NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Cornell University

NEW YORK STATE OF OPPORTUNITY | Hudson River Estuary Program

Natural Resources Inventories: A Tool for Proactive Conservation of Natural Areas

Photo by Laura Heady

October 19, 2016
Southeast New York Stormwater Conference, Beacon, NY

Laura Heady
Conservation and Land Use Coordinator
Hudson River Estuary Program and Cornell University

Hudson River Estuary Program

Working to achieve six key benefits:

- vital estuary ecosystem
- clean water
- resilient communities
- conservation of fish, wildlife, and habitats
- preservation of river's natural scenery
- enhanced opportunities for education, access, recreation, and inspiration

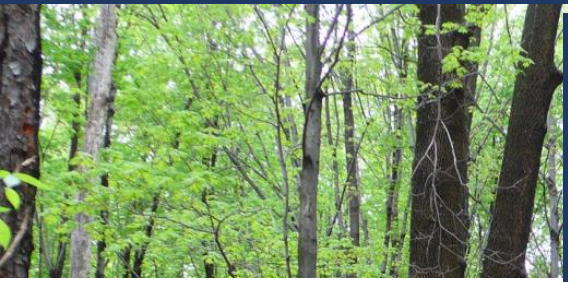
http://www.dec.ny.gov/lands/4920.html

Today's Presentation

- What's at stake?
- Natural resources inventories (NRIs): The process and examples
- Guidebook: *Creating a Natural Resources Inventory*

Photo by Laura Heady

What's at stake if we don't plan proactively to conserve important natural resources?



natural resources

- water quality and quantity
- flood control
- temperature moderation
- carbon storage
- clean air
- human health
- recreation and education
- scenery
- fisheries and forest products
- natural pollinators

→ **"ecosystem services"**

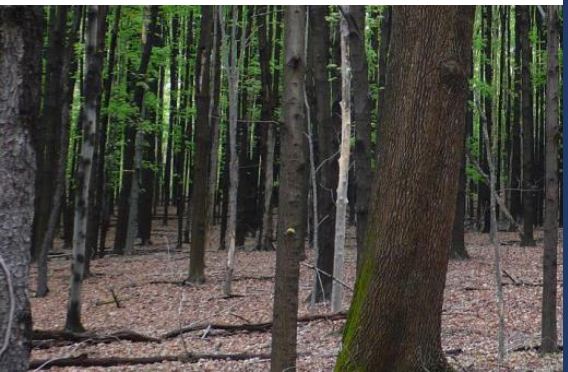


Photo by Laura Heady

What's at stake?

Economic Benefits of Open Space:

"In many instances, it is less expensive for a community to maintain open space that naturally maintains water quality, reduces runoff, or controls flooding than to use tax dollars for costly engineered infrastructure projects such as water filtration plants and storm sewers."

What's at stake?

Climate Change Resilience

Conservation of natural resources like forests, wetlands, and floodplains can help communities build resiliency to:

- increasing temperatures,
- sea level rise, and
- variability in precipitation.

Photo by L. Heady


Photo by C. Bowser

What's at stake?

Clean Water

Natural areas help keep water clean by:

- reducing runoff,
- preventing erosion,
- storing floodwater,
- filtering sediment, nutrients, and other contaminants.

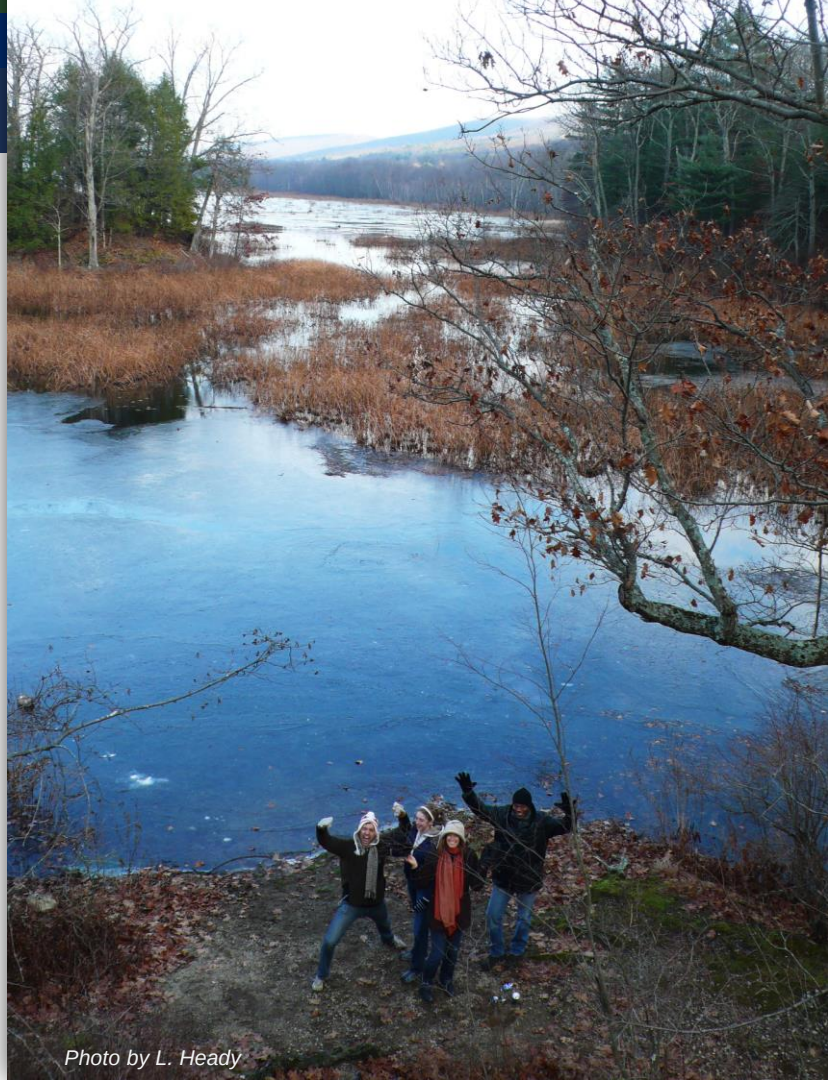


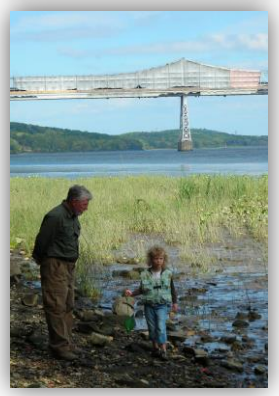
Photo by L. Heady

What's at stake?

Habitat

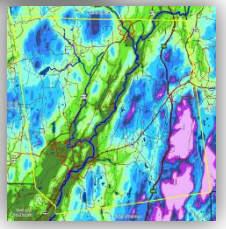
Large, well-connected natural areas provide habitat for wildlife and plants.

Recommended Conservation and Planning Approach

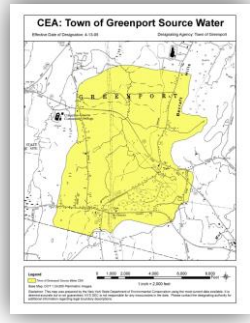


identify what you have

prioritize



plan, protect, manage



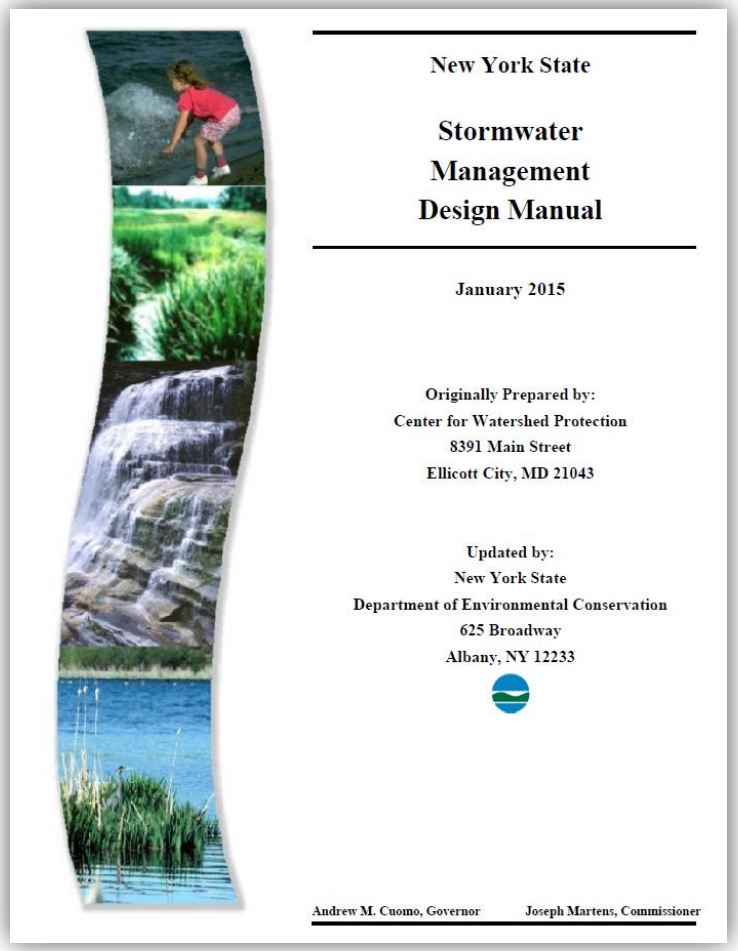
at any scale

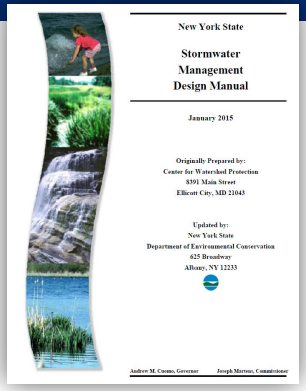
“increased emphasis on holistic approach”

“In the context of stormwater management, the term green infrastructure includes a wide array of practices at multiple scales”

“On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains and wetlands.”

“On the local scale, green infrastructure consists of site- and neighborhood-specific practices and runoff reduction techniques.”

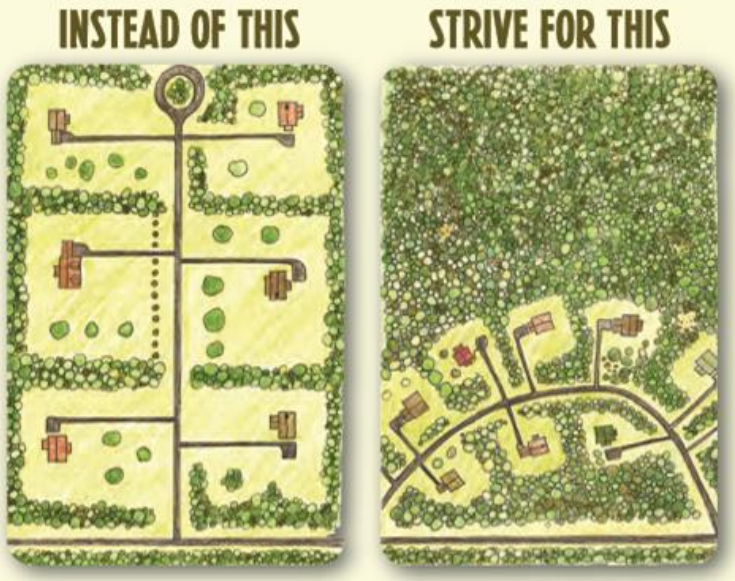




"The first step in planning for stormwater management using green infrastructure is to avoid or minimize land disturbance by preserving natural areas."

Planning practices include:

- preservation of undisturbed areas
- preservation of buffers
- reduction of clearing and grading
- locating development in less sensitive areas
- open space design
- soil restoration



From Make Room for Wildlife, Wildlife Conservation Society Adirondack Program

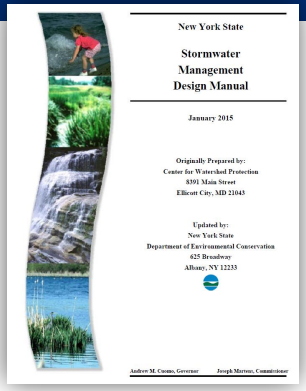


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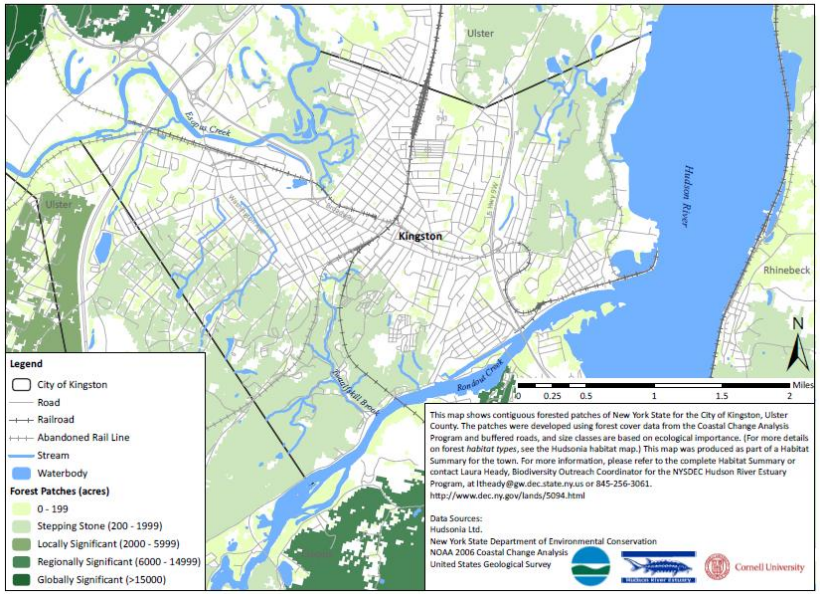
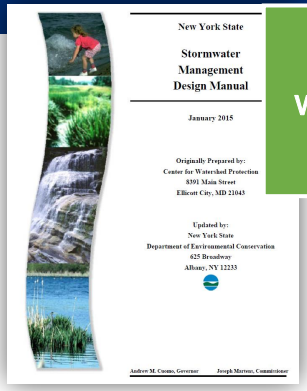
Figure 5: Forests in Kingston, NY





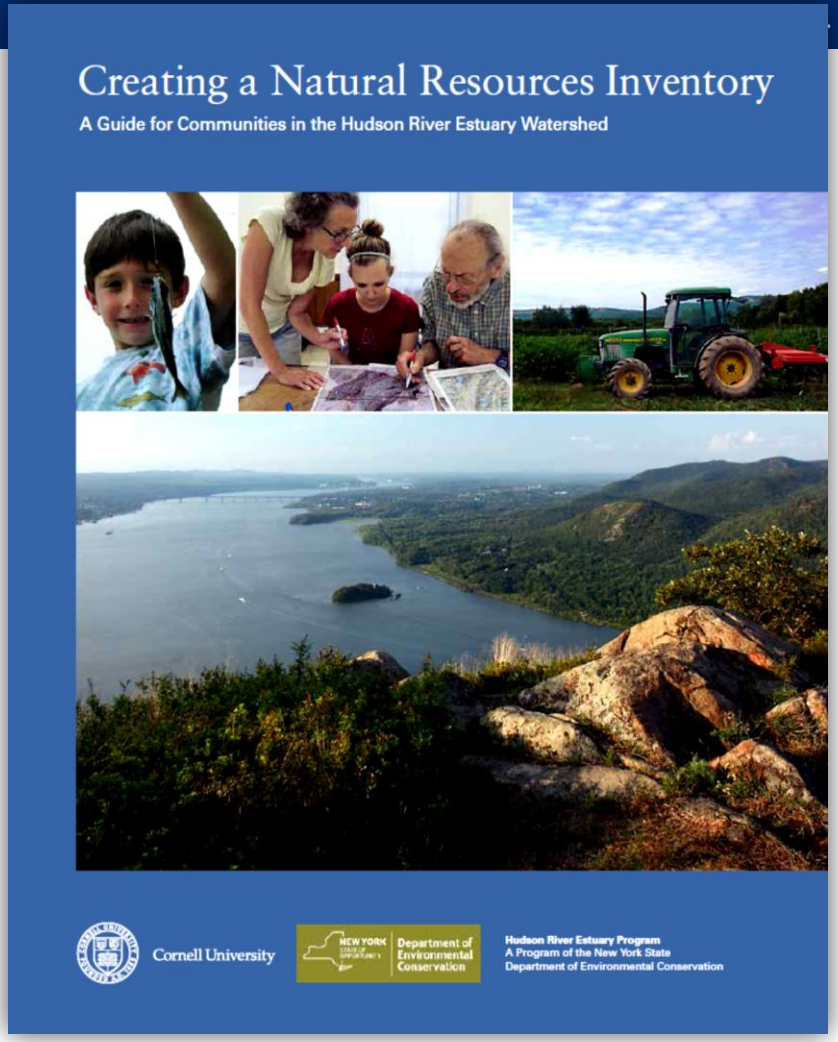
identify what you have

Many practices require *identifying what you have:*

Table 5.1 Planning Practices for Preservation of Natural Features and Conservation

Practice	Description
Preservation of Undisturbed Areas	Delineate and place into permanent conservation undisturbed forests, native vegetated areas, riparian corridors, wetlands, and natural terrain.
Preservation of Buffers	Define, delineate and preserve naturally vegetated buffers along perennial streams, rivers, shorelines and wetlands.
Reduction of Clearing and Grading	Limit clearing and grading to the minimum amount needed for roads, driveways, foundations, utilities and stormwater management facilities.
Locating Development in Less Sensitive Areas	Avoid sensitive resource areas such as floodplains, steep slopes, erodible soils, wetlands, mature forests and critical habitats by locating development to fit the terrain in areas that will create the least impact.
Open Space Design***	Use clustering, conservation design or open space design to reduce impervious cover, preserve more open space and protect water resources.
Soil Restoration	Restore the original properties and porosity of the soil by deep till and amendment with compost to reduce the generation of runoff and enhance the runoff reduction performance of post construction practices.

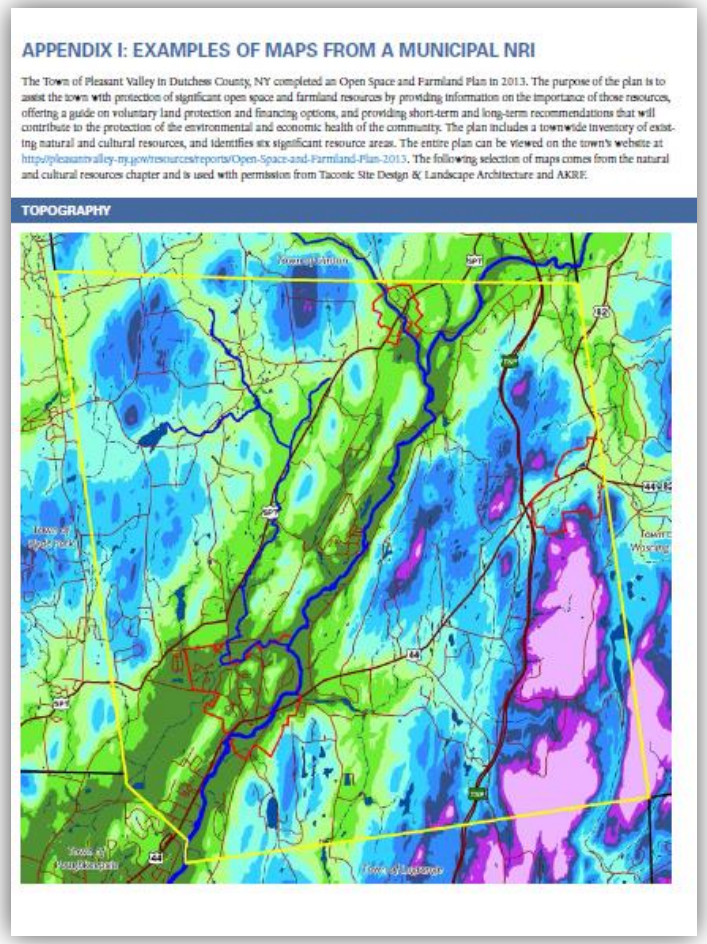
identify what you have



identify what you have

What is a Natural Resources Inventory (NRI)?

- a compilation and description of natural resources within a particular area (municipality, watershed, region)
- primary focus is naturally-occurring resources, but many communities also include cultural resources



APPENDIX I: EXAMPLES OF MAPS FROM A MUNICIPAL NRI

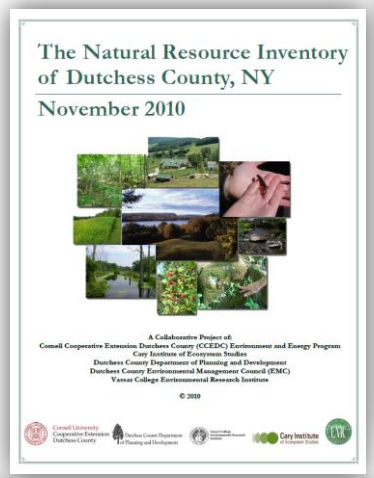
The Town of Pleasant Valley in Dutchess County, NY completed an Open Space and Farmland Plan in 2013. The purpose of the plan is to assist the town with protection of significant open space and farmland resources by providing information on the importance of those resources, offering a guide on voluntary land protection and financing options, and providing short-term and long-term recommendations that will contribute to the protection of the environmental and economic health of the community. The plan includes a townwide inventory of existing natural and cultural resources, and identifies six significant resource areas. The entire plan can be viewed on the town's website at http://pleasantvalley-ny.gov/resources/reports/Open-Space-and-Farmland-Plan-2013. The following selection of maps comes from the natural and cultural resources chapter and is used with permission from Taconic Site Design & Landscape Architecture and AKRF.

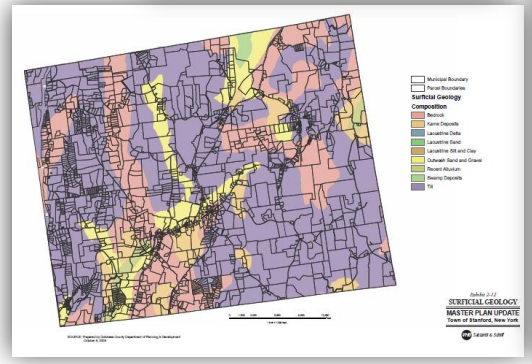
TOPOGRAPHY

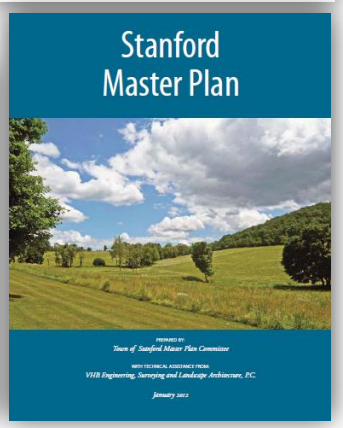
What is a Natural Resources Inventory (NRI)?

It can take many forms, for example:

- a stand-alone document, or a chapter in a comprehensive or open space plan
- a series of GIS maps, PDF maps, Google Earth Pro maps, or a display of large-format maps
- a watershed characterization in a watershed plan, or a county-wide or regional inventory

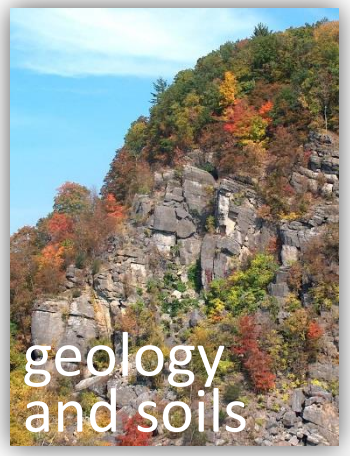


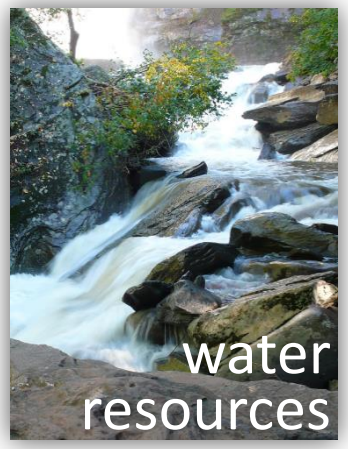


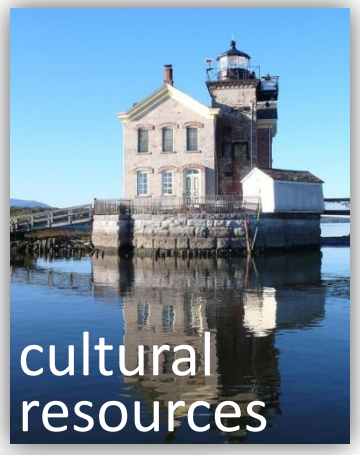


How many of you use NRIs?

What is included in an NRI?







Photos by Laura Heady

What is included in an NRI?

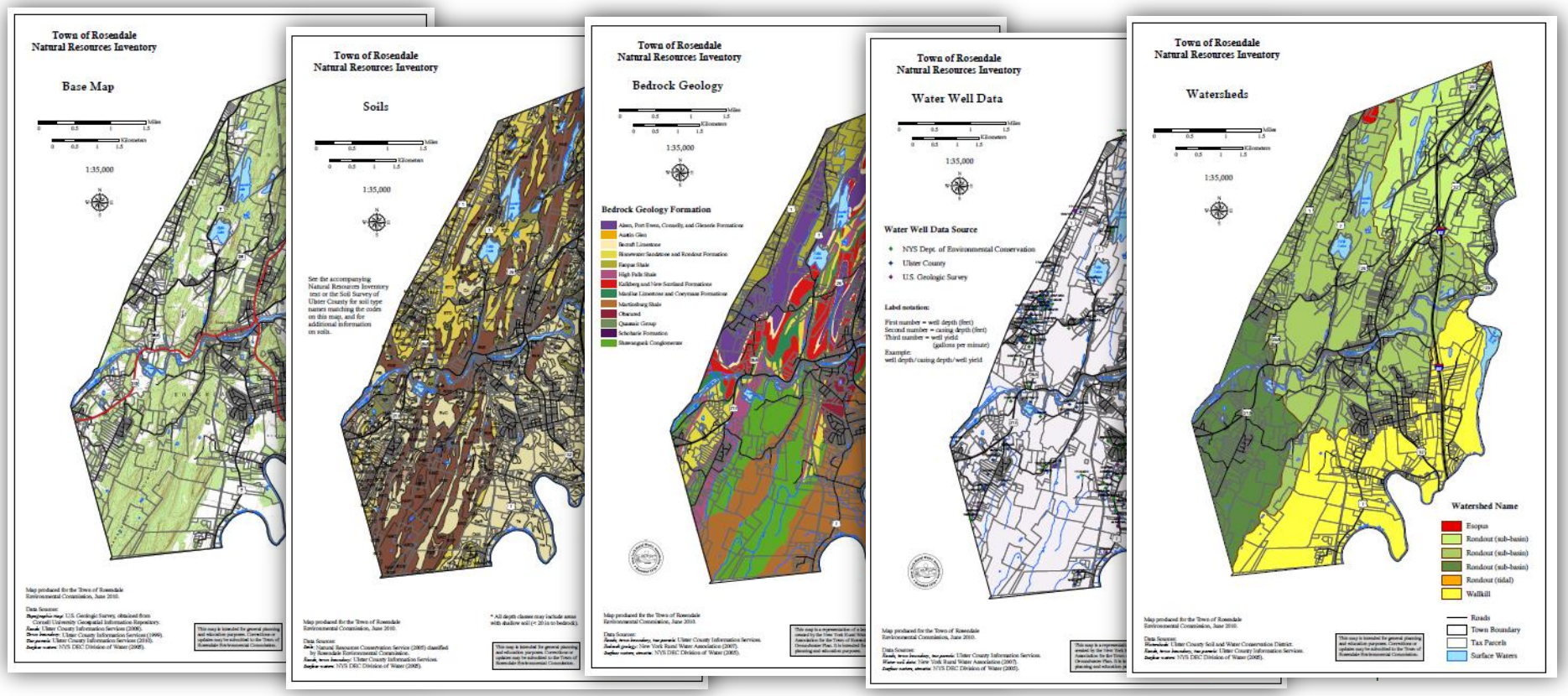
- *What does your community want?*

Two approaches:

- "Basic" NRI – uses publicly available data
- "Detailed" NRI – basic data + new analysis or study

Photo by Laura Heady

What is included in an NRI? 1) maps



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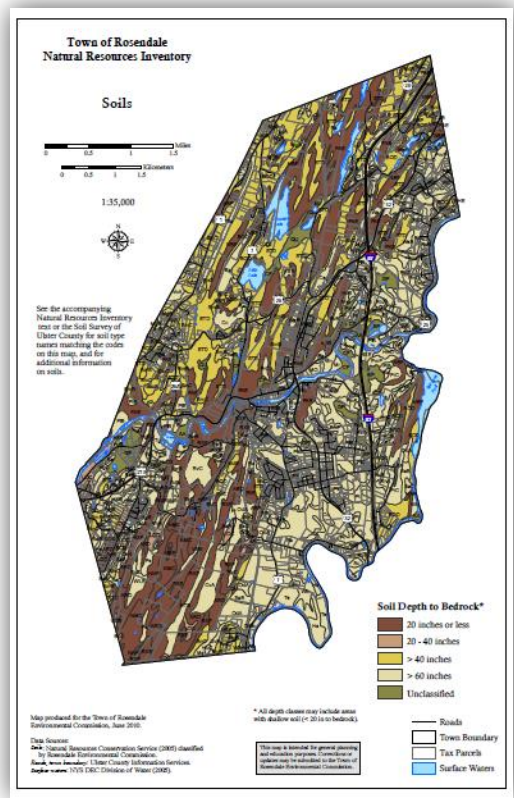


1) maps

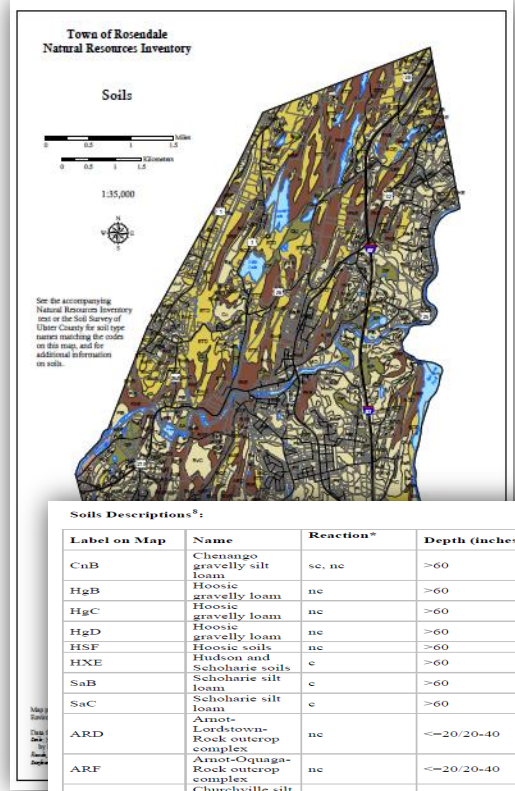
2) data and sources

Soils Descriptions[8]:

Label on Map	Name	Reaction*	Depth (inches)	Drainage**
CnB	Chenango gravelly silt loam	sc, nc	>60	sx-w
HgB	Hoosic gravelly loam	nc	>60	x-w
HgC	Hoosic gravelly loam	nc	>60	x-w
HgD	Hoosic gravelly loam	nc	>60	x-w
HSF	Hoosic soils	nc	>60	x-w

[8] The source for these descriptions is the *Soil Survey Manual,* U.S. Department of Agriculture, Natural Resources Conservation Service (updated 1993), at http://soils.usda.gov/technical/manual.

What is included in an NRI?



1) maps

2) data and sources

3) **report** (goals, methods, resource descriptions, findings, recommendations)

Soils Descriptions[6]:

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HgD	Hoosic gravelly loam	nc	>60	x-w
HSF	Hoosic soils	nc	>60	x-w
HXE	Hudson and Schoharie soils	c	>60	mw
SaB	Schoharie silt loam	c	>60	mw-w
SaC	Schoharie silt loam	c	>60	mw-w
ARD	Arnot-Lordstown-Rock outcrop complex	nc	<=20/20-40	mw-sx/w
ARF	Arnot-Oquaga-Rock outcrop complex	nc	<=20/20-40	mw-sx/w-x
CvA	Churchville silt loam	c	>60	sp
LOC	Lordstown-Arnot-Rock outcrop complex	nc	20-40/<=20	w/mw-sx

Soils and Topography

Soils

Soil underlies and shapes the biodiversity of a region. Such soil characteristics as pH (acidity and alkalinity), drainage, soil texture, depth to bedrock, and slope inform the types of habitat likely to occur in a particular area, with distinctive natural communities becoming established on calcareous (alkaline) soils, acidic soils, clayey soils, sandy soils, and shallow soils, among other soil types.

Soil characteristics also influence human uses of the land: soils range in suitability for food production, their proneness to flooding and inundation, vulnerability to soil erosion and soil instability, and efficiency at filtering pollutants and wastes. What we grow, where we build, and how we maintain the quality of our environment depend directly on the nature of our soils.

Why inventory natural resources?

Photo by G. Goff

NRIs provide an opportunity to educate and raise awareness about a community's natural assets.

- educates landowners
- prepares developers
- contributes to community vision

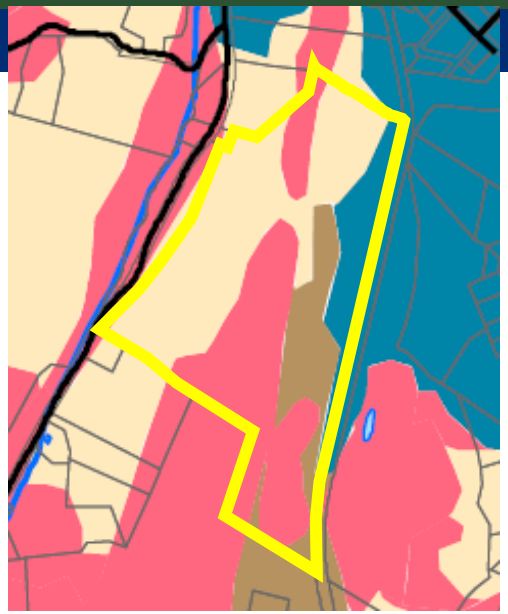
Why inventory natural resources?

NRIs provide a valuable reference for planning, designing, and reviewing. They help decision-makers to:

Photo by Laura Heady

- know what questions to ask
- inform site visits
- provide consistency in reviews
- consider the context of a project, i.e., the “big picture”

air photo



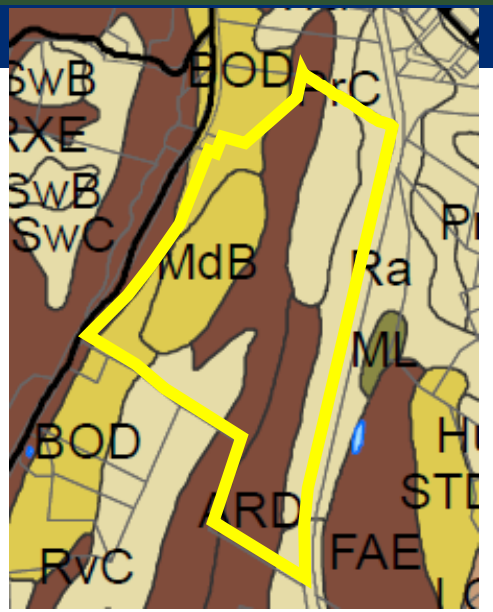
bedrock geology

Lacustrine clay and silt (fine-grain deposits deposited in glacial lakes)

Glaciolacustrine delta (sand and gravel deposits often underlain by finer-grained sand and silt/clay)

Bedrock outcrops with thin (less than 3 feet), discontinuous glacial till

Till (dense, unsorted clay, silt, sand, gravel, boulders)



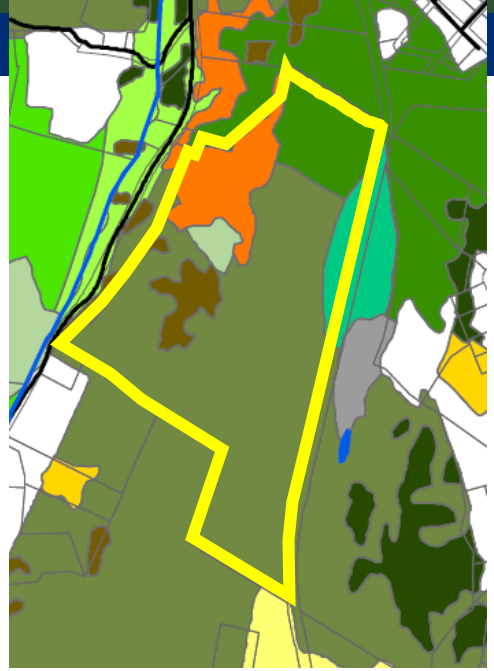
soils

Soil Depth to Bedrock*

- 20 inches or less
- 20 - 40 inches
- > 40 inches
- > 60 inches
- Unclassified

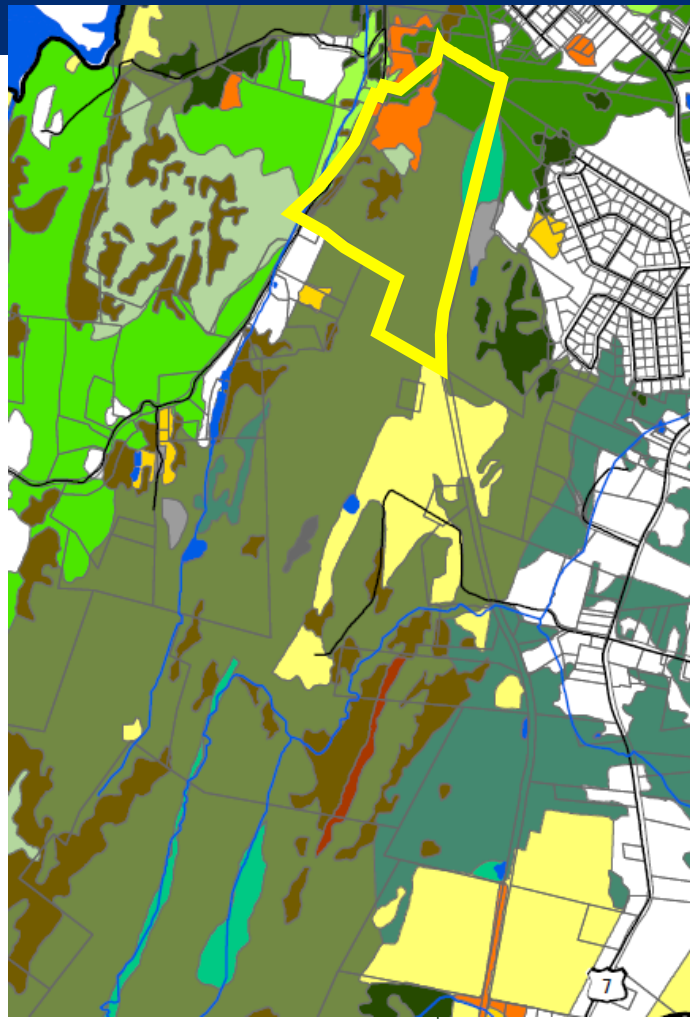
wetlands

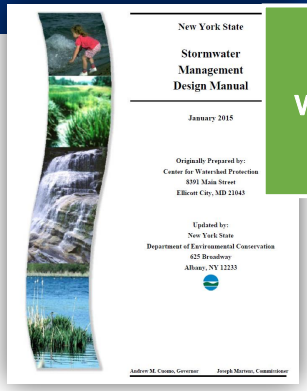
- DEC-Regulated
- National Wetlands Inventory
- DEC and NWI
- Hydric Soils



ecological communities

- Successional forest
- Hemlock-northern hardwood forest
- Chestnut oak forest
- Appalachian oak-pine forest
- Red maple-hardwood swamp
- Cleared/logged land





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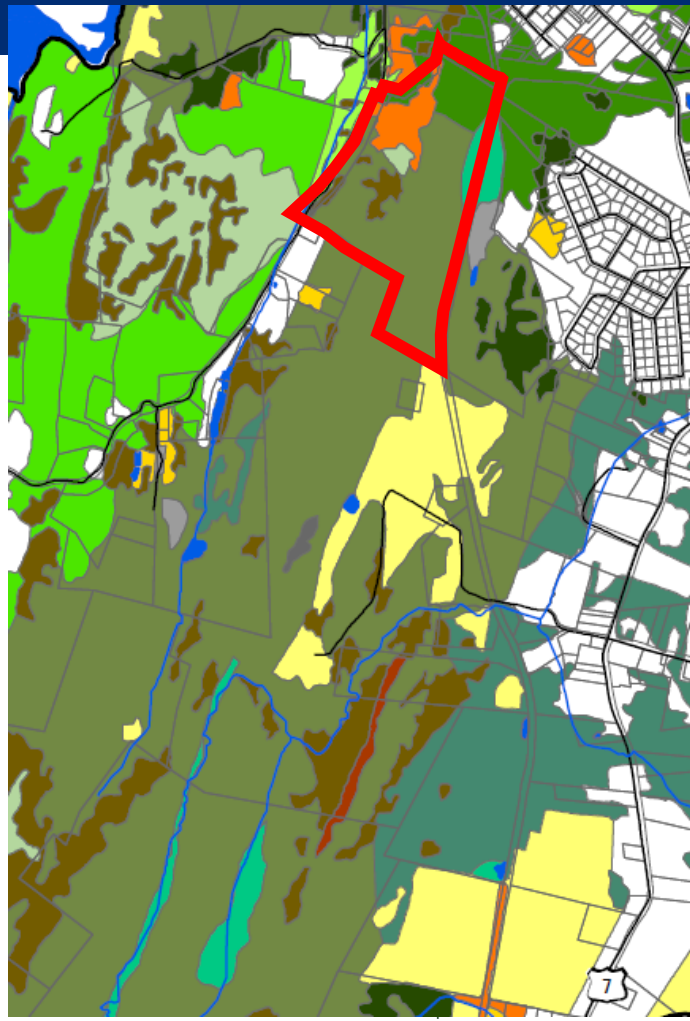
Open Space Design	Use clustering, conservation design or open space design to reduce impervious cover, preserve more open space and protect water resources.
Soil Restoration	Restore the original properties and porosity of the soil by deep till and amendment with compost to reduce the generation of runoff and enhance the runoff reduction performance of post construction practices.

What have we learned about the site?

- **mostly forested** ***(and beyond parcel)***
  - contiguous chestnut oak forest on ridges of shallow soils and outcrops
  - patches of hemlock, oak-pine, and successional forest
- **small area of cleared land**
- **red maple hardwood swamp on eastern border**
- **stream along western edge**



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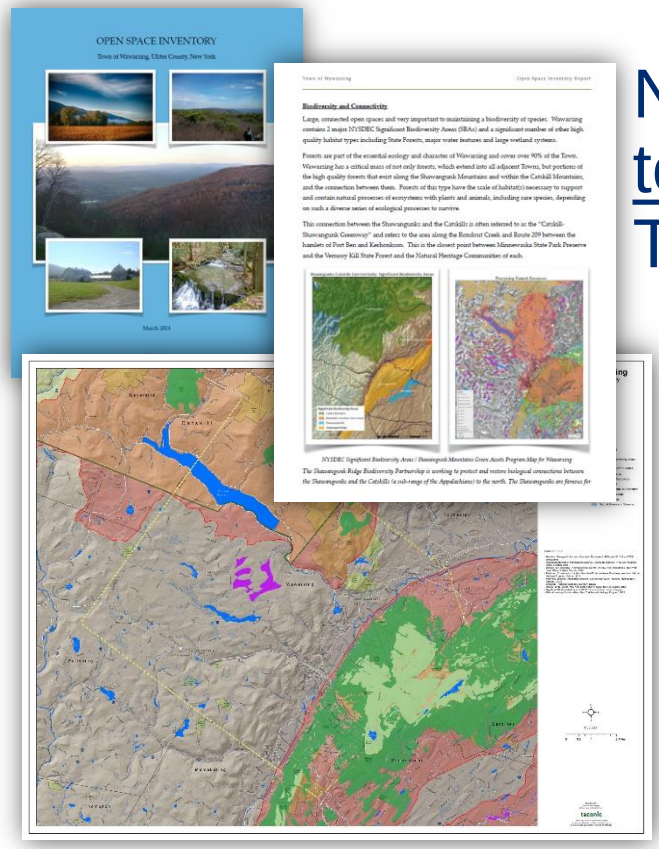


NRIs also help us view resources at a <u>town-wide or county scale</u> (and beyond). They provide:

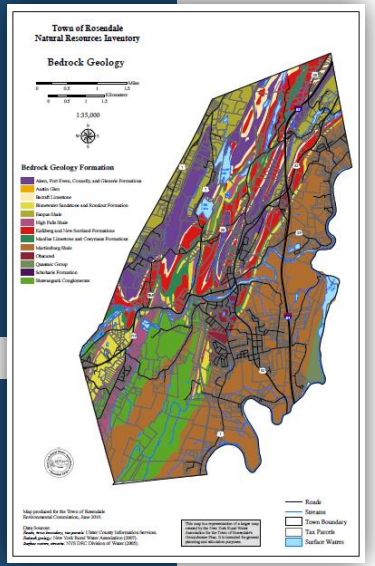
- visualization of natural features and interconnectedness
- foundation for comprehensive plan and zoning updates, open space planning, watershed planning

Examples of Inventory Projects

Town of Rosendale NRI

Done by: environmental commission, volunteers
$$$: Minimal costs covered by commission's budget

- Used existing data + commission created original data on historical and cultural sites, and protected open space.



Town of Shawangunk OSI

Done by: team of graduate students, which included resident
$$$: Minimal costs covered by town board

- Used existing data + created original data and analysis on unfragmented forest, riparian travel corridors, and wetland/floodplain buffers.

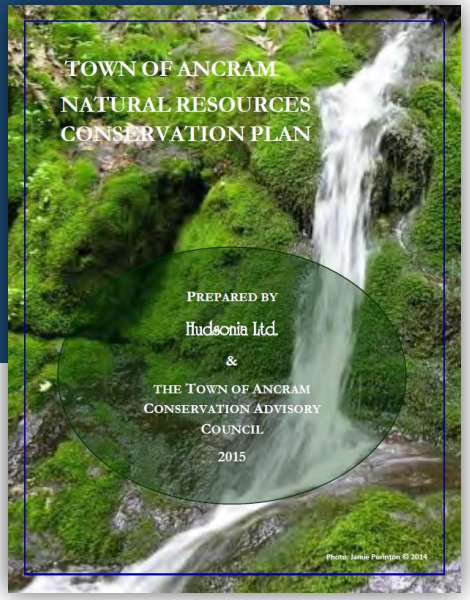
Examples of Inventory Projects (cont'd)

Town of Ancram Natural Resources Conservation Plan

Done by: CAC and Hudsonia Ltd.

$$$: Funding from Hudson River Valley Greenway, Hudson River Bank and Trust Foundation, and the Town

- Used existing data + habitat mapping completed by volunteers.



Examples of Inventory Projects (cont'd)

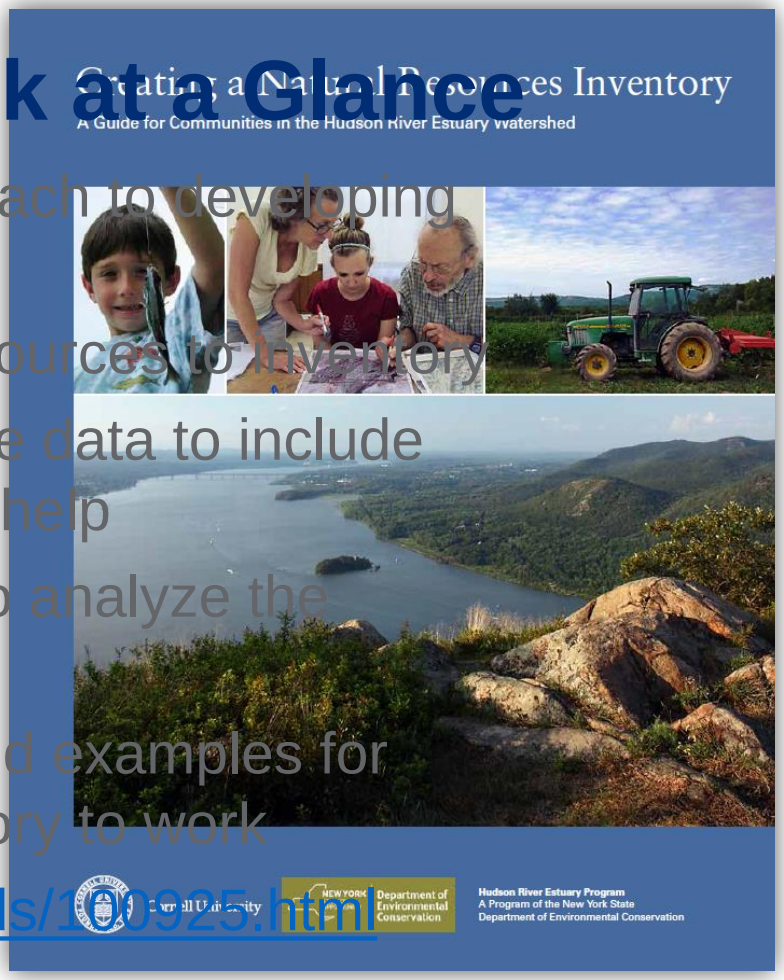
Town of Pleasant Valley Open Space and Farmland Plan

Done by: Open Space Committee,
Taconic Site Design and AKRF
$$$: Funding from Hudson River Estuary Grant

- Used existing data to inventory natural resources and identifies and describes priority areas.

The Guidebook at a Glance

- Outlines an approach to developing an inventory
- Recommends resources to inventory
- Suggests available data to include and where to find help
- Considers ways to analyze the results
- Presents ideas and examples for putting the inventory to work



www.dec.ny.gov/lands/100925.html

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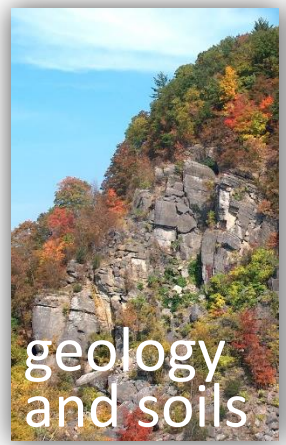
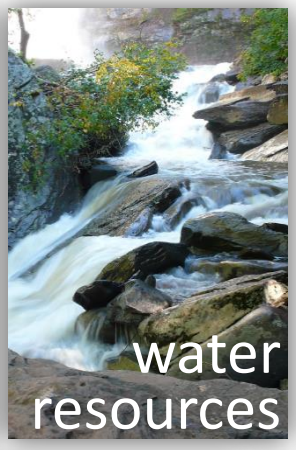
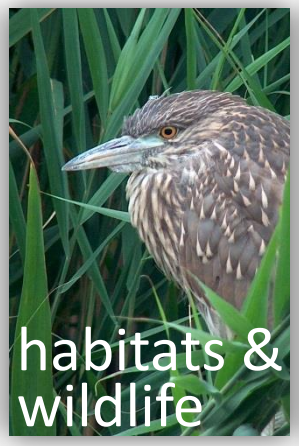
Resources to include in an NRI:







Photos by Laura Heady

Table 2: Suggested Inventory Components and Recommended Data: The following list primarily includes widely-available national and New York State data sets. Additional regional data sets may exist and in many cases, county agencies like planning departments have more localized data and should be consulted at the start of the inventory project. In all cases, local data should be included where available and appropriate.

Inventory Component	Recommended Data to Include	Page
Base Map	• Municipal boundaries, transportation and utility networks, topography, aerial imagery, regional watershed boundaries, streams and waterbodies, landmarks	16
Geology and Soils		
Bedrock and Surficial Geology	• Bedrock and surficial geology features and table with geologic unit attributes	16
Soils	• Soil survey units and table with attributes	18
Slopes	• Percent slope calculated from a digital elevation model	19
Water Resources		
Groundwater and Aquifers	• Unconsolidated aquifers	19
Watersheds	• National Hydrography Dataset 10-digit HUC or other regional watershed boundaries • 12-digit HUC subwatershed boundaries • Smaller watersheds of interest to the NRI effort	21
Streams and Waterbodies	• National Hydrography Dataset streams and waterbodies	22
Floodplains	• FEMA floodway and 100-year and 500-year floodplains	23
Wetlands	• National Wetlands Inventory data • DEC Freshwater Wetlands data • Hydric soils from county soil survey	24
Water Quality: Assessment and Standards	• DEC Water Quality Classifications • DEC Waterbody Inventory/Priority Waterbodies List • Water quality monitoring data	26
Water Quality: Potential and Known Contamination Sites	• SPDES permit sites • Hazardous waste sites	28
Habitats and Wildlife		
Significant Biodiversity Areas	• Hudson Valley Significant Biodiversity Areas	28
Hudson River Coastal and Shoreline Habitat	• Documented submerged aquatic vegetation • Tidal wetlands • Significant Coastal Fish and Wildlife Habitats • Hudson River shoreline habitat type • Significant natural communities	29
Stream and Riparian Habitat	• See Streams and Waterbodies section, above • Significant natural communities • Migratory fish runs • DEC trout and trout spawning streams • Known aquatic barriers to resident and migratory fish movement (e.g., dams, culverts)	30
Wetland Habitat	• See Wetlands section, above • Significant natural communities	32
Forests	• Large forest patches • Matrix forests and linkage zones • Significant natural communities	33
Grasslands and Shrublands	• *NYS Breeding Bird Atlas* and *NYS Amphibian and Reptile Atlas* data • Significant natural communities	34
Rare Plant and Animal Species and Significant Natural Communities	• Rare plant and animal species and significant natural communities • Areas of known importance for rare species and significant ecosystems • *NYS Breeding Bird Atlas* and *NYS Amphibian and Reptile Atlas* data	36
Unfragmented Habitat Blocks	• There are currently no region-wide publicly available data sets. See Chapter 4 for existing methodologies.	39
Climate		
Climate Conditions and Projections	• Scenic Hudson's sea level rise projections for the Hudson River estuary • Table with current average climate conditions and projections of future climate conditions	40
Cultural Resources		
Historic Resources	• National Register and NYS historic districts and individually-designated historic sites • National Heritage Corridor/Area and NYS Heritage Areas	41
Scenic Resources	• Scenic Areas of Statewide Significance • Scenic byways	43
Recreation Resources	• Outdoor recreation destinations and amenities • Public trails and fishing sites • Conservation and public lands	44
Land Use		
Zoning and Tax Maps	• Municipal zoning and tax maps • Real property tax records	45
Land Use and Land Cover	• National Land Cover or Coastal Change Analysis Program (C-CAP) data set	46
Farmland	• Prime farmland soils and farm soils of statewide importance • Agricultural districts	47
Conservation and Public Lands	• Conserved or publicly owned lands under federal, state, county, town, or private ownership • Conservation easements	49

Each resource description includes:

- background
- what to include (readily available data)
- detailed inventory studies (to gather new, local data)
- where to find help

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.

United States Geological Survey
HUC watershed delineations, StreamStats tool for local watershed delineation

DEC Hudson River Estuary Program
Technical and mapping assistance

Hudson River Watershed Alliance
Watershed Atlas maps, information on local watershed groups, watershed plans, and intermunicipal agreements

Local watershed association
Maps, watershed assessments and plans

County agencies (such as planning department, soil & water conservation district, or Cornell Cooperative Extension)
Maps, watershed plans

Streams and Waterbodies

Background

Streams, reservoirs, lakes, and ponds and their adjacent riparian (streamside) habitats provide critical benefits to communities, including clean water, flood management, and recreational opportunities like fishing and kayaking. The health of the Hudson River estuary is closely linked to the health of its tributaries and their watersheds.

There are various classification systems for surface water systems based on a range of physical conditions, habitat values, and human uses, including hydrology, flow, average depth, surface area, temperature, habitat structure, water quality, sensitivity to pollutants, and recreational uses, among other attributes. A basic NRI may simply document known streams and waterbodies, while detailed inventory studies can research characteristics relevant to local water resource concerns and interest.

Perennial streams flow continuously throughout years with normal precipitation, but some may dry up during droughts. *Intermittent streams* only flow seasonally or after rain. They can easily be overlooked when dry, but have great impact on the water quality and quantity of larger downstream waters and warrant attention. Stream barriers, such as dams and poorly designed and installed culverts, can have serious effects on stream habitat, local flooding, and water quality. Bridges, open-bottom culverts and similar structures that completely span a waterway and associated riparian area and floodplain usually have the least impact on streams. Stream habitat values are discussed further in the Stream and Riparian Habitat section.

Poorly planned development in a watershed can dramatically increase the amount of stormwater runoff, chemicals, sediment, and other contaminants entering streams and waterbodies, threatening water quality, degrading habitat value, and increasing flood risk. Precipitation has become more variable and extreme with climate change in the Northeast, exacerbating these threats. Annual rainfall occurring in heavy downpour events increased 74% between the periods of 1950-1979 and 1980-2009, and most areas of the Hudson Valley have been impacted by serious flooding in recent years (Rosenzweig et al. 2011). Thorough documentation of streams and waterbodies in an NRI can help communities to plan for and mitigate future flood risk as precipitation trends continue. See the Floodplains section for more information on flooding considerations and Appendix F for information on precipitation projections in the Hudson Valley. See the Water Quality and Land Use sections for further discussion of watershed connections to surface water pollution, water quality assessment, and monitoring studies.

Poorly planned development in a watershed can dramatically increase the amount of stormwater runoff, chemicals, sediment, and other contaminants entering streams and waterbodies, threatening water quality, degrading habitat value, and increasing flood risk.

What to include

Streams and waterbodies can be mapped and described using the USGS National Hydrography Dataset or more detailed local data sources, where available. (Some municipal and county agencies have developed finer-scale stream maps, for example.) This information may be displayed together with watershed boundaries, which provide logical units for evaluating surface water resources (see Watersheds section). The National Hydrography Dataset can be viewed online using the USGS Hydrography Viewer and GIS data can be obtained from the USGS website. It may be helpful to combine features such as floodplains, riparian wetlands and forests, waterbodies, and subwatersheds in a single map in the NRI.

Hanging culverts prevent fish from travelling upstream. © M. Adamovic

Detailed inventory studies

Intermittent streams and small waterbodies are not captured on USGS and statewide stream maps. These important resources can be identified and delineated through airphoto interpretation, map analysis, local knowledge, and site visits to create more accurate maps. See Appendix E, Biodiversity Assessment, for details.

The New York State Inventory of Dams and the USGS National Hydrography Dataset document a small fraction of dam locations. Many dams, especially small ones, are missing from these data sets. Culvert data sets do not exist on any standard, county, or statewide scale in New York. The DEC Hudson River Estuary Program is collecting information on dams and culverts in the Hudson Valley. Field surveys can fill in missing dam and culvert information.

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.

United States Geological Survey
National Hydrography Dataset, Hydrography Viewer

DEC Hudson River Estuary Program
Technical and mapping assistance, aquatic barrier information

Hudson River Watershed Alliance
Watershed Atlas maps

Local watershed association
Maps, watershed plans

County agencies (such as planning department or soil & water conservation district)
Maps

Floodplains

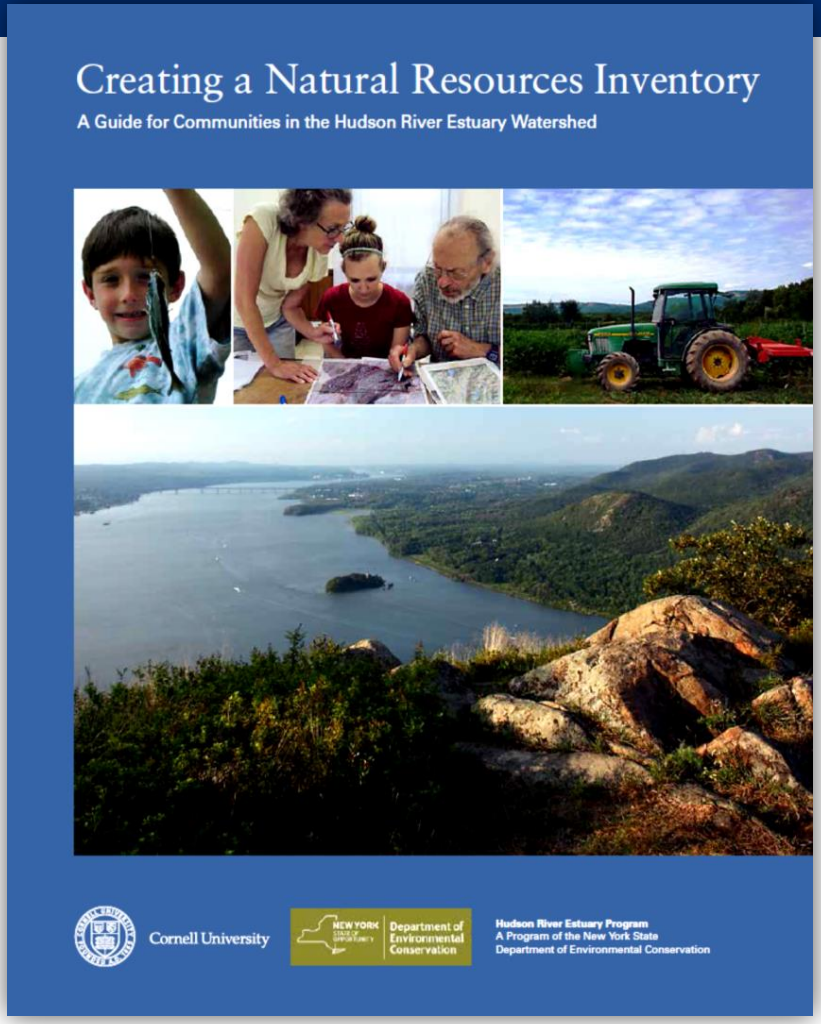
Background

Floodplains are low-lying areas adjacent to streams and other waterbodies that become inundated during heavy precipitation or snowmelt. By slowing and storing floodwaters, floodplains reduce downstream flood damage and serve as a safety zone between human settlement and the damaging impacts of floods. Naturally vegetated floodplains help prevent erosion, recharge groundwater, and

can serve as travel corridor
productive ecosystems are
plants and animals that to
support the in-stream food
ural state, they provide sp
that cause streams to expe
change course. Floodplain
are also where land-use ch
stream quality.

Floodplains have tradition
Federal Emergency Manag
the US Department of Ho
based on flood frequency
expected to have a 1% or
dated in any given year (o
year flood"). It is importa
their statistical flooding in
on the best data and techn
mapping. Due to many var
dictable nature of floods,
the variable intensity of la
some flood-prone areas m
floodplain maps, and flood
over time as more informa

Naturally vegetated floodplains help to



- PDF version available to view or download at: www.dec.ny.gov/lands/100925.html
- Limited number of print copies available
- Technical assistance available for Estuary watershed communities
- Estuary Grant funding

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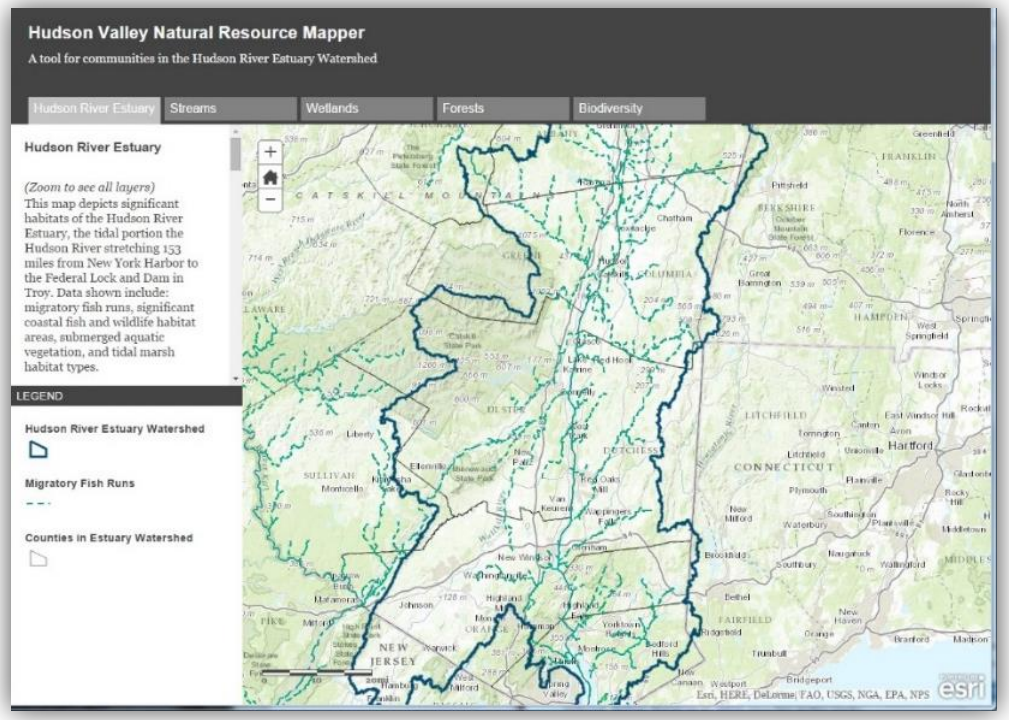
Hudson Valley Natural Resource Mapper

Interactive web tool with five map tabs:

- estuary
- streams & watersheds
- wetlands
- large forests
- biodiversity



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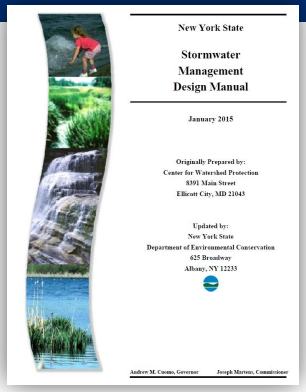
www.hudson.dnr.cals.cornell.edu/mapper



"Conservation of natural areas such as undisturbed forested and native-vegetated areas, natural terrain, riparian corridors and wetlands on a development project can help to preserve pre-development hydrology of the site and aid in reducing stormwater runoff and pollutant load."

Having a good inventory can guide how to conserve natural areas in meaningful ways, with multiple benefits.

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Photo by Laura Heady

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Thank you!

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