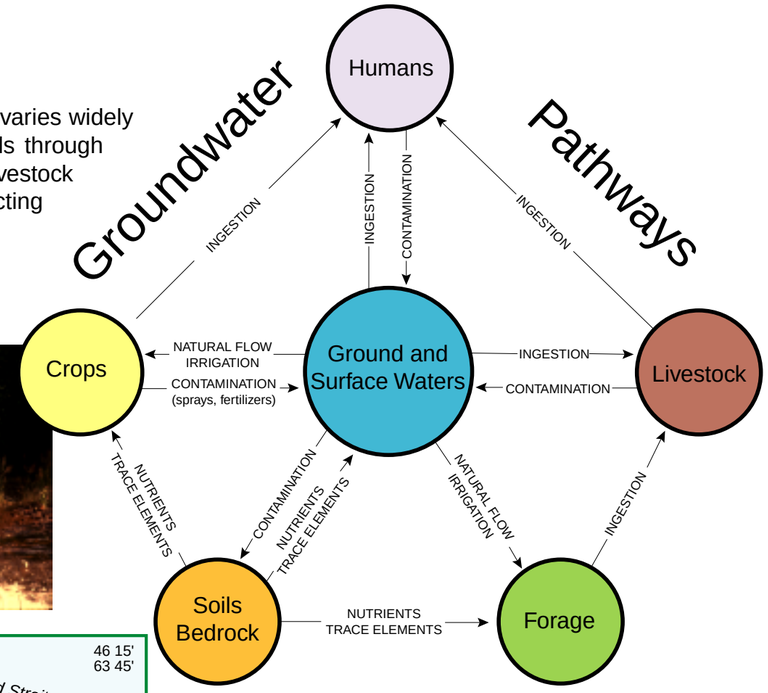
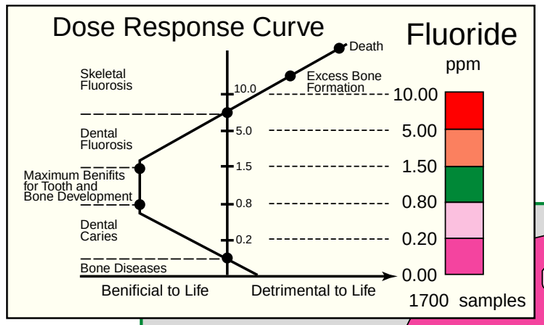
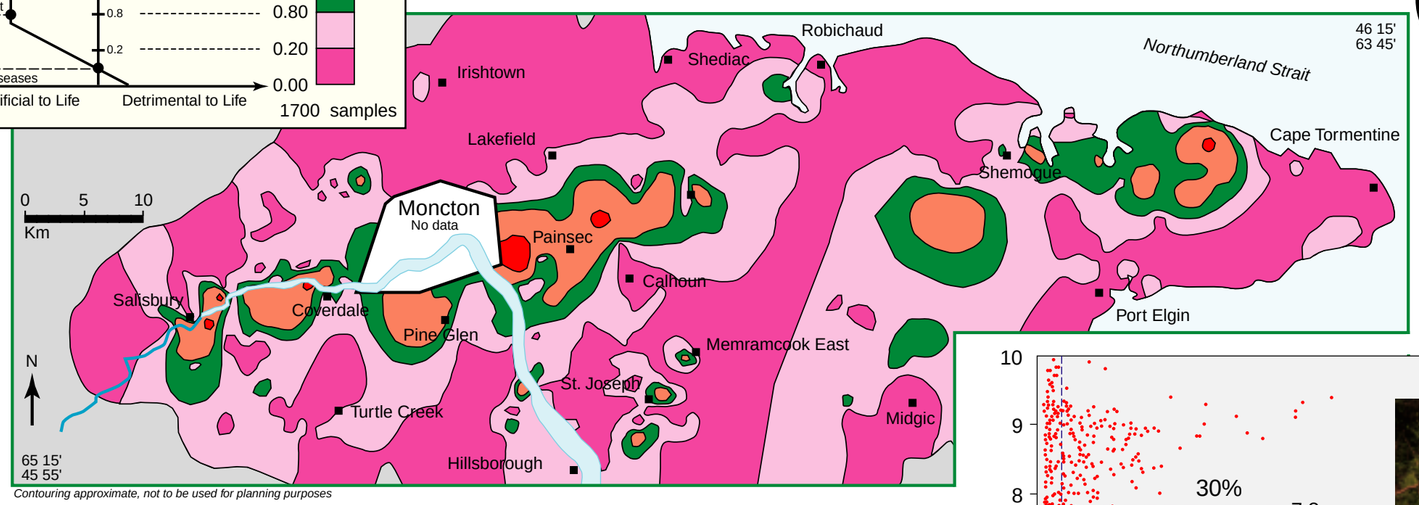
# GROUNDWATER GEOCHEMISTRY AND ENVIRONMENTAL ISSUES

As our country grows, so too does the importance of groundwater to home and industry. The chemistry of groundwater varies widely throughout Canada, reflecting the diverse geological and geochemical properties of the bedrock and surficial materials through which groundwater flows. As displayed on the groundwater pathways diagram, humans rely on water for crop and livestock production as well as a source of drinking water. In this context it is important to understand the geological factors affecting groundwater resources that are tapped in wells and springs.




In the Maritimes, the effects of geology on groundwater composition and its importance to health and land use, can be illustrated by variable levels of fluoride. More than half a million people in the provinces of Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, and eastern Quebec (Gaspé), depend upon groundwater derived from the Maritime Carboniferous Sedimentary Basin. Because the bedrock topography of this basin is subdued and poorly drained, surface waters tend to have naturally high concentrations of humic acids from wetlands and vegetation and are commonly adversely affected by commercial forestry and agricultural practices. The response is that levels of fluoride vary greatly throughout this region (see map), subsequently affecting the health of the local population.



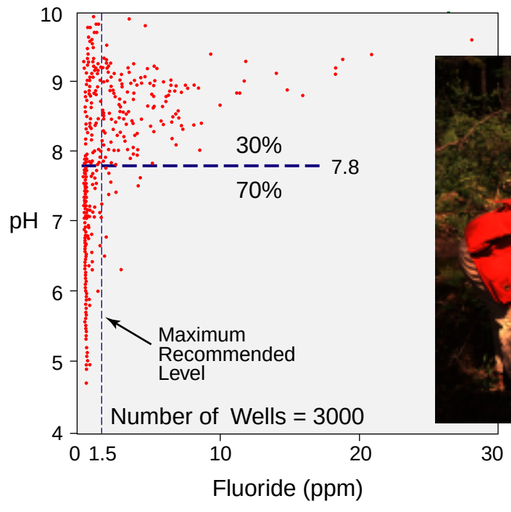




*Contouring approximate, not to be used for planning purposes*

For the Moncton area, a contour map depicting Dose-Response flouride concentrations in well water illustrates areas of potential concern for health and environmental protection. The map shows areas where flouride concentrations are considered low and may result in health problems, as well as areas where concentrations are high and either dental or skeletal fluorosis could occur (see Dose Response Curve). Geochemical maps such as this can be used to plan strategies for health protection in a geological context.

## Predicting Fluorine Levels

Fluorine occurs naturally in rock, entering groundwater where minerals dissolve. Too much or too little fluoride in drinking water can be harmful to human health (see Dose Response Curve). Healthy teeth require fluoride concentrations to be more than 0.8 ppm and less than 1.5 ppm. However, concentrations greater than 8.0 ppm can result in a severe crippling disease known as skeletal fluorosis.




In a study of 3000 wells in the Carboniferous Sedimentary Basin of New Brunswick, Prince Edward Island, and Nova Scotia, approximately 5% of the wells have fluoride levels above 1.5 ppm, indicating an increased risk of dental and skeletal fluorosis for populations in these areas of high fluoride (see Dose Responce Curve). Ninety eight percent of high fluoride wells have a pH greater than 7.8 while 30% of all wells in the study area have a pH above 7.8. These results demonstrate that a simple, low-cost determination of groundwater pH can be used to rapidly test well waters for high fluoride levels and identify areas of potential health risk.