Inventory Components

Base Map

Background

A base map depicts background reference information such as roads, landmarks, political boundaries, and landforms, onto which other thematic information is displayed. The base map should be prepared, reviewed, and finalized before proceeding with other NRI maps. With the exception of topography (which may not appear on all maps) the base map data can serve as the basis for other inventory map layouts. Aerial photography can be especially useful to orient map users to the study area and may warrant inclusion in a second base map.

What to include

Municipal boundaries. Neighboring municipalities can be identified for easier map interpretation.

Study area boundary. The study area boundary may include the entire community, a portion of the community (e.g., a local watershed), or several communities (e.g., a regional watershed). It should include at least a one-mile extension beyond the study area to show the resources that extend beyond study area boundaries, or an area sufficiently large to show ecologically significant intermunicipal features.

Transportation networks (roads, railroads, and trails). Key road names can be added to the NRI map.

Utility networks (electric transmission and gas lines).

Regional watershed boundaries.

Surface water features (lakes, ponds, rivers, and streams).

Topography. Topography may be displayed with contour lines, a shaded digital elevation model, or a topographic quadrangle image. It isn't necessary to use the topographic base on all subsequent maps. It can clutter a map that already has several other data layers, making interpretation difficult.

Aerial photography. High resolution (6 inches to 1 foot) orthoimagery is now widely available for many areas of New York State.

Major landmarks (e.g., hamlets, named summits).

Note: With the exception of local landmarks, all of the GIS data above are available statewide through the NYS GIS Clearinghouse.

Where to find help

See Appendix A for organization contact information, Appendix C for sources of GIS data, and Appendix D for more information about available topographic maps and aerial photography.

County planning department or regional planning commission
Mapping assistance

Hudson Valley clay was historically used for brick-making. © L. Heady

Aerial photography

Aerial photography taken in spring before trees leaf out can be used to identify ephemeral streams and small wetlands. Color-infrared imagery can be used to define types of land cover and land use. Oblique imagery from Google Earth and Bing Maps are especially useful for desktop analysis and offer the ability to rotate the image.

GEOLOGY AND SOILS

Bedrock and Surficial Geology

Background

The geology of the Hudson Valley is diverse and has helped to shape the character of its natural communities as well as its human communities; for example, cement industries line the Hudson River as a result of the area's large supply of limestone and gypsum. Geological characteristics have an effect on many factors, such as topography, groundwater resources, migration of pollutants, and mineral resources. The properties of bedrock geology and surficial geology (loose deposits above bedrock) also strongly influence soil properties, as well as groundwater and surface water chemistry, which in turn influence the type of ecological communities that can thrive. For example, alkaline environments and the calcium rich or *calcareous* condition that is often associated with limestone bedrock often support more unique or rare plants and biodiversity than other areas (Anderson and Ferree 2010, Kiviat and Stevens 2001). Significant geological features can also be important economically, by providing destinations for outdoor recreation such as hiking or scenic assets that attract tourists, or opportunity for mining operations.

Knowledge of geological properties is important for making sound planning decisions. For example, if bedrock is close to the surface, foundation and road construction is more expensive and may cause other environmental problems such as erosion. Information about geology is also used for identifying sand and gravel aquifers and sources of sand, gravel, and crushed stone for building and road construction.

What to include

Surficial and bedrock geology data for New York State are available in GIS format and print maps from the New York State Museum (NYSM). The maps are highly generalized (at a scale of 1:250,000) and cannot be relied on to describe the precise geology at any particular area on the ground. The maps are still very useful, however, for describing the general geological character of an area. The map is divided into five sheets; the Lower Hudson and Hudson-Mohawk sheets cover the Hudson Valley region. Corresponding tables and narrative text in the NRI can include bedrock types and characteristics of interest. For example, calcareous bedrock that may be associated with uncommon natural communities can be determined from the NYSM bedrock geology map along with Appendix 6 of the *Biodiversity Assessment Manual for the Hudson River Estuary Corridor* (Kiviat and Stevens 2001), which includes information to help determine the calcareous or acidic nature of mapped bedrock in the Hudson Valley region.

Detailed inventory studies

Geological features of interest can be added to maps of surficial and bedrock geology types. New York State Department of Environmental Conservation's (DEC) Division of Mineral Resources maintains a data management system on mines regulated under the Mined Land Reclamation Law of 1975. Locations of mines and quarries that are not regulated by DEC can be identified from the county soil survey, United States Geological Survey (USGS) topographical maps, and local knowledge. In addition to mapping active or abandoned mines, the work group may want to identify the community's mineral commodities, such as sand and gravel. Some sand and gravel deposits are also important for groundwater recharge (see Groundwater and Aquifers section). Combining data on mineral resources with soils, hydrology, and land-use information collected as part of the NRI will help inform community-based decisions concerning use of these geological resources.

Detailed geology studies have been completed for many places in New York. Check with USGS, New York State Geological Survey, county soil and water conservation district, and local academic institutions to see what is available for the study area. The USGS publication, *Geological and Water Supply Reports and Maps: New York*, contains a list of maps and reports relating to geology and mineral and water resources, completed before 1976. Other sources of information include municipal records and knowledgeable members of the community.

Where to find help

See Appendix A for organization contact information, Appendix B for publications and web resources, and Appendix C for sources of GIS data.

New York State Museum and *NYS Geological Survey*
Bedrock and surficial geology maps and GIS data

DEC Division of Mineral Resources
New York State Mined Land Reclamation Database

United States Geological Survey
Geology reports for New York

County soil and water conservation district
County soil survey maps

The remains of 19th century bluestone quarries are common in the Catskills. © I. Haeckel

Soils

Background

To understand the natural processes of the land, and to plan land use accordingly, there is no more fundamental place to start than soil. Soil controls decomposition of organic matter and biogeochemical cycles; regulates water flow; influences the vegetation, habitat type, and agricultural potential of particular locations; and supports human habitation and structures (Randolph 2003). Soil acts as a natural filter to help protect the quality of water and air, regulates rates of aquifer recharge versus runoff, and supports food production and growth of forests and biological communities that society depends on.

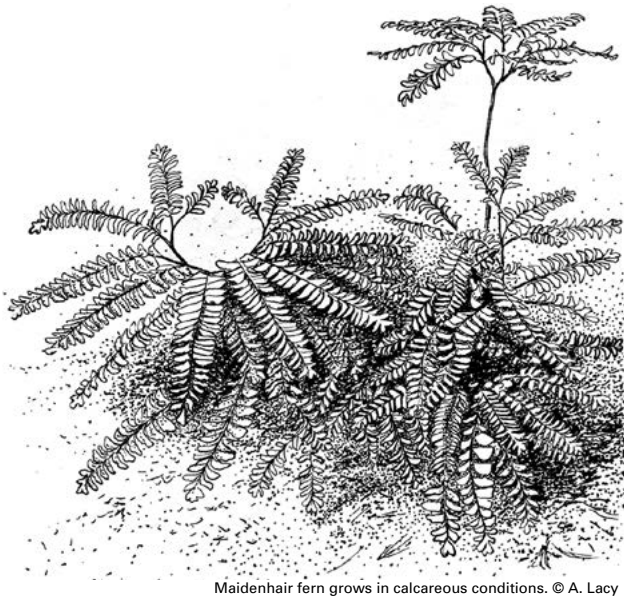
Soil information is critical for land-use planning as it helps to determine where it is appropriate or feasible to build. Each soil type has a certain set of characteristics defined by (but not limited to) properties such as permeability, drainage, available water capacity, pH, depth to bedrock, and risk of corrosion. Consideration of soil properties is important for planning and designing drainage systems; siting of structures; evaluating the potential for septic systems; assessing the need for specially-designed foundations, basements, and roads; determining the feasibility of excavation; and so forth.

Soil properties are important for identifying ecological resources, as well (see Heady and Stevens 2011). Drainage classes provide information on wetlands; *poorly* and *very poorly drained soils* are hydric soils that can be used as wetland indicators and *somewhat poorly drained soils* are indicators of possible wetland locations. Similarly, *muck* or *peat soils* are considered wetland soils. As with bedrock geology, the chemistry of soil influences the kinds of ecological communities that occur in a given place. Calcareous soils are often associated with uncommon habitats and rare species.

Agriculture and forestry practices are also informed by soil data. Soils influence what crops are best to grow, whether irrigation or drainage is needed and how to design irrigation systems, and whether soil amendments are necessary. Soil properties can inform which farms are most valuable for preservation. (See Farmland section.)

What to include

Soil Survey maps and a companion report are available for every county in New York State from the Natural Resources Conservation Service (NRCS). The surveys categorize soil data into series, types, and phases. Soil series delineate soils originating from the same parent materials and having relatively uniform structural engineering properties except for texture. Soil series are the main unit of a county's detailed soil survey. Within a series, differing soils are broken down into soil phase categories according to slope and other properties. The polygons or map units displayed on the soil maps are differentiated at the phase level. Traditional hard copy



Maidenhair fern grows in calcareous conditions. © A. Lacy

soil survey maps are available from county soil and water conservation districts and digital copies of soil survey reports can be downloaded from the NRCS website. The NRCS online Web Soil Survey also allows users to access and download digital soil survey data from the Soil Survey Geographic Database (SSURGO). SSURGO files may also be downloaded for GIS use from the NRCS Geospatial Data Gateway. It is useful to include a map in the NRI displaying soil phases, which can be color-coded to display a particular property of interest to the community, such as depth to bedrock.

The study area's prominent soils and their key characteristics can be described in the inventory report to interpret the soil maps. A table can be used to list soils by their series, phase, and map unit, along with properties that are of particular interest to the community; these could include parent material, drainage classes, depth to high water table, percolation rate, texture, erosion potential, hydrologic soil group, reaction (e.g., calcareous), and depth to bedrock. Consult with the planning board or engineer to determine what would be most useful. Appendix 6 in Kiviat and Stevens (2001) summarizes the soil properties, including drainage class, reaction, and depth to bedrock, which are most useful for identifying places that may be ecologically important in the Hudson River estuary corridor. For an overview of how soils information is used in Biodiversity Assessment, see Appendix E.

Where to find help

See Appendix A for organization contact information, Appendix B for publications and web resources, and Appendix C for sources of GIS data. See Appendix D for more information about available soil maps.

Natural Resources Conservation Service
- Soil Survey Geographic Database (SSURGO), Web Soil Survey application, digital soil survey reports

County soil and water conservation district
- County soil survey maps

Slopes

Background

Steep topographical features can bring special character to a community, often providing scenic vistas, hiking opportunities, and natural beauty. Steep slopes are environmentally sensitive, however, and require special attention during land-use planning because they are vulnerable to soil erosion, excessive stormwater runoff, and slope instability. Disturbance of steep slopes can introduce sediment and impact the quality of adjacent water resources.

What to include

A slopes map can display steepness in the study area by percent slope class, based on a digital elevation model (DEM). DEMs with 10-meter spacing are available for most of New York through a partnership between USGS and DEC. These DEMs were produced using contour lines compiled for USGS 7.5-minute quadrangle maps, and are hosted by Cornell University Geospatial Information Repository (CUGIR). More recently, higher-resolution DEMS have been created using LIDAR (light detection and ranging) data in some parts of New York State. Check the NYS GIS Clearinghouse to find the finest-scale data available for the study area. Note that creating a map of slopes using a DEM entails an analysis that may require the assistance of a consultant or GIS professional. General data and narrative about slope can also be obtained from county soil surveys. To help with interpretation of the slopes map in the NRI, describe the significant topographical features and steepness characteristics of the study area in the report.

Where to find help

See Appendix A for organization contact information and Appendix C for sources of GIS data.

Cornell University Geographic Information Repository
Digital elevation models for New York State

New York State Orthos Online interactive mapping tool
High-resolution digital elevation models for selected areas of New York State

WATER RESOURCES

Groundwater and Aquifers

Background

At least one-quarter of New Yorkers depend on groundwater supplies for drinking water, and many Hudson Valley communities depend entirely on groundwater. Groundwater also supports habitats and species, and is particularly important during dry periods when it is often the dominant source of water flowing in streams and rivers. Groundwater is found between grains of sand, gravel, silt, or clay *(unconsolidated sediments)* or in the cracks and fractures of bedrock (*consolidated sediments*). The saturated geologic zones in sediments and bedrock that receive, store, and transmit significant amounts of water to wells and springs are called *aquifers*. The upper surface of the saturated zone is called the *water table*. Groundwater is recharged when rain and melting snow slowly infiltrate through the soil. The land surface principally contributing to aquifer recharge is called the *aquifer recharge area*. This is generally all watershed land areas aside from streams and their riparian margins, which are *aquifer discharge areas*.

Forested slopes and streambanks are less vulnerable to erosion. © I. Haeckel

An assumption is often made that groundwater is less vulnerable to spills and pathogens than surface water and less likely to be contaminated. In reality, aquifers can become polluted by a variety of mechanisms, including chemical spills, leaking buried sources such as landfills or underground storage tanks, road salt, common household use of herbicides and other chemicals, and improperly spaced or poorly installed septic systems. *A wellhead protection area*, usually a subset of the larger aquifer recharge area, is the area surrounding and upgradient of a public water supply well or well field of interest. Wellhead protection programs seek to limit contaminants in such areas to limit water quality risks to well water.

Regional aquifer depletion is rare in New York, but local groundwater overuse occurs when water withdrawal exceeds local recharge and can result in nearby wells running