T12.5 CLIMATE AND RESOURCES

The climatic regions of the province (see Figure T5.2.1) play a role in determining Nova Scotia's resource base for agriculture, fishing, forestry, recreation and tourism. Climate affects the growth, composition and distribution of biotic communities (see T10.3), surface water and the water budget (see T8.1) and the development of soils (see T9.1, T9.3). In addition, there is a relationship between climate and the ocean.

Our settlement trends, the types of activities we choose and the technology used to accomplish them relate to climate and the availability of resources. Technologies such as solar and wind power recognize the potential of climate as a resource.

The climate of an area changes naturally in short-term fluctuations and over extended periods of time. These changes can be measured by the variations from average conditions. Recently, documented changes in global climatic trends have caused concern that some human activities may be rapidly modifying the composition of the earth's atmosphere and changing global, and possibly local, climate. In order to determine the extent of possible impacts of modern climatic trends, scientists are studying the correlation between post-glacial climatic change (see T4.1) and current global climatic changes.[1]

This Topic begins with consideration of the effects of climate on agriculture, as an example of the connection between climatic variables and industry. The second section outlines technologies related to climate. The Topic concludes with a discussion of issues related to global climate change.

CLIMATE AND AGRICULTURE

Both day-to-day weather and the long-term climate in general have a significant effect on the agriculture industry in the province. Farmers face many problems: crops limited by insufficient heat; a short frost-free season; sparse snow cover and extreme minimum winter temperatures; dry spells in mid-summer and prolonged rainy periods in the spring and fall; and periodic lack of sunshine.

Temperature affects plant processes mainly by controlling the rate of development. The concept of growing degree-days or heat units assumes that plant growth is directly related to the average temperature. There are certain minimum temperatures below which plants do not develop. For perennial crops, a threshold temperature of 5°C is most valid, while for tender, heat-loving plants, such as beans and corn, a base temperature of 10°C is more appropriate. Thus, growth and reproduction of any plant is proportional to temperatures above the base temperature. When temperatures are low, development is slow. This is a major factor determining which crops can grow in Nova Scotia and also how quickly a specific crop will develop.

The lack of heat units is further complicated by a relatively short frost-free season. Many crops are extremely sensitive to temperatures below 0°C and thus require seeding–through–harvest to take place between the last spring frost and the first fall frost. As a result, the heat units to develop the crop to maturity must be sufficient during this frost-free period to ensure an acceptable yield.

The coastal effect on Nova Scotia's weather results in an excess of 1300 mm of precipitation per year, of which over three-fourths is rain, in many locations in the province. Snow tends to act as a buffer and to insulate crops and their root systems; however, with too much rain and not enough snow, many perennial fruit crops are left exposed to extremely cold minimum temperatures throughout the winter months. This results in permanent injury to the plants and, in recent years, has had a significant effect on blueberries, strawberries, apples and grapes, as well as on some forage species.

Although not commonly recognized, frequent dry spells can occur throughout the summer, placing many crops under water stress. To alleviate this, farmers are turning to irrigation as a valuable management tool to guarantee optimum yields.

Wet spells, mainly during the spring and fall months, are common in Nova Scotia. Although timely rain is quite beneficial, too much early rain can delay many seeding and other field-related operations, while, on the other hand, too much rain in the fall can delay the harvest.

As in other temperate regions, variability of the weather in Nova Scotia can also affect the operations of other resource-based industries. Forestry, fishing, tourism and engineering activities tend to be seasonal but may be interrupted by exceptional conditions or "unseasonable weather". For example, skiing and other winter sports in lowland and coastal areas may be restricted owing to lack of snow. Outdoor activities in summer, such as festivals and general beach recreation, may be limited by cold or wet weather. Organizers can use historic weather data to predict the most suitable date for their event, but this is not always reliable.

SOLAR AND WIND ENERGY

As well as influencing the resources in Nova Scotia, our climate is, in itself, a resource. Sun and wind are both potential energy sources, and various technologies have been developed to exploit them. There is little scientific documentation on the possible effects these technologies may have on the landscape; however, certain natural requirements are necessary to make them efficient.

Solar Energy

Solar energy is most appropriately used in heating buildings and water. Nova Scotia's relatively temperate climate and availability of winter sun make the province one of the best areas in Canada for taking advantage of solar energy. Although there is considerable variability in the amount of available sunlight in different parts of the province, Halifax solar data can be used as an example of just how much solar energy is available in Nova Scotia. Halifax has 1900 hours of bright sunlight per year, slightly over five hours a day, and its average intensity on the sloped roof of a typical Nova Scotia house is 2803 kilowatt hours per square metre per year. The sunlight on 8 m^2 is enough to provide all the space heating for such a house.[2] It is also worth noting that sunlight does not have to be bright in order for it to be useful. Diffuse sunlight provides forty per cent of all solar gain to a south-facing sloped window in Nova Scotia.[2] Microclimate conditions are more important to effective solar energy use than regional differences.

Integration of solar technology into the design of commercial, industrial and institutional buildings can also reduce traditional energy costs. A key solar element in such buildings is the use of natural lighting, because lighting costs are often the largest single energy cost in many large buildings.

One solar technology that is just beginning to become cost-effective is photovoltaics (PV), which uses photo cells to produce electricity directly from sunlight. To date, PV has had mainly niche uses, such as for remote telecommunication relays, marine beacons (the Canadian Coast Guard is a major user of PV) and remote cottages. However, rapid technological development is bringing PV costs down; so much that in some areas in the world, large-scale PV generation facilities feed competitively priced electricity directly into regional electrical grids. This use of solar energy will probably grow substantially in the next few years. Solar energy thus may become a major energy source in Nova Scotia.

Historically, little conscious use has been made of solar energy in Nova Scotia, with the exception of traditional building elements, such as greenhouses, sun porches, solariums and south-facing windows. However, spurred by the oil crisis in the 1970s, there was considerable experimentation with the use of solar energy, primarily for space heating and mainly in single-family dwellings, but also in a few agricultural applications, such as heating barns and drying crops. Government support in the 1970s and early 1980s encouraged considerable growth in solar technology; in the 1990s, environmental concerns have been responsible for a rekindling of interest.

Wind Energy

Windmills were used in Nova Scotia in the 1800s for pumping water and for powering sawmills. They were usually squat, wooden structures resembling the classic Dutch windmill.[3] Today, a number of modern designs of wind turbines are available for generating electricity from the wind. A wind-power generator must have a battery system to take over during extended periods of light or calm winds.

The landscapes best suited for generating wind energy are flat and treeless; each tower requires 1–1.2 ha. Higher areas where the wind funnels through mountain passes are also appropriate. The optimal wind conditions are steady, constant streams averaging 21 km per hour. In winter, the increased demand for heating in Nova Scotia coincides with increased wind; however, freezing rain can be a problem.

The height of the towers and lines can be a hazard to migrating birds. Flyways are generally 90–105 m high, and, although height of towers is site specific, they can be as short as 30 m high, and the power lines can be buried.

Test sites in Wreck Cove in Cape Breton (sub-Unit 552c) and Minudie Marsh in Cumberland County (Unit 532) are determining profiles on wind speed, roughness, direction, temperatures and gust conditions.

GLOBAL CLIMATIC CHANGES

Some of the results of climatic change appear beneficial at first glance. Many people would welcome less-severe winters with the resultant reduced fuel bills. Less frost would mean a longer growing season. However, there will be effects on ecosystems that are not necessarily positive. In some cases, species cannot evolve fast enough. Nova Scotia's geographic orientation as a peninsula increases the potential for species' isolation or extinction. The typical boreal habitats and their species of much of the province would eventually be replaced by temperate habitats and their species.[4] Pests and diseases that cannot survive our current climate could in future present problems to agriculture and forestry sectors. Although the nature and extent of impacts on the biosphere that result from human activity altering the composition of the atmosphere cannot be predicted with a high degree of confidence, people must be aware that changes will occur. Climatic changes are also causing concern within the fishing[5] and forestry industries,[6] as well as having potential effects on freshwater resources.[7]

Global Warming

Global warming is considered to be a result of an imbalance in the natural carbon cycle caused by the burning of fossil fuels, deforestation, agricultural practices and industrial activities. These contribute to an increase in levels of carbon dioxide, methane and nitrous oxide. These compounds have existed in the atmosphere for millions of years and have helped to maintain the temperature of the earth at a level that permits life as we know it, by means of a phenomenon called the greenhouse effect. Outgoing infrared radiation from the earth's surface is partly absorbed by these greenhouse gases and reradiated back down towards the surface. The greenhouse gases are starting to accumulate at such a rate that scientists are predicting changes in the earth's climates.

To try to forecast the nature and magnitude of climate change, scientists have used very powerful computers to simulate future climates, using what are referred to as general-circulation models. The results indicate that, for a doubling of the carbon dioxide in the atmosphere, the average temperature of the earth will increase in the order of 3.5°C, with increases being lowest near the equator and highest at high latitudes. To date, these models cannot predict accurately changes in climate on the scale of counties or even provinces the size of Nova Scotia, but the results are still useful.

Increasing temperatures are expected to cause the top layer of the oceans to expand, resulting in higher sea levels, threatening coastal wetlands and estuaries with inundation. Increased melt of the Greenland glaciers could decrease the temperature of the Labrador Current, causing local cooling along portions of the east coast of Canada, rather than the warming predicted for further inland.

Air Quality

The most common air pollutants are sulphur dioxide, nitrogen dioxide, carbon monoxide, suspended particulate matter, ozone and total reduced sulphur. At certain concentrations in the air, each can have an effect by itself, or they may contribute to other air-quality problems. Routine monitoring of air quality is done for one or more of these pollutants, depending on location; therefore, a little more is known about them than about other classes of pollutants. There are six additional families of toxic air pollutants: polycyclic aromatic hydrocarbons, volatile organic compounds, dioxins and furans, metals, polychlorinated biphenyls and pesticides. Even though standards exist for a few toxic air pollutants, very little is known about their sources, concentrations and effects.

Acid Precipitation

Emissions of sulphur dioxide, and to a lesser extent nitrogen oxides, cause acid precipitation, the first widely recognized air-pollution problem that can be caused by distant sources. In fact, most of the acid precipitation that occurs in Nova Scotia is caused by sources in the Ohio River valley, Ontario, Quebec and the eastern United States. Emissions from local sources have some impact on the province but may also contribute to an acid-precipitation problem in sensitive areas downwind of Nova Scotia, for example, Newfoundland. As a result of agreements between the federal government and the provinces and between Canada and the United States, reductions in emissions have already occurred and will continue to occur. The most sensitive areas of Nova Scotia, however, may not show much improvement (see T7.2).

Ground-level Ozone

Formed by chemical reactions between volatile organic compounds and nitrogen oxides in the presence of sunlight, ground-level ozone is also referred to as urban smog. It can cause serious respiratory problems, affect plant growth and deteriorate artificial materials such as rubber. Ground-level ozone usually originates in urban areas, but in Nova Scotia, ozone is largely imported from other regions, as shown by the relatively high levels measured at Kejimkujik National Park (Region 400).[8]

Ozone-layer Depletion

In the stratosphere, a layer 50 km above the earth's surface, ozone is also found in very low concentrations. If all this ozone could be confined to a layer at the surface of the earth, it would be only 3 mm thick. This small amount of ozone is beneficial rather than harmful, because it filters out much of the damaging ultraviolet radiation from the sun. The emission of chlorofluorocarbons (CFCs) and, to a lesser extent, other compounds is causing depletion of this ozone layer, reducing its ability to shield us from harmful ultraviolet radiation. CFCs, which are artificial products used in fire extinguishers, refrigeration and air-conditioning units, foam products and as solvents in the electronics industry, are gradually being eliminated. Although there is no evidence that the depletion of stratospheric ozone has had measurable effects on ecosystems, the possibility of damage increases with ozone losses.[9] By the end of 1995, legislation will prevent the manufacturing, importation and use of CFCs in many nations of the world.

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Associated Topics

T4.1 Post-glacial Climatic Change, T5.1 The Dynamics of Nova Scotia's Climate, T5.2 Nova Scotia's Climate, T8.1 Freshwater Hydrology, T9.1 Soil-forming Factors, T9.3 Biological Environment, T10.3 Vegetation and the Environment

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