in the Maritimes.

The distinctive character of this ecodistrict results in part from its relatively dry, warm climate combined with rich calcareous soils. Its precipitation is lower than in the adjacent Central Uplands Ecoregion, and its lengthy growing season is second only to that of the even warmer Grand Lake Ecoregion.

Soils

Soils derived from the widespread calcareous bedrock dominate the ecodistrict. Soils formed from limestone are associated with the Undine, Siegas and Caribou units. They are slightly more fertile than materials derived from weathered calcareous siltstone, slate, or sandstone such as those of the Carleton and Muniac units.

Non-compact soils of the Caribou Unit cover much of the terrain. These well drained, deep, loamy soils contain easily crushed,

weathered shale fragments and are among the most fertile soils in New Brunswick. Relatively shallow, bedrock-derived residual soils of the Undine Unit are common, and compact basal tills of the Siegas Unit also are present locally.

Coarse-textured glaciofluvial deposits of the Muniac Unit line the Saint John River valley and some of its tributaries such as Monquart Stream. The Carleton Unit is similar to the Caribou Unit but is more compact at depth; it is predominant around Woodstock and Florenceville.

Biota

The original forest cover has been greatly disturbed by more than two centuries of dense settlement. Tolerant hardwood stands once dominated the area but now exist only as small woodlot oases in a widespread agricultural matrix. The few undisturbed ridgetops at low elevation support sugar maple and beech with white ash, ironwood, butternut, and basswood. These communities grade downslope (7c) into a mixed forest of sugar maple, balsam fir and beech. Caribou Unit soils in particular tend to support good-quality sugar maple and white ash stands.

Red spruce and hemlock generally are confined to steep slopes (4). Hemlock also occurs with hardwood, as on a forested slope between Lanes Creek Inlet and Phillips Flats just north of Upper Woodstock.

The flooded alluvial bottomlands (7b) located in the Eel River valley contain butternut and basswood, whereas calcareous, poorly drained flatlands (6c) are characterized by cedar stands such as occur at Payson Lake and Williamstown Lake. The latter location is dominated by cedar with black ash, red maple, and white elm.

Agricultural fields and roads have fragmented the landscape, so that it has an historically low frequency and size of fires, despite relatively dry summers. Consequently, pines are rare, whereas white spruce and tamarack reveal the location of many old-field sites. Intolerant hardwood species consist mainly of trembling aspen and large-tooth aspen with birch, and are restricted to abandoned farmlands.

A hardwood stand near Murphy Corner contains one of the few known Canadian sites for the moss *Entodon brevisetus*. It grows on the trunks of tolerant hardwoods such as sugar maple and ironwood.

The combination of widespread calcareous soils, warm climate,

and diverse (although much reduced) stands of tolerant hardwoods has given the Meductic Ecodistrict one of the richest arrays of unusual plants in the province. As much of the original forest has been either converted to agriculture or flooded by hydroelectric dam projects, several elements, especially understorey plants have become scarce. Canada violet, which may have been extirpated from Nova Scotia and is almost gone from Maine, appears at several sites near Woodstock. Showy orchis grows beneath mature hardwood stands on the banks of the Meduxnekeag River, along with yellow lady's-slipper, maidenhair fern and Goldie's fern. Rareties such as ten-rayed sunflower and sweet viburnum may also be found along the shores and bottomlands of the ecodistrict.

Ketch Lake southwest of Charleston hosts an albino version of the small purple-fringed orchis and also is a haven for the rare Clayton's or Dorcas copper butterfly, which relies on shrubby cinquefoil for larval food. Visitors to beech stands in the ecodistrict may witness another rare butterfly—the early hairstreak—which lays its eggs on beech nuts.

Prime remnants of the forest type that once covered much of the ecodistrict can still be found. Oak Mountain Ecological Reserve sits 120 m above the surrounding terrain and protects a community dominated by sugar maple, beech, white ash, ironwood and basswood. A similar mature hardwood stand lies northeast of Howard Brook near Skedaddle Ridge. In spring, the site displays a prismatic understorey of Dutchman's breeches, bloodroot, spring beauty, Selkirk's violet, smooth yellow violet, red trillium, and foamflower.

At Williamstown Lake, wetlands provide important habitat for waterfowl. First Eel Lake has also hosted notable bird species, with nesting loons, bald eagle, osprey, scarlet tanager, wood duck and pied-billed grebe.

The ecodistrict is one of the primary breeding areas for scarlet tanager, warbling vireo, and wood thrush in the Maritimes.

Settlement and Land Use

The ecodistrict lies within traditional Maliseet territory, and has been inhabited by aboriginals for at least the last 3500 years. A major native village located near present-day Meductic was strategically situated along the Eel River portage one of the most ancient and well used overland routes between the Saint John River valley, Passamaquoddy Bay, and New England. Another important

village occurred near present-day Bristol.

Canoeists following the Eel River portage hiked inland from Meductic and entered Eel River at Benton. They paddled upriver to First Eel Lake and from there proceeded along another portage to North Lake, which empties into Grand Lake on the St. Croix river system. From Grand Lake, they could travel either west to Penobscot and Kennebec country in Maine via Penobscot River, or continue southward along the turbulent St. Croix River to Passamaquoddy Bay.

Meductic derives from the Maliseet word *medoctic* meaning ‘the end’, referring to the Eel River-Saint John confluence being the end of the Eel River-Passamaquoddy portage.

Early non-aboriginal settlers lived almost exclusively along the shores of Saint John River rather than inland. The first wave of immigrants in the late 1700s consisted of Loyalists and pre-Loyalists dissatisfied with their original, more southerly New Brunswick land grants. The end of the Napoleonic wars brought a second wave of newcomers in the early 1800s: mainly Scots, Irish, English, and disbanded soldiers.

Settlers relied mainly on agriculture, logging, and mining for their livelihood, and used Woodstock as the commercial hub. The completion of two major railway lines from southern New Brunswick through Woodstock in the 1860s and 1870s put an end to the romantic Saint John River steamboat expeditions, but expanded local economic development.

Remnants of an early grist mill can still be seen where Summit Brook crosses Scotch Lake Road about 1 km from Route 105. The mill was powered by a waterfall on the brook.

Deposits of iron, marl, gold, silver, lead, copper, limestone, and manganese were discovered here during the 19th century, although not all were developed. The largest operation was an iron mine and smelter near Jacksonville that worked from 1848 to 1884 .

Agricultural activities occupy about 32% of the total land area and are situated mainly over soils of the Caribou Unit. The predominant cash crop of potatoes is planted in rotation with grain; livestock and dairy operations round out the mixed farming activities.

Forest lands in the area today consist almost entirely of non-industrial woodlots and Crown land.

The confluence of the Meduxnekeag and Saint John rivers occurs at Woodstock, New Brunswick. Photograph © Ron Garnett–AirScapes.ca.





The wetlands of Meductic Ecodistrict are known for their exceptional plant diversity which includes orchids such as rose pogonia.

5.3 Meductic Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 250, 306 ha

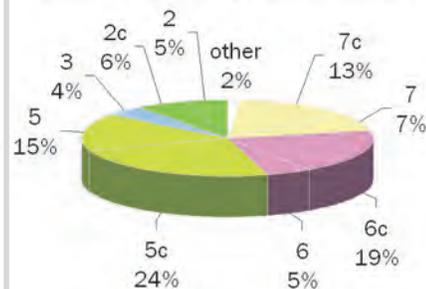
Average elevation above sea level: 159 m

Average May–September precipitation: 400–450 mm

Average annual degree-days above 5°C: 1500–1600

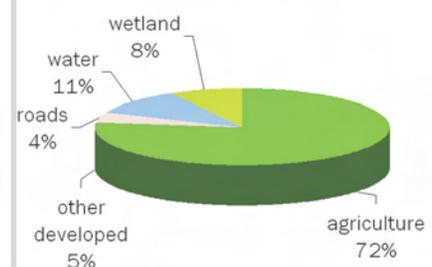
65% of Meductic Ecodistrict has forest cover

ecosite coverage of forest area

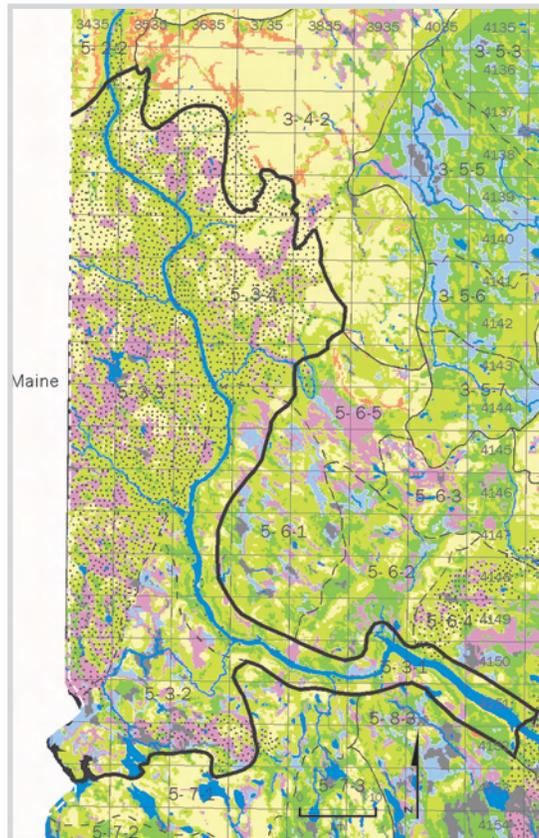


35% of Meductic Ecodistrict is not forested

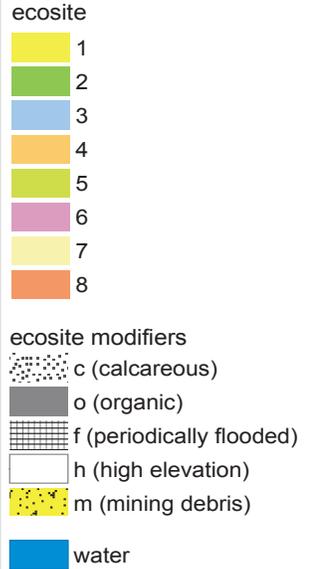
uses of non-forest area



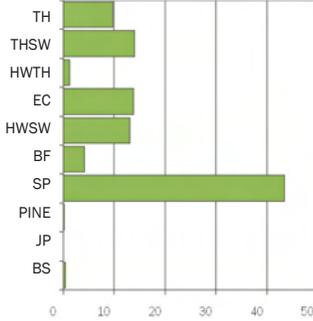
Percent cover of forest stand types by ecosite



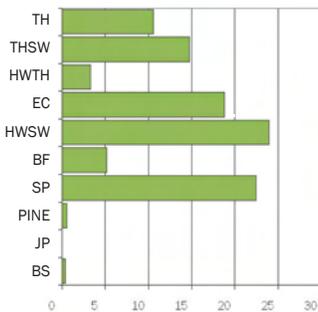
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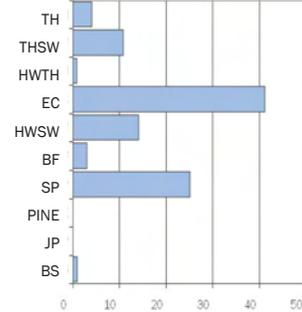
ecosite 2



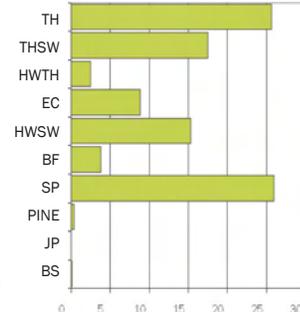
ecosite 2c



ecosite 3



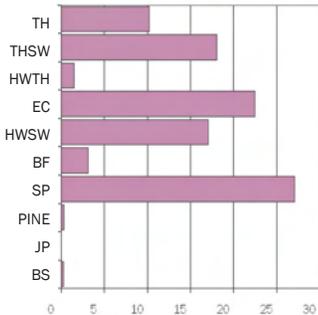
ecosite 5



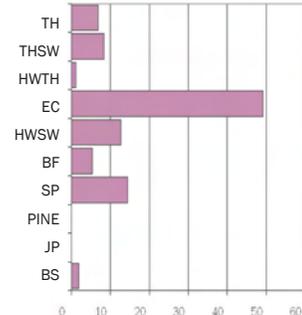
ecosite 5c



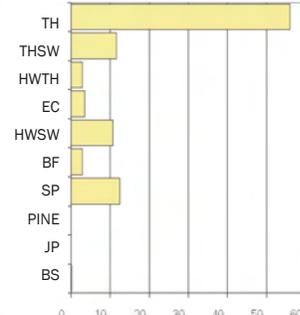
ecosite 6



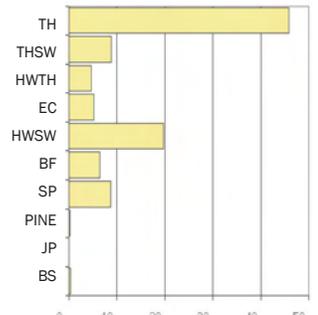
ecosite 6c



ecosite 7



ecosite 7c



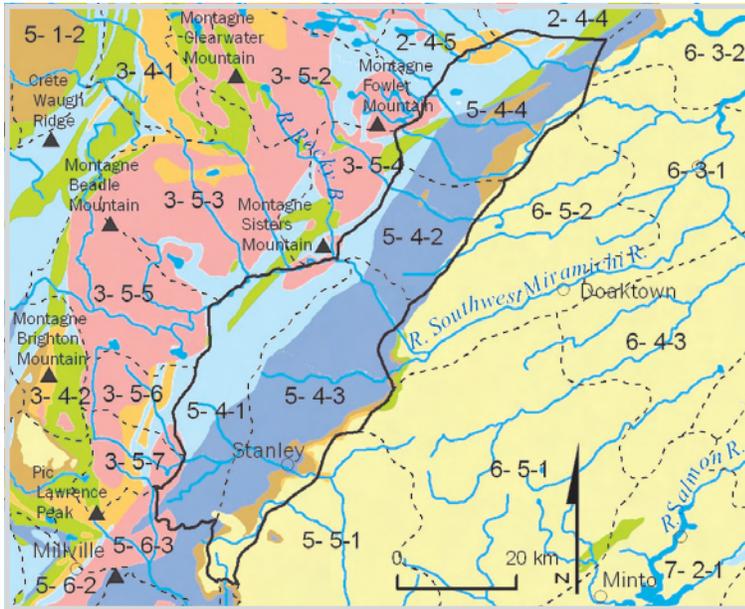
Vertical axis: TH—tolerant hardwood species; THSW—tolerant hardwood with softwood species; HWTH—intolerant hardwood and tolerant hardwood species; EC—eastern white cedar; HWSW—intolerant hardwood and softwood species; BF—balsam fir; SP—red or white spruce; PINE—white pine; JP jack pine; BS—black spruce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

5.4. Buttermilk Ecodistrict

The Buttermilk Ecodistrict lies in central New Brunswick and forms an elongated transitional zone between the elevated Central Uplands Ecoregion and the lower terrain of the Eastern Lowlands Ecoregion.

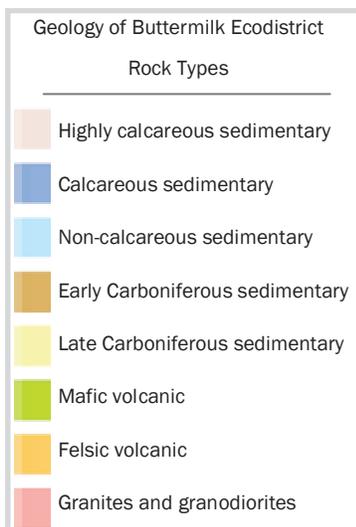
Geology

The bedrock distinct here is wedged between two distinct geological areas: the large igneous intrusions of the Napadogan



Ecodistrict, and the Carboniferous sedimentary lowlands which begin at the Bantalor Ecodistrict and cover the eastern third of the province. Within the Buttermilk Ecodistrict, the strata form elongated alternating bands of diverse bedrock.

The western area is composed of Cambrian to Ordovician metasedimentary rocks consisting of metaquartzite, metagreywacke, and slate of the Tetagouche Group. A small plug of Devonian granitic rock intrudes the terrane just north of Todd Mountain.



The eastern area is underlain by Silurian greywacke, siltstone, and slate belonging to the Kingsclear Group. These younger strata are more calcareous than are the Tetagouche Group and thus are less resistant to erosion. They are rimmed on the southeast boundary by a narrow band of Carboniferous grey, red, and green sandstone, silt, and conglomerate.

The Catamaran Fault angles southwest across the northern tip of the region. This major regional lineament begins at Miramichi Bay and transects most of central New Brunswick.

Landscape and Climate

The landscape has a decided slope, as elevations decrease from approximately 300 m along the western border to 150 m in the east. This is caused in part by tectonic uplift, and in part by the different lithologies in the east and west sections of the ecodistrict causing different rates of bedrock erosion.

The resistant metasedimentary strata in the west underlie such

features as Turnbull Mountain, Otter Slide Mountain, and Winding Hill. The more easily eroded Silurian bedrock in the east produces a landscape with somewhat gentler relief, especially near Williamsburg Brook and Monaghan Brook.

Rivers are a dominant landscape feature. A few have their origins within the ecodistrict (the Renous and Taxis, for instance) but most arise in the igneous uplands beyond the western border, and flow straight through the Buttermilk Ecodistrict en route to their watershed destination.

Many significant Miramichi feeder rivers make an appearance here: the Little Southwest Miramichi, Renous, Dungarvon, Southwest Miramichi, and Taxis. The only substantial river that drains into the Saint John River watershed is the Nashwaak River, which lies in the extreme south.

The tilted landscape dictates that nearly all the rivers flow from northwest to southeast. Only Catamaran Brook is at variance. It leaves Catamaran Lake to head southwest, but is diverted by the Catamaran Fault to flow northeastward instead. Lakes in the region are few and small, as the land is too sloped and well drained to allow much lacustrine accumulation.

The largest lake in the ecodistrict is McKendrick Lake, which is slightly longer than 1 km.

Topographic relief is defined as much by river action as by differential bedrock erosion. Several of the rivers—especially the Southwest Miramichi, Little Southwest Miramichi, South Branch Renous and Dungarvon—have cut deeply into the sedimentary terrane to create gorges that drop almost 150 m. The combination of incised valleys and bedrock faulting has created a number of interesting landscape phenomena. A steep river canyon called The Jaws lies upstream from Boars Head Narrows on Dungarvon River, and is a popular spot to view salmon. Where Falls Brook meets the Southwest Miramichi, it topples over a plateau in a single, spectacular vertical drop of 35 m in what likely are the highest waterfalls in New Brunswick.

Buttermilk Falls on Nashwaak River north of Red Rock is much more subdued than Falls Brook, but is another lovely feature of this ecodistrict.

In keeping with its transitional nature, the ecodistrict has a slightly drier, warmer climate than the Central Uplands Ecoregion to the northwest, but is somewhat cooler than most ecodistricts in the adjacent Eastern Lowlands Ecoregion.



Falls Brook Falls. *Communications New Brunswick photo.*

Soils

Most soils are fertile, medium-textured, compact basal tills derived from calcareous bedrock and belonging to the Carleton Unit. They are concentrated in the eastern section of the landscape.

The western portion is covered by a variety of soil units derived from metasedimentary, or mixed metasedimentary and igneous, bedrock. The soils here are coarser textured and less fertile, and often contain pebbles of slow-weathering metasedimentary and granitic rocks.

Exposed bedrock and residual soils of the Glassville and Serpentine units dominate the hilltops and upper slopes, whereas deeper, compact soils of the Holmesville and Long Lake units cover the broad ridges and lower slopes.

Biota

The higher hills and calcareous slopes (7,7c) are dominated by tolerant hardwood forests of sugar maple, yellow birch, and beech. These communities tend to occur more frequently over the calcareous Carleton soils.

Stands of sugar maple, yellow birch, and beech are accompanied by red spruce, balsam fir, red maple, and the occasional hemlock on the gentler upper to mid-slopes (5). Scattered white pine and hemlock become more common on lower slopes (4) such as along Miramichi River.

Several fine examples of mixed forest in this area occur near Catamaran Brook. The low, rolling hills possess an impressively diverse collection of sites with hemlock, cedar, red spruce, white pine, balsam fir, yellow birch, and sugar maple. In the understorey may be found Indian cucumber-root, pipsissewa, sweet colt's-foot, pink pyrola, and several orchid species.

The slightly calcareous soils in this ecodistrict have encouraged the rapid growth of shrubs including mountain maple, beaked hazel and hobblebush beneath the mixed forest and tolerant hardwood stands. Shrub competition consequently is somewhat more severe here than in adjacent ecodistricts with less fertile soils.

Cedar is common on calcareous soils and generally is associated with black spruce, red spruce, and balsam fir in poorly drained areas (3, 6). It also can occur on upper slopes (7, 7c).

A notable cedar wetland is situated just west of Sutherland Siding. The swamp contains cedar, poplar, and balsam fir with white adder's-tongue and some uncommon round-leaved hepatica.

The rare closed gentian grows in the Bartholomew Lake area, close to where naturalists have observed a number of butterfly species, including the rare early hairstreak, hoary elfin, and hoary comma. Their larvae feed on beech nuts, mayflower, and skunk currant, respectively.

Several rivers and streams provide spawning grounds for sea-run brook trout, and for the famous Miramichi salmon. The riverbanks also support an annual migration of sports fishermen and anglers.

Settlement and Land Use

Buttermilk Ecodistrict lies within traditional Maliseet territory. The area was used by early aboriginals for hunting and fishing, and for overland excursions between the Saint John and Miramichi rivers. A major canoe route passed through this ecodistrict up the Naskwaak River to Cross Creek and across a portage to the Taxis River, which led to the Southwest Miramichi. The Taxis River was named after a Mi'kmaq called Pier Tax or Taxous who lived in the area.

European settlement in the area received a boost in the 1830s with the construction of the Royal Road from Nashwaak to Stanley. Immigrants were enticed by advertisements of the New Brunswick and Nova Scotia Land Company, headed by Edward Stanley (hence the village of Stanley). Hayesville was named after its first postmaster, Peter Hayes, who arrived from Ireland in 1821.

Most of the villages were located beside rivers: Hayesville and Tugtown along the Southwest Miramichi River, for instance, and Stanley and Giant's Glen on the Naskwaak River. The last-named village received its title allegedly because some of its original Irish inhabitants were notoriously short. The village of Limekiln had several nearby lime kilns that local residents used to burn the local calcareous bedrock into lime fertilizer.

The 1912 completion of the National Transcontinental Railway (NTR) from Moncton to Québec encouraged the development of a few new communities along the line. McGivney became a major railway depot at the junction of the NTR and the Canada Eastern Railway between Fredericton and Chatham. Yet despite the Royal Road and the railway, most of this area remained unpopulated. Even today, it is virtually uninhabited north of the Southwest Miramichi River.

The ecodistrict's forests were exploited long before the first

permanent European settlers arrived. The larger rivers such as the Southwest Miramichi and Renous allowed easy access to timber and provided a route to sawmills upriver in Boiestown and Doaktown. As with many other regions of the province, the largest trees were felled before 1820, five years before the 1825 Miramichi Fires.

Agricultural activities are concentrated over the lime-rich soils in the vicinity of Williamsburg, Cross Creek, Maple Grove, and Parker Ridge.

5.4 Buttermilk Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 215, 338 ha

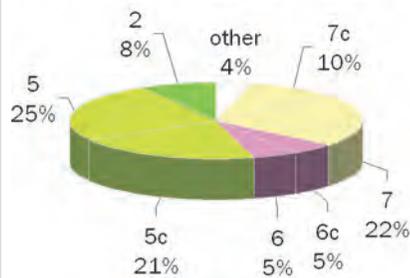
Average elevation above sea level: 245 m

Average May–September precipitation: 450–500 mm

Average annual degree-days above 5°C: 1650–1750

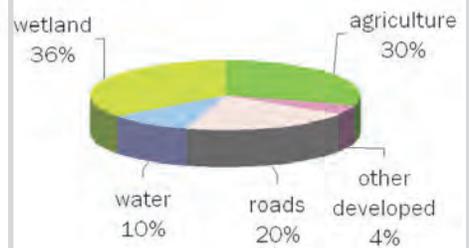
95% of Buttermilk Ecodistrict has forest cover

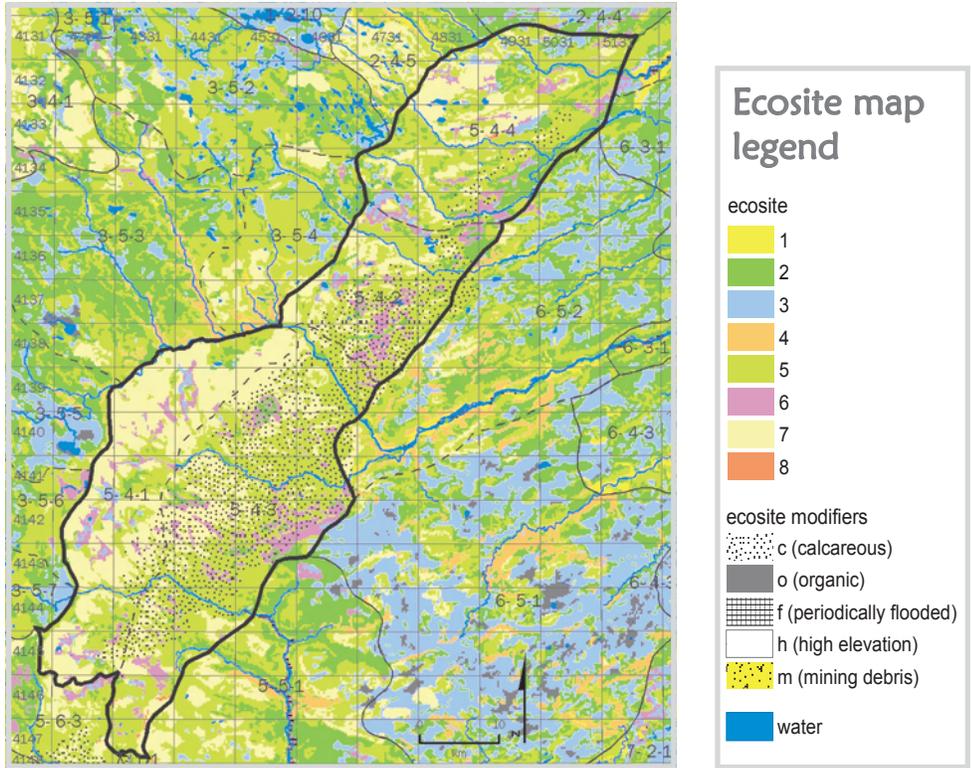
ecosite coverage of forest area



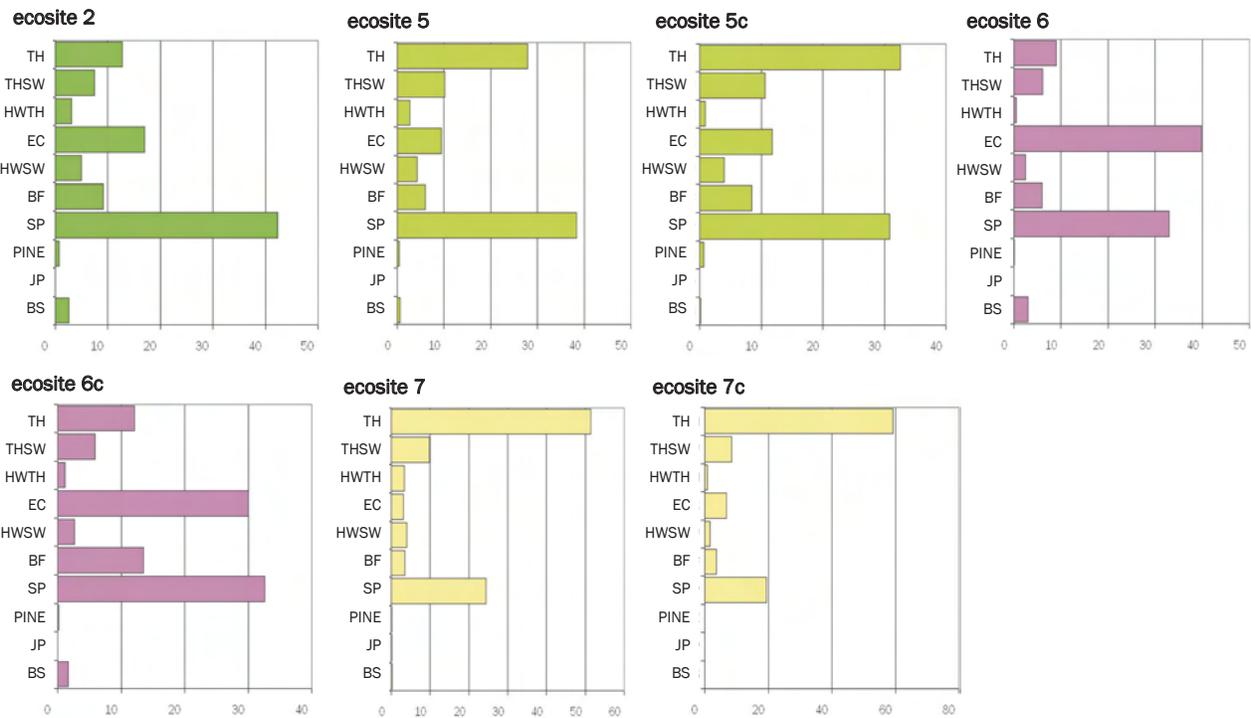
5% of Buttermilk Ecodistrict is not forested

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.

5.5. Cardigan Ecodistrict

The Cardigan Ecodistrict is a gently rolling area in central New Brunswick. It straddles, and is bisected by, the lower reaches of the Nashwaak River.

Geology

The bedrock is composed almost entirely of Carboniferous sedimentary rocks. Most of these lithologies consist of grey to olive sandstone and conglomerate with minor siltstone and shale. Strata

of red sandstone, conglomerate, and siltstone also are situated in patches near Cross Creek and McLeod Hill.

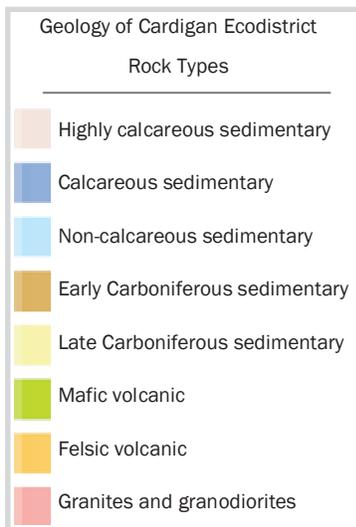
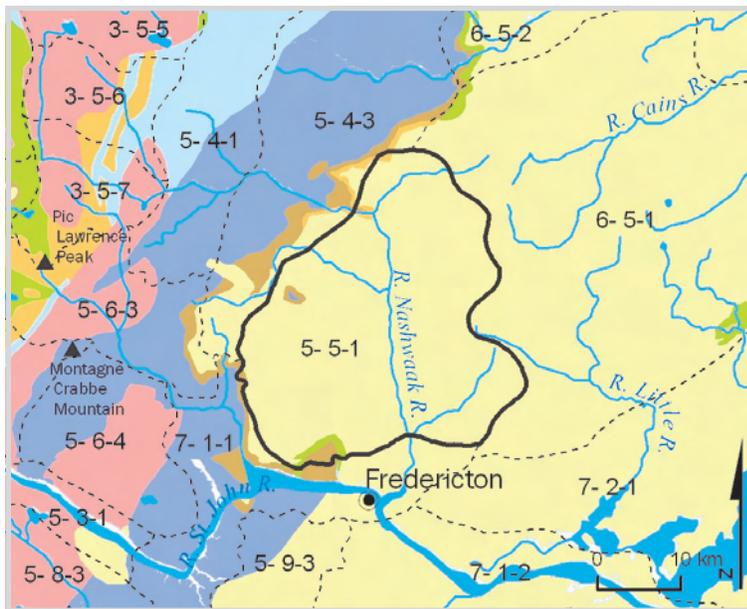
McLeod Hill is one of two sites in the ecodistrict featuring igneous bedrock. Basalt, mafic volcanic rock, underlies the McLeod Hill escarpment, and also occurs at the village of Manzer on the Nashwaak River.

The sedimentary rocks in the northern part of the ecodistrict are highly fossiliferous. Rock outcrops holding large fossils of Pennsylvanian tree trunks occur along the road northwest of

Nashwaak Bridge near Cross Creek Station. Cross Creek Station also contains Pennsylvanian plant fossils and pyrite nodules in a sandstone outcrop associated with a coal seam.

Landscape and Climate

The Nashwaak River valley bisects the ecodistrict into two plateaus that sit at about 150 m above sea level. The landscape lacks dramatic peaks or valleys, and relief rarely exceeds 60 m. Topographic variety is achieved only where the Nashwaak River and its tributaries have incised the soft, sedimentary bedrock into moderate hills and valleys with good drainage. The Nashwaak River valley forms a corridor for two highways and a railway line running parallel to, and within a few hundred metres of, the river. Almost all streams and rivers here lead to the Nashwaak River in a dendritic pattern resembling veins on a leaf. The main exception is Nashwaaksis Stream, which drains directly into the Saint John River.



The landscape features few lakes, due to the irregular, well draining terrain. One of the few is Killarney Lake, which in summer provides a cool swimming retreat for the residents of nearby Fredericton.

The climate is relatively warm and dry, but does not attain the warmer average temperatures of the Grand Lake Ecoregion to the south.

Soils

Virtually all soil units are derived from Carboniferous grey sandstone and red mudstone. They range from compact tills to glaciofluvial deposits and have a variety of textures. Where the soils are coarse textured and acidic, they possess limited fertility, although microsites with more favourable growing conditions occur in zones with well drained seepage slopes.

Soils of the Reece Unit are the most widespread and consist of compact, medium-textured basal tills. Two large ablation deposits of the Sunbury Unit are found north of Killarney Lake and around Dunbar Stream. These droughty soils are deep, coarse textured, and cobbly, with low water retention.

A large glaciofluvial deposit belonging to the Riverbank Unit overlies Penniac Brook, whereas more recent alluvial deposits cover the Nashwaak and Tay river valleys. Both deposits are coarse textured and very gravelly with low fertility. The alluvial deposits, tend to be capped with the more fertile, fine-grained silts and sands of the Interval Unit. Peat soils of the Organic Unit are scattered along the headwaters of Nashwaaksis Stream and Penniac Brook. As well, the lower reaches of Nashwaaksis Stream feature a small area of Mafic Volcanic Unit soil derived from the Royal Road basalt.

Biota

The predominant forest cover occurs on moist, mid-slope terrain (5) and is composed of red spruce, balsam fir, and red maple with scattered hemlock and white pine.

Occasional stands of sugar maple, yellow birch, and beech occur in the west where soils are deep and loamy on ridgetops and upper slopes (8). Black spruce and cedar are more prevalent in the east adjoining Bantalor Ecodistrict, where peaty soils are more common (3, 6).

Jack pine and black spruce are plentiful throughout the Eastern, Grand Lake and Valley lowlands but are scarce in this ecodistrict. Historically, fires here have been smaller and less

frequent than in adjoining ecodistricts. This may be due in part to the relief created by the wide, deeply incised river valleys, and to the natural fire break formed by the Nashwaak River. The hardwood-dominated landscape to the west also may have provided some protection from fire, as flames move more readily through coniferous forests.

Extensive communities of red maple, trembling aspen, large-toothed aspen, balsam fir, white birch, and grey birch occur on areas disturbed by logging activities. The formerly abundant forests of mature white pine all but vanished in the early 1800s due to heavy cutting. Today, however, many pure stands of young white pine appear to be thriving along the lower valley slopes (2) and bottomlands (7b) of the Nashwaak River.

Settlement and Land Use

The Cardigan Ecodistrict lies within traditional Maliseet territory. The area was used by early aboriginals for hunting and fishing, and for overland excursions into Miramichi country. A major canoe route passed from the Saint John River up the Naskwaak River to Cross Creek and across a portage to the Taxis River, which led into the Southwest Miramichi River. The village of South Portage on Highway 8 marks the site of one former portage, and Cross Creek reportedly was named in reference its position at the crossroads between the Naskwaak and Miramichi river systems.

The earliest non-aboriginal inhabitants of the lower Nashwaak River were French grant-holders in the 1600s, who set up forts at the mouth of the Nashwaak River in the Aukpaque Ecodistrict. The upper Nashwaak, however, remained essentially unsettled until construction of the Royal Road in 1832. The road encouraged settlement by English, Scottish, and Irish immigrants who established such villages as Durham Bridge, Taymouth, and Penniac.

The early 1800s also saw settlement in communities beyond the Nashwaak River valley at places such as Woodlands, Birdton, and Cardigan. The last two villages represent some of the very few Welsh communities in New Brunswick, and the local churches still preserve graveyards with Welsh surnames engraved on worn marble tombstones.

Coal deposits occur across the area but have not been commercially developed. Outcrops of rough sandstone along Highway 8 are occasionally quarried for rubble stone. The Royal Road basalt quarry at McLeod Hill produces construction material and road aggregate for the greater Fredericton area.

5.5 Cardigan Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 86, 707 ha

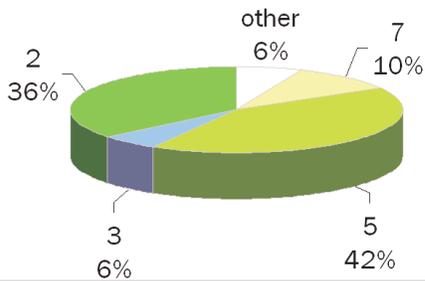
Average elevation above sea level: 150 m

Average May–September precipitation: 400–450 mm

Average annual degree-days above 5 °C: 1550–1700

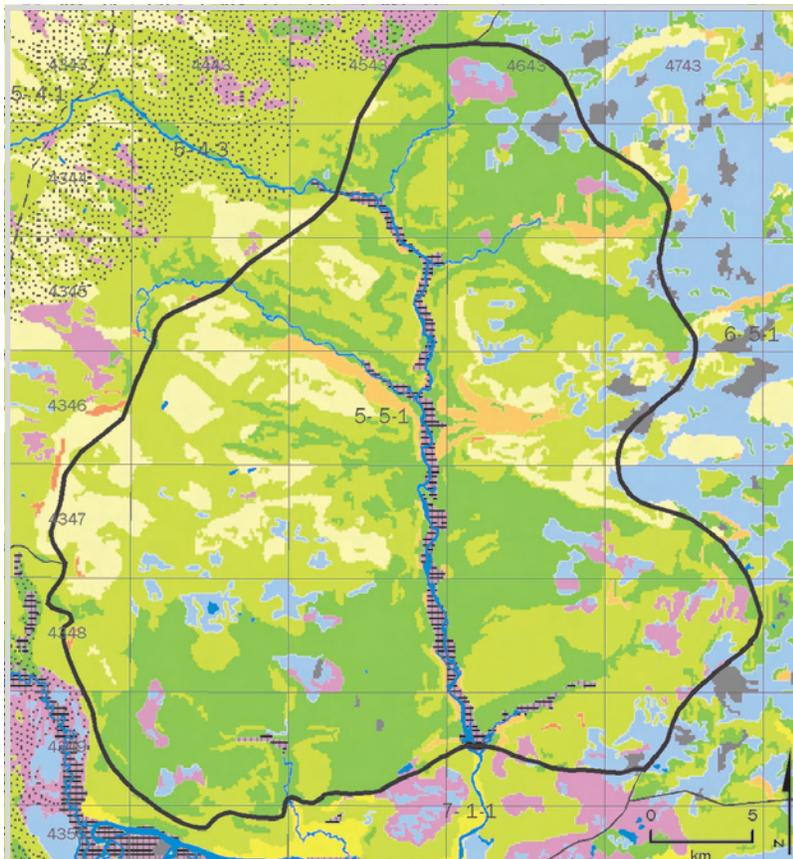
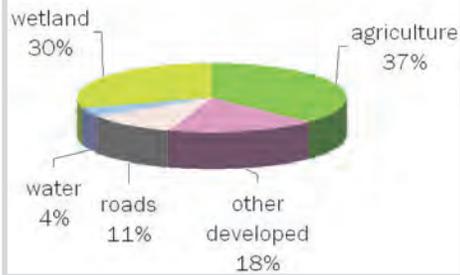
91% of Cardigan Ecodistrict has forest cover

ecosite coverage of forest area



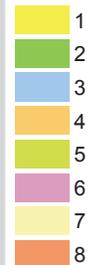
9% of Cardigan Ecodistrict is not forested

uses of non-forest area

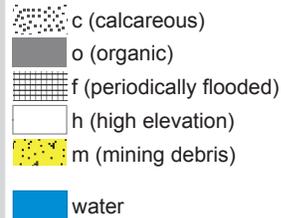


Ecosite map legend

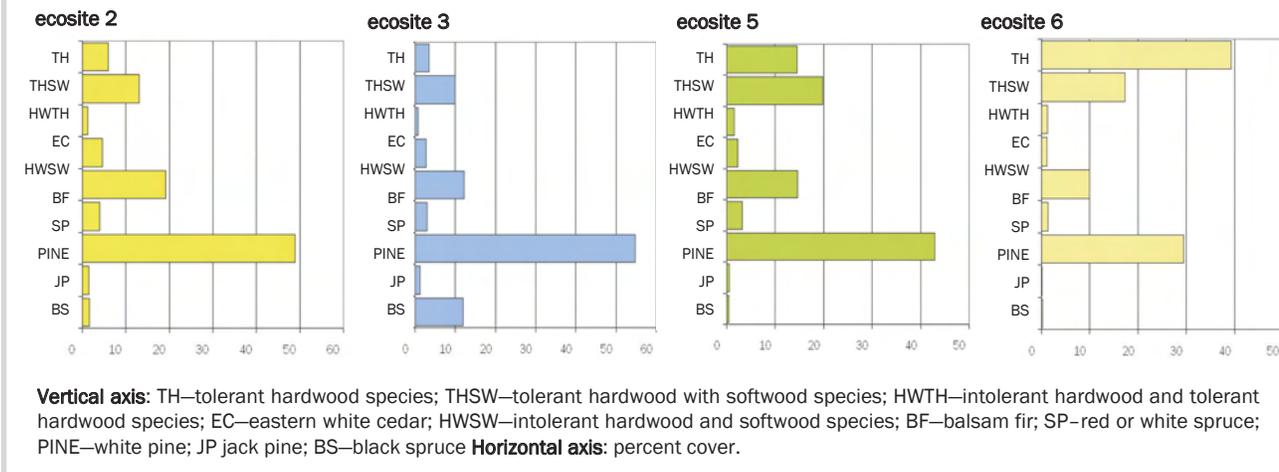
ecosite



ecosite modifiers



Percent cover of forest stand types by ecosite



5.6. Nackawic Ecodistrict

The Nackawic Ecodistrict is an undulating area in west-central New Brunswick that parallels the Saint John River but lies just east of the river valley.

Geology

The western third of the Nackawic Ecodistrict is underlain primarily by Cambrian to Ordovician sedimentary rocks of the Tetagouche Group, which contain greywacke, siltstone, and sandstone. The northwest corner contains Carboniferous sedimentary rocks composed of red and grey sandstone, siltstone, and conglomerate. Between the two sedimentary areas are alternating bands of Devonian felsic and mafic rocks.

The remainder of the ecodistrict consists of two large intrusions of granite and granodiorite that bracket an extensive area of Silurian quartzose and calcareous greywacke and slate. The granitic rocks are centred around Nackawic and Springfield.

A small zone of Silurian calcareous sedimentary rocks occurs in the extreme southeast corner in the vicinity of Scotch Lake. The only true carbonate deposit is represented by a small pocket of Ordovician limestone at South Waterville.

Landscape and Climate

The landscape forms a series of broad ridges separated by more rolling lowlands. Most ridges and mountains are underlain by

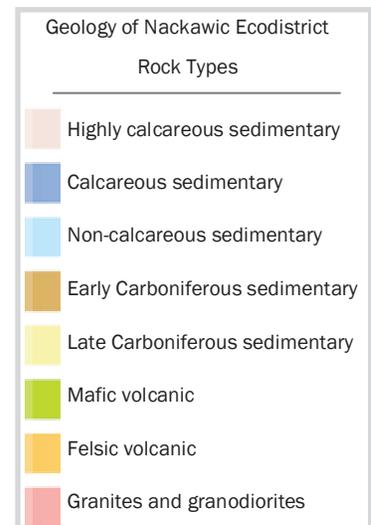
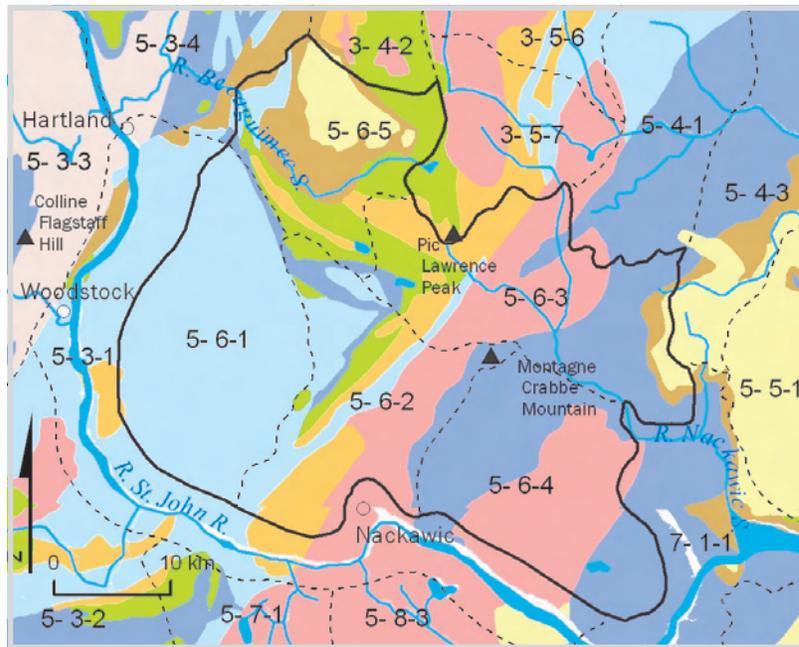
volcanic or granitic terrain, such as Big and Little Spruce peaks and Maple Ridge. In some locations such as Dorn Ridge, a prominence has been created through the differential erosion of siliceous (that is, more resistant) and non-siliceous (less resistant) sedimentary rocks. The lowlands tend to be concentrated over the western area of Cambrian to Ordovician sedimentary rocks, and contain more wetland areas than does the rest of the ecodistrict. Another lowland area occurs around Scotch Lake over the calcareous sedimentary rocks.

Elevations tend to increase from south to north. They begin at about 120 m where the region hugs the Saint John River valley, then gradually rise to 400 m in the highlands near Cloverdale, where the landscape merges with the rugged terrain of Bantalor and Serpentine ecodistricts in the Central Uplands Ecodistrict.

Rivers dominate this ecodistrict. The tributaries and branches of Nackawic Stream cover much of the area, converge at a point near Pinder, and then flow downhill to meet the Saint John River at Nackawic just outside the ecodistrict. The Keswick River and its associated streams flow through the northeast corner of the region and are mirrored in the northwest corner by Becaguimac Stream and its feeders. The rivers here generally meander around topographic highs instead of incising the landforms.

Lakes are generally modest in size and depth. The most outstanding is Ayers Lake in the northwest. It is 21 m deep and is one of only a dozen lakes in the province with a self-sustaining population of lake trout. The undisturbed nature this pristine lake makes it one of the most beautiful wilderness spots in the province.

The climate here is relatively moist and warm. The area receives slightly more precipitation than do adjacent ecodistricts to the east and west. Temperatures are somewhat cooler than in



Grand Lake Lowlands Ecodistrict to the east, but become warmer farther west towards the lowlands of Saint John River valley.

Soils

Areas underlain by metasedimentary rocks occur in the western third of the ecodistrict, and are associated with moderately fertile compact tills of the Holmesville Unit. Calcareous sedimentary rocks in the east have given rise to compact and non-compact tills of the Carleton and Thibault units. These latter units overlie the terrain near Scotch Lake and Hainesville, and represent the most fertile soils in the area, especially where they are well drained.

Soils derived from granitic bedrock, or from a mixture of granitic and metasedimentary rocks, are represented here by several units including the Juniper, Tuadook, Irving, and Catamaran. These sandy, stony soils are concentrated over granitic bedrock areas along the Nackawic Stream and around Springfield.

Glaciofluvial deposits are represented by the Gagetown and Grand Falls units, which span the lower Nackawic Stream and the South Branch Becaguimec Stream respectively.

Elsewhere, small areas of Organic Unit soils coincide with bogs and fens. These poorly drained soils occur mainly in the western region, with one isolated patch over a bog just north of Upper Queensbury.

Biota

The dominant forest is composed of red spruce, balsam fir, and red maple with significant hemlock. Pure hemlock stands are restricted to less disturbed areas with a slightly cooler topoclimate.

The well drained ridgetops (8) support tolerant hardwoods such as sugar maple, yellow birch, beech, and white ash. The moist, strongly acidic granitic slopes (5) display a high proportion of coniferous trees, whereas the moist sedimentary upper slopes (7) have fewer conifers and more hardwoods.

Areas underlain by acidic, sandy, or stony soils are dry and low in nutrients; the associated cover is most often black spruce and pines. White pine once was plentiful across the ecodistrict, but now is abundant only on coarse-textured valley bottoms (2). At the other ecosite extreme, cedar is prevalent in softwood stands on moist seepage slopes (6) and calcareous soils rocks (6c, 7c). Cedar-softwood forests also occur over Organic soil areas.

Early successional stands contain trembling aspen and large-toothed aspen with white birch, grey birch, and red maple.

Several interesting or rare plants occur at Carrs Siding east of Maplewood including two species of grape fern and the adder's tongue fern.

The shallow waters of Scotch Lake are habitat for Robbin's spikerush, one of only a handful of know locations for this plant species.

Settlement and Land Use

The Nackawic Ecodistrict lies within traditional Maliseet territory. The area lies directly opposite a major early native village at Meductic, and was used by aboriginals for hunting and fishing. *Nackawic* was derived from the Maliseet *nelgwaweegek* meaning *straight stream*. The name referred to the fact that Nackawic Stream's lower reaches originally paralleled the Saint John River. Construction of the Mactaquac dam has since realigned and altered waterways all along the middle Saint John River valley.

Europeans did not arrive here until the early 1800s, and settlement did not begin in earnest until after 1840. Over time, immigrants established villages whose names immortalize the original grant recipients. Ebenezer Briggs lived in Briggs Corner, Peleg Staples in Staple Settlement and William Caverhill in Lower Caverhill. A group of Scottish immigrants from Roxburgh and Dumfries opted for collective rather than individual nomenclature calling their community Scotch Lake.

Today, forestry on both private and Crown land is a major regional employer. Agricultural areas presently cover 8% of the ecodistrict and are dominated by pasture and grain crops, which are cultivated to support beef and dairy production.

A variety of economic mineral deposits have been discovered here including molybdenum, zinc, coal, bog manganese and beryl. Limestone formerly was quarried from the Waterville area, but, with the exception of sand and gravel, the ecodistrict's mineral resources have remained undeveloped.

5.6 Nackawic Ecodistrict at a Glance

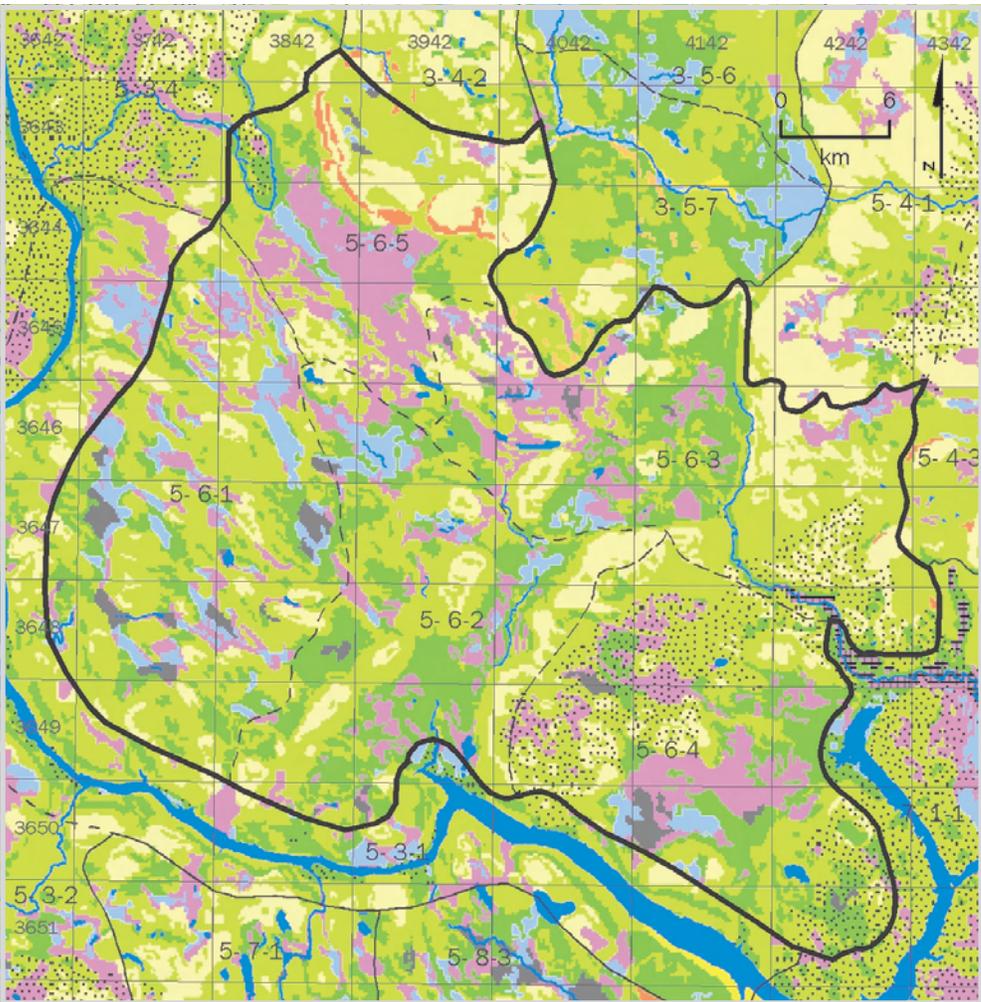
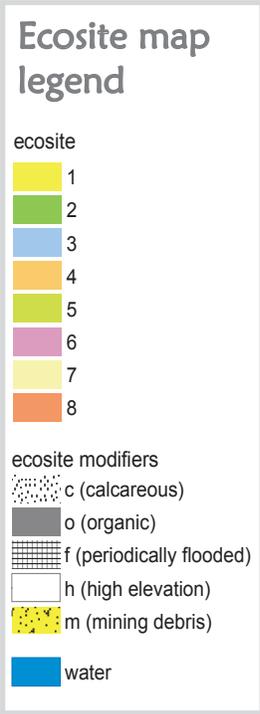
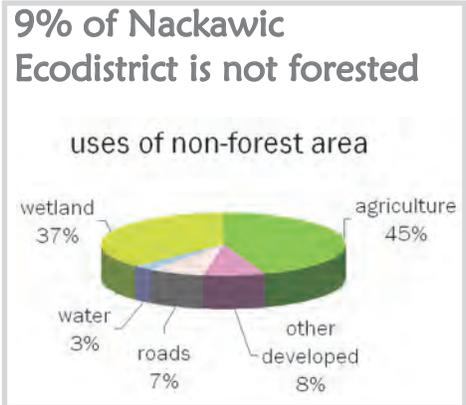
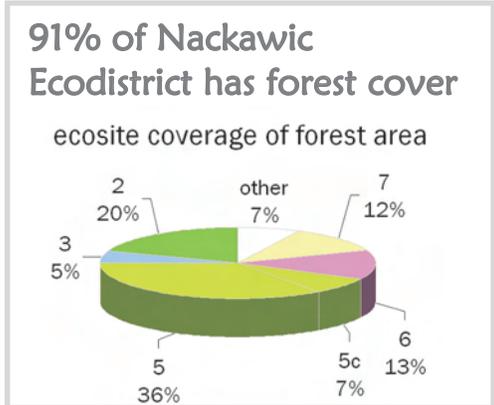
Ecoregion: Valley Lowlands

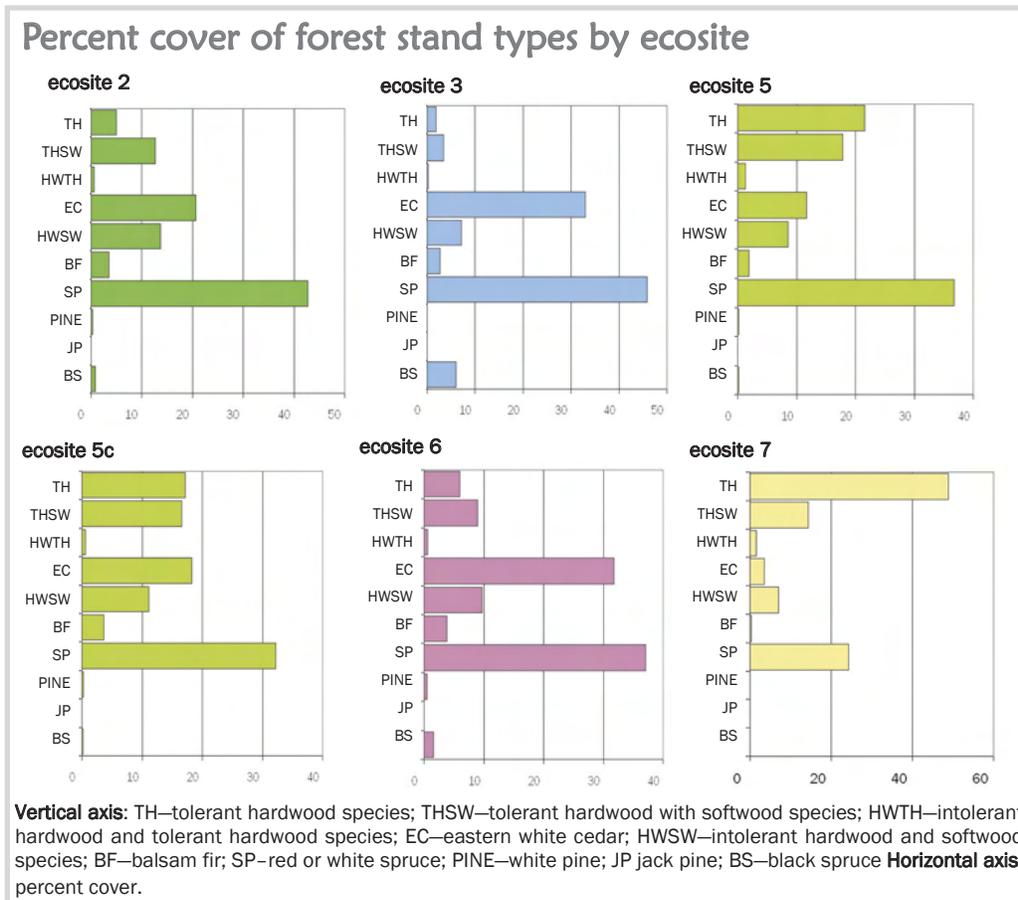
Area: 143, 646 ha

Average elevation above sea level: 185 m

Average May-September precipitation: 425–450 mm

Average annual degree-days above 5°C: 1650–1700





5.7. Cranberry Ecodistrict

The Cranberry Ecodistrict is a small, lake-bound plateau area in southwest New Brunswick wedged between the Maine border and the Grand Lake Lowlands.

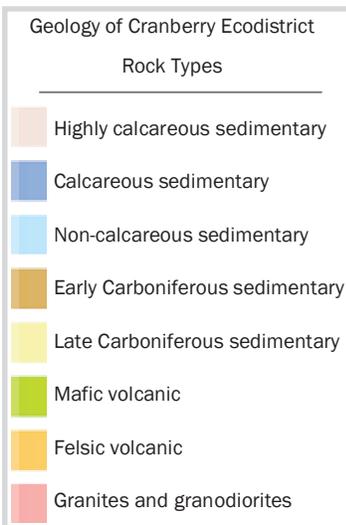
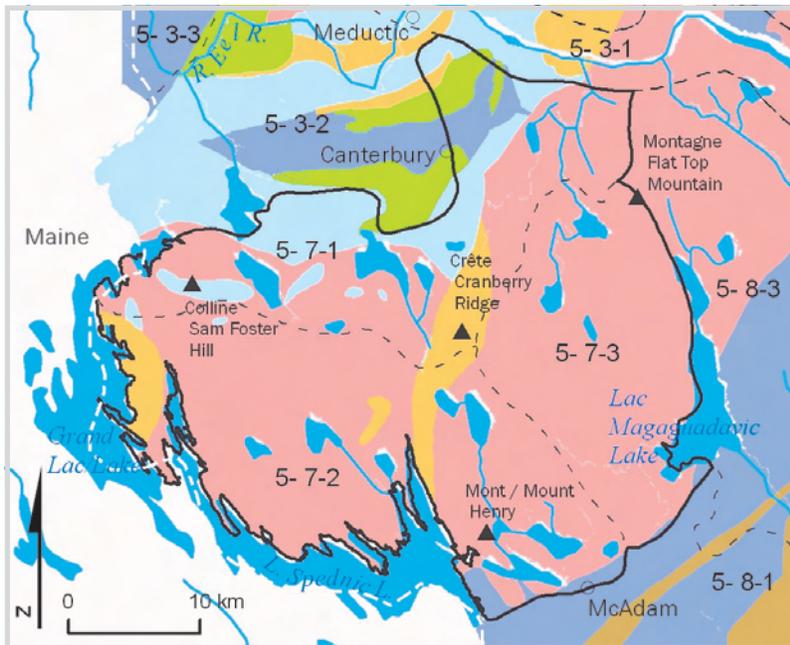
Geology

The bedrock consists primarily of pink granitic rock with areas of muscovite-bearing granite and felsic porphyry. Granodiorite occurs in two small zones, one underlying Cranberry Ridge south of Canterbury, and the other on the western border where it has given rise to Green Mountain and Pemberton Ridge.

A strip of Cambrian to Devonian sedimentary rocks skims the northwest boundary. These rocks are composed of feldspathic sandstone, siltstone, shale with quartzite and minor carbonates. A small patch of resistant Devonian mafic volcanic rocks is also present here and has created the topographic feature called Dorrington Hill.

Landscape and Climate

The landscape here is among the most scenic in the province, with numerous granite-bound lakes and dramatic topography. It is a region of steep-sided hills that rise 100 m above the surrounding



ecodistricts, and ridges that crest over 220 m. Cranberry Ridge provides the highest elevation in the ecodistrict at 406 m.

The many local lakes and their associated rivers show a pronounced northwest-southeast alignment that originated with the regional bedrock structure and later was amplified by glacial effects. The lineation was followed by the old St. Andrews and Québec Railway line built from St. Andrews through Canterbury to Richmond Corner in the mid 1800s.

The ecodistrict's borders are defined by its lakes: Magaguadavic and Little Magaguadavic lakes in the east, and Grand and Spednic lakes in the west. The middle of the ecodistrict is marked by a sequence of lakes—Second Eel, Third Eel and LaCoote—that join Palfrey and Spednic lakes. Together, these waterways form a lovely trail which, with a few portages, enables the energetic paddler to move from the Eel River in the north down to the St. Croix River and eventually Passamaquoddy Bay.

As a consequence of its relatively high elevations, the ecodistrict intercepts more moisture than adjoining ecodistricts to the north and east. The summer temperatures here are exceeded only by ecodistricts of the Grand Lake Lowlands Ecoregion.

Soils

The granite bedrock in the western area is overlain primarily by soils derived from a mixture of glacially transported metasedimentary rocks and local granitic rocks. Many of these compact, loamy basal tills belong to the Long Lake Unit and are more fertile than soils obtained from purely granitic bedrock.

Soils derived from granitic terrain are more common in the

eastern region, and are represented by an extensive area of non-compact ablation tills belonging to the Juniper Unit. These soils are deep and extremely coarse textured.

The ridges northwest of Magaguadavic Lake are covered by compact basal tills of the Tuadook Unit. Although they also are derived from granite, these soils have a fine loamy texture and are somewhat more productive than Juniper soils.

Biota

The dominant forest cover is a tolerant hardwood community composed of beech, sugar maple, yellow birch, and red maple with occasional red oak and white ash on the ridges (8). On well drained mid-slopes, the forest tends to be a mixture of red spruce and balsam fir with hemlock (5). Notable hemlock stands can be found along the shores of Spednic and Palfrey lakes.

Cedar is prevalent on a variety of ecosites (3, 6, 7, 7c), where it can occur with red spruce, black ash, and red maple. Black spruce and tamarack tend to be concentrated more in the acidic bogs such as occur in the southeast corner near Foster Lake (3b).

Widespread patch-cutting and selected harvesting resulted in abundant intolerant hardwood stands consisting of trembling aspen, large-toothed aspen white birch, grey birch, and red maple.

A beautiful and remote forest stand occurs on East Grand Lake, and consists of mature sugar maple, yellow birch, and hemlock. The lake supports lake trout, land-locked salmon, and brook trout, whose populations have been boosted by stocking programs. Bald eagles nest in trees along its cobblestone shoreline, as well as at Spednic Lake a few kilometres farther south.

Most of the rare or vulnerable plants in this area are associated with its streams or lakes. Diggity Stream on the east shore of Spednic Lake supports a population of silky dogwood and the rare low water-milfoil. The shallower waters at North Lake contain New Brunswick's first recorded population of floating bladderwort.

Shogomoc Stream lies in the eastern part of the ecodistrict, flowing between steep granitic hills east of Dow Settlement. The rare riverweed nestles just below the waterline along the stream.

Settlement and Land Use

The Cranberry Ecodistrict straddles the traditional territory of the Maliseet and Passamaquoddy who hunted and fished throughout the area. Native encampments dated at 6000 to 7000

years old occur along the chain of lakes and rivers comprising the Spednic Lake-St. Croix River system. One of the early aboriginal villages was situated on the southern boundary at St. Croix, and was named Kilmaquac.

The earliest known European inhabitants were Loyalist descendants who arrived in the early 1800s, settling close to the Saint John River valley. The communities' names reflect their original dwellers such as Allandale after Adam Allan, and Dow Settlement after David Dow. A few communities such as Cottrell and Shogomoc also arose beside the railroad from St. Andrews through Canterbury after 1858, but these short-lived villages have long since been abandoned.

The largest town is McAdam, which sits on the border between Cranberry and Magaguadavic ecodistricts. The McAdam railway station lay at the junction of railroads heading north to Edmundston, west to Montreal, and south to St. Andrews or St. Stephen, and formerly serviced sixteen trains a day. This heritage building was constructed in 1911 of granite quarried from local glacial boulders, and was declared a National Historic Site in 1976.

Residents who did not work for the railway were employed almost solely in the timber business, cutting trees, and running sawmills. Today, logging, outfitting, and tourism are mainstays of the local economy.

McAdam Railway Station is a National Historic Site. Photograph courtesy of the Village of McAdam.



5.7. CRANBERRY ECODISTRICT



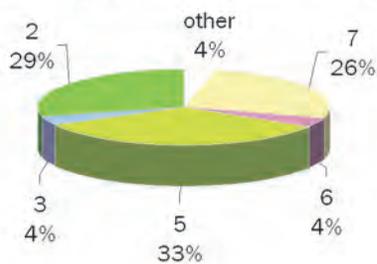
Camping and canoeing are popular pastimes in the Cranberry Ecodistrict. This site at Diggity Stream has been in use as a campsite for more than 2000 years.

5.7. Cranberry Ecodistrict at a Glance

Ecoregion: Valley Lowlands
 Area: 121, 333 ha
 Average elevation above sea level: 166 m
 Average May-September precipitation: 450–475 mm
 Average annual degree-days above 5°C: 1600–1700

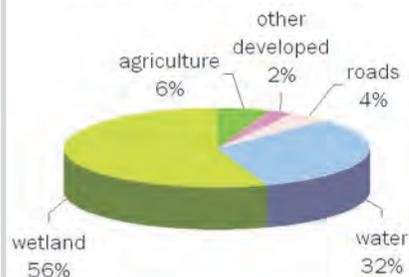
86% of Cranberry Ecodistrict has forest cover

ecosite coverage of forest area



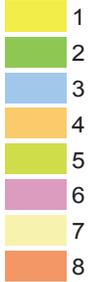
14% of Cranberry Ecodistrict is not forested

uses of non-forest area

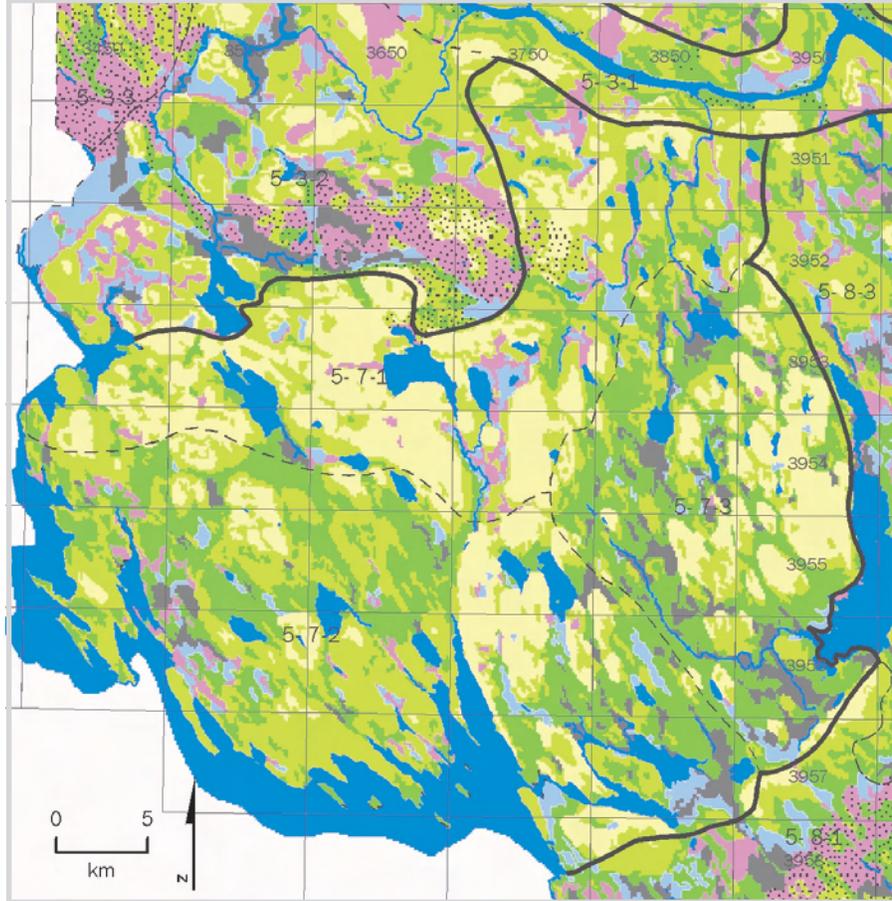
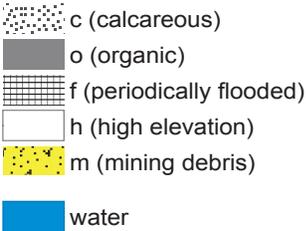


Ecosite map legend

ecosite

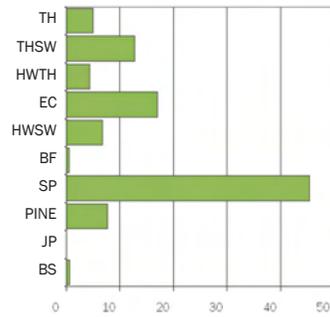


ecosite modifiers

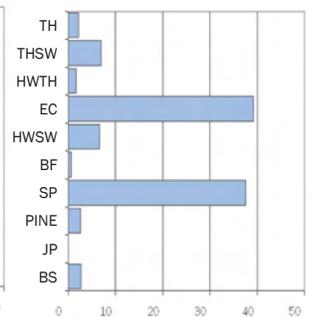


Percent cover of forest stand types by ecosite

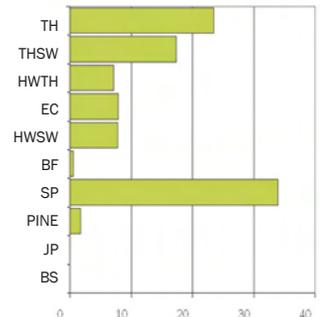
ecosite 2



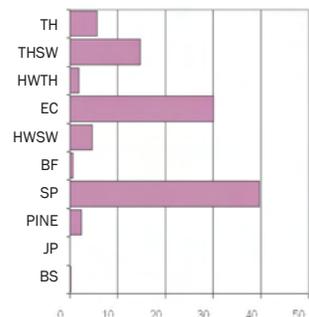
ecosite 3



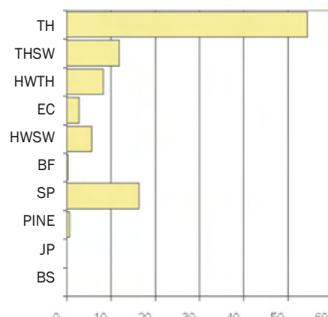
ecosite 5



ecosite 6



ecosite 7



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.

5.8. Magaguadavic Ecodistrict

Magaguadavic Ecodistrict is an undulating plateau, intermediate between higher elevations of the Cranberry Ecodistrict to the northwest, and the low-lying Fundy Coastal Ecodistrict to the south.

Geology

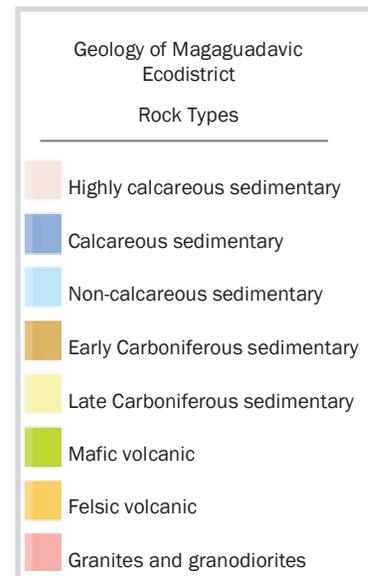
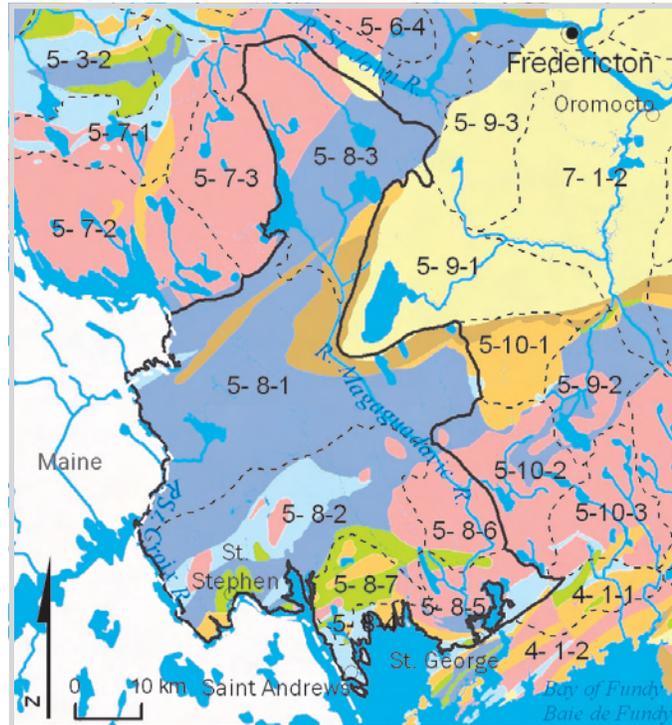
The bedrock consists primarily of two basic rock types: Ordovician to Devonian sedimentary strata and Silurian to Devonian granitic rocks.

The central core of the ecodistrict comprises Silurian calcareous sandstone, slate, and siltstone adjoining a narrower belt of siliceous Ordovician shale, greywacke, and siltstone. Another small zone of Silurian-Devonian sedimentary rock stretches along the coast of Passamaquoddy Bay. The St. Andrews peninsula also is composed of Silurian to Devonian red and grey sandstone, shale, and conglomerate, with bands of Devonian mafic volcanic rocks. These rocks include basalt that contains white vesicles, the remains of volcanic gas bubbles that subsequently became filled with calcite.

Elsewhere, the predominant bedrock is composed of Silurian to Devonian of granite and granodiorite. The most extensive area occurs in the southeast, and encompasses Lake Utopia and Digdeguash Lake. The St. Stephen area contains a mixed assemblage of granitic and gabbroic rocks, and another area of granite appears northeast of Magaguadavic Lake.

In addition to these more dominant lithologies, a small patch of Devonian felsic volcanic rocks borders the shores of Harvey Lake. Just south of Chamcook, is a narrow band of Jurassic diabase that transects the St. Andrews Peninsula; it represents the youngest bedrock unit in the area.

Some volcanic outcrops along Harvey Lake display a hexagonal pattern of columnar jointing that developed hundreds of million years ago as the rocks cooled.



Landscape and Climate

The landscape to a large degree reflects the shape of the underlying bedrock. The central core underlain by the softer sedimentary rocks has low relief, many wetlands, meandering streams, and minimal relief. The granitic terrain northeast of Magaguadavic Lake is much more rugged and hosts impressive features such as Blaney Ridge and Magundy Hill. The large granitic pluton around Lake Utopia and Digdeguash Lake is rimmed with a chain of small mountains that overlook the Bay of Fundy.



New Brunswick (left bank and islands) is separated from Maine (right bank) by the St. Croix River. Part of the Grassy Islands protected natural area is pictured here.

The areas of greatest relief result mainly from differential erosion of bedrock. Prominent features such as Tower Hill and Pleasant Ridge, for instance, represent isolated plugs of resistant Devonian granite that have intruded the softer Ordovician sedimentary rocks. The northwest-trending bedrock lineation also has affected the alignment of local rivers, lakes, roadways, and railway lines.

The height of land is situated so far north that all but the most northerly streams empty south in the Bay of Fundy, rather than into the Saint John River. The largest rivers are the St. Croix and Magaguadavic. The St. Croix River forms the western boundary of the ecodistrict and flows southeast through a series of lakes, wetlands, and rapids before reaching the St. Croix estuary at Passamaquoddy Bay. The Magaguadavic River begins at Magaguadavic Lake, then flows southeast to enter the Bay of Fundy at St. George. Following a nearly parallel path, the Digdeguash River originates just south of McAdam and empties into Passamaquoddy Bay near Bocabec.

Two lakes in the ecodistrict have developed some unusual features. Second Kedron Lake is one of only a few know lakes in the world with burrballs. Burrballs are round balls composed of organic debris such as leaves and twigs, fine silt, and sand. When the loose material collects in ripple marks on the lake bottom, the constant rolling action along the bottom can compact the debris into a perfect ball. Lake Utopia, contains saucer-shaped concretions made of iron and manganese called 'cow patties'.

The ecodistrict's borders touch the Saint John River valley and the Fundy coast, and its western edge abuts the State of Maine. The highest points occur at Pleasant Ridge and Upper Magaguadavic, both at about 270 m. Elevations elsewhere are fairly low, ranging from 150 m in the north to sea level in the south.

The higher ecodistricts to the northwest and east of Magaguadavic Ecodistrict help to give it a dry and warm climate. Its moderate elevations and largely inland location also prevent it from being overly affected by the cool, moist influence of the Bay of Fundy.

Soils

The dominant soils—the Thibault and Carleton units—are derived from calcareous sedimentary rocks and are concentrated in the low-lying central core. Loamy, non-compact soils of the Thibault Unit are common around McAdam and the Kedron lakes. Compact basal tills of the Carleton Unit also occur here, especially east of McAdam and southwest of Canoose Lake. These finely textured soils are silty loam to clay loam, and generally are poorly drained because of low relief.

Glaciofluvial deposits occur along the Magaguadavic and the Digdeguash rivers, with a large swath near Brockway. These deep, coarse-textured soils are associated with the Riverbank and Gagetown units. With their dry and nutrient-poor nature, they tend to support remnant white pine and red pine stands.

Several swamps and bogs have formed near Digdeguash River and are covered with Organic Unit soils. Other areas are overlain primarily by assorted soils of granitic and metasedimentary derivation.

Biota

Cedar is a dominant species here and occurs in many stand types ranging from flat, wet bogs to calcareous upper slopes. Various uncommon plants including colourful orchid species may be associated with these cedar stands. Black ash, red spruce, cedar, and red maple frequent the extensive bogs and swamps (3b) in the ecodistrict's central core.

Moist mid-slope terrains (5) support red spruce and balsam fir with white pine hemlock and cedar as the dominant softwood cover. Hemlock also occurs on cool, moist sites along rivers and lakes (2). The Grassy Islands in St. Croix River support an impressive stand of hemlock as well as a diversity of ecosystems including grasslands, shoreline forest communities and freshwater marshes.

Pure stands of white pine occur along upper reaches of the Magaguadavic River over areas of droughty, coarse-textured soils, and are visible for several kilometres where they straddle Highway 3

The alignments of the landforms in this photo from the Canoose area reflect the direction of glacial advance in the last ice age (northwest to southeast).



around Brockway. A mature red pine stand in the Brockway area is home to the eastern pine elfin and hoary elfin butterflies. The larval food of the eastern pine elfin is white pine and/or jack pine, whereas hoary elfin larvae eat mayflower.

Shade-tolerant forests of sugar maple, yellow birch, beech, and red oak are found on low ridgetop sites (8) such as Flume Ridge west of Big Kedron Lake and Blaney Ridge east of Magaguadavic Lake. An oak forest also grows over a dry acidic site at Woodland on the St. Croix River. The nearby rivershore at Spragues Falls is the only known setting in New Brunswick for common lousewort, now believed to have disappeared from Currie Mountain west of Fredericton.

Intolerant hardwood stands are dominated by red maple and trembling aspen with red spruce and balsam fir, suggesting an eventual transition to a tolerant, coniferous forest cover.

The plentiful bogs, lakes, and wetlands found in mid-ecodistrict contain a number of significant plants including the rare southern twayblade. Canoose Lake hosts the uncommon swamp fly-honeysuckle and the rare mermaid weed, and the margin of Kendricks Lake supports Atlantic manna-grass.

Sam Orr Pond receives infusions of saline water at high spring tides, which augments the pond's regular inflow of freshwater from surface drainage, yet allows it to retain enough heat to protect the only known population of quahogs in the Bay of Fundy. This warmer water species is normally restricted to the waters south of Cape Cod or to the Gulf of St. Lawrence.

Several interesting faunal species also rely on the wetlands and lakes for their habitat. New Brunswick's first documented sighting of crayfish was made at the confluence of Canoose Stream and the St. Croix River. A favourite destination for herpetologists is Twin Lakes north of Blueberry Mountain, where many species of New Brunswick amphibians and reptiles have been observed.

The St. Andrews headland is a crucial feeding and staging area for waterfowl and shorebirds. The St. Croix estuary adjoining and just above St. Andrews provides habitat for waterfowl and shorebirds, including American black duck, goldeneye, eiders, scoters, and bufflehead.

The St Croix River, like many salmon rivers in the province, has seen a decline in its salmon population. Chamcook Lake is one of the deepest lakes in New Brunswick and has one of the few self-sustaining lake trout populations.

Settlement and Land Use

Magaguadavic Ecodistrict lies in traditional Passamaquoddy territory and encompasses the St. Croix River, which was a vital link in ancient overland portages between New England, the Bay of Fundy, and Saint John River valley.

For at least 2500 years, aboriginals occupied the shores of Passamaquoddy Bay and its inshore islands. Dozens of native encampment sites dated at 6000 to 7000 years old have been uncovered along the chain of rivers and lakes comprising the St. Croix river system bordering the ecodistrict. They relied on the area's game, shellfish, seabirds, fish, and other natural resources, and left behind hundreds of shell midden sites as testament to their lengthy presence.

The earliest Europeans were French settlers under Sieur de Monts. They spent the 1604-05 winter on St. Croix Island before leaving for the warmer climes of Annapolis Valley in Nova Scotia. Loyalists began to settle the coast in 1783 at places such as St. Andrews, St. George, and St. Stephen. Fishing, farming, logging, and sawmilling were the typical occupations.

The ecodistrict was the first in the province to be commercially exploited for timber, and reports indicate that by 1805 the forests had been heavily scoured. Some sixty sawmills were erected at St. Andrews, St. Stephen, along the Magaguadavic River, the Digdeguash River, and elsewhere.

The sawmill remained as an economic mainstay for the rest of the century, but subsequently were augmented by the St. George granite quarries and a textile mill in St. Stephen. The St. George quarries located in and around Lake Utopia produced some of the finest quality granite pillars and monumental stone in North America. They were active from 1872 until the 1930s.

The regional economy is currently sustained by forestry, tourism, blueberry farming, aquaculture, and commercial fishing.

This view of St. Andrew's-by-the-Sea includes Minister's Island in the background, and the historic Algonquin Hotel (left). *Photograph © Ron Garnett–AirScapes.ca.*



5.8 Magaguadavic Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 301, 809 ha

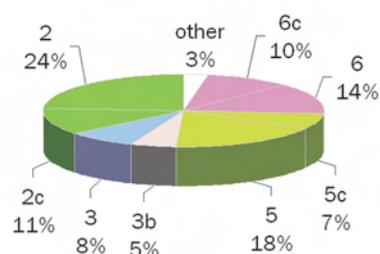
Average elevation above sea level: 115 m

Average May–September precipitation: 450 mm

Average annual degree-days above 5°C: 1600–1700

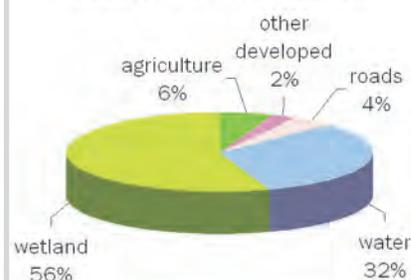
82% of Magaguadavic Ecodistrict has forest cover

ecosite coverage of forest area



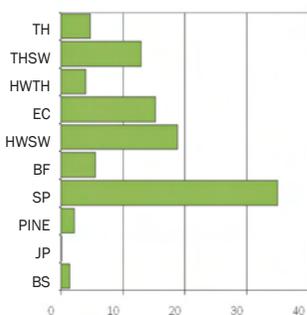
18% of Magaguadavic Ecodistrict is not forested

uses of non-forest area

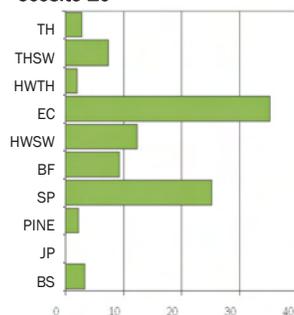


Percent cover of forest stand types by ecosite

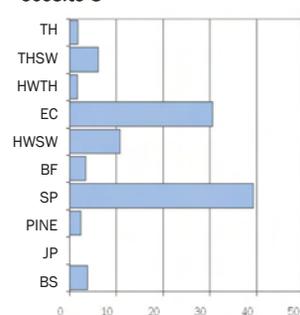
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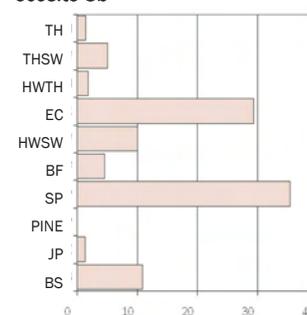
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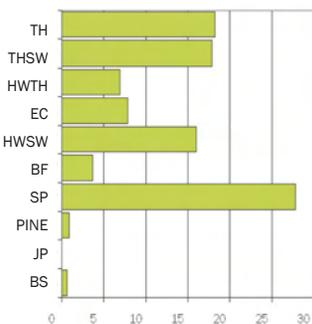
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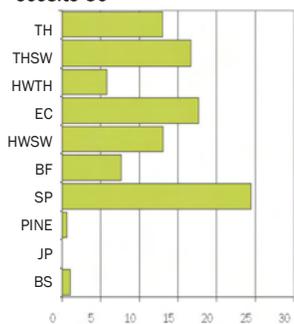
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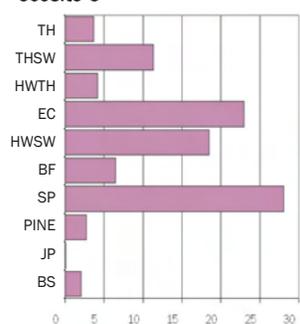
ecosite 5



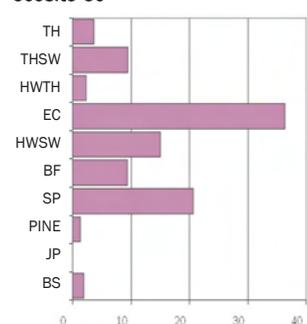
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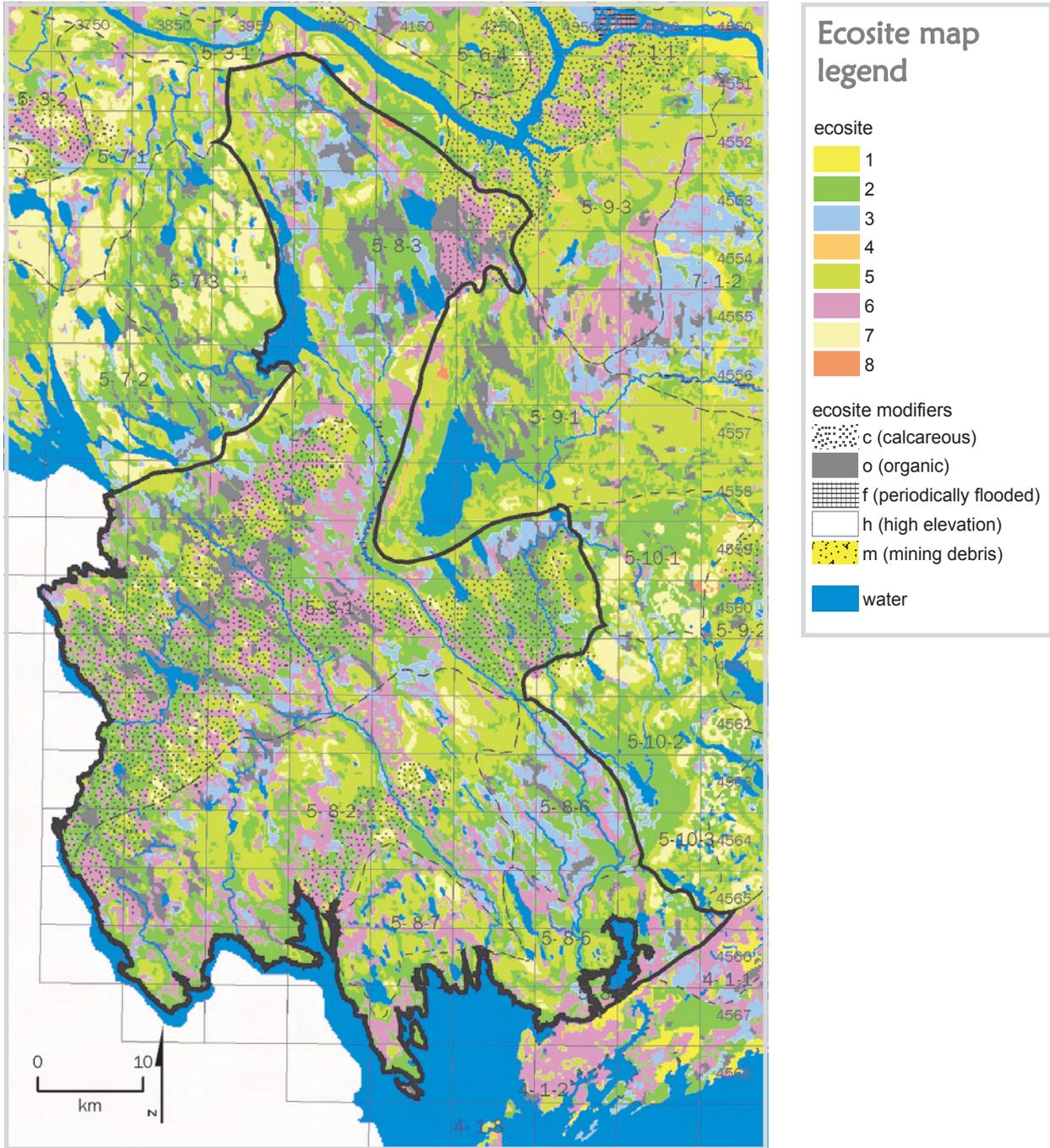
ecosite 6



ecosite 6c

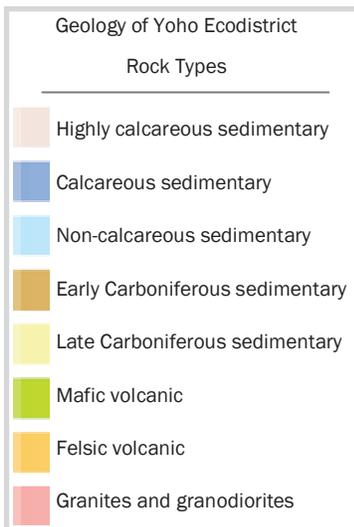
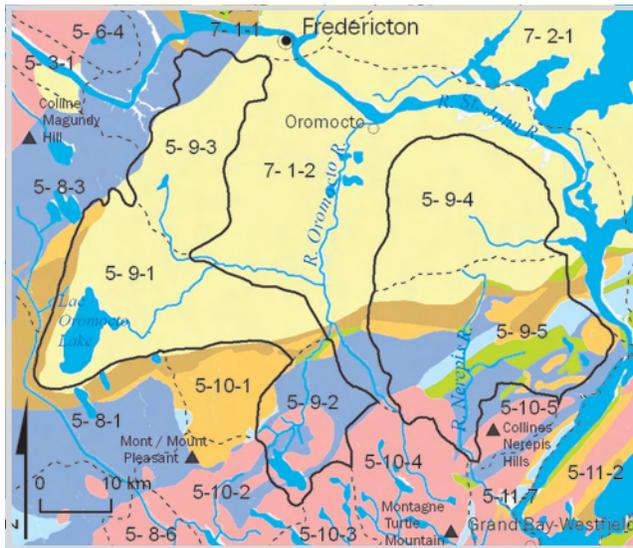


Vertical axis: TH—tolerant hardwood species; THSW—tolerant hardwood with softwood species; HWTH—intolerant hardwood and tolerant hardwood species; EC—eastern white cedar; HWSW—intolerant hardwood and softwood species; BF—balsam fir; SP—red or white spruce; PINE—white pine; JP jack pine; BS—black spruce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



5.9. Yoho Ecodistrict

The Yoho Ecodistrict is located in southern New Brunswick west of the Saint John River. It consists of two distinct upland areas separated by wetlands and tributaries of the broad Oromocto River.



Geology

Rocks in the northern part of the ecodistrict possess a fairly uniform lithology with red and grey Pennsylvanian conglomerate, sandstone, siltstone, and shale belonging to the Cumberland Group. A small intrusion of felsic volcanic rocks occurs near the village of Harvey, where local roadcuts reveal the flow-banded rhyolite that underlies Harvey Mountain.

Rocks in the southern portion display a more complex assemblage. They are composed mainly of interbedded Silurian to Devonian mafic and felsic volcanic rocks, with assorted metasedimentary rocks. A narrow

band of calcareous sedimentary rocks occurs between Sand Brook in the west and Petersville Hill in the east.

Silurian to Devonian granitic plutons also occur in the south, specifically in the vicinities of Evandale, Welsford, and South Oromocto Lake. The pink granitic cliffs just south of Welsford reach 66 m in height and are popular with rock-climbing enthusiasts.

Landscape and Climate

The landscape shifts gradually from low-lying, rolling relief in the north where rocks are easily eroded to higher, more rugged hills in the south where rocks are resistant. Wetlands are prevalent in the north, especially around Oromocto Lake, but are less common in the south.

Most rivers in the west drain into the Oromocto River, either directly or via the South Branch Oromocto River. Those in the east flow into the Oromocto or Saint John river systems. The landscape lacks well defined bedrock lineations or topographic constraints such as mountain valleys that would give strong direction to the waterways. Instead, the rivers meander across the terrain before reaching their watershed destination.

The relatively flat terrain and lack of major bedrock faulting has

encouraged the formation of several lakes, the largest being Oromocto Lake, Yoho Lake, and South Oromocto Lake. The first two are bound by sedimentary strata, whereas the third is surrounded mainly by granite. South Oromocto Lake's granitic nature allows for cold waters with a sizeable brook trout population. Its acidic bedrock, however, has made the waters extremely sensitive to acid rain and snow.

Oromocto Lake is one of only two freshwater lakes in the province with saucer-shaped iron-manganese concretions in the bottom. The concretions are up to 15 cm in diameter, and occur on the glacier-formed ridges of sand and rock that characterize much of the lake bottom.

Although the ecodistrict lacks the dramatic mountains or steep valleys of more northerly regions, it has a number of interesting geographic features. The 274 m granitic peak of Logans Mountain is the highest point in the area, and perches 130 m above the surrounding landscape to offer a fine vista over nearby South Oromocto Lake. A 100 m escarpment called Shaving Ridge occurs along the southwest boundary near Oromocto Lake, and appears to define the contact between separate formations of the Cumberland Group.

As well, the South Branch Oromocto River possesses a spectacular gorge. The river here races through a canyon, crashes over beds of steeply dipping Devonian sandstone in a turbulent waterfall, then battles downstream through a chain of rapids to finally reach the Oromocto River beyond.

The ecodistrict lies in the rain shadow of the Cranberry Ecodistrict uplands to the west, and consequently has a dry and warm climate. The growing season and summer precipitation data are similar to those of the Eastern Lowlands Ecoregion.

Soils

The dominant soils are compact basal tills derived from red Pennsylvanian sedimentary rocks. Of these, the finer textured soils—sandy clay loams to clay loams of the Stony Brook Unit—are most common, whereas the medium-textured soils of the Tracy and Harcourt units are more scattered. These acidic soils tend to be poorly drained, except on ridges and in scattered patches containing the sandy and shallow soils of the Fair Isle Unit.

The greyer sandstones have produced basal tills of the Reece Unit, which appear intermixed with coarse-textured, bouldery

ablation tills of the Sunbury Unit around Oromocto Lake.

Calcareous sedimentary strata transect the landscape in the south and have produced fertile, well drained loamy soils. They belong to the Carleton and Thibault units, and occur in the vicinities of Juvenile Settlement and Pleasington. Calcareous soils also occur around Harvey and Inchby Ridge, where red, compact loams and sandy loams of the Parry and Salisbury units sustain the most arable land in the region.

The least fertile soils are associated with areas of volcanic and metasedimentary rocks, and belong to the Mafic Volcanic, Lomond and Serpentine units. They are shallow and stony with limited agricultural capacity. Soils of the Mafic Volcanic Unit are typically less acidic and are associated with species rich plants communities.

Biota

The ecodistrict has been highly disturbed by intensive settlement, logging activities, and military training at Canadian Forces Base Gagetown. The resulting early successional forest is prevalent across the landscape, and is composed of red maple, white and grey birch, and trembling aspen.

Elsewhere, a typical Valley Lowlands forest occurs on well drained, mid-slope areas of less disturbance, and is composed of red spruce, balsam fir, and hemlock with red maple (5). Red oak and red pine are found more infrequently various soil types. Black spruce, red spruce, balsam fir, and cedar are widespread on poorly drained soils (3, 6).

A mixed community of beech, sugar maple, yellow birch, red spruce, balsam fir, and white pine occasionally occurs on exposed ridgetops (8). Yellow birch and sugar maple are more abundant on well drained areas of calcareous soils. Poorer quality hardwood stands dominated by beech and sometimes red oak occupy the highly acidic upper slopes (7, 8), whereas hemlock, red spruce, white pine, and red oak sometimes occupy the lower slope positions and shallow soils (2). Several natural, pure stands of red oak and red pine grow on moderately well drained, loamy soils.

Several of the interesting or rare plants here are associated with lakes. One such shallow-water, boreal lake supports two intriguing quillworts: Tuckerman's quillwort and the rare Acadian quillwort. The lake also hosts the newly identified prototype quillwort that has been found only in Lakes in New Brunswick, Nova Scotia, and Maine. The prototype quillwort was designated as *of Special*

Concern by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) in 2005.

Yoho Lake is one of only a few known locations in New Brunswick to support Robbin's spikerush. Clammy hedge-hyssop or small-flowered, *gratiola* also grows in wetlands near the lake's outlet.

Settlement and Land Use

The ecodistrict straddles traditional Maliseet and Passamaquoddy territory. Aboriginals used the land regularly for hunting, fishing and trapping expeditions, as well as for overland travel between the Saint John River valley and Passamaquoddy Bay.

The first permanent non-aboriginal settlements were established in the early 1800s, and their names reveal the immigrants' origins. Cork (also known as Teetotal Settlement) was established by Irish from Fredericton who had taken the pledge before leaving Ireland. Tweedside was named by its Scottish inhabitants. The village of Germany was home to German immigrants with the surnames of Knorr, Fromm, and Schenk.

Several villages in the eastern half of this ecodistrict were expropriated in the mid-1950s when the Canadian government created the military base at Camp Gagetown. Driving through the base, one can still see graveyards of these former communities, their faded headstones dating back to the mid-1800s.

Coal outcrops occur throughout the Pennsylvanian strata, but coal has not been mined here to any degree. Deposits of tin, silver, iron, molybdenum, lead, zinc, and other metallic minerals are associated with the granitic and volcanic rocks, but to date have not been commercially developed. Forestry remains a mainstay of the local economy.

5.9. Yoho Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 208, 412 ha

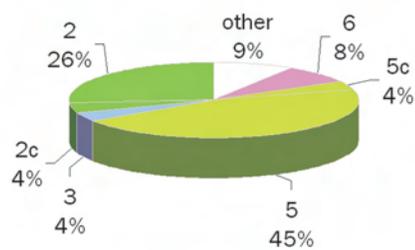
Average elevation above sea level: 60 m

Average May–September precipitation: 400–450 mm

Average annual degree-days above 5°C: 1600–1800

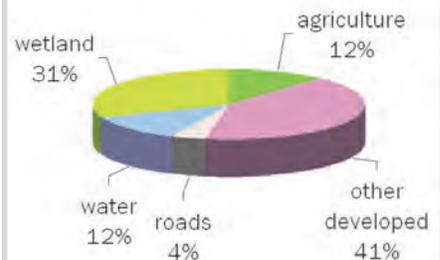
77% of Yoho Ecodistrict has forest cover

ecosite coverage of forest area



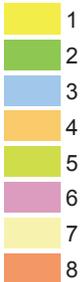
23% of Yoho Ecodistrict is not forested

uses of non-forest area

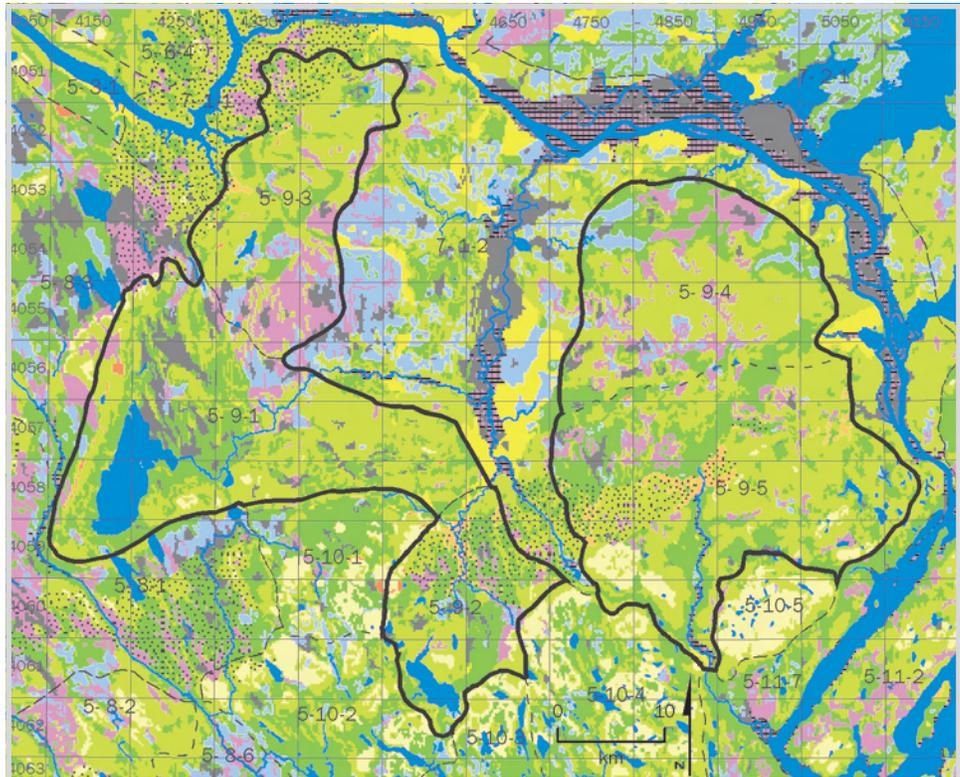
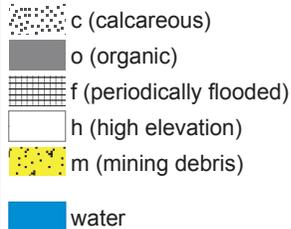


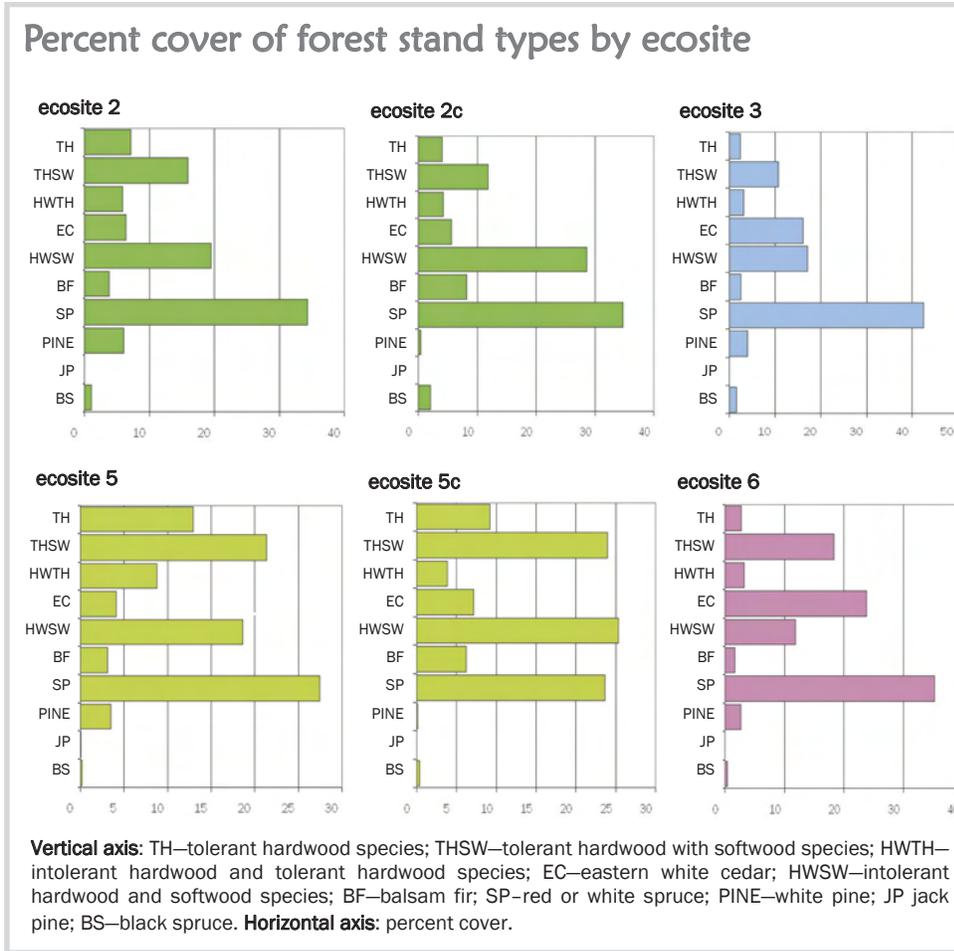
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ecosite modifiers





5.10. Mount Pleasant Ecodistrict

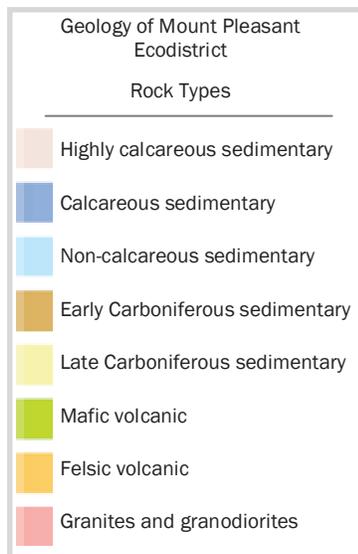
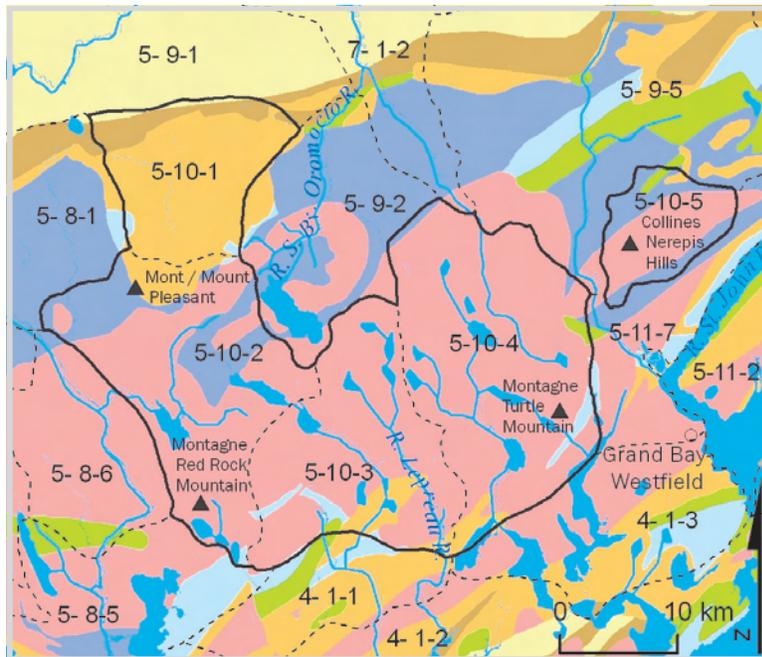
The Mount Pleasant Ecodistrict is located in southwest New Brunswick west of the Saint John River. It consists of an eastern and a western segment that are separated by a short section of the Nerepis River.

Geology

The western area of the ecodistrict is underlain primarily by Devonian granites and granodiorites belonging to the St. George Batholith. An area of Devonian granitic, volcanic, and sedimentary rocks fills the northern lobe.

Between the granitic and felsic volcanic rocks is a small zone of Ordovician to Silurian metasedimentary rocks that include carbonaceous to non-carbonaceous shale, siltstone, and greywacke.

The much smaller eastern segment contains Silurian granites and sedimentary rocks; the latter are composed of non-calcareous



sandstone, siltstone, and conglomerate.

Landscape and Climate

The ecodistrict displays a strongly rolling plateau of rugged granite, perched above the lower, flatter terrain of adjoining ecodistricts. The granitic rock is relatively impervious to water and consequently is covered with many lakes that fill depressions in the landscape.

The lakes' names reflect a miniature natural and cultural history of the region: Moose Lake, Loon Lake, Trout Lake, Turtle Lake, Eagle Lake, Mosquito Lake, Crystal

Lake, Coronary Lake and Disappointment Lake. The last-named body of water formerly was called Mistake Lake, and in Passamaquoddy was known as *Esquagamook* or *end lake* in reference to its location at the head of Lepreau River.

Most rivers in the western segment arise from one or other of the lakes and flow southward directly into the Bay of Fundy. One of the few exceptions is the Piskahegan River in the north, which heads north out of the highlands towards the Magaguadavic Ecodistrict, then angles abruptly south to join the Magaguadavic River. Rivers in the eastern segment drain from the granitic Nerepis Hills into the Nerepis River, which enters the Saint John River at Woodmans Point outside the ecodistrict.

The eastern section of the ecodistrict rises 120 m to 220 m above the surrounding lowlands; hills in the western section sit 75 m above the surrounding terrain, but attain an elevation of 330 m.

This climate is relatively warm and moist. Its growing season and precipitation are intermediate between those in the drier, warmer Grand Lake Ecoregion to the northeast and the colder, wetter Fundy Coast Ecoregion to the south. During the summer, fog from the bay frequently extends into the ecodistrict, possibly creating favourable conditions for the dense red spruce regeneration seen in many clearcut areas.

Soils

The dominant soils are coarse-textured material derived from granitic and sedimentary ablation deposits. Two large glaciofluvial deposits of the Gagetown Unit are found near McDougall Lake and north of Mosquito Lake along the Lepreau River. Similarly coarse soils of the Juniper and Irving units occur as deep ablation deposits lining the bottom of broad valleys. All of these soils support slow-growing red spruce, red pine, red maple, and white birch. In some valley bottoms, the soils consist wholly of coarsely shattered bedrock. This is one of the few localities in New Brunswick where an open woodland community dominated by low shrubs and lichens develops naturally.

Residual, shallow soils of the Big Bald Mountain Unit cap many of the higher hilltops. Compact basal tills of the Tuadook and Catamaran units are less common, but they have a higher percentage of sedimentary clasts, a relatively fine texture, and a greater capacity to hold water. As a result, they tend to be more productive and support a greater diversity of flora and fauna. The best soils in the district belong to the Parry, Salisbury, Thibault, and Carleton units, which line the northern edge of the ecodistrict.

Biota

The landscape here is dominated by red spruce that is in association with red maple, white birch, and balsam fir.

Dry hilltops and upper slopes (7, 8) are capped by tolerant hardwood stands of beech, sugar maple, and red maple with occasional red spruce, ironwood, and white ash. These communities are particularly common in the Nerepis Hills.

The drier mid-slopes (4) have more tolerant hardwoods and less balsam fir than do the moist mid-slopes (5). Coarse-textured, lower slopes (1) and moist flatlands (2) tend to contain over 80% softwood species, mainly red spruce, black spruce, and pine.

Remnant red pine stands are found on lower sandy or stony soils. The frequency of fire-adapted species such as red pine and white pine, together with widespread low blueberry and teaberry suggests either a history of frequent fires across the area, or poor, acidic soil conditions that allow these typically fire-adapted species to reproduce in the absence of fire.

Areas disturbed by tree harvesting are dominated by intolerant hardwoods, particularly white birch, grey birch, red maple, and trembling aspen; many of these areas lie along major rivers that

The Piskahegan Stream tumbles southward toward its confluence with the Magaguadavic River. Beech Hill rises in the background.





The Nerepis Hills rise abruptly on the east side of the Nerepis River Valley. The Lepreau Ecodistrict occupies the plateau, while the river is situated in the Yoho Ecodistrict. Photograph © Ron Garnett–AirScapes.ca.

provided easy access to the forest lands.

Black spruce occurs on poorly drained soils (3) with red spruce, balsam fir and red maple, but cedar and tamarack are uncommon on these sites. The bog at Little Tomoowa Lake Protected Natural Area provides an example of the variation in peatland vegetation. Its vegetation pattern shifts from rooted aquatic plants

through to floating sphagnum moss and eventually to a stunted forest of black spruce and tamarack. Another bog, just south of this site, suggests a coastal influence as evidenced by the presence of cloudberry and crowberry. In New Brunswick, these plant species typically are restricted to coastal peatlands and headlands.

The lakes here support a variety of wildlife, and bald eagles, have taken up residence in a number of large lakeside trees in the ecodistrict. Two of the more pristine lakes are Lake Anthony and Clear Lake. West Long Lake is one of the few lakes in the province with a self-sustaining lake trout population.

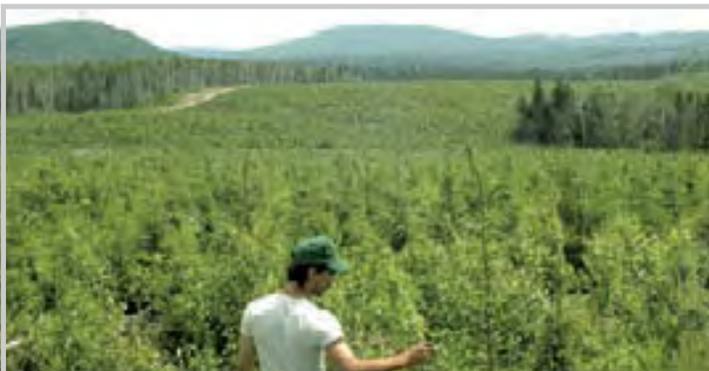
Settlement and Land Use

Mount Pleasant Ecodistrict straddles the traditional territories of the Maliseet and Passamaquoddy. The area was used for hunting and trapping expeditions, and for overland travel to the Oromocto River system. A native village apparently was located just beyond the ecodistrict at the confluence of the Saint John and Nerepis rivers.

The area seems to have had very little “settlement appeal”, as it has virtually no historic or modern settlements. The windswept, non-arable granitic terrain likely discouraged anyone who had a choice of living along the far more hospitable Fundy Coast or Saint John River valley. Due to its lack of settlements and poor access, the area has received less attention from naturalists and many interesting finds await here.

Economic mineral deposits are found here along intrusive contacts

Conifer plantations are extensive in the Mount Pleasant Ecodistrict.



between granitic plutons and older rocks, or within the plutons themselves. A wide range of metallic and non-metallic minerals have been discovered: tin, tungsten, bismuth, copper, molybdenum, lead, silver and gold, to name a few. To date, only the Mount Pleasant deposit has been mined. It also holds the world’s largest known reserves of indium, a rare earth element used to produce coating agents for computer screens.

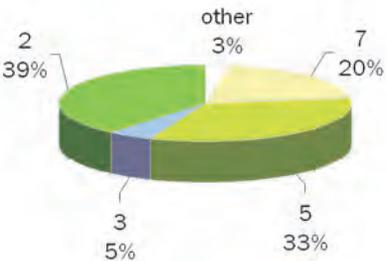
Forestry is an important activity in the area that since the late 1970s has created much new road access. Forest tracts here are divided mainly between large industrial freehold land and Crown land.

5.10. Mount Pleasant Ecodistrict at a Glance

- Ecoregion: Valley Lowlands
- Area: 117, 632 ha
- Average elevation above sea level: 185 m
- Average May-September precipitation: 475–500 mm
- Average annual degree-days above 5°C: 1700–1800

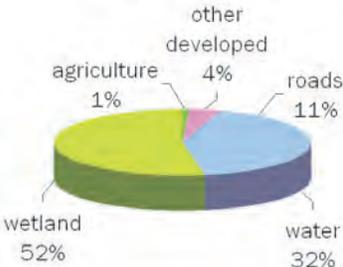
89% of Mount Pleasant Ecodistrict has forest cover

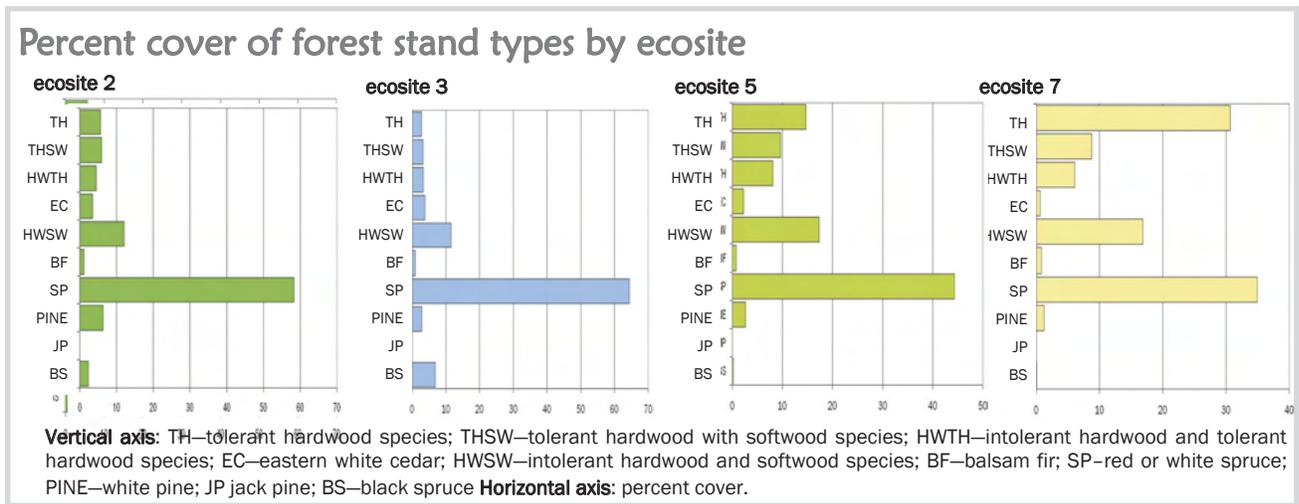
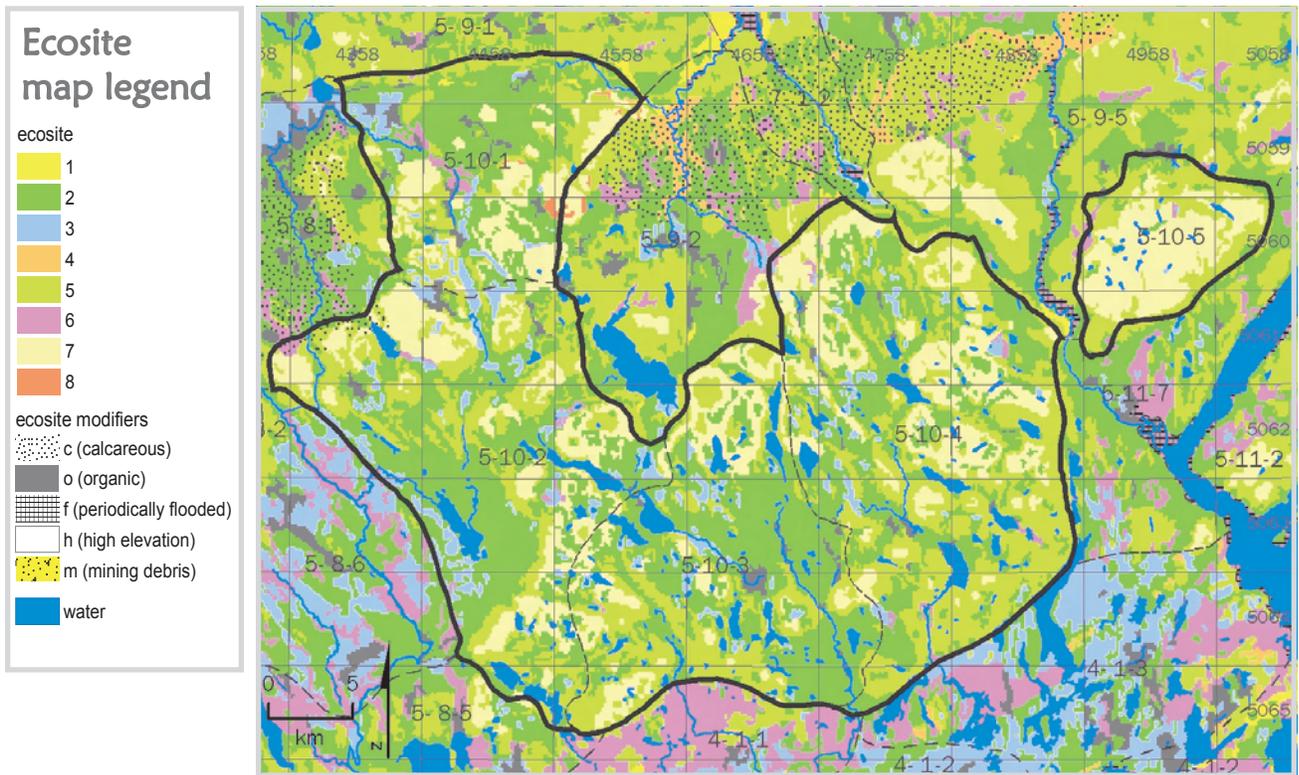
ecosite coverage of forest area



11% of Mount Pleasant Ecodistrict is not forested

uses of non-forest area





5.11. Kingston Ecodistrict

The Kingston Ecodistrict is situated in southern New Brunswick in the lower Saint John River valley. It straddles the Kingston Peninsula, and the valleys of Kennebecasis Bay, Kennebecasis River, Belleisle Bay, and Long Reach.

Geology

Bedrock from the northeast border of this ecodistrict down to about Norton is dominated by red to grey Mississippian sedimentary rocks. They include sandstone, conglomerate, siltstone, and mudstone with minor evaporites such as limestone, halite (salt), and potash. The presence of limestone is reflected in small pockets of karst terrain; salt springs in the Sussex area reveal halite (salt-bearing) deposits below surface.

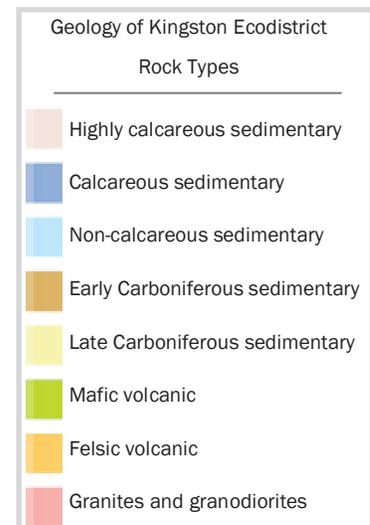
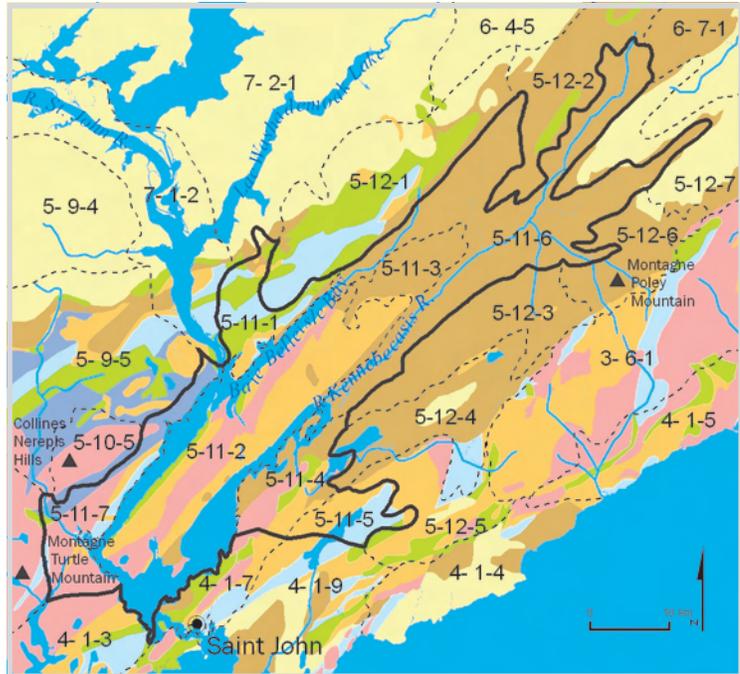
Precambrian igneous and sedimentary rocks occur near Rothesay include limestone of the Green Head Group which, at about 1 billion years old, are the oldest rocks in the province. The Kingston Peninsula also is underlain by Precambrian or younger volcanic rocks, Mississippian red sedimentary rocks and Silurian granites. A similar rock assemblage occurs near Nerepis on the west shore of the Saint John River.

The extensive, northeast-trending Belleisle Fault transects the ecodistrict. Both Belleisle Bay and Long Reach owe their existence to this major structural lineament, which is clearly visible as a rusty, brecciated zone in a roadcut on Highway 7 opposite Long Reach.

The Hampton area exemplifies the geological scope in the ecodistrict. A person standing on Highway 1 near Hampton can see red conglomerate beside the road, then glance northward at Precambrian volcanic hills. About 600 million years ensued between formation of the volcanic rocks and the younger conglomerates.

Landscape and Climate

The landscape is dominated by the Kennebecasis and Belleisle



reaches of Saint John River which, together, define the perimeter of the Kingston Peninsula.

The Kennebecasis Reach begins as Kennebecasis Bay, then narrows into the Kennebecasis River. The river in turn splits into Millstream River, Smith Creek, and Upper Kennebecasis River, which drain three eastern lobes of the ecodistrict. The northern reach originates as Long Reach, then angles around Shampers Bluff to become Belleisle Bay. Shampers Bluff is a beautiful location with a peaceful aspect, and shelters one of two known New Brunswick occurrences of the small-flowered bitter cress.

The Kennebecasis and Belleisle valleys feature perched hills, valleys, cliff faces, and swift streams. Their resistant volcanic rock interbedded with less resistant sedimentary rock makes for a dramatic landscape that owes much to differential erosion. The Kennebecasis hills have been the subject of many paintings by the famous Saint John artist, Jack Humphrey.

The northeast segment around Sussex has a lower relief that is more rolling than rugged. The countryside here reveals pastoral vistas that have enchanted visitors since the early 1800s, and its gentle hills sustain one of the most intensively farmed regions of the province.

The highest elevation of 220 m occurs at Raymond Mountain north of Bloomfield.

The region has a relatively dry and warm climate that becomes even warmer as one moves north away from the Bay of Fundy and toward upper reaches of the Kennebecasis.

Soils

The northeast area is overlain mainly by soils derived from red and grey sedimentary rocks. These slightly calcareous, sandy loams have variable texture and belong to the Salisbury, Saltsprings, and Parry forest soils. They tend to have impeded drainage on flat terrain but, where well drained to moderately well drained, they represent the most fertile land in the ecodistrict and typically have been cleared for agriculture.

The upper reaches of the Kennebecasis River and its tributaries are lined in places by fertile alluvial soils of the Interval Unit. The same area contains zones of coarse-textured, gravelly glaciofluvial deposits of the Gagetown and Kennebecasis units. These acidic, dry soils are better suited to drought-tolerant pines.

Shallow, medium-textured soils of the Lomond and Popple

Depot units are derived from a mixture of igneous and sedimentary rocks and cover much of the Kingston Peninsula. They are composed of loams to silty loams with a high gravel component, and are somewhat acidic but suitable for mixed farming where slopes are favourable.

Biota

Nearly 60% of the land area supports intolerant hardwood stands, active farmland, or inactive agricultural fields, a consequence of nearly three centuries of concentrated human activity. The dominant softwood cover of white spruce and balsam fir with some red spruce (5, 7) is most apparent where fields have been abandoned for many decades.

Cedar is locally abundant on sites with calcareous soils (6c). The damp soils of Lower Kars Stream on Belleisle Bay, sustain a community of cedar and black ash with an understorey of orchids, trillium, and the Eurasian orchid helleborine. The moist rocky ledges along the stream harbour the first known New Brunswick locality of Virginia mountain mint. Large colonies of the rare whorled loosestrife grow farther down the bay on the south shore of Long Reach near Westfield.

Jack pine, white pine, and red pine tend to prefer gravelly, sandy soils along rivers and streams (1), or dry escarpments. The Rockville escarpment on Trout Creek hosts a stand of white and red pine with some jack pine and red oak. The very rare rock spikemoss also occurs on cliffs at this site.

Tolerant hardwood stands composed of beech, sugar maple, red maple, and yellow birch with some red spruce occupy hilltops along the few uncleared river slopes and ridgetops (5, 7). White ash and ironwood with some oak often accompany these stands and become the dominant overstorey species in a few dry, ridgetop locations.

The understorey at Hampton Ridge hosts a high diversity of rare or unusual plants. Skunk cabbage, white baneberry, and small purple-fringed orchid all grow on the ridge itself, or along the adjacent floodplain area.

Perhaps the most exotic flora are those associated with the Sussex salt springs. Near Sussex, the saline soil environment has been preserved by localized salt springs, which today support several species with a saline affinity: toad rush, chickenclaws or glasswort, and coastal salt grass.

Kingston Ecodistrict also features a number of wetlands with significant bird habitat. Grassy Island near Oak Point on the Saint John River was the first confirmed breeding site for Wilson’s phalarope in the Maritimes. The island and neighbouring floodplain areas are also unique in hosting a recently established breeding population of greater scaup. Common tern and assorted gulls also nest here.

The Hampton marsh extends from Darlings Island to Bloomfield. It embraces the backwaters and baylets of the Kennebecasis River, and is one of the most species-diverse wetlands in New Brunswick.

Settlement and Land Use

Kingston Ecodistrict lies within traditional Maliseet territory. Archaeologists have uncovered evidence of habitation dating back at least 3500 years. Important aboriginal settlements were located at Apohaqui, the Hammond River mouth, and elsewhere, where marshes and rivers provided abundant fish, waterfowl, game, and other food sources. The present-day village of Milkish in this ecodistrict was named after the Maliseet word *amilkesh* meaning *preserving place*, and lies close to where the Maliseet dried their fish.

The name *Apohaqui* is derived from a Maliseet word meaning *the junction of two streams*—in this case, the Millstream and Kennebecasis rivers.

The Kennebecasis River valley received its first European immigrants in the 1600s and, within a century, was densely populated. Unlike other ecodistricts where early settlements seldom ventured beyond the banks of waterways, villages in the Kennebecasis Valley formed one long eastward chain that almost met the string of villages flanking the Petitcodiac River.

The landscape was cleared and farmed so early and intensively that a visitor to Sussex in the 1850s was able to praise its “air of a civilised, old settled region”. Shortly after his visit, the valley became transected by one of the first provincial railroads: the European and North American Railway between Saint John and Shediac.

The Trout River winds its way toward its confluence with the Kennebecasis river in this scene near Sussex Corner. Photograph © Ron Garnett—AirScapes.ca.



For many years, Sussex-made cheese and butter became famous across Canada and was flavoured with salt extracted from the Sussex salt springs.

Commercial logging began in the late 1700s, although timber volumes never approached anything like the tonnages removed from the Restigouche or Miramichi ecodistricts. The majority of all forest lands in the area today are privately owned by non-industrial woodlot owners.



The Hammond River completes its run from its source in the Caledonia Ecodistrict to the Kennebecasis River near Hampton. Photograph © Ron Garnett–AirScapes.ca.

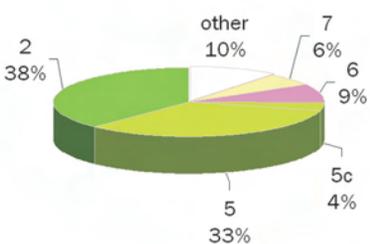
Prospectors working in the region discovered, and occasionally developed, deposits of salt, manganese, gypsum, coal, copper, lead and zinc over the last two centuries. Today, potash is mined in the Sussex area.

5.11 Kingston Ecodistrict at a Glance

- Ecoregion: Valley Lowlands
- Area: 182, 294 ha
- Average elevation above sea level: 74 m
- Average May–September precipitation: 425–450 mm
- Average annual degree-days above 5°C: 1600–1750

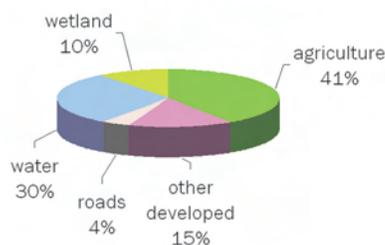
62% of Kingston Ecodistrict has forest cover

ecosite coverage of forest area



38% of Kingston Ecodistrict is not forested

uses of non-forest area

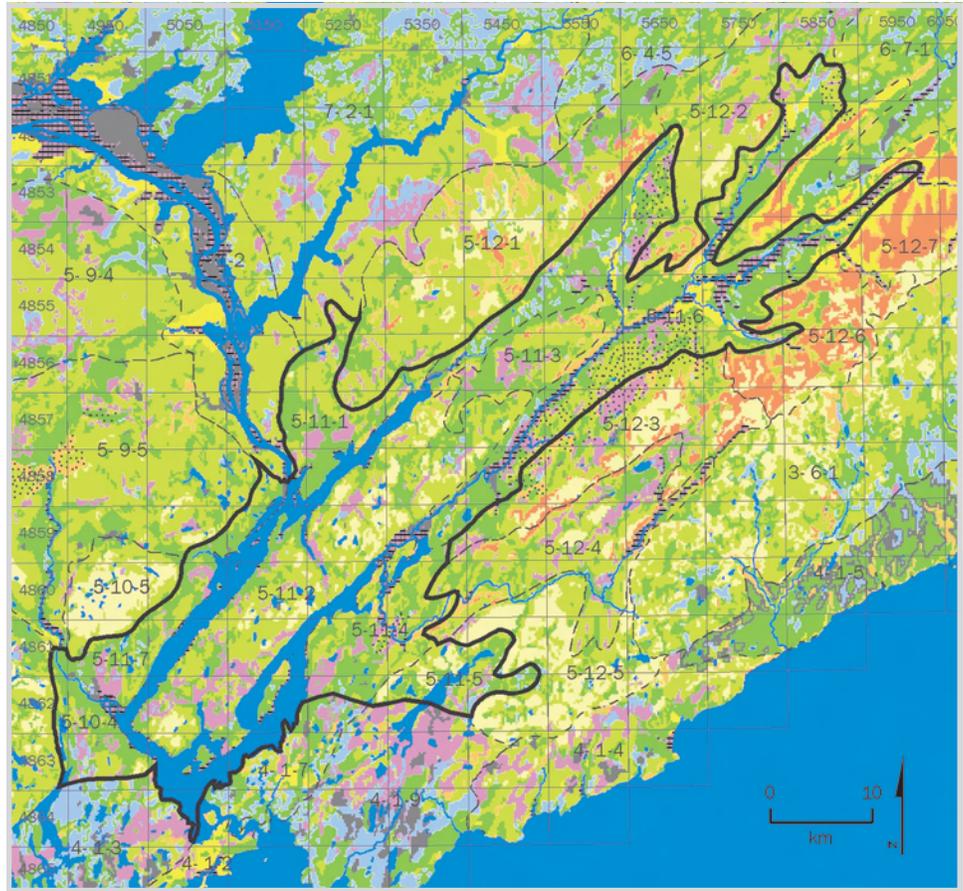
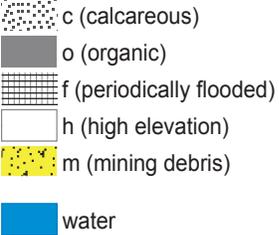


Ecosite map legend

ecosite



ecosite modifiers

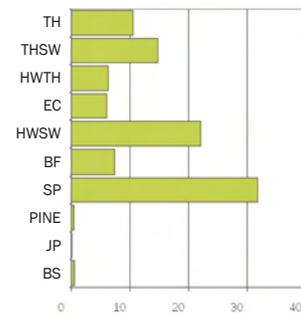


Percent cover of forest stand types by ecosite

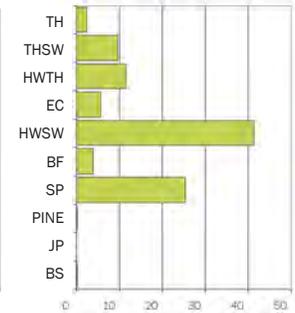
ecosite 2



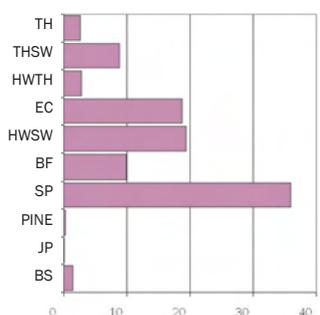
ecosite 5



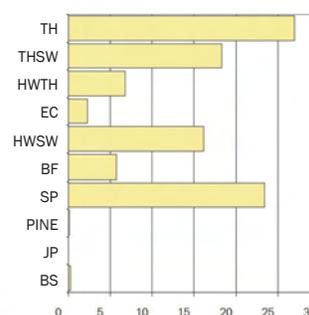
ecosite 5c



ecosite 6



ecosite 7



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.

5.12. Anagance Ecodistrict

Anagance Ecodistrict is a rugged, bi-partitioned terrain in southern New Brunswick that borders the northern edge of the elevated Caledonia Ecodistrict and brackets the low-lying Kennebecasis Ecodistrict.

Geology

The geology here presents a highly complex assemblage of lithologies. The predominant rocks are Pennsylvanian to Mississippian sedimentary strata containing red to grey conglomerate, sandstone, siltstone and shale with some evaporites including potash. These rocks are slightly calcareous to calcareous and, in some locations such as Hanford Brook, contain invertebrate fossils.

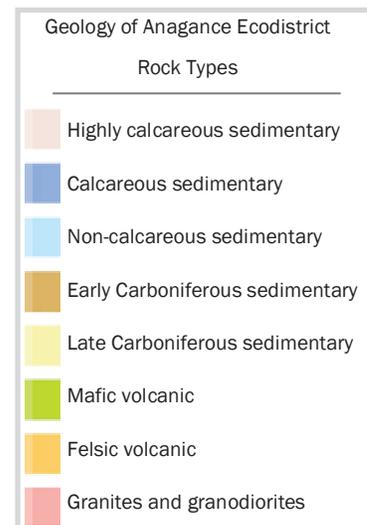
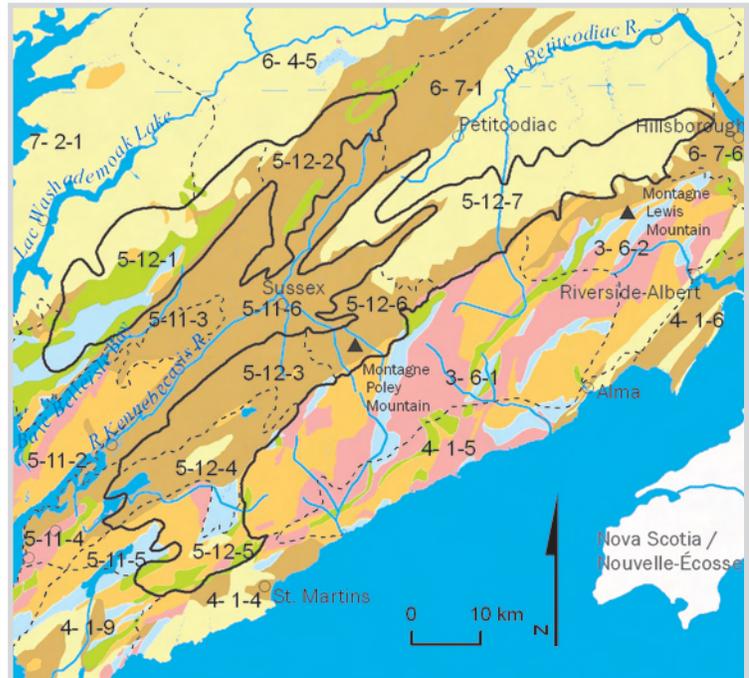
Two zones of older rocks also are present: one in the vicinity of Springdale in the north, and the other below Upham in the south. The northern zone comprises a mixture of Ordovician to Silurian sedimentary rocks interbedded with Cambrian to Silurian felsic and mafic volcanic rocks. The southern zone is underlain by Precambrian felsic to mafic volcanic rocks and granites that are among the oldest rocks in the province.

Three major northeast-trending faults intersect the bedrock and are part of a regional lineation that has influenced the direction of river drainage and topography throughout the ecodistrict.

Landscape and Climate

The ecodistrict's configuration consists of two elongated portions of land that include, and are separated by, Anagance Ridge. The upper portion lies north of Belleisle Bay and Kennebecasis River and reaches from Hatfield Point to Havelock. The lower portion is situated south of Kennebecasis River and stretches from Upham Mountain in the west to within a few kilometres of the Petitcodiac River in the east.

The landscape presents a dramatic contrast of steep, river-filled



valleys curving around rugged hills and mountains, all of them trending northeasterly to mirror the underlying bedrock structure. A tributary of Parlee Brook is lined by amphitheatre gorges, one of which has a 75 m cliff face that is popular with rock climbers. Ridges typically rise 150 m with their crests reaching above 200 m; the maximum elevation of 320 m occurs in the vicinity of South Branch.

Several stories lie behind the naming of some topographic features in this area. Bull Moose Hill recalls a moose who broke his neck in a pasture near Hampton in the early 1800s. A small paper mill was established by M. Frances and Sons on Paper Mill Hill. Samp Hill, refers to samp, a porridge made of ground cornmeal and boiled maple sap.

Rivers in the northern section flow either northward into the Washademoak watershed or south into the Belleisle-Kennebecasis watershed. Rivers in the south flow uniformly north or northwest into the Kennebecasis or Petitcodiac rivers. The rugged terrain has a noticeable absence of lakes, except for Cassidy Lake northeast of Upham.

The predominance of Mississippian bedrock has given rise to a number of solution caves formed by underground streams dissolving the limestone strata.

The ecodistrict has a dry and warm climate, and is protected from southwesterly storms by the high elevation Caledonia Ecodistrict.

Soils

The more calcareous sedimentary rocks yield deep horizons of fertile loam to sandy loam belonging to the Parleeville-Tobique and Parry units. These compact tills support sugar maple and yellow birch on the hillsides. Pine and spruce tend to favour sites with more sandy or gravelly soils, such as those formed where the bedrock is highly conglomeratic.

The less calcareous sedimentary rocks have produced a variety of soils. Loose stony tills of the Sunbury and Reece units occupy the hills and valleys east of Springdale. They are derived from siliceous grey sandstone, and support jack pine, beech, and intolerant hardwood stands. Soils associated with reddish sandstone occur in the north and belong to the Stony Brook and Harcourt units.

The metasedimentary and volcanic rocks have produced shallow, less fertile soils of the Serpentine and Britt Brook units, and are concentrated in the vicinities of Hatfield Point and Upham.

Biota

Tolerant hardwood stands composed of beech, sugar maple, and yellow birch with minor white ash and ironwood occur on upper slopes and ridgetops covered by fertile soils (4,7, 8). On less fertile soils, beech, red maple, and aspen often predominate.

A typical hardwood community of this type covers the escarpment north of Waterford with a ridgetop sugar maple, ash and beech community grading downslope into red oak and ironwood. The base of the escarpment holds an unusual grove of pure ironwood growing on fine talus material.

Softwood forests tend to be associated with lower slopes and shallow soils on hillsides (2). They are composed of red spruce, balsam fir, and white spruce with occasional hemlock and white pine. A mixed forest of hemlock and red spruce with mature sugar maple and beech occurs along Parlee Brook, where one of the hemlock stands protects a population of large round-leaved orchid. Several stands of hemlock also sit atop Pisgah Mountain.

White pine, jack pine, and red pine often occur on sites with droughty coarse soil (1), suggesting that fire has had an historic impact upon the landscape. Cedar is found primarily on the wetter and more fertile soils (6).

Although bogs are uncommon due to the rugged relief and scarcity of broad plains, a few wetlands exist in the north where the land borders the flatter terrain of the Grand Lake and Castaway ecodistricts. Here, Marrtown and Millstream bogs form part of a larger marshy area south of Canaan River. A wetland near Waterford is home to the rare species northern adder's tongue.

Solution caves are rare in New Brunswick but occur in this ecodistrict. One such cave is 115 m long, 3 m wide, with a stream flowing through its entire length. It is a winter hibernation site of the rare eastern pipistrelle bat. Even short visits to see them can harm their chances of survival, and they should be left undisturbed.

The calcareous bedrock near Havelock has given rise to a rich hardwood community on Butternut Ridge. Once resplendent with butternut trees, the ridge now guards less than half a dozen trees of this species, the remainder having been felled with the spread of agriculture in the area. Furniture created with Kings County butternut, especially butternut from this ridge, was famous among provincial craftsmen and today is prized by antique dealers across the Maritimes.

The elevated terrain overlooking Kennebecasis River valley has been heavily logged and now is dominated by an intolerant hardwood forest of red maple, trembling aspen, large-toothed aspen, white birch and grey birch. These early successional stands have a beech component on ridgetops such as Mount Pisgah, suggesting that a beech-dominated climax community potentially could develop on the sandy, nutrient-poor soils.

Settlement and Land Use

Anagance Ecodistrict straddles traditional Maliseet and Mi'kmaq territories, and has had an aboriginal presence for at least



This red spruce mixedwood forest is near Parlee Brook.

the last 2500 years. Native villages were located just outside the ecodistrict along the shores of the Kennebecasis and Washademoak waterways. Early reports show that the aboriginals made extensive use of the salt springs in the Anagance area. They also traversed the interior for the purposes of hunting and overland travel.

The ecodistrict lay inland from the Kennebecasis River valley, which was one of the earliest sites in Canada populated by non-aboriginals. By the early 1800s, European and Loyalist inhabitants had expanded their settlements inland, lured by the relatively arable soil and inviting climate.

Logging began in the late 1700s and reached its pinnacle in the early 1800s, although timber volumes never approached anything like the tonnages removed from the Restigouche or Miramichi ecodistricts.

Many early villages were given names that revealed something of their local history and economy. Markhamville was named after Colonel Alfred Markham who operated manganese mine in the area. Salt was produced from salt springs near the villages of Salt Springs and Salina (salina is Latin for salty), and was used to flavour home-made butter.

The Penobsquis Sulphur Springs Company operated from the town of Springdale, presumably availing itself of a nearby sulphur

spring. East Scotch Settlement was established in 1823 by people from Perth, Scotland. Various religious leanings also are evident in locations such as Goshen (the biblical land of milk and honey), Mount Pisgah (a mountain visited by Moses) and Damascus (as in the road to...).

Prospectors in the 1800s uncovered many economic minerals in this region: salt, potash, copper, gold, gypsum, zinc, manganese, and bog manganese. Some finds were simply explored, whereas others were mined sporadically.

The more recent mining operations include a silica quarry and a potash mine, both near Cassidy Lake. Workers at the silica quarry excavate a quartz-rich, unconsolidated sand and gravel deposit, and process the silica locally. The potash mine was situated south of Cassidy Lake and produced ore between 1985 and its closure in 1997 due to severe underground flooding.

The limestone deposits surrounding Havelock have been quarried since at least the early 1800s. They currently support a major regional industry producing material for the aggregate, agricultural, and chemical markets.



Red oak and white pine are common species on ridges in the Anagance Ecodistrict.

5.12 Anagance Ecodistrict at a Glance

Ecoregion: Valley Lowlands

Area: 164, 814 ha

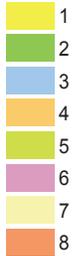
Average elevation above sea level: 124 m

Average May-September precipitation: 425–450 mm

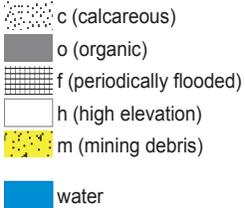
Average annual degree-days above 5°C: > 1700

Ecosite map legend

ecosite

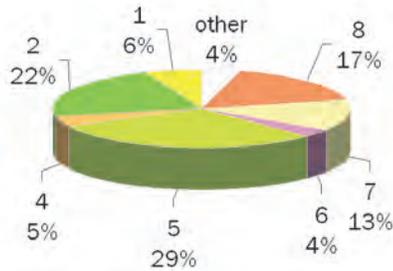


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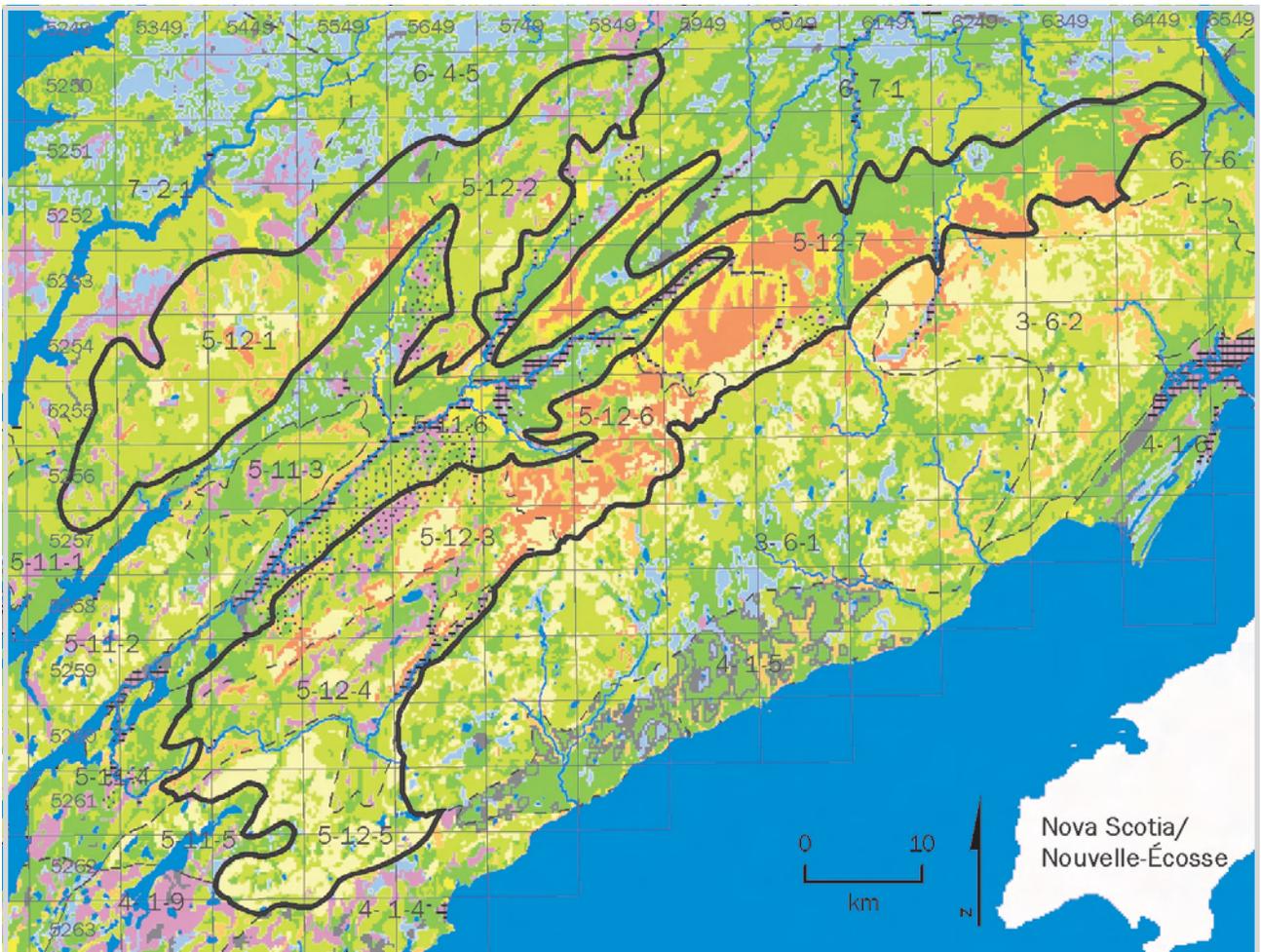
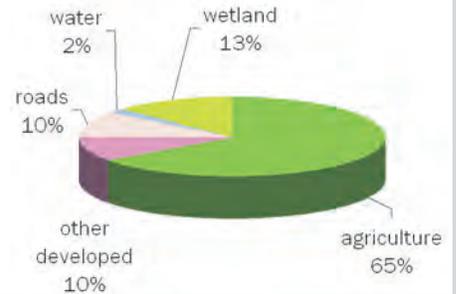
88% of Anagance Ecodistrict has forest cover

ecosite coverage of forest area

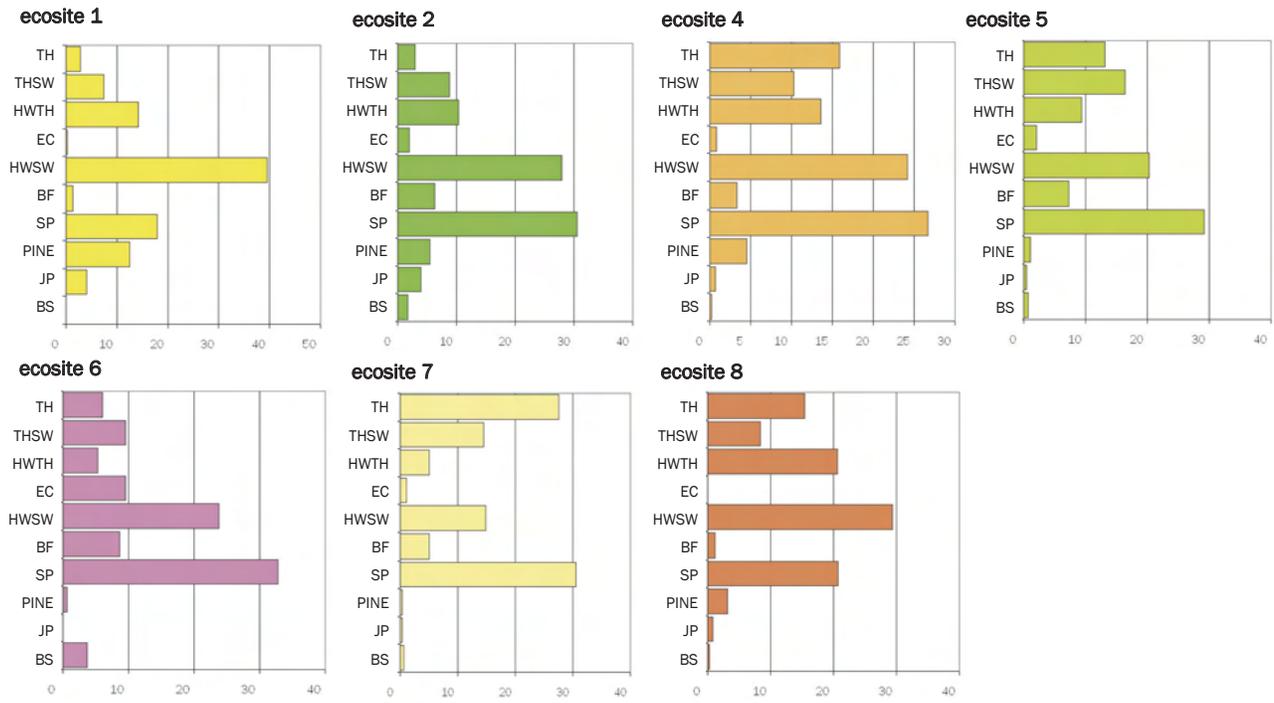


12% of Anagance Ecodistrict is not forested

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.

