The 2010 New Hampshire Envirothon
"Protection of Groundwater Through Urban, Agricultural, and Environmental Planning"
From the Soils Perspective

The interaction between the soil and land use can have a profound effect on both surface and groundwater quality and the quantity. Many events that impact the soil, including both urbanization and agriculture, will also impact our groundwater. These include the use of pesticides, fertilizers, animal manure, and storm water runoff which often contains metals, nutrients, salts and other chemicals that can leach into groundwater basins.

Soils have three primary roles within our environment:
1) They serve as a *medium for plant growth* and to *regulate the movement and uptake of nutrients*.
2) They serve as an *environmental buffer to pollutants*.
3) They serve to *regulate the flow of precipitation* within a watershed, whether it percolates into the soil, becomes overland flow into lakes and streams, is taken up by plants, or evaporates back into the atmosphere.

There are numerous factors that impact the health and function of these ecosystems, which in turn may result in social, environmental, and economic issues and problems. For example, in areas of numerous buildings, construction sites, or those have been paved for streets and parking lots (ex. where the landscape is significantly altered), the summer temperatures are often higher than in the surrounding countryside and the water pollution is often more concentrated. A major adverse by-product of this disturbance is water pollution due to runoff, construction, stream modification, and soil compaction. Pollution predominantly occurs in the form of fertilizer and pesticides being carried by erosional sediment and leaching out of the soil into surface waters and the ground water.

The most significant type of pollution entering our water supply is **soil sediment** (a direct result of erosion), which makes up 47% of the non-point source pollution in this country. The leaching of nutrients makes up 13%, pathogens make up 9 % and pesticides make up 3 %. Some of the other types of pollutants include salinity, acidity, and an increased biological oxygen demand.

One of the most detrimental effects of disturbance on a soil is the increased susceptibility to erosion. Several factors may attribute to this increased susceptibility. Destroying the organic surface layers, which act like a sponge and protect the mineral soil from eroding, is a major problem. The destruction of the organic surface layer is typically caused by adding or removing material to the soil surface. In forested areas the thickness and moisture content of the organic surface layers will vary considerably. The organic surface layer is typically thicker in colder wetter climates (such as northern New Hampshire), than in the southern part of the state. Removal of the organic layer removes this layer of protection.

Organic layers are the primary reservoir that holds plant nutrients. If some of the organic layers are removed, then the capacity of the reservoir becomes smaller and the amount of available

nutrients is decreased. Furthermore, the surface of the soil may loose its buffering capacity and have a detrimental decrease in pH due to manipulation.

There are many conservation practices that will help to reduce erosion. Knowing the soil properties will help determine the proper management practice to apply. Vegetative filter strips or riparian buffer zones are two examples of conservation practices valuable in erosion control efforts.

Understanding the soil component is a very important aspect in any natural resource assessment. Soils maps and interpretations are valuable tools in natural resource planning and site assessment. Soil interpretations are based on the various soil properties found in each Soil Map Unit. Each soil will have its own unique set of properties and each horizon (layer) in the soil may have a unique set of properties, as well. There may be only one or two layers in a soil or there may be many layers.

Important soil properties are: Depth, Texture, Structure, Color, Slope, Consistency, pH, Bulk density, Drainage class, Available water holding capacity, Hydraulic conductivity, and Flooding frequency.

For example, soils that are formed in sands and gravels (texture) will have a high rate of water movement (Hydraulic conductivity) and are excellent recharge areas for groundwater aquifers.

There are over three hundred soils series identified in New Hampshire and over 18,000 soils in the United States. The difference in these soils is a direct result of soil development. The development of a soil is influenced by *five soil forming factors* that contribute to make one soil different from another:

Time – how long the soil has been developing
Parent Material – where the soil material came from
Biotics – organic material and influence
Topograph*y* – slope and aspect
Climate – temperature and rainfall

Understanding the various properties of the soil and developing appropriate conservation practices will have a positive effect on our groundwater.

For more information:

Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/

Field Book For Describing and Sampling Soils: http://soils.usda.gov/technical/fieldbook/