Natural Environment

Background Report
Plan Review



reVISION Plan Review
Some Community Assembly Required

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Broadly, we can divide the world into two general environments: built and natural. The built environment is one that humans have created. The natural environment is one that exists on its own, without the help of humans. Of course, there is overlap between both. The built environment depends on resources found in the natural environment. The natural environment supports the built environment, but can also limit it. The two are constantly changing.

The Ecosystem

The term ecosystem describes the interaction between living things and the habitat they live in. An ecosystem can be tiny, huge or any size in between. An ecosystem includes the living things (humans, insects, mammals, reptiles, down to the tiniest organisms), the habitat (water and land features) and the processes that link them all together. Living things need the ecosystem to survive and the ecosystem is changed by living things. Ecosystems are always changing and evolving.

Living Things

The living things, or species, vary widely, from humans to microscopic organisms. Some living things have evolved and thrived in the same place: these are called native species. Native species live in balance with other native species and their environment. They do not harm their natural environment. The piping plover, for example, is native to Eastern Canada. Spruce, birch and maple are local native tree species. Non-native species are living things that have been either introduced to a new location, but still work well in their new environment. Invasive species are introduced to a location and displace native species. They are harmful to their new ecosystem. Dandelions, for example, are native to Europe and Asia, but were intentionally spread into the Americas. They have since spread because of their many fluffy seeds.

Extinction is when a species ceases to exist. Species at risk are the living things that are in danger of becoming extinct or disappearing. Most species at risk are being harmed by human activities that change or remove their habitat. It is important to recognize and protect these species. There is presently no way to re-introduce species that have gone extinct.

There are six species at risk in the Municipality. Two species are birds, the Piping Plover and the Roseate Tern. Both of these birds are endangered across Canada. The Wood Turtle is a reptile species at risk across Canada. Moose are endangered in mainland Nova Scotia and the Southern Flying Squirrel is at risk nationally. The Boreal Felt Lichen is endangered across Canada.

Habitats for all these species are found in a number of specific locations in the Municipality.

Biodiversity

Ecosystems with many kinds of living things have biodiversity. Biodiversity makes an ecosystem strong and resilient. When some species are struggling, other species may thrive; the whole ecosystem stays resilient to changes. In contrast, when one species dominates an area, it is more susceptible to dying at the first sign of harm, because each member of the species behaves the same way. If one member struggles, the whole species and whole ecosystem struggles. Farms that grow a lot of one crop (a monoculture) are more susceptible to diseases, for example. If the farm were biodiverse, more species would likely survive a particular disease. The whole ecosystem would not be completely wiped out by one disease.

Ecosystem Connectivity

Ecosystems are more vulnerable when they are isolated, or fragmented. Living things can move between well connected ecosystems or habitats. Species can move temporarily (migration) or

permanently. In connected ecosystems, species can move when they are under stress. If a drought strikes one part of a connected ecosystem, species can move elsewhere to find food and water. Species are very vulnerable if they live in small, separated fragments of habitat.

On a large scale, oceans separate ecosystems. Eastern Canada is a completely different ecosystem than Western Europe, with different species. On a smaller scale, rivers and mountains can separate habitat. Certain types of ecosystems block the movement of some species; two pieces of similar habitat may have a desert between them that most animals cannot cross.

Humans build many things that break up natural ecosystems. Roads, buildings, parking lots, dams, mines and clear-cutting all disturb and fragment natural ecosystems. They can physically block movement, or make it difficult for species to travel by removing shelter, water or feeding locations. A map in the appendixes show the level of habitat fragmentation within the Municipality.

Habitat

A habitat, broadly, is made up of land features and water features.

Land Features

Land features can include landforms such as valleys and mountains, forests and deserts. They also include underlying bedrock, surficial material, and soil. The general shape of a landscape is called topography. Landscapes are constantly changing and have been since the beginning of time. Major landscape changes occur at an incredibly slow rate, over thousands or millions of years. The large hills in the Maritimes were at one time towering mountains that have eroded over hundreds of millions of years. Smaller changes like a beach eroded by a hurricane, or a stream changing its course are more easily seen.

The deepest underground material that directly impacts humans is bedrock. Bedrock is enormous pieces of solid rock that form the outer layer of the Earth. Surficial material is loose, rough matter that sits on top of bedrock. Soil sits on top of surficial materials.

Most bedrock formed millions of years ago, although new rock is still being created naturally in certain places every day. Bedrock has been solidified, bent, pushed around, and compressed extremely slowly over time. Some bedrock is softer than others, and cracks and breaks more easily. Nova Scotia has a very complex make-up of bedrock. Lunenburg County alone has 9 different rock formations. A lot of the province is scattered with granites, sandstones, and slates. Granite is a very hard, solid bedrock that is very difficult to break into. Sandstones and slates however, are much weaker. Sandstones are made up of sand that have been pushed together with extreme force to form hard rock. They are easy to chip away because they are made of so many tiny individual particles. Water erodes sandstones very easily. Slates look more like a lot of very thin layers that chip away easily into sheets.

Some bedrock can be seen at the surface of the ground, which is called an outcrop. Nova Scotia has a lot of granite outcrops. In most cases surficial material and soil have been dumped over top of



Granite Outcropings are pieces of granite bedrock visible at the surface. (wikimedia.org)

bedrock. In Nova Scotia – which was largely shaped by glaciers – material was dragged overtop of the bedrock and left there when glaciers retreated. This surficial material is typically made of bigger particles than soils and sands. When glaciers scraped across the bedrock of Nova Scotia and surrounding provinces, they chipped away and picked up material from the bedrock and transported it to other places. This is why it is common to find surficial material made up of granites overtop of non-granite bedrock. Surficial material can be found from thin to thick layers on top of bedrock. A thick layer of surficial material with a large amount of organic matter creates a strong landscape for biodiversity and farming. Bedrock outcrops with little to no surficial material or soil are very harsh environments for vegetation, and only support very specific, resilient vegetation. Bedrock, surficial geology and soil maps are included in the apendixes.

Soil

Soil is the upper-most layer of earth, generally consisting of a mixture of organic matter, clay and rock particles. It is an incredibly powerful natural resource because it sustains plant life and growth. Soils can vary hugely based on its contents. It can have a high concentration of clay, where the particles are extremely tiny and easily saturated with water. Soil can also be more sandy and dry, with larger particles that allow water to pass through them more easily.

Organic matter is the residue of decayed plants and animals. Soils with lots of organic matter provide nutrients to support plant growth. Soils that have a lot of organic matter are very good at storing carbon dioxide (a greenhouse gas) and releasing it very slowly. This helps slow the negative effects of climate change.

Soils are porous, meaning that there is space between particles. Different types of soil have different sized spaces between the particles. Water is able to move through the pores in soils at a fairly slow speed. This movement filters pollutants out of the water.

Water Features

Water features include salt water, fresh water, and brackish water (a mix of salt and fresh water). It includes water that occurs on the surface and water that occurs below the surface, such as:

- Oceans
- Lakes
- Streams, rivers and brooks
- Ponds
- Wetlands
- Groundwater

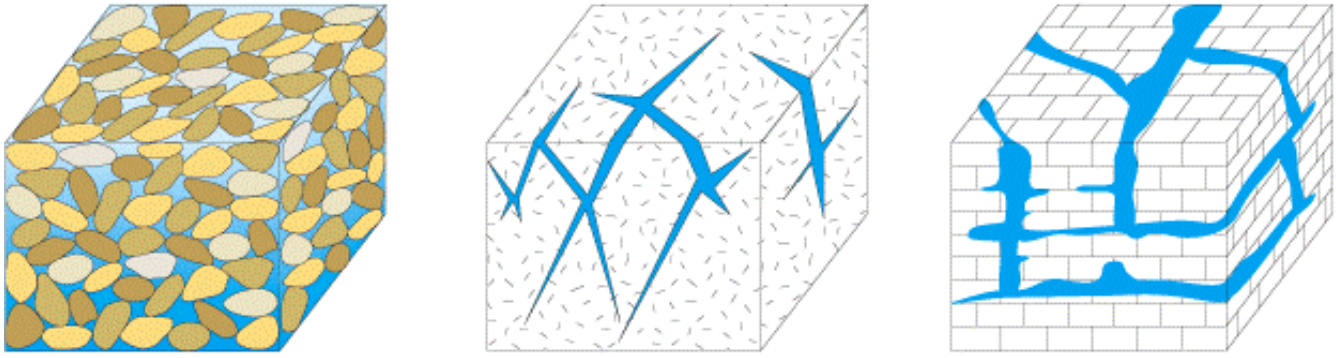
Because living things need water to survive, water is an essential part of every habitat on Earth. The Earth's water supply is roughly 97% salt water (found in the oceans), and only 3% fresh water (most of which is held in glaciers). Different water features offer different types of habitat for different types of species.

Fresh Water

Fresh water is naturally occurring water on the Earth's surface. It is found in lakes, rivers, streams, ponds, wetlands, groundwater, and ice. These features are not exclusive to fresh water – they can also occur with salt water. Fresh water is generally defined as having less than 1% salt concentration. Living things that need fresh water to survive would not be able to survive in salt water environments.

Ground Water

Groundwater is fresh water that exists and moves underground through cracks, pores, and holes in soil and rock. It is easy to forget about because it is not as visible as lakes and streams or surface water. Groundwater moves very slowly, and exists virtually everywhere underground. It



A. Well-sorted sand

B. Fractures in granite

C. Caverns in limestone

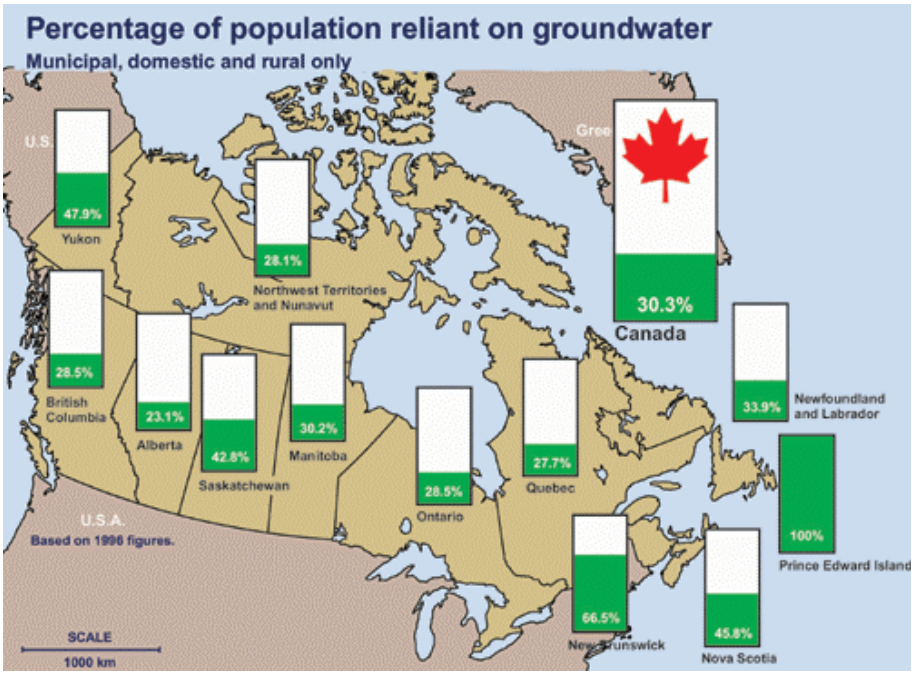
Modified from Heath (1998)

Above: Groundwater moving through different materials. **Bottom:** The percentage of residents relying on groundwater varies by province.

flows through different underground materials at different speeds. The speed depends on the type of rock, and the size of holes between rocks and soil particles. Groundwater moves quickest in loose soil and rocks with bigger cracks and space between them. Many parts of Nova Scotia have hard, solid granite rock (image B above); water can only pass through the cracks in these rocks. In contrast, places with a thick layer of surficial material and soil will have groundwater that moves more quickly through it before reaching the bedrock.

People access this water through wells and pipes. Groundwater is used across Canada for drinking water, farming and manufacturing. The Maritime Provinces in particular depend a lot on groundwater.

Groundwater takes time to replenish after it's been removed. It will recharge faster where the water can move quickly, like in looser soils. It is important for governments to know how long it takes different areas to recharge, so water can be properly regulated. They need to know how many people or wells are accessing the groundwater, how much groundwater is available, and how long it takes to replenish. The amount of water that can be used depends on these factors, but also varies depending on the seasons and the weather. During dry-spells, less groundwater can be drawn, because it is recharging slowly. Drawing too much water without letting it recharge is called overdrafting. This can cause long water shortages.



Groundwater is easily contaminated. Leftover material from mines, careless sewage disposal, leaking gasoline tanks,

pesticides and fertilizers, landfills and spills can all pollute groundwater. Because groundwater moves so slowly, it often takes a long time to detect the source of contamination.

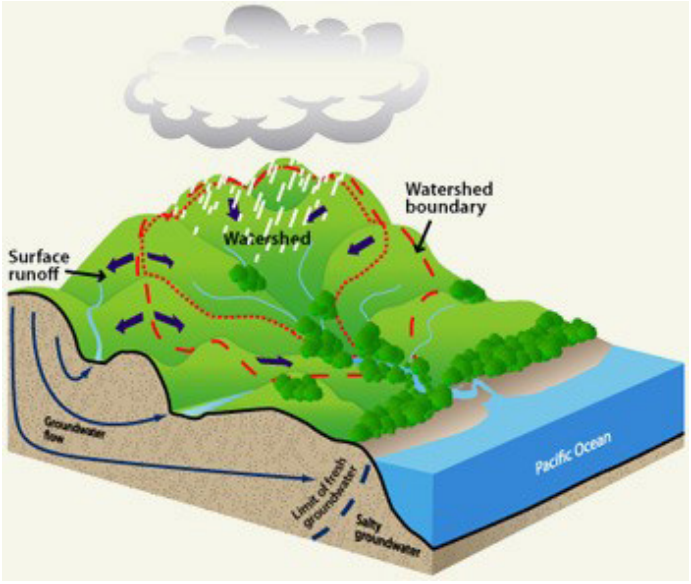
Locally, Nova Scotia's groundwater is sometimes contaminated from excessive highway salting. Arsenic, uranium, and lead are naturally-occurring elements that are found in groundwater. For these reasons, Nova Scotians are advised to regularly test their wells. Where people are settled along the coast, salt water can infiltrate into groundwater from the ocean. Salt water contamination can be avoided with proper well design and setbacks from the coast.

Watersheds

Watersheds are the areas, or basins, in which all surface water drains into one stream, river or river system, before eventually draining into the ocean. A watershed ends at a divide where water drains into a different stream or river. These divides are ridges or other high points.

Within the Municipality, most watersheds drain into Mahone Bay, including the Middle River, the East River, the Gold River and Martin's River watersheds. Tiny watersheds on the western side of the Aspotogan Peninsula drain into Mahone Bay, while watersheds on the eastern side of the Peninsula drain into St. Margaret's Bay. The Lahave River watershed begins near Forties and Fragville, and leaves the Municipality before draining into the Atlantic Ocean. Similarly, areas around Card Lake drain into the Avon River, which empties into the Minas Basin, outside the Municipality.

Scientists at Dalhousie University and the Nova Scotia Government have created a watershed assessment program. The program reviewed water quality threats in all Nova Scotia watersheds. Some threats to water quality are natural, such as acidic runoff from rock formations. Most threats are from human activity, such as damming rivers, filling wetlands or building roads and houses. These activities can change how water flows and increase the risk of erosion.



Wetlands are basins where all water drains into one river or river system before draining into the ocean.

Most watersheds in the Municipality have moderate threats to water quality. One exception is the Gold River, which has low threats to water quality. Other exceptions are the small streams along the coast that drain directly into the Atlantic; water quality in these small watersheds is highly threatened.

Areas with high threats include the Aspotogan Peninsula and coastal areas near Chester, Chester Basin and Western Shore. Threats to water quality include acid rock drainage and soil erosion. Soil erosion is a threat because of the type of soil and the amount of development. In general, more roads, buildings and hard surfaces increase stormwater runoff. More stormwater runoff increases erosion.

Wetlands

Wetlands are important habitats that serve a variety of species. The groundwater level in wetlands is near or above the land's surface. Wetlands, such as marshes or swamps, are regularly or permanently saturated with water. They can have fresh water, salt water, or a mix of both (called brackish). The

water-tolerant plants in wetlands filter pollutants from the water, drastically improving water quality. Wetlands also slow the speed of water running through them. This means that they help control flooding, protecting downstream habitats and infrastructure. Their mix of water, vegetation and land make for biodiverse habitats that are critical for rare and endangered species. Wetlands are also efficient at removing carbon from the air, storing it, and releasing it very slowly back into the atmosphere. This process slows down the effects of climate change. Wetlands and watercourse maps are provided in the appendices.

The Coast

The coast is arguably the most dynamic landscape on Earth. It is where land meets the ocean, and where fresh water meets salt water. It is where countless habitats overlap with one another. It is always changing.

The Intertidal Zone

The most versatile part of the coast is the intertidal zone, the space between high tide and low tide. It can be an array of different habitats and landscapes, from rocky cliffs, to beaches to salt marshes. It can be an extremely biodiverse area, home to all types of animals and plants. It overlaps with marine ecosystems (deep water ecosystems) and terrestrial ecosystems (ecosystems bound to land). This dynamic zone is shaped largely by wind currents and wave action. Human activities on the coast can have significant, negative impacts on the inter-tidal zone.

Species found throughout the intertidal zone are very adaptive to changing conditions. On a daily basis, water comes up and goes down and weather changes quickly. Several salt marshes are found in the Municipality. These parts of the intertidal zone provide habitat to many species.

Because the intertidal zone is constantly changing, it is extremely hard to regulate. To date, it has been very poorly regulated. For example, it is hard to say if setbacks should be measured from the low tide mark or the high tide mark (or maybe a different mark). The fact that low and high tide marks change every day adds to the complication. Without standard regulations, comparable coastal properties will likely be regulated differently in different municipalities.

Erosion is common in the intertidal zone, where wind and water chip away the shoreline. A property might lose centimeters or meters of land each year to the ocean. This problem will likely increase with sea level rise.

Ecological Land Classification

Ecosystems can be classified by their natural features. The features that define each ecosystem are geology, landforms, climate, soil, water features, plants species and animal species. A broad look at our ecosystem shows that our location near the Atlantic Ocean creates our unique climate. The Maritime Provinces, parts of Quebec and parts of New England are all part of the Atlantic Maritime EcoZone. This area has cooler summers and warmer winters than other parts of Canada. There is high precipitation and many storms. The land is heavily forested, usually with a mix of hardwoods and softwoods.

Within the broad ecosystem of the Maritimes, areas closer to the ocean have warmer winters and milder summers than inland areas. Lowland areas tend to have warmer temperatures and better soil than the highlands. For these reasons, most people in the Maritimes live in lowland areas near the Coast. Most farming happens in lowland areas with better soil and warmer temperatures.

Ecodistricts

There are four smaller ecosystems, called ecodistricts, that make up the Municipality. The lands closest to the Atlantic Coast are part of

the **South Shore** ecodistrict. These lands on the Aspotogan Peninsula are less than 10 km from the coastline. The coastline in this area is rugged with many inlets, bays and islands that are mostly unsheltered from Atlantic storms. Some sheltered islands and coastline on Mahone Bay are outside this ecodistrict. The climate is very moist. The bedrock is mostly hard greywacke and granite. Soils are thin and drain poorly. The combination of thin soils and storms makes it hard for many tree species to grow. Stunted spruce is common, especially on exposed coastal headlands. In more sheltered areas trees like balsam fir will grow, but the thin soil still limits the types of trees.

The **Lahave Drumlins** ecodistrict runs from near Card Lake to Kejimikujik National Park. Drumlins (low, tear-drop shaped hills formed by glaciers) are the major land form. The eco-region has earlier springs and milder winters than many areas of the province. Well drained, deep soils on the drumlins are often farmed. Soils between the drumlins tend to be shallower and sandy. Most forests are evergreen, but the deeper soils on the drumlins support hardwoods like maple, oak and beech. These tree species can also be found in the valleys near major rivers like the Lahave and Martins. Balsam fir is a native tree species that has become the main tree farmed for Christmas Trees.

The **South Mountain** ecodistrict is large. In general, the ecodistrict is a long, low ridge of gentle hills running east to west from Yarmouth County to Windsor. The landforms and granite bedrock are similar across the whole region. The climate is similar to the Lahave Drumlin ecodistrict, but the South Mountain receives more snow due to its higher elevation. There are some drumlins, but not enough to define the district. Soils are shallow, stony and dry. Many areas have bedrock outcrops or large granite boulders. Warm, dry summers are common, leading to dry forests and soils. Fire plays an important role in shaping forests. White and red pine are common and will reforest burnt areas, along with black spruce. Hardwood trees are found in mature, unburnt stands on the slopes of hills. Sugar maple, beech, birch and oak are the most common hardwoods.

The **St. Margaret's Bay** ecodistrict is composed of low, round hills that slope down towards St. Margaret's Bay and Mahone Bay. Some sheltered areas of coastline in Mahone Bay are part of this ecoregion. Along the coastline, salt marshes and coastal beaches are important features. The climate is moist, but not as moist as the South Shore ecodistrict. Soils are well drained and thin, but not as thin as in the South Shore ecodistrict. Wetlands are common, and the Gold and Middle Rivers drain a lot of the area. Evergreen forests are common, with a mix of spruce, hemlock, and pine. There are some hardwood stands and mixed forests on deeper soils. This whole ecosystem was once heavily forested. Centuries of human activity have fragmented forests and left few old growth stands.

Natural Processes

Living things and their habitats are linked together by many natural processes. The natural environment is constantly changing, both in small ways and in major ways. It would change on its own without the presence of humans; however, humans have dramatically increased the rate of change and the scale of change. Every part of our environment is interconnected. One small change can have a completely unexpected impact in a different area.

The Water Cycle

The hydrologic cycle, also known as the water cycle, is the way that water transforms and circulates around the Earth. Water circulates in different forms between the land and the sky. Water is always moving and changing forms.

First, water falls from the sky in the form of precipitation (rain, snow or sleet) on either land or

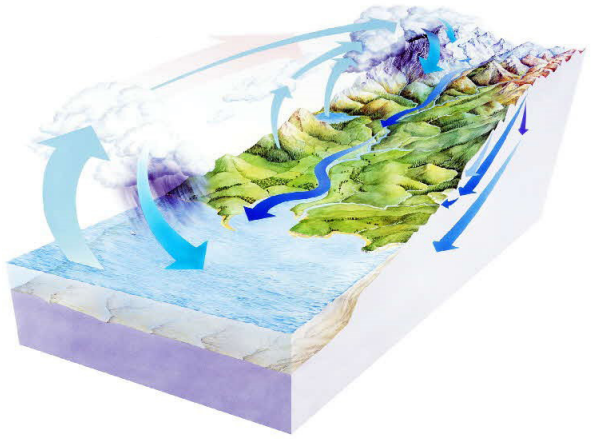
ocean. Water that falls onto land is either consumed by plants, filters into the ground or flows into lakes, rivers and streams. The force of gravity pull water towards the ocean. The land's topography channels and directs the water.

Some water evaporates into the air. Clouds store water in the form of ice crystals and water droplets. The rest of the water in the atmosphere is in the form of water vapour. Clouds and vapour move through the sky, typically from above the oceans to above the land. Vapour then condenses and forms tiny droplets in the clouds. When clouds meet cool air, they release the water droplets, which fall towards land or sea. The process beings over again.

Human activities can change the natural water cycle. In a natural environment, rain falls onto trees and other plants, which slows runoff. Some water is stored in ponds or slowly seeps through soil to become groundwater. Compare this to a parking lot where water is pushed over top of the asphalt and is unable to go through it. This is an impermeable surface: water is unable to penetrate the surface and is diverted around it. Any water that hits asphalt, concrete or roofs needs to go somewhere. It either flows into storm sewers, or flows over the hard surface until it reaches soil or another permeable surface. Impermeable surfaces can increase the amount of stormwater runoff, which carries dirt and other pollutants into water bodies and erodes stream and river banks.

Disturbance and Succession

Living things and their habitats are constantly changing. The way that environments generate and establish living things is called succession. Landscapes that have been completely barren, like newly exposed rock, sand dunes, or lava flows, can in time foster life. The first species are microscopic. As they grow, reproduce and die they create nutrients that support further species. Under the right circumstances, simple, hardy plants like moss



Water moves constantly within the water cycle.

and lichens will establish themselves. Once the very first living things, the "pioneer species", are established the landscape begins to slowly change. Erosion produces more sand and small rocks, which form the basis of soil. The remains of dead plants provide organic matter to enrich the soil. This process helps give other plants like grasses and small shrubs a foothold in the environment. More plant species means more insects and other small animals can live in the environment. Biodiversity continues to grow as new species colonize the ecosystem.

After thousands and thousands of years, the ecosystem may reach the stage of a "climax community" that is complex and appears stable. Old growth Acadian Forests in Nova Scotia are an example of a climax community. This particular type of succession, where nature creates something from nothing, is called primary succession.

Secondary succession is more common. This happens when a landscape has been disturbed, triggering a new growth cycle. Natural disturbance happens every day at different scales:

- Wildfires
- Hurricanes
- Flooding
- Drought

- Landslides
- Erosion

Human activity often disturbs natural environments, either directly or indirectly:

- Clear-cutting forests
- Manmade wildfires for fire prevention
- Overgrazing
- Logging
- Introduction of non-native species
- Elimination of species
- Climate change
- Development and construction
- Mining

All of these events can cause major changes to landscapes and habitats. Many living things die, and many habitats are completely destroyed or permanently changed. However, natural disturbances have been happening since the beginning of time. Some living things only thrive in disaster-stricken areas. Jack pines, for example, grow best in landscapes that have been subject to fires. Some landscapes take a few years to regenerate, while others may take thousands of years. Because living things and habitats existed before disturbances, regeneration happens more quickly than primary succession. The soils already have a base of organic matter, which helps new plant growth. As more plants grow, more animals are drawn to the regenerated environment. The landscape will reach a "climax community" faster than during primary succession.

Erosion

Erosion is wind or water action removing soil and rock from landforms, then transporting and depositing it in a new location. In Nova Scotia, coastal erosion from waves and strong winds is clear to see. The shape of the province is also caused by erosion. The Atlantic shore is very jagged with many coves and islands; much of it has been worn away. The Fundy shore is smoother. This is partially caused by the type of rock holding stretches of shoreline together. The pattern is also caused by the heavy waves pounding the unprotected Atlantic coast. The shores along the Bay of Fundy are better protected from severe erosion.

River and stream banks also erode. River banks are supported by grasses and trees, which help hold together the soil. Removing trees and plants near streams can increase erosion by making banks less stable. Human development can also increase stormwater runoff, which causes flooding and erosion. Erosion deposits sediment into waterways. Streams and rivers flowing through the heavily settled parts of the Municipality are at a high risk of erosion and sedimentation.

Climate Change

Climate change is the gradual warming of the Earth. The warming is caused by human activities that have added more carbon dioxide to the atmosphere than natural systems can absorb. The extra carbon dioxide traps heat in the atmosphere.

Scientists predict that as the earth warms, weather patterns will change. Polar ice caps are melting, causing sea levels to rise. Weather will be warmer but also more extreme. Heat waves may become longer and hotter. Rainfall patterns may change dramtically.

There are two main ways to deal with climate change. Mitigation means reducing carbon dioxide emissions to slow climate change. Driving less is an example of mitigation. Adaptation means changing in order to deal with negative impacts of climate change. Building better storm sewers to prevent flooding is an example of adaptation.

The Municipal Climate Change Action Plan (MCCAP) identified thirteen hazards. The largest

hazards are sea level rise and storm surge, which will affect coastal areas. Other hazards affecting the whole Municipality include:

- More inland flooding
- More hurricanes and extreme weather
- More heatwaves and droughts
- Different animal and plant diseases
- Changes to forest cover

These hazards could damage private and public infrastructure, such as wharves, roads and homes. Warmer ocean water could harm inshore fisheries and fish farms. Drought could hurt farmers and reduce water supplies. Understanding and preparing for these major risks is an important part of creating a new Municipal Plan.

Sea Level Rise

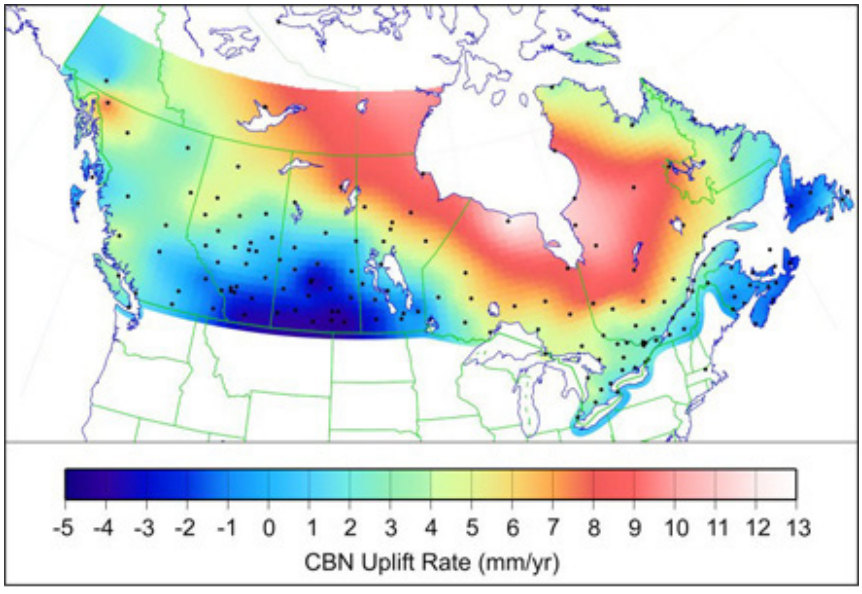
Our province has over 13 000 km of coast line, making it obvious to Nova Scotians that the sea level changes. It changes every day with the tides. What is less obvious is that the average sea level is slowly changing. For most coastal regions, sea level is rising and causing dangerous and damaging effects.

In Nova Scotia, the sea level is rising as a result of three processes: land subsidence, melting of nonpolar glaciers, and thermal expansion. Land subsidence means that the Earth's crust – the physical province of Nova Scotia – is sinking. A massive glacier retreated off of the Hudson's Bay area thousands of years ago. The Earth's crust at the center of Hudson's Bay is still lifting up after being relieved of the pressure. In turn, other areas of Canada are slowly sinking as the Earth's crust attempts to balance the massive forces caused by the Hudson's Bay uplift. Nova Scotia is currently sinking at about 2-3 millimeters per year.

In addition to land subsidence, massive glaciers like the ones in Greenland, are melting due to global warming. This melting adds water to the oceans, causing the sea level to rise.

Finally, thermal expansion happens when water molecules heat up and move a little quicker than normal. Molecules bounce off each other and take up more space. Although the process happens at a very tiny scale, it causes water to expand. Global air temperatures and ocean temperatures are increasing. As the world's oceans heat up, water expands, contributing to sea level rise.

These three effects combined are causing the average sea level to rise along the coast of Nova Scotia. The effect will be most notable in low-lying, coastal areas built up with houses and infrastructure. In Lunenburg County, the total sea level is expected to gradually rise between 1.5m and 2m by the year 2100. The Municipality has done preliminary mapping to show what land is lower than 2m. These maps are included as an appendix to this report.



Nova Scotia is sinking at a rate of between 2 and 3 millimetres per year.

Storm Surge

Storm surges increase the threat from sea level rise. Storm surges are extreme storms that raise or lower sea level to abnormal heights. They can last anywhere between a few hours to several days. In the worst case, a major storm surge would occur at high tide. Wind, waves and low air pressure force water up and over land, flooding low lying area. Storm surges will have even greater impacts in the future when the normal sea level will already be higher.

There are different ways of classifying a storm surge. They are typically classified by how likely they are to happen. Mild storms are more likely to happen than intense storms. A 2-year storm is one that is likely to occur once every 2 years. A 500-year storm is one that is likely to occur once every 500 years. A 500-year storm is both rare and very intense. Nova Scotia experiences nor'easters at about the same rate and intensity as a 2-year storm surge. Hurricane Juan represents Nova Scotia's 100-year storm surge.

Storm surges are happening more frequently than they used to. What was once the 100-year storm is now the 50-year storm. Each time a major storm hits, we risk losing land, houses, livelihoods, unique ecosystems, infrastructure and critical services. The Climate Change Action Plan was based on the assumption of potential storm surges up to 5 metres by 2100.

Conclusions

It is tough to understand the complex habitats and processes that make up the natural environment. The natural environment impacts human activities and human activities impact the environment. To help understand these interactions, Dalhousie University students identified environmentally sensitive areas across the Municipality. Municipal staff helped the students decide what environmental features should have the most priority, including:

- Water resources
- Rare ecosystems or natural features
- Connected habitat

The student project identified how sensitive different natural landscapes are to threats. These threats include climate change and human activities. The assessment gave priority to natural features that were important to humans, particularly water quality and flood control.

In general, this assessment found the most sensitive areas to be in the centre of the Municipality. Heavily settled areas near the coastline had less environmental value, because natural areas had been fragmented or built over. Environmentally friendly approaches can still be used in built up areas to protect water quality, limit erosion and prepare for sea level rise.

A series of maps from the students report is available in the appendixes of this report, showing:

- Watercourses and wetlands
- Habitat fragmentation
- Overall environmental sensitity

Sensitive environmental areas are an important resource. How to value and steward these areas for many users will be important to consider during the Plan Review.